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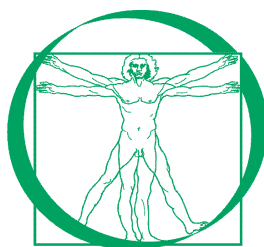
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Pre-participation screening in Sport and Exercise

1

Low QRS voltages in olympic athletes: prevalence and clinical correlates

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BACKGROUND: Recently, novel interest on low QRS voltages (LQRSV) was prompted observing LQRSV in arrhythmogenic cardiomyopathy (ACM) patients, even before occurrence of symptoms/events. Aim of the study is to assess prevalence and clinical correlates of LQRSV in Olympic athletes, evaluated and followed-up within our cardiovascular (CV) screening program.

METHODS: 516 athletes consecutively examined (2010-2011) were included. LQRSV was defined as QRS amplitude <0.5 mV in limb and/or <1.0 mV in precordial leads. CV evaluation included 12-lead and exercise ECG, echocardiography and, selectively, additional tests to confirm diagnosis. Mean follow-up was 5±2 (1-9) years.

RESULTS: Majority of athletes (493; 96%) showed normal/increased R/S-wave voltages, but 23 (4%) had LQRSV. No differences were observed in LQRSV athletes compared to normal/increased QRS voltages for QRS duration, QTc and PR intervals, left ventricular cavity size and mass, gender and sport participated. However, premature ventricular beats (PVBs), occurred more frequently in LQRSV (39% vs. 7%; P<0.001), originating from left or right free ventricular wall. No diseases or events were registered in LQRSV athletes over the follow-up.

CONCLUSIONS: In Olympic athletes, prevalence of LQRSV was 4%. Athletes with LQRSV did not differ from other athletes for sport participated or cardiac dimensions, but more frequently (39% vs. 7%) showed PVBs from either left or right free ventricular wall. Therefore, in LQRSV athletes' long-term follow-up including serial clinical evaluations is needed to definitely clarify the clinical significance.

2

Limited diagnostic value of questionnaire-based pre-participation screening algorithms: a "risk-exposed" approach to sports activity

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BACKGROUND: Several pre-participation screening algorithms (PPSAs) have been proposed to assess sports eligibility in different populations. They are usually based on self-administered questionnaires, without further medical assessment if no risk factors are documented. Unlike these PPSAs, the Med-Ex "Formula Benessere" Program includes a complete cardiovascular (CV) screening for all participants. The purpose of this study was to compare the data derived from Med-Ex Program to the indication acquired applying several PPSAs, assessing their accuracy in detecting medical and/or CV abnormalities in general and athletic population.

METHODS: The Med-Ex database, consisting of medical history, physical examination (including body composition), blood tests, resting and exercise stress ECG in 464 male subjects (38.4 aged) was analyzed and matched to several PPSAs - PAR-Q (1991-2019), AHA/ACSM (1998-2009-2014-2015), EACPR (2011) - retrospectively simulated.

RESULTS: Six hundred and ten (610) medical and/or CV abnormalities were detected in the Med-Ex study group. Applying different PPSAs, over the 30% of subjects with CV abnormalities would be considered eligible without further medical consultation. In particular, the 40% of subjects with ECG abnormalities, the 30% with hypertension, the 25% with impaired fasting glycaemia and the 20% with obesity should be missed applying the PPSAs criteria alone.

CONCLUSIONS: According to PPSAs based on self-administered questionnaires, 30% of subjects with medical and/or CV abnormalities would be considered eligible to sports activity without any further medical assessment. This "risk exposed" approach should revise the use of these PPSAs for sports practice in favor of a more responsible medical-guided CV screening.

3

The effects of gender affirming treatment on the sporting performance and muscle memory of transgender athletes: the Tavistock transgender athlete study

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vement, *Human and Health Sciences, University of Rome "Foro Italico", Rome, Italy*

BACKGROUND: Integration of transgender athletes into sports categories is becoming more prominent with the rising numbers of those identifying as transgender in society. Whether it is fair for transgender athletes to be integrated into their affirmed gender category holistically in sport is the crux of debate for International Sports Federations (IFs). The aim of the Tavistock Transgender Athlete Study (TTAS) is to investigate changes in physiology and sports performance measures from pre-GAT through 2 years of GAT in athletic transmen and transwomen while secondly, investigating the potential testosterone legacy effect of myonuclei muscle memory, comparing all outcomes to ciswomen athletes.

METHODS: Conversely, after 1 year of GAT in trained individuals, transmen's running (15%) and upper body strength (43%) disadvantage to ciswomen disappeared. After 2 years of GAT, trained transwomen's baseline upper body muscular strength advantages (15-31%) over ciswomen were eliminated, although running performance advantage (9%) was maintained. Nevertheless, performance measures data outside of strength and running is scarce.

RESULTS: Data on non-athletic transmen show muscle mass and strength gains while retaining lower limb strength disadvantage to ciswomen after 1 year of gender-affirming treatment (GAT). Non-athletic transwomen show muscle mass loss, while retaining lower limb strength had advantage over ciswomen after 1 year of GAT.

CONCLUSIONS: This will elucidate what advantages/disadvantages transgender athletes gain/lose after 2 years of GAT over their cisgender competitors and provide a timeline of when these changes in physiology and performance occur. The TTAS will guide IFs to create the fairest transgender integration policy and maintain the integrity of sport.

4

Return to play: an italian follow-up method in COVID-positive young athletes

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BACKGROUND: The Italian Sports Medical Federation (FMSI) has recently drawn up a protocol named return-to-play (RTP) practical recommendations on how to exclude cardiorespiratory complications of COVID-19 in athletes who have to return to competitive activities. We present our experience in Reggio Emilia on the use of PTP protocol as possible solutions for management of athletes in the context of the COVID-19 pandemic. The aim is to understand which investigations are useful in a screening protocol aimed at protecting health but also avoiding inappropriate examinations.

METHODS: From February 2021 to April 2021 all athletes with positive test result of SARS-CoV-2 who had undergone to medical examination previously were enrolled. For each person we collected personal history, spirometry, resting/stress-test ECG with oxygen saturation monitoring, echocardiogram, Holter and chest CT. Screening evaluation was performed in 90 consecutive athletes SARS-CoV-2-positive (55 male, 35 female of mean age 13 years).

RESULTS: Only two of the athletes we examined revealed significant severe SARS-CoV-2-related disease. In one case of this showed specific imaging feature to myocarditis and another athlete was found a palsy of the seventh cranial nerve. The cardiovascular effects and long-term consequences of COVID-19 are currently unclear.

CONCLUSIONS: Our study confirms that these screening athletes before restarting training and competitions could be a useful, easy to perform and above all effective method to immediately recognize complications from COVID-19 disease. In our experience, preliminary clinical evaluation is essential to determine which protocol diagnostic tests are really better to use.

5

A cost-benefit and effectiveness study for athletes' pre-participation screening in municipality of Thessaloniki, Greece

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BACKGROUND: This study was designed to assess the economic feasibility and sustainability of a telemedicine cardiovascular pre-participation screening (PPS) via a trans-telephonic ECG monitoring.

METHODS: A cost-benefit analysis was conducted on the market perspective, where the University operates as a private firm and the athlete must travel to undertake the PPS *versus* the societal, non-profit perspective with a specialized medical team operating at the training fields. The evaluation of the costs was based on the findings of a pilot study made on a sample of 506 athletes.

RESULTS: From the market perspective, the price at 23.2€ will lead to a benefit-cost ratio over unity when the alternative option is a private clinic and below unity for a public hospital. Prices in the range of 20-25€ predict a probability of 13% for the institution not to suffer losses. The price should be set at 27€ for a 50% probability to have earnings, but without cost benefits to the athletes. From a non-profit perspective, when a geographical pricing scheme was applied, the telemedicine project was found to be socially

desirable. With the average price set at 18.4€ and the average variable costs kept below 5€, uncertainty was split evenly between earnings and losses. However, a fund capital of at least 400.000€ should be raised to preserve the sustainability of the project.

CONCLUSIONS: The results demonstrate that a non-profit PPS in athletes including tele-cardiology ECG service is more efficient than providing a for-profit PPS of analogue screening examinations.

6

Skeletal age as a determinant of bone mass in adolescent males. A cross-sectional study

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BACKGROUND: Adolescence is characterized by rapid changes in the skeletal system with 80–90% of total bone mass acquired by late adolescence depending on the skeletal site. The study clarifies if skeletal age can predict the total and regional bone mineral density (BMD) and bone mineral content (BMC) in adolescent males.

METHODS: A cross-sectional study involves 115 Portuguese adolescent males (age 12-16 years). Left hand x-rays were performed to assess skeletal maturity using Tanner-Whitehouse (TW3) and Fels Methods. BMC and BMD, and body composition were assessed using dual-energy X-ray absorptiometry. Spearman's correlation was used to assess the linear association between bone maturation variables (*i.e.* chronological age, bone age - FELS and TW3, carpal Skeletal Age (SA) TW3, maturity index and age at peak height) and values of BMC. Pearson's correlation was used to assess the linear association between bone maturation variables and BMD.

RESULTS: A higher chronological age was associated with higher BMC/BMD values in the lower back ($\rho=0.345$; $P<0.001$) and upper limbs ($\rho=0.264$; $P=0.004$). Bone age assessed by FELS and TW3 was associated with higher BMC/BMD values in the lumbar, lower and upper limbs. The carpal TW3 values and the maturity index showed positive and statistically significant correlations with all BMC/BMD measures.

CONCLUSIONS: A higher skeletal age is positively correlated with higher BMC and BMD and not necessarily correlated with biological age. Skeletal age should also be considered when assessing maturation and growth in young individuals.

7

The impact of different sports on total and regional bone mineral density in young portuguese athletes

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BACKGROUND: Bone turnover is affected by exercise throughout the lifespan, especially during adolescence.

The study investigates the impact of different sports on tissue composition, total and regional bone mineral content and bone mineral density between soccer and swimming Portuguese adolescent athletes.

METHODS: Seventy-six (76) adolescents aged 12-16 years participated in this cross-sectional study: 36 swimmers and 40 soccer players. Bone mineral content, bone mineral density and body composition, were assessed for the whole body and at standardized regions using dual energy X-ray absorptiometry.

RESULTS: Soccer players exhibited higher BMC for the whole body (1528.4 ± 108.3 vs. 1404.1 ± 50.3) than swimmers (and for all specific regions of the body ($P<0.05$), except the upper limbs where swimmers exhibited higher BMC (195.7 ± 35.2 vs. 191.8 ± 36.7). Soccer players showed significantly higher BMD values for the whole body (+ 6%, $P<0.001$), as well as BMD in the lower back (+ 4.4%, $P=0.001$), trunk (+ 6%, $P<0.001$) and lower limbs (+ 6%, $P<0.001$), (40.2 ± 6.7 vs. 35.5 ± 5.4) and fat mass (20.9 ± 3.5 vs. 18.5 ± 2.8) ($P<0.05$).

CONCLUSIONS: Exercise seems to promote and benefit bone mass gains during growth for specific regions of the skeleton. Soccer has greater impact on specific regions of the pelvis and swimming on the upper limbs.

8

Thermography and heart rate variability in marathon runners as predictors of thermoregulation and risk of malignant hyperthermia

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BACKGROUND: Exertional heat stroke (EHS) is a life-threatening condition common at mass-sporting events and is associated to central nervous system and cardiovascular dysfunction. Autonomic nervous systems modulate thermoregulation during exercise through cardiovascular responses such as increase of cardiac output and peripheral vasodilation.

The aim of this study was to analyze the autonomic nervous system behavior, using heart rate variability

(HRV), and relationship with central temperature and peripheral vascular response (PVR).

METHODS: Twenty-nine (29) male marathoners, 42.14±6.27 years that completed the Marathon in 264.18±41.27 minutes, were evaluated with 15 minutes ECG, for HRV and vascular reactivity test evaluated by digital thermic image, 24 hours before and immediately after marathon.

RESULTS: After marathon, heart rate and low frequency/high frequency relation increased and all parameters of HRV reduced, showing decreasing in HRV. About PVR and temperature, we observed peripheric thermoregulatory responses with increased in 2.5°C than basal. The central temperature increased 3.3%, and maximum value was 37.7 °C, 24.1% of the athletes had a higher temperature than 37 °C. All vascular reactivity variables increased after marathon except time to attained maximal temperature. We found positive correlation between the HRV variables before and thermic variables after marathon, were higher values of HRV was correlated with better vasodilation.

CONCLUSIONS: After marathon a decreased in HRV occurred, showing fatigue and performance decrease. Marathoners with higher HRV indices, higher parasympathetic predominance and more efficient autonomic mechanism showed best vasodilation responses and thermoregulation. Higher decreases in HRV imply in reduced thermoregulation, showing HRV parameters how an important tool to prevent EHS.

9

Screening for adolescent idiopathic scoliosis in pre-participation screening: preliminary results

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BACKGROUND: Aerobics is very popular nowadays. In fact, there are different types of aerobics dancing such as Hi-low impact, Taebo, Hip Hop aerobics, Bench or step aerobics, retro, Latin and the most popular at present, Zumba. However, there are questions that lingers in one's mind; how safe is the exercise dance program; how knowledgeable the instructors of the said fitness dance program are. In the current study, the researcher wants to find out the common injuries suffered by aerobics instructor. The objective of this research is to give suggestions and recommendations to all aerobic dance instructor in order to avoid injuries while performing or teaching aerobics dance.

METHODS: The researcher studied local and foreign settings of the aerobic routine programs. She compared the two settings as to the injuries incurred by the Instructors and found out that both settings have almost the same conclusion or outcome regarding the injuries sustained by aerobics dance instructors. The researcher utilized purposive sampling in the selection of the respondents including 40 male and 60 female instructors teaching Hi-Low impact, Step aero, Taebo, Zumba. Some of the questionnaires were personally delivered while some were sent through e-mail and messenger. Retrieval of the questionnaires did not pose difficulty on the part of the researcher since she is also affiliated with different fitness association.

RESULTS: The study identified that there are 3 types of common injuries suffered by aerobics instructors namely: direct, indirect and overuse injuries which usually take place while performing aerobics. The aerobics instructors "seldom" suffered direct injuries. It also showed that they "often" suffered indirect injuries while "seldom" suffered overused injuries. Since the study showed that there are aerobic dance instructors who still suffered the 3 types of injuries, the researcher formulated recommendations.

CONCLUSIONS: The current study develops strategies and technique in improving aerobic dance routine to lessen or totally eliminate injuries, while performing such activities.

Genetics, Molecular biology and Sport

10

Effect of PHB1 on FOF1-ATPase and mitochondrial function in energy metabolism

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BACKGROUND: In eukaryotic cells, the main biological function of mitochondria are the synthesis of ATP. F₀F₁-ATPase is located on the inner membrane of mitochondria and participates in oxidative phosphorylation and ATP production in electron transport chain. It is closely related to the energy metabolism of the body. Prohibitin1 (PHB1) is a highly conserved protein evolution, widely distributed in various organisms. At present, the effect of PHB1 on F₀F₁-ATPase and mitochondrial function is not clear. The current study investigates the mechanism of PHB1 on FOF1-ATPase and its effect on exercise capacity, and whether PHB1 can be used as a scientific basis for regulating energy metabolism.

METHODS: The rat model of moderate-intensity

exercise and exhaustive exercise and a complete C2C12 cell line culture system, PHB1 overexpression and RNA interference in adenovirus vectors were established. 32 8-week-old healthy male SD rats were randomly divided into three groups: normal control (NC), moderate intensity exercise (MIE) and acute exhaustive exercise (AEE) groups. NC: routinely raised. MIE: Rats were run at 15m/min per day for 60min until the end of the 8th week. Slope: 10%. AEE: The rats were subjected to acute exhaustive exercise after 8 weeks. They were sacrificed 48h after the last experiment. PHB1 expression, ATP content, F₀F₁-ATPase, oxidative stress (ROS), cellular oxygen consumption rate (OCR), and mitochondrial respiratory function (RCR) in skeletal muscle were measured by animal and cell experiments.

RESULTS: Compared with NC, MIE group RCR (+73%, P < 0.001), ATP content (+48%, P < 0.05), F₀F₁-ATPase activity (+79%, P < 0.05), PHB1 expression (+42%, P < 0.01), ROS level (-75%, P < 0.001) decreased; AEE group RCR (-58%, P < 0.05), ATP content (-55%, P < 0.05), F₀F₁-ATPase activity (-56%, P < 0.001), PHB1 expression (-31%, P < 0.01) decreased, and ROS (+79%, P < 0.05) increased. In C2C12 cells, PHB1 overexpression group, ATP content (+86%, p < 0.01), F₀F₁-ATPase mRNA level (+59%, P < 0.05), F₀F₁-ATPase protein expression level (+69%, P < 0.05), F₀F₁-ATPase activity (+226%, P < 0.01), and OCR (+256%, P < 0.01), ROS level (-74%, P < 0.01) indicated significant enhancement of cellular respiratory function. In the low expression group of PHB1, ATP content (-21%, P < 0.01), F₀F₁-ATPase mRNA level (-64%, P < 0.05), F₀F₁-ATPase protein expression level (-89%, P < 0.05), F₀F₁-ATPase activity (-93%, P < 0.01), and OCR (-190%, P < 0.01), ROS production was significantly increased (+104%, P < 0.01), and cellular respiratory function was significantly reduced.

CONCLUSIONS: In energy metabolism, PHB1 may play a role in stabilizing the mitochondrial structure and positively regulating F₀F₁-ATPase activity, thereby enhancing mitochondrial function and promoting energy metabolism.

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Prescription of physical activity - Prevention and treatment of disease

11

The effects of regular tennis participation on musculoskeletal health

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BACKGROUND: The prevalence of musculoskeletal (MSK) conditions is increasing and many physical acti-

vity guidelines fail to combat this. The present study investigated whether regular tennis participation is more effective at enhancing MSK function than meeting the current physical activity guidelines.

METHODS: Ninety (90) participants took part in this Cross-sectional study including 43 tennis players (25 women and 18 men) and 47 nonplayers (26 men and 21 women). MSK function was assessed by cluster analysis of 3 factors:

1) Electromyographic fatigability of prime movers during handgrip, knee extension, and knee flexion;

2) Isometric strength in the aforementioned movements; and

3) Body composition measured by bioelectrical impedance analysis. Maximal oxygen uptake was assessed to characterize cardiorespiratory fitness.

RESULTS: Tennis players displayed greater upper body MSK function than nonplayers when cluster scores of body fat percentage, handgrip strength, and flexor carpi radialis fatigue were compared by covariance analysis, using age as a covariate (tennis players, 0.33±1.93 *vs.* nonplayers, -0.26±1.66; P < 0.05). Tennis players also demonstrated greater lower extremity function in a cluster of body fat percentage, knee extension strength, and rectus femoris fatigue (tennis players, 0.17±1.76 *vs.* nonplayers, -0.16±1.70; P < 0.05).

CONCLUSIONS: The present study revealed improved MSK functionality in tennis players compared to age-matched healthy active nonplayers. This may be due to the hybrid high-intensity interval training nature of tennis. The findings suggest tennis as a viable alternative recommendation to existing physical activity guidelines for promoting MSK health.

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Effects of multimodal exercise and leucine-enriched whey protein on musculoskeletal health in older adults: Liverpool Hope University - Sarcopenia Ageing Trial (LHU-SAT)

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BACKGROUND: Increasing protein intake alone, or in combination with exercise, is suggested as a promising strategy to enhance musculoskeletal health. However, randomized controlled trials are needed to confirm this assertion.

METHODS: One hundred (100) community-dwelling, older adults [69±6 years] were randomized to four [Control (C); Exercise (E); Exercise+Protein (EP); Protein (P)] independent groups. E and EP groups completed 16 weeks of exercise [resistance (2 times/week) and functional (1 time/week)] on non-conse-

cutive days. EP and P groups were also administered a leucine-enriched whey protein supplement (3 times/day) based on body weight (1.5g/kg/day). Muscle mass, strength, and function [short-physical performance battery (SPPB) and six-minute walk test (6MWT)], and myoelectrical muscle fatigue (surface EMG) were measured pre- and post-intervention.

RESULTS: At post-intervention, leg extension (E: +103n; EP: +93n) and flexion (E: +48n; EP: +41n) strength, and scores on the SPPB (E:+0.6 points; EP: +0.6 points) and 6MWT (E: +48m; EP: +55m) improved in E and EP respectively ($P < 0.05$ vs. C), with no further differences between-groups. Likewise, fatigability of the rectus femoris (E: -4.8%/min, $P = 0.007$, $ES = 0.86$; EP: -3.3%/min, $P = 0.045$, $ES = 0.58$) and bicep femoris (E: -3.9%/min, $P < 0.001$, $ES = 1.46$; EP: -4.3%/min, $P < 0.001$, $ES = 1.58$) muscles improved in E and EP groups respectively ($P < 0.05$ versus C).

CONCLUSIONS: Physical exercise is a potent method to enhance musculoskeletal health in older adults. However, leucine-enriched whey protein did not augment this response in those already consuming sufficient quantities of protein at trial enrolment.

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Effects of maximal strength training on bone mineral density in people living with HIV and receiving anti-retroviral therapy: a randomised controlled trial

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BACKGROUND: Anti-retroviral therapy (ART) is associated with low bone mineral density (BMD) among people living with HIV (PLWHIV). Although physical activity is recommended for improving bone health in patients with reduced BMD, data on effects of strength exercises on low BMD among PLWHIV is scarce. The current study aimed to determine the effects of maximal strength training (MST) on BMD among PLWHIV in Blantyre, Malawi.

METHODS: Twenty-six (26) PLWHIV with reduced BMD were randomised into a training group (TG, N.=15) and control (CG, N.=11). The TG underwent 12 weeks of MST, while the CG maintained their usual lifestyle. Measurements of BMD, 1 repetition maximum (1RM), heart rate (HR), maximal oxygen uptake, weight, height and body mass index were obtained before and after the intervention in the TG and CG. Descriptive statistics and Student's *t*-tests were used to analyse data.

RESULTS: At base line, there were no significant differences in age ($P = 0.34$), height ($P = 0.91$), weight

($P = 0.43$) and body mass index ($P = 0.34$) between participants in the TG and the CG. After the intervention, there were significant improvements in lumbar BMD ($P < 0.001$) and HR ($P = 0.03$) in the TG compared to the CG. There were significant improvements in 1RM in both TG and CG ($P < 0.001$).

CONCLUSIONS: MST improves lumbar BMD and strength in PLWHIV receiving ART in Blantyre, Malawi. MST may be used as an alternative therapy for treating reduced BMD in PLWHIV.

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The effect of swimming exercise on an adult patient with attention deficit and hyperactivity disorder (ADHD)

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BACKGROUND: Attention Deficit and Hyperactivity Disorder (ADHD) is a complicated, chronic mental disorder, which is often diagnosed during childhood and develops up to adolescence and adulthood. Certain symptoms characterize the disorder, including inattention, hyperactivity, impulsivity, decreased self-esteem and unstable attitude. Sport and physical activity have been shown to play a major role in the development of cognition, memory, and motor reaction time, especially among ADHD adolescents.

The aim of the current project was to plan and evaluate the effectiveness of an aerobic swimming program on a patient diagnosed with ADHD.

METHODS: The intervention program was performed for 8 weeks, with a training frequency of 3 times per week. The patient was evaluated using the Beck Depression Inventory (BDI), the Barratt Impulsiveness Scale (BIS), and the Hospital Anxiety and Depression Scale (HADS) before, during and after the physical intervention, by self-reporting.

RESULTS: After the eight-week intervention, an important reinforcement of attention, lowering of hyperactivity, impulsive behavior and stress symptoms were observed. All three psychometric tests indicated an improvement of the patient's mental state.

CONCLUSIONS: Taking into consideration the concerns regarding medicals' prescription with adverse side effects for people with ADHD, swimming can be a promising supplementary therapy. However, further studies are needed to understand the association between physical exercise and improved performance in ADHD patients.

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Exercise intervention for prevention of sarcopenia in the elderly

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BACKGROUND: To evaluate the preventive effects of different exercise interventions on sarcopenia in elderly women.

METHODS: Two-hundred and sixty (260) sarcopenia Chinese female subjects (of mean age 61.2 ± 10.1 yrs) were investigated. Forty-eight (48) of them were lost to follow-up. They were randomly divided into Aerobic Exercise (AE) intervention group (N.=75), Resistance Exercise (RE) intervention group (N.=68) and Control group (N.=69). All signed informed consent. Intervention methods: 3 times a week, 60 minutes/per, 12 weeks.

AE: Walking, jogging, swimming, tai chi and aerobics. **RE:** With the help of a chair elastic belt dumbbell for large muscle groups and multi-joint training, respectively by 40%, 50%, 60% 1RM exercise for 4 weeks. Test indicators: Height, Weight, Muscle Mass, Grip Strength (GS), Chair Sit to Stand (STS), Timed Up and Go (TUG).

They were tested before intervention and 12 weeks after training. ANOVA test by using SPSS20.0.

RESULTS:

1) The muscle mass increased by 2.8% in the RE group significantly higher than that in the other two groups ($P < 0.05$).

2) The GS in the RE group increased by 13.1%, higher than that in the other two groups ($P < 0.05$).

3) Compared with the control group, the STS in the AE group and RE group were significantly improved (-18.1% and -15.6%), and the TUG were significantly reduced (1.7% and 11.0%) ($P < 0.05$).

CONCLUSIONS: Exercise intervention has a positive prevention and treatment effect on sarcopenia in elderly women, and can improve muscle mass, muscle strength and physical activity function.

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Effectiveness of supervised and home-based exercises on radiographic and baropodometric parameters, and life quality in idiopathic scoliosis adolescents

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BACKGROUND: Idiopathic Scoliosis is a clinical entity that affects 1-3% of children and adolescents. Although exercise is a common treatment method, there is still need of added knowledge about the effectiveness of different exercises.

The purpose of the current study was to investigate the effects of personalized exercises (PE) on Cobb angle, baropodometric measurements and life quality in adolescents with idiopathic scoliosis.

METHODS: A total of 39 adolescents randomly

divided into two groups as Supervised and Home-based Exercise (SE and HE). Cobb angle was measured, the Scoliosis Research Society-22 (SRS-22) questionnaire was completed and baropodometric analysis was done at the beginning and end of the study. Thirty-three (33) of the participants (mean age: 13.45 ± 1.64) were able to complete the study. SE group received two days of 45 minutes of individualized and supervised exercise and did additional three days of home-based exercises for 3 months. SE focused on correction of the curve and increasing the lumbar-pelvic stabilization. HE group exercised five days a week at home.

RESULTS: In the SE group, the Cobb angle improvement was greater than that in the HE group ($P=0.002$). SRS-22 subtotal scores improved in both groups, but there was no significant difference between groups. Baropodometric analysis showed no significant improvements in groups.

CONCLUSIONS: Regular exercises led significant Cobb angle reduction and life quality increase in adolescents with idiopathic scoliosis. Cobb angle could be reduced even more when the exercise program is individualized and supervised.

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Research on the guidance of exercise prescription to improve the adolescents' spinal health problems

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BACKGROUND: Child spinal deformities is a quite serious entity because of the sedentary behavior that is characterized by screen-dependent learning, entertainment and other sit-in activities, which have become a regular daily behavior pattern for Adolescent idiopathic scoliosis (AIS) that may progress sharply during growth. In order to intervene with spinal deformities, daily behavior pattern management with sport training was to build to promote their spinal health.

METHODS: A cross-sectional study of physical constitution, body composition and bone mineral density (BMD) was conducted to analyze the internal mechanism and external factors by comparing the correlation degree of behavioral patterns, physical health. The adolescents with spinal health problems were selected as intervention subjects, and MTT theory was used to verify the effect of exercise prescription and reliability for the spinal health problems.

RESULTS: Low body mass index (BMI) was a highly effective indicator of the incidence of scoliosis in adolescents. Sedentary time and its static lifestyle were highly correlated with the occurrence and severity of spinal health problems ($R=0.84$). The development of the core muscle groups on both sides of the spine was

correlated with back strength and scoliosis ($R=0.67$), BMD, vital muscle group balance stability and spinal health are not highly correlated, but the effects on cervical, shoulder and back pain caused by scoliosis and its spinal health problems are widespread.

CONCLUSIONS: Sedentary and bad posture habits lifestyle are the main external causes of adolescent spinal health problems. It is suggested that the diurnal behavior activity pattern of teenagers, especially screen-dependent sedentary behavior should be managed and the adolescent spinal health intervention should be concerned more about the everyday behavior pattern.

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A within-subject design study investigating the effect of isometric training on lower limb power output

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BACKGROUND: Isometric training (IST) utilizes isometric contractions, in which the muscle-tendon unit is held at a constant length once activated. IST is used early in the rehabilitation process, aiming to provide analgesia and increase strength. IST at multiple muscle lengths increases strength and explosive strength; however, its transferability to dynamic performance and power development is questionable. The current study aims to investigate the effect of an isometric, home-based exercise program on lower limb power.

METHODS: Sixteen (16) healthy volunteers participated in the current within subject design study. A baseline measurement (BASE), 3 weeks before the intervention start was performed. Participants then followed a 6-week lower limb IST intervention. Their power output was tested before (PRE), in week 3 (MID) and after the intervention (POST) by performing three countermovement jumps on a jump mat.

RESULTS: There was a statistically significant increase in Power (W) between time points PRE and POST (697.64 ± 169.56 vs. 762.71 ± 210.03), and PRE and MID (697.64 ± 169.56 vs. 754.96 ± 202.26). Additionally, a significant increase in % change of power from BASE between PRE and POST ($0.61 \pm 4.28\%$ vs. $9.10 \pm 7.41\%$) and PRE and MID ($0.61 \pm 4.28\%$ vs. $8.16 \pm 6.91\%$) was observed.

CONCLUSIONS: The current study suggests that a home-based IST intervention can be effective in developing lower limb power in healthy adults. Further research should be conducted to confirm that IST can be used as a training tool with multiple objectives; injury prevention, rehabilitation, strength, and power development.

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Online physical activity and nutritional supplementation: effects on strength and functional capacity in chronic kidney disease patients

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BACKGROUND: Chronic kidney disease (CKD) is a pathological condition that induces or aggravates sarcopenia and is characterized by the loss of muscle mass and strength. CKD decreases the physical capacity (PC) and the life quality and increases the cardiovascular mortality. Literature data suggest that regular physical activity (RPA) in combination with dietetic-nutritional treatments is effective to counteract CKD progression and comorbidities.

The current pilot study evaluates the potential beneficial effects of 6-weeks online PA protocol, combined with functional bars supplementation, on strength, PC and CKD progression.

METHODS: Ten (10) CKD patients (of mean age 60 ± 5.1 years) were enrolled and randomized in 2 homogeneous groups for age and gender:

A) RPA protocol combined with functional bars that were analysed for active metabolites and total antioxidant capacity;

B) Only RPA protocol. Muscle strength, PC, body composition and laboratory parameters were evaluated at baseline and after 6 weeks.

RESULTS: Currently, we analyzed preliminary data. Group B showed an increase of muscle strength (handgrip right $+3.5\%$; left $+9.5\%$), body mass index, fat free mass ($+3.1\%$) and a decrease of fat mass (-6.8%), while group A showed an increase of fat mass ($+1.76\%$) and a reduction of fat free mass (-0.76%). In both groups, we observed an increase of estimated-glomerular filtration rate and a reduction of creatinine and, only in the group A, a decrease of azotemia.

CONCLUSIONS: Our preliminary data suggest that the study promises to improve not only the knowledge about the impact of RPA and nutritional therapy on CKD, but also their combined effect.

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Physical activity as a protective factor in arterial stiffness in middle aged female teachers

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BACKGROUND: Generally, stressful work and aging negatively affects health and can increase the risk of cardiovascular diseases. There is a lack of research using objective measures of health in middle aged female teachers. The aim of the present study was to collect data about health status, body composition, blood pressure and arterial stiffness in primary school teachers and analyse the risk and protective factors of their lifestyle. The participants involved were over 35 years of age and had more than 10 years' experience as school teachers.

METHODS: One hundred and two (102) subjects (of mean age 50.55 ± 6.57 years) were recruited from different primary schools using the snowball research method. Data collected included body mass index (BMI) and body composition (BF%), information from a health behaviour questionnaire (regular breakfast, physical activity and smoking) and resting arterial stiffness measured via TensioMed arteriography.

RESULTS: The mean BMI and BF were 26.36 ± 5.12 and 28.81 ± 5.53 in teachers. A frequency of 36% was overweight and 19% was obese. According to the questionnaire, 61% of the teachers ate breakfast regularly and 8% were physically active every day and 19% smoked. Fifteen percent (15%) of the subjects were hypertensive. The mean PWV was 8.62 ± 1.75 m/s and 23% had elevated pulse wave velocity. According to the odds ratio calculations, the less than 5 MVPA per week elevated the risk of arterial stiffness. The regular breakfast and smoking had no effect on PWV.

CONCLUSIONS: Half of the investigated middle-aged teachers already had some health problems. The health-related concepts as regular physical activity and mental health programs for teachers would be essential to prevent chronic cardiovascular diseases.

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Decline in vigorous physical activity in young adults during the second lockdown caused by COVID-19 pandemic: results of cro-pals follow-up study

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BACKGROUND: The current study aimed to explore the difference in physical activity (PA) level between the first and second lockdown due to COVID-19 pandemic in young adults.

METHODS: The study is a part of a follow-up CRO-PALS longitudinal study conducted on young adults (21–23 y.o., N.=57). Analyses for this research are based on data from the first (during March) and the second (during December) wave of COVID-19 related restrictions in 2020. Moderate and vigorous PA (MPA and VPA) were assessed, and MPA to VPA was calculated during both waves. Sign tests were employed to investigate differences in medians for each PA variable between 1st and 2nd wave of restrictions.

RESULTS: Between two lockdowns, change in

VPA was noticeable, where 61.4% adults decreased their VPA while 10.5% of them did not report any change (median difference: -60 min/week, $P=0.012$). However, difference in MPA was not significant although 47.4% of individuals reported a drop in weekly level of MPA (median difference: -30min/week, $P=1.00$). Additionally, MPA to VPA tended to drop, but the difference failed to reach significance (median difference: -26 min/day, $P=0.11$).

CONCLUSIONS: Our findings suggest that adults showed a further decline in PA level during the second lockdown. More specifically, the evident drop in VPA due to rigorous restrictions caused by the COVID-19 pandemic could potentially affect cardiometabolic health in young adults. Therefore, to preserve optimal health status in adults during COVID-19 pandemic, effective PA initiatives and policies should be incorporated on a national and global level.

Wearable and other Technologies in Sports Medicine

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Effectiveness of video instructions and real-time biofeedback in addition to verbal instructions to improve jump and balance performances in active healthy subjects: an assessor-blinded, three-arms, randomized clinical trial

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BACKGROUND: Strategies to learn motor tasks are crucial in Rehabilitation and Sports Medicine. Besides Verbal Instructions (VER), technological methodologies have been proposed, as Video Instructions (VID) and Real-Time biofeedback (RT-bf). The former allows observing a video-modeling execution of motor performances. The latter uses sensors to transmit back to the subject motion details during the execution of a specific task. The current study assesses the effectiveness of these technological methodologies, in addition to VER, on jump and balance performance.

METHODS: Two hundred and sixty-two (262) active healthy subjects (228 male of a mean age 39.5 ± 8.2 years) were randomized in 3 groups: VER, VER+VID and VER+RTbf. All subjects received a VER protocol by a specialized trainer before jump and balance tests (6x-Squat Jumps and Single Leg Stance). After a 5-minutes resting period, tests were repeated.

During rest, VER group received refresh of verbal instructions, VER+VID group watched a video execu-

tion of tests. VER+RT-bf group received no intervention, but a real-time biofeedback was applied during post-intervention assessment: bar graph representation of jump's height and red-dot Center of Pressure (COP) displacement.

RESULTS: Improvement of jump height in VER+RT-bf group [2.3cm (0.9-3.5)] was significantly higher ($P<0.001$) than others [VER: 0.4cm (-0.5-2.05); VER+VID: 0.8 cm (-0.7-2.7)].

VER+RT-bf group showed a reduction of COP displacement [VER+RT-bf: -2.15cm^2 (-17.58-8.78); VER+VID: 0.71cm^2 (-13.08-13.08); VER: -0.31cm^2 (-14.83-13.77)], although not statistically significant.

CONCLUSIONS: The addition of a RT-bf protocol to verbal instructions significantly improves vertical jump performance more than the addition of VID protocol or VER protocol alone.

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Effects of re-warm up practice on heart rate variability during half-time in male professional soccer players

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BACKGROUND: The aim of the current study was to evaluate the heart rate (HR) during resting and after the re-warm up practice in the matches' half-time (HTime) in professional male soccer players.

METHODS: Eighteen (18) different starting line-up players (excluded goalkeepers), playing in the same Greek Superleague 2 team, were assessed in 11 official matches during the 2019/20 season. The Polar GPS Team System Pro recorded the players' HR in the: 5th min and 10th min after the first half completion (passive recovery), in the 14th min (post re-warm up) and in the 15th min of the HTime (start of the second half). The re-warm up practice consisted of a 2 min field-based high-intensity passing game. Repeated measures analyses of variance, along with the Bonferroni test were used for the statistical treatment of this data.

RESULTS: The players' HR was significantly higher after the re-warm up routine compared to the other conditions. Specifically, the players' HR after the HTime re-warm up was recorded as high as 175b.min⁻¹, ($P<0.05$) in relation to their HR at the 5th min (113b.min⁻¹), 10th min (110b.min⁻¹) and 15th min (129b.min⁻¹). Regarding the players HR after the re-warm up routine, the multiple comparisons revealed that the players gradually performed with significantly lower HR during the HTime soccer-specific re-warm up from the 1st to the 11th official match (185b.min⁻¹ vs 174b.min⁻¹, $P<0.05$).

CONCLUSIONS: The current study suggests that the HR measurements during resting and after the re-warm up in the half-time must be taken into account for the evaluation of the professional soccer players' competitive performance.

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Combined physical and hypoxic exercises. A perspective non-medicinal method for increasing the physical working capacity

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BACKGROUND: A promising direction in the development of methods of physiological training for people involved in intense muscle activity is the use of physical exercise in a hypoxic environment, which, due to the synergy effect, accelerates the formation of adaptive changes in the body and, as a result, a rapid increase in physical endurance. The purpose of the study is to increase human physical working capacity through intense muscle training in conditions of normobaric hypoxia created in the normobaric hypoxic chambers (NHC).

METHODS: Twenty-four (24) males were examined [14 people - the main group (MG), 10 people - the control group (CG)] aged from 19 to 23 years. The training programs included 15 cycles of a 3-hour stay of the subjects in NHC. They performed physical activity on an exercise bike and a treadmill. The physical work's assigned power was 70-100 W, duration 120-140 minutes with several breaks. The MG subjects had a reduced (up to 16-17%) oxygen concentration. In the CG was simulated hypoxia conditions where was supplied clean atmospheric air to the complex rooms.

RESULTS: An essential (significant) increase in physical working capacity was observed only at persons with MG, and positive tendency in dynamics of indicators of all used functional tests remained and in the remote period of supervision.

CONCLUSIONS: Consequently, the method based on a rational combination of physical and normobaric hypoxic training in NHC can be an effective and safe means of increasing the physical working capacity of a person engaged in intense muscular activity.

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Impact of visual input on knee stabilizer muscles electromyographic pre-activation in tennis players: a pilot study

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BACKGROUND: Anterior cruciate ligament (ACL) injury frequency is often underrated in tennis players. Pre-activation of the knee stabilizer muscles by surface electromyography (sEMG) analysis has a predictive value in ACL injury risk evaluation.

The current pilot study estimated the role of visual input on thigh muscle pre-activation via sEMG in a population of tennis players.

METHODS: Male adult semi-professional tennis players were recruited from July to August 2020. They were asked to fall with the dominant lower limb from a step, to assess in a knee dynamic valgus stress condition the rectus femoris (RF), vastus medialis, biceps femoris, and medial hamstrings (MH) muscle timing. To highlight the impact of visual inputs, the participants performed the test blindfolded and not blindfolded and subsequently on a clay and grass court.

RESULTS: Twenty (20) semi-professional male players (of mean age 20.3 ± 4.8 years) showed a protective early muscle activation when the subject lacked visual input, but also when faced with a less safe surface such as clay than grass. Regarding the posteromedial- anterolateral relationship (MH/RF ratio), tennis players showed a significant higher MH/RF ratio if blindfolded (22.0% vs. 17.0%; $P < 0.01$) and falling on clay (17.0% vs. 14.0%; $P < 0.01$).

CONCLUSIONS: These findings suggested that the neuro-activation would tend to protect the anterior stress of the knee in tennis players in case of absence of visual input is absent or falling on a surface considered as unsafe. An adequate proprioceptive training should be planned to avoid ACL injuries in tennis players.

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Three and two dimensional foot analysis by digital peltatogram (DPG) in athletes with plantar fat pad atrophy

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BACKGROUND: Plantar fat pad atrophy (PFFA), actually a thinning of the plantar fat under the heel or the metatarsal heads, may be a cause of considerable pain. Predisposing conditions to PFFA include rheumatological disease which affects the foot connective tissues, and conditions that result in abnormal foot and heel pressure, such as diabetes mellitus type-2 and cavus foot. Obesity, frequent use of high-heeled

shoes and corticosteroid injections for foot pain relief may increase the risk. PFFA is especially detected in endurance or longtime runners with hollow feet.

The current study aims to identify potential causes of PFFA by digital peltatogram (DPG) and the subsequent treatment methods in athletes.

METHODS: Seventy-eight (46 female and 32 male) athletes with an age ranging from 15-32 years, were included in the retrospective cohort study. Gait analysis in walking and standing conditions by DPG (MatScan, Tekscan Inc, MA, USA) was applied.

RESULTS: Athletes' medical history was negative for any metabolic disease associated with PFFA, while 12 (6 female and 6 male) athletes reported diabetes mellitus and 3 female athletes reported rheumatoid arthritis in their family history. Five males were diagnosed with heel spur, 9 with hollow feet with metatarsal drop and 5 with plantar fasciitis. Fourteen females were diagnosed with metatarsal drop, 5 with heel spur, 2 with plantar fasciitis and 3 with obesity.

CONCLUSIONS: DPG may offer a valuable help during the PFFA investigation in athletes.

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Postural and gait abnormalities diagnosed by digital peltatogram (DPG) in athletes

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BACKGROUND: Digital peltatogram (DPG) is a contemporary system of dynamic gait analysis. Its working principle is based on special sensors that record the pressure and the gravity center position of the human body during standing and walking.

The current study aims to investigate the options that DPG may offer in the postural and gait abnormalities diagnosis in athletes.

METHODS: Three hundred and sixty-four (212 male and 152 female) athletes with an age ranging from 6 to 35 years were included in this retrospective cohort study. Gait analysis in walking and standing conditions by DPG (MatScan, TekscanInc, MA, USA) was applied.

RESULTS: Abnormalities like valgus, flat and hollow feet, as well as hallux valgus, heel spur, dropped metatarsal head, varus and valgus knees, leg length discrepancy, scoliosis were diagnosed and DPG data were recorded for each one of them. DPG data analysis may be used for the athletic shoes' better design, custom-made anatomical, anti-shock shoe orthotics, and application of limb prosthesis.

CONCLUSIONS: DPG may be used in the diagnosis of postural and gait abnormalities in athletes, but also in the prevention and treatment of these conditions.

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Plantar fasciitis in athletes: the detection by digital pelmatogram (DPG)

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BACKGROUND: Plantar fasciitis is a common cause of foot pain in athletes. At the final stages of the stance phase of the gait cycle, the angle between toes and metatarsals increases, leading to plantar fascia distention and subsequent aseptic inflammation and micro-tears. Predisposing factors are foot pronation, unsuitable shoes during exercise, leg length discrepancy, Achilles tendon shortening, flat feet and claw toe.

The current study aims to identify potential causes of plantar fasciitis by digital pelmatogram (DPG) and the subsequent treatment methods in athletes.

METHODS: Forty-six (46) athletes (age ranging from 16 to 28 years) suffering from plantar fasciitis symptoms were included in this retrospective cohort study. Gait analysis in walking and standing conditions by DPG (MatScan, Tekscan Inc, MA, USA) was applied. The follow-up period was for 6 months.

RESULTS: Hollow foot was diagnosed in 28 (16 male and 12 female) athletes coexistence of hollow foot with heel valgus in 11 (6 male and 5 female) athletes and leg length discrepancy in 7 (4 male and 3 female) athletes. Treatment included custom-made shoe orthotics according to the DPG analysis, non-steroidal anti-inflammatory drugs and shock-wave foot physiotherapy. Symptom improvement and return to normal exercise was achieved for all of them.

CONCLUSIONS: Plantar fasciitis can be a disabling condition for athletes. DPG can effectively assist the diagnosis and subsequent treatment and follow-up.

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Medial tibial stress syndrome investigated by digital pelmatogram (DPG) in athletes

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BACKGROUND: Medial Tibial Stress (MTSS) or Shin-Splint Syndrome is a clinical condition defined as exercise-induced pain along the posteromedial (distal third) tibial border caused by repetitive loading stress during running and jumping. It usually appears in athletes changing training level, ground morphology or quality, or shoe type. Predisposing factors are valgus and flat feet, valgus knees and out-toeing.

The current study aims to identify MTSS potential causes by DPG and the subsequent treatment methods in athletes.

METHODS: Fifty-three (53) athletes (with an age ranging from 16 to 28 years) suffering from MTSS symptoms were included in this retrospective cohort study. Gait analysis in walking and standing conditions by DPG digital (MatScan, TekscanInc, MA, USA) was applied. The follow-up period was for 4 months.

RESULTS: Valgus and flat feet with valgus knees were diagnosed in 26 (17 male and 9 female) athletes, valgus feet with valgus knees in 16 (6 male and 10 female) athletes and valgus feet with valgus knees and out-toeing in 11 (4 male and 7 female) athletes. The main clinical finding was tenderness during palpation on the tibia anterior surface and pain recurrence during exercise initiation. Treatment included exercise avoidance, non-steroidal anti-inflammatory drugs and custom-made anti-shock shoe orthotics according to the DPG analysis. All athletes returned to their previous level of activity in 2-4 months without symptom recurrence.

CONCLUSIONS: MTSS can be a disabling condition for athletes. DPG can effectively assist the diagnosis and subsequent treatment and follow-up.

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Implementation of wearable technologies at the Tokyo Olympics

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BACKGROUND: Real-time data-tracking technologies designed to integrate several sensors and real-time monitoring a spectrum of biomechanical-physiological variables are reality. This is possible due to the use of a cloud-based ecosystem (CBE), allowing novel telemedicine strategies being implemented during sporting events conducted in challenging environments (*i.e.*, heat).

The current research aims to evaluate the early signs of exertional heat stress (EHS) in athletes at Tokyo 2020, using a combination of thermoregulatory-cardiovascular-biomechanical-performance metrics. Materials and Preliminary Findings Athletes participating in the Tokyo Olympics will be recruited, focusing on race walking (20/50 km), marathon, triathlon, road cycling and mountain biking.

METHODS: The following variables will be measured and live transmitted during events, utilizing wearables/sensors connected to CBE. Foot-mechanics and heart rate (HR) will be measured, using foot-worn inertial sensors (GaitUp, Switzerland) and wireless HR monitor (Polar, Finland), respectively. Core body and skin temperature will be assessed via a miniaturized "pill" device and prototype skin sensor (BodyCap, France). Real-time monitoring will be achieved via a smart watch (TicWatch Pro3, Hong Kong) with an eSIM connected to our CBE. Technologies, CBE and metrics successfully validated across pilot tests and real events. Particularly, during a >2.5 hour with three wearables connected and real-time transmission to the cloud, battery at the conclusion was >50%.

RESULTS AND CONCLUSIONS: This technological implementation will help characterize athletes' physiological and EHS during Tokyo 2020 competitions and determine the future management of athletes during medical emergencies by more timely diagnosis. The implementation of such applications would be particularly welcome in the field of medicine and workplace.

Nutrition and metabolism in sports

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Effects of low-fat diet with different exercise interventions on lipid metabolism in skeletal muscle

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BACKGROUND: To determine the effect of low-fat diet with different exercise interventions on the expression of lipid metabolism proteins in skeletal muscle of obese mice.

METHODS: Forty-five (45) nutritional obese male C57BL/6J mice were divided into three groups: low-fat diet group (LFD), low-fat diet combined with high-intensity interval training group (LH) and low-fat diet combined with moderate-intensity continuous training group (LM). Exercise was performed on the treadmill without slope, 6 days a week, 1 hour a day. During the 5-week exercise intervention, the running speed increased gradually. The energy composition of low-fat diet was: protein 10%, fat 10%, carbohydrate 80%.

Western blot was used to detect the protein contents of pAMPK α , AMPK α (Thr172), PGC-1 α , PPAR α and CPT-1 in skeletal muscle. One-way ANOVA was used for the data analysis.

RESULTS: Compared with LFD group, the expression of pAMPK α /AMPK α ratio, PGC-1 α PPAR α CPT-1 protein in LH group increased significantly ($P < .05$), the expression of pAMPK α /AMPK α ratio PGC-1 α protein in LM group increased significantly ($P < .05$). Compared with LM group, the expression of pAMPK α /AMPK α ratio and PPAR α CPT-1 protein in LH group increased significantly ($P < .05$).

CONCLUSIONS: Low-fat diet combined with exercise was more effective than low-fat diet alone in enhancing the lipid metabolism of skeletal muscle. Compared with LM, LH is more effective in enhancing the lipid metabolism level of skeletal muscle in mice, mainly through AMPK-PGC-1 α -PPAR α mediated lipid metabolism pathway.

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Characteristic of different loads on oxygen consumption of walking uphill

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BACKGROUND: To study the characteristic of oxygen consumption when walking uphill under different load conditions.

METHODS: Ten (10) male subjects were selected. Age range: 23-26 years old; height: 176.6 \pm 5.0 cm; weight: 71 \pm 8.3 kg. The load weight is no load, 15kg and 30 kg respectively. The load was in the form of weight-bearing vests, the test was carried out on a treadmill with a walking speed of 4km/h, the angle of the treadmill is 0,8 and 10 degrees. The oxygen consumption VO₂ were collected by the Cortex MetaLayer 3b. SPSS 22.0 was used to process the analysis data, and nonparametric test was used to compare the differences of each index under different load.

RESULTS: When walking on flat ground, VO₂ (ml/min/kg): load 0 kg: 14.3 \pm 1.4; 15 kg: 15.9 \pm 1.6*; 30 kg: 18.7 \pm 1.8**. "*" indicates that compared with the previous load, $P < 0.05$, "**" means $P < 0.01$.

At 8° uphill, VO₂ (ml/min/kg): load 0 kg: 27.8 \pm 2.4; 15 kg: 30.0 \pm 6.4; 30 kg: 34.7 \pm 6.2.

At 10° uphill, VO₂ (ml/min/kg): load 0 kg: 31.4 \pm 2.1; 15 kg: 36.2 \pm 5.1**; 30 kg: 40.0 \pm 4.5.

There was no significant difference in VO₂ between 8° and 10° walking with 30kg load, but there was significant difference in VO₂ between different angles under other loads.

CONCLUSIONS:

1) The oxygen consumption increased with the increase of slope and load, but the effect of slope on oxygen consumption was more obvious.

2) When walking uphill, the influence of medium and high load on oxygen consumption is similar.

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Over-hydration and associated muscle damage may explain acute kidney injury from marathon running in the biomarkers after sporting incapacitation study (BASIS)

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BACKGROUND: To investigate relationships between fluid regulatory strain and renal injury in participants of the Brighton Marathon.

METHODS: Seventy-nine (79) volunteers underwent blood sampling at rested baseline (B) and upon successful marathon completion (T0), with 18 additionally sampled next-days (T24). Body mass (BM) and total body water (TBW) were estimated by bio-electrical impedance. Samples were analyzed for markers of fluid regulatory strain (Na⁺; copeptin) and renal injury (creatinine; neutrophil gelatinase associated lipocalin, NGAL; kidney-injury molecule-I, KIM-1), plus creatine kinase (CK). Runners were categorized as Acute Kidney Injury (AKI, rise in sCr at T0 or T24 $\geq 26.4 \mu\text{mol.L}^{-1}$) or nAKI (rise $<26.4 \mu\text{mol.L}^{-1}$).

RESULTS: At T0, ΔBM was -1.75 ($P<0.0001$, 95% C.I. -2.10 to -1.38) kg, but TBW was unchanged ($P=0.5308$). All biomarkers increased B to T0 ($P<0.01$), with KIM-1 and CK increasing further at T24. AKI affected 58 % of runners. *Versus* nAKI, AKI runners demonstrated increased TBW (main effect $F=4.38$, $P=0.0409$), tendency to greater muscle mass (main effect $F=3.55$, $P=0.0649$) and significant elevations in T0 copeptin and NGAL, but no difference in BM. At T0, correlations existed for copeptin with sNa ($r=0.45$, $P<0.0001$) and CK ($r=-0.27$, $P=0.0109$), for NGAL with Δ creatinine ($r=0.36$, $P=0.0013$) and for CK with next-day (T24) KIM-1 CK ($r=0.55$, $P=0.0175$).

CONCLUSIONS: Renal stress from marathon running did not associate with diminished TBW or next-day injury risk. Greater body water in AKI and relationships between copeptin/CK and CK/KIM-1 support a role for over-hydration and associated muscle damage in marathon-related AKI.

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Iron deficiency among young football players in Slovenia

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BACKGROUND: Young athletes are at risk of iron deficiency because of increased iron needs that correspond with growth, onset of menses in female athletes

and alterations to dietary intake. The objective of this study was to describe prevalence of iron deficiency among young football players and compare it among different age groups.

METHODS: There were 347 male football players less than 19 years old included in the study. They were divided into three age groups. The cutoff value for iron deficiency was defined as ferritin <30 mcg/L. Three stages of iron deficiency were defined. To evaluate the differences between different groups of athletes Pearson chi-squared test was used. $P<0.05$ was considered statistically significant.

RESULTS: Almost one fifth of athletes (17,6 %) had iron deficiency. Most of them had stage 1 iron deficiency (low ferritin levels). Only three football players had stage 2 iron deficiency (low ferritin levels and erythrocyte markers (MCV and/or MCH)) and only one athlete had stage 3 iron deficiency (iron deficiency anemia). One athlete had dilutional pseudoanemia with normal iron stores and erythrocyte markers. Prevalence of iron deficiency was lower among oldest football players compared to middle-aged ($P<0,001$) and the youngest athletes ($P=0,013$). There was not any significant difference between the youngest and middle-aged athletes ($P=0,429$).

CONCLUSIONS: Early recognition of iron deficiency is crucial because depleted iron stores have negative impact on health, well-being and performance before iron deficiency anemia occurs.

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Disordered eating, body image disturbances and mindfulness in eating in elite synchronised swimmers

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BACKGROUND: This study sought to investigate the level of disordered eating (DE) and body dysmorphia in elite synchronized swimmers in the UK and its association with mood disturbances and mindfulness in eating.

METHODS: Thirty-nine female elite synchronized swimmers (age 17.22 ± 2.70 years, body mass 55.96 ± 6.06 kg) and 49 non-athletes (age 21.80 ± 4.49 years, body mass 67.17 ± 14.00 kg) participated in this study. Participants completed the mindful eating questionnaire, the eating attitudes test (EAT-26), the body image concern inventory and the profile of mood states.

RESULTS: Athletes demonstrated a higher prevalence of DE by 19% compared to non-athletes, despite the lack of significant differences in the DE score ($P>0.05$). Although no significant differences were found in the total mood disturbance (TMD) and body image concern (BICI) scores between groups, athletes exhibited a higher prevalence of BICI and a

lower prevalence of TMD ($P>0.05$). A higher mindful eating score in the disinhibition subscale and a lower score in the external subscale was found in athletes ($P<0.05$). Moreover, there was an inverse relationship between the mindful eating disinhibition and distraction subscale with dieting, bulimia and oral control ($P<0.05$) with mindful eating and BICI being significant predictors of bulimia, explaining 30% of its variance in athletes.

CONCLUSIONS: Synchronized swimmers exhibit similar levels of mindful eating compared to non-athletic females, with differences noted only in the disinhibition and external subscales. The level of mindful eating and body dissatisfaction appear to play a determining role in DE in this high-risk population.

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Iron deficiency in professional athletes: modern advancements in management and treatment

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BACKGROUND: Iron deficiency has long impacted professional and recreational athletes, consistently more frequently than their sedentary counterparts. Management of iron status is of unique importance, since it influences oxygen transportation to the exercising muscle, its oxidative and mitochondrial function, impacting performance directly.

This paper aims to collect the up-to-date data on pathophysiology, management and treatment, as well as evaluating the importance of hepcidin in iron circulation.

METHODS: Using the keywords "iron deficiency athletes" on PubMed search engine, 551 results came back. After abstract review, 101 papers were relative with the topic. Their study provided 9 more papers as references.

RESULTS: Cut-off values may differ across the world, however it is generally accepted that iron deficiency can be classified in three categories: iron depletion, iron-deficient erythropoiesis, and iron-deficient anaemia. Approximately 27% of sportspeople are iron-deficient, while 6-8% are anaemic, with high-endurance sports appearing as a risk factor. Gastrointestinal microbleeding, microscopic haematuria, sweating, nutrition and menstrual bleeding have long been attributed as main causes for iron stores depletion in athletes. Nevertheless, the hepcidin regulation is surfacing as a main factor in regulating iron bioavailability. The upregulation of interleukin-6 during exercise increases hepatic hepcidin production, subsequently reducing iron absorption.

CONCLUSIONS: While dietary iron intake is still the initial treatment intervention, followed by iron supplements of 100mg daily, the regulation of hepci-

din emerges as an important factor. Minimum dosage can protect from possible side effects, while maximizing iron bioavailability. Further research is needed to better organize modern and up-to-date supplementation and treatment protocols.

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Novel molecules regulating energy homeostasis in sport physiology

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BACKGROUND: Proper food intake is an important issue in sport physiology. Some sports need strict weight control, regarding sport categories, some need weight control for better sport achievements, and all sports need well balanced food intake to keep appropriate weight and body composition, managing healthy sport life. Thus, to reveal the possible mechanisms of weight balance in sport provokes much interest regarding appetite regulating some new molecules such as Leptin, Ghrelin, Peptide Tyrosine-Tyrosine (PYY), Amylin and the last novel one, Irisin.

METHODS: The last decade literature of scientific articles ($N.=57$) was taken to reveal energy homeostasis mechanisms. Systematic reviews of randomised controlled trials for each molecule regulating energy homeostasis, according to Cochrane database literature were included and analyzed.

RESULTS: Released from the fat tissue, Leptin sends signals to hypothalamus, inhibiting the hunger. Leptin increases when fat increases. Excess fat cells produce leptin to lower the appetite and body uses own fat stores, diminishing adipocytes fat storage. In obesity, Leptin resistance is possible. Peptide Ghrelin, from gastrointestinal system, regulates appetite while empty stomach, acting on hypothalamus to increase hunger, gastric secretion and gastrointestinal motility, preparing for food intake. Ghrelin has opposite effect of Leptin with competitive ability to same brain receptors. Ananorexigenic PYY produced by distal gut, suppresses energy intake. After meal, it increases, but dieting decreases its level. Amylin, linked to insulin is increased in obesity, but decreases after weight loss, having synergistic effect with Leptin, causing negative energy balance. Irisin is a novel myokine, derived from skeletal muscle while exercise, positively correlates with obesity, but without change while dieting.

CONCLUSIONS: According to mechanisms of action, diet-induced weight loss decreases molecules concentrations, except for Ghrelin and Irisin. A high fat/protein diet increases PYY level; a high carbohydrate diet increases Amylin but lowers Ghrelin level. These molecules are more investigated on experimental animals, thus to elucidate energy homeostasis regulation in humans, further studies are needed.

Doping and antidoping

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Efficiency in conducting of anti-doping controls in Serbia

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BACKGROUND: Anti-doping Agency of Serbia (ADAS) was established in 2005. From the beginning, on national level, ADAS performed 6825 doping controls (DCs) and 90 adverse analytical findings (AAF) have been found. Purpose of this study is to determine efficiency of performed DCs in different sports.

METHODS: Inclusion criteria were that at least 50 DCs were performed in the sport in last 10 years on national level. In total, there were 5324 DCs and 52 AAF in 27 different sports. For each sport and year efficiency score (e-score) was calculated as ratio of AAF number and total number of DCs performed.

RESULTS: Results of ANOVA showed significant difference of e-score between types of sports ($P < .001$). If we compare the whole sample e-score, it can be seen that team sports have an e-score close to it, the individual significantly higher and the both individual and team sports significantly lower. Based on Bonferroni post-hoc test, significant difference exists between individual sport with e-score of 0.04111 and both individual and team sports with e-score of 0.00233. Statistically significant difference exists between bodybuilding (e-score=0.178571) and boxing (e-score=0.09090) in comparison to other sports.

CONCLUSIONS: Our results show that in the future ADAS should take in account e-score in assessment of the chances of observing positive results in each individual sport. Also, e-score should be considered when risk assessment is measured for type of sport, individual, team and both team and individual

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The effect of anabolic androgenic steroids doping on the endocrine system

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BACKGROUND: The usage of anabolic androgenic steroids (AAS) as a doping method emerged in the 1960s, aiming to improve professional athletes' performance. Despite anti-doping measures, detailed side-effect documentation and regulation, they remain popular, especially amongst recreational athletes and competitive bodybuilders.

This review aims to study the prevalence of AAS

usage, as well as its specific effects on the endocrine system.

METHODS: Using the keywords "anabolic androgenic steroids athletes endocrine" on PubMed search engine, 362 results came back. After abstract review, 51 papers were relative with the topic. Their study provided 8 more papers as references.

RESULTS: AAS doping is more popular in men than women, while over 20% of fitness-centre athletes report current or past AAS usage. AAS doping has an effect on the hypothalamus-hypophysis-gonads axis, suppressing gonadotropin-releasing hormone production, subsequently reducing testosterone, luteinizing hormone and follicle-stimulating hormone production. Furthermore, AAS administration could possibly hinder thyroid function, as higher thyroid-stimulating hormone and lower thyroxine values were observed in recent studies. Higher corticosterone and lower adrenocorticotropic hormone concentrations were also observed, alongside an increased insulin resistance in AAS users. Finally, damage caused in hormonal-secreting brain regions could justify aggressiveness and generalized anxiety disorder.

CONCLUSIONS: While AAS effects on gonadotropins have been extensively studied, there is further need for research of their effect on other aspects of the endocrine system, given their widespread use. Professionals of sports medicine should have a detailed and thorough knowledge on the side effects of AAS doping, as well as their potential reversibility.

Sports supplements

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The prevalence of nutritional supplements use among elite and amateur greek athletes: a cross-sectional study performed in 1518 athletes

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BACKGROUND: Nutritional supplements are widely used, as quick means of nutritional support and performance enhancement. Aim of this study was to estimate the prevalence of nutritional supplements' use among Greek athletes.

METHODS: Participants were older than 12 years old, actively performing an Olympic sport for at least one year before their enrollment in the study. A 5 part questionnaire was distributed. Athletes were categorized as "elite" (national and/or international level) and

“amateur”, and as “minors” (age <18 years old) and “adults”, further divided into 4 groups (18-24, 25-30, 31-39, and >40 years-old).

RESULTS: 1518 athletes (mean age 21.8 years) from 27 different sports participated in the study. 613 were categorized as “elite” (40.4%). The overall prevalence of supplements’ use was 64.9% (“minors”: 49.3%), (“elite”: 75%, Chi square test, $P<0.001$). The percentage of athletes consuming nutritional supplements was greater in individual sports (Chi square test, $P<0.001$). The mean number of supplements used was 4.14 (range 1-25). The older the athletes, the greater the prevalence (Kendall’s tau=0.27, $P<0.001$) and the more supplements consumed (Kendall’s tau=0.29, $P<0.001$). Energy drinks were the most popular, consumed by 30.9% of all athletes and 47.7% of supplement users. Energy increase was the commonest use rationale (80.8%), followed by nutritional enhancement (68.2%) and performance improvement (48.2%).

CONCLUSIONS: Male, older, “elite” and individual sports’ athletes, used supplements more frequently and in greater amount. Considering that improper supplement use may be more harmful than beneficial, those providing supplements to athletes, should act following international guidelines.

Sports injuries: prevention, rehabilitation and return to play

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Single-leg neuromuscular function of elite athletes prior to returning to sports after lower-limb injuries

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BACKGROUND: A recent review suggested that the muscle function tests for injured athletes that are commonly used are not demanding enough or not sensitive enough to identify differences between injured and non-injured limbs. In this regard, few studies have examined the neuromuscular function of the injured athletes using single-leg tests.

As such, the purpose of the current study was to assess the single-leg strength and power function of injured elite athletes prior to returning to sports.

METHODS: Sixteen (16) elite athletes with lower limb injury who attended the Sports Medicine and Rehabilitation Clinic at the National Sports Institute of Malaysia from 2017 to 2018 were recruited to partici-

te in the study. Upon completion of the rehabilitation program, and prior to returning to sports, the athletes performed the isometric single-leg press strength test and single-leg drop jump test from a 24cm platform. Another 34 non-injured elite athletes were recruited as control and went through similar tests. The mean of the absolute differences in strength and drop jump power measures between the injured *vs.* the non-injured leg were compared against that of the right *vs.* left leg of the control group.

RESULTS: The absolute differences in mean force and jump height (from the 24cm single-leg drop jump test) between the 2 legs of the injured athletes were significantly higher than that of the non-injured athletes ($P=0.002$ and $P=0.006$, respectively). However, the absolute differences in single-leg rate of force development, contact time, reactive strength index and isometric single-leg press strength between the 2 legs of both groups of subjects were not significantly different.

CONCLUSIONS: The current findings indicate that the 24cm single-leg drop jump test may serve as a sensitive qualifying assessment for elite athletes prior to returning to sport after lower limb injuries.

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Osteoporosis after anterior cruciate ligament reconstruction

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BACKGROUND: Increased osteoporosis after anterior cruciate ligament reconstruction (ACLR) should be considered a factor for return to play.

METHODS: One hundred and fifty-six (156) patients were examined for bone mineral density (BMD) loss after ACL reconstruction.

RESULTS: A bone loss of 14%-21% in the knee region in the affected extremity 1 year after ACL reconstruction. In a conservatively treated group (complete or partial ACL tears), a small yet significant bone loss in the patella (3%) and proximal tibia (2%) on the affected side was found. A bone loss of approximately 17% in both calcanei 2 years after ACL reconstruction using the arthroscopic technique, bone-patellar tendon-bone (BPTB) grafts, and aggressive rehabilitation was found as well. A bone mineral density (BMD) reduction was also measured in the calcanei 5 years after ACL reconstruction using hamstring tendon autografts. The reduction for the females and males was 10% and 7% respectively. The reduction in the hip region was 3%-4%. The patients underwent surgery 1 year after ACL injury, and by that time they had a low activity level.

CONCLUSIONS: BMD loss in an ACLR procedure should be taken under consideration for the rehabilitation program of every patient and considered in the return to play time.

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Patients with better psychological readiness to return to sport have better knee neuromuscular control during single leg hop landing after anterior cruciate ligament reconstruction

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BACKGROUND: Better psychological readiness to return to sport (RTS) measured by Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI) scale has been shown to be associated with successful RTS after ACL reconstruction. However, the relationship between psychological readiness and neuromuscular recovery remains unclear. This study aims to compare neuromuscular function between patients with higher ACL-RSI scores and those with lower scores.

METHODS: Sixteen male pivoting sport players (mean age: 25.13 ± 4.13) with unilateral ACL reconstruction 7 with higher (≥ 90) ACL-RSI scores vs. 9 with lower (≤ 75) ACL-RSI scores, mean post-operative: (10.56 ± 2.48 months) were included. Quadriceps and hamstring function was evaluated by isokinetic muscle strength tests at $60^\circ/s$ and $180^\circ/s$ and the single leg hop (SLH) test. During the landing phase of SLH test, knee biomechanics was captured by the 3D motion analysis system (VICON) and muscle activity of vastus medialis (VM), vastus lateralis (VL), semimembranosus (SM) and biceps femoris (BF) was evaluated by the electromyography (EMG).

RESULTS: Patients with higher ACL-RSI scores demonstrated increased maximum knee flexion angle (57.73 ± 5.61 vs. 41.14 ± 4.12 , $P=0.012$), greater limb symmetry index (LSI) in maximum knee valgus (1.44 ± 0.41 vs. 0.50 ± 0.10 , $P=0.026$) and increased LSI in VL EMG activity (1.38 ± 0.44 vs. 0.51 ± 0.10 , $P=0.045$) during landing when compared to those with lower ACL-RSI scores. No significant difference was found in isokinetic muscle strength measures between groups ($P>0.05$).

CONCLUSIONS: Our study showed that patients with better psychological readiness for RTS have better knee neuromuscular control during single leg hop landing at the time for sport return. Interventions aimed at improving psychological states after ACL reconstruction warrant further investigation.

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Relationship between quadriceps strength asymmetry and gait asymmetry in individuals after anterior cruciate ligament reconstruction

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BACKGROUND: Lower extremity movement asymmetries may contribute to re-injury and knee osteoarthritis after anterior cruciate ligament (ACL) reconstruction surgery. This study aimed at examining knee movement asymmetry during walking and the relationship between knee movement asymmetry and isometric quadriceps strength asymmetry in individuals with ACL reconstruction.

METHODS: Kinematic and kinetic data for 24 males with unilateral ACL reconstruction were synchronously collected. Isometric quadriceps strength with knee flexed at 60° was assessed using an isokinetic dynamometer during a maximum voluntary isometric contraction. The inter-leg difference and coefficient of multiple correlations of the knee biomechanics and the quadriceps strength symmetry index between injured and uninjured legs were calculated to investigate side-to-side symmetry.

RESULTS: The isometric quadriceps strength of the injured leg was significantly lower than that of the uninjured leg ($P<0.001$). Knee flexion angles and knee extension moments were smaller in the injured leg than that in the uninjured leg during both loading response ($P=0.007$, $P=0.047$) and mid-stance phases ($P=0.005$, $P=0.028$). Isometric quadriceps strength asymmetry was significantly correlated with asymmetry in the peak knee flexion angle during loading response and mid-stance phases. Isometric quadriceps strength asymmetry was also significantly correlated with asymmetry in the peak knee extension moment during the mid-stance phase.

CONCLUSIONS: Individuals after ACL reconstruction demonstrate knee movement asymmetries in the sagittal plane. Quadriceps strength asymmetry is correlated with asymmetry in knee flexion angle during the early stance phase and knee extension moment during the mid-stance phase.

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Higher anger-inside scores correlate with overuse sports injuries: a preliminary cross-sectional study

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BACKGROUND: Sports injury is a complex phenomenon and growing evidence shows that psychosocial factors play an important role and the question whether these factors can be used in risk assessment is an intriguing area of research because psychosocial or psychotherapeutic interventions can be used to decrease the rate of sports injury.

We aimed to investigate if there is a relationship between anger expression or impulsivity and the sports branches or features of sports injury (mechanism, type, grade, etc).

METHODS: We included 138 patients presented

to the outpatient clinic. The patients were physically examined and injury features were noted. Trait Anger- Anger Expression Scale and Barratt Impulsivity Scale-11 were applied. The statistical analysis was done using SPSS 20. Sports branches were categorized as team/individual, strength/endurance/both, contact/non-contact; injury types were categorized as acute/overuse, contact/non-contact. Independent samples *t*-test, Pearson's correlation and one-way ANOVA were used for statistical analyses.

RESULTS: We found a significant correlation between team sports and non-planning factor of impulsivity ($P=0.010$); overuse injuries and anger-inside factor of anger expression ($P=0.034$); annual injury rate and weekly exercise time ($P=0.001$).

CONCLUSIONS: Our study showed that the psychosocial factors can affect sports injuries. It can be interpreted that athletes directing their anger inside are more prone to overuse injuries and being a team member could make athletes behave in an unplanned way. We think psychosocial factors and psychotherapeutic interventions might be considered in the prevention of sports injuries.

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Incidence and types of injuries of legs, clinical torsion profile and isokinetic characteristics of knees and ankles in young female handball players

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BACKGROUND: The red light is activated according with the injuries in handball. At the last summer Olympic Games in Rio, handball was on the second place by the rate and incidence of injuries. Prevention of the injuries, especially in women handball players, is a serious challenge. The present study records the incidence and type of legs' injuries, clinical torsion profile and isokinetic characteristics of ankles and knees of young male handball players.

METHODS: 68 female handball players participated in this study (17.61 ± 2.07 y). During a year, at January and August, we made an isokinetic testing of both ankles (plantar and dorsal flexion) and knees (flexion and extension), evaluating follow parameters: Peak TQ (N-M), Peak TQ/BW (%), Max Rep Tot work (J), Avg Power (Watts), Acceleration and deceleration time (msec), Ag/Ant (%) and ROM (deg). We measured lengths of both legs (cm), angle of torsion with pediscolimeter (deg) and, with an angle measurement tool, we measured: internal and external rotation of right and left hip (deg), Q angle (deg), tight foot angle (deg) and foot progression angle (deg) of both legs. We noticed the incidence and types of injuries of legs (per/1000h training session and competition, rest days without training). We used descriptive statistics, *t*-test and correlations ($P < 0.05$).

RESULTS: 25% from all female (18% overuse, 82% traumatic) handball players had injury of lower extremities. There were 30.67 injuries/1000 hours of training/competition, with 9.82 hours absence of training/competition. 35% of all injuries of lower extremities were distortions of art. talocruralis, mainly right one, and 17% meniscal injuries. Tight foot angle of right leg was significantly increased (7.65 ± 5.06 to 11.38 ± 5.96). Acceleration time in flexion of right (41.76 ± 11.99 to 35.29 ± 13.33 msec) and left knee (45 ± 13.55 to 37.35 ± 7.39 msec) and range of motion (ROM) of the right knee were significantly decreased. There was significantly negative correlation between tight foot angle of right knee and acceleration time in flexion of left leg.

CONCLUSIONS: Incidence of injuries of legs in our study was lower than European one, with higher incidence of overuse injuries. Significantly decreased acceleration time in flexion and ROM of right knee, accordingly with negative correlation of tight foot angle of right knee with acceleration time of flexion of left knee were maybe one of the reasons connected with incidence of injuries of legs in this group.

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Adding a structured educational session to the rehabilitation program of soccer players following anterior cruciate ligament reconstruction: a feasibility study

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BACKGROUND: To date, nothing was done to examine the effectiveness of adding a structured educational session to the rehabilitation program of soccer players post anterior cruciate ligament reconstruction (ACLR). This research aimed to determine the feasibility and acceptability of conducting a randomized controlled trial (RCT) examining this.

METHODS: A feasibility RCT was conducted in collaboration with the largest sport rehabilitation center in Riyadh. Professional and amateur soccer players undergoing ACLR rehabilitation were invited to participate and they were randomized into two groups; usual care plus a structured educational session (intervention group) or usual care alone (control group). This feasibility study included three indicators related to recruitment number, acceptability of the intervention and randomization, and retention rate. Regarding the secondary objectives, an independent samples *t*-test was conducted to compare between the mean differences of the intervention and the control group in the used outcome measures: Tampa scale for Kinesiophobia-17 (TSK-17), ACL return to sport after injury (ACL-RSI), and the International Knee Documentation Committee (IKDC) for knee function.

RESULTS: Overall, 36 players were screened over

the one-day recruitment period. All of the 36 satisfied the inclusion criteria. One participant (2.7%) did not wish to participate, and most of the participants reported that the intervention and randomization were acceptable. Of those, 30 (85.7%) players completed the study and five (14.3%) more players declined to participate for the second follow-up. Regarding the secondary objectives, there were significant mean differences in both the TSK-17 ($P=0.026$) and for the ACLRSI ($P=0.009$) in favor of the intervention group. No significant difference was found between the groups in the IKDC ($P>0.05$).

CONCLUSIONS: The findings of this feasibility study indicate that conducting an RCT examining the effectiveness of adding a structured educational session to the rehabilitation program for soccer players post ACLR is feasible and acceptable. However, a number of factors need to be considered before conducting the full-scale RCT; longer follow-up time, more recruiting centers in multiple cities to have larger samples and diverse groups. Besides, more than one educational session would be preferable.

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Strength deficits and optimal time for return to play in acl reconstruction with hamstrings' autografts: a prospective, randomized, comparative study between suspensory and expandable anatomical femoral fixation

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BACKGROUND: The aim of the study was to evaluate strength and functional capacity after anterior cruciate ligament reconstruction with hamstring tendons using two different anatomical femoral fixation techniques.

METHODS: Forty-eight (48) male patients with ACL rupture were block randomized to the expandable or suspensory femoral fixation group. The primary outcome measures were functional and strength capabilities (Hamstrings/Quadriceps ratio) at 60°/s and 180°/s by use of a Cybex before and at 6, 9, 12 and 24 months after surgery. Secondary measurements were anteroposterior knee stability at 2 years' (KT-1000), the degree of tunnels' widening (CT scan preoperatively and at one year) and functional outcome using IKDC 2000, Lysholm score and Tegner activity scale at 3,6,12, and 24 months post-surgery. Comparison of data was performed by use of a paired *t*-test and analysis of variance, with a $P<0.05$ level of significance.

RESULTS: The mean preoperative (60-60) H/Q was -16.99 ± 20.97 and -11.23 ± 19.32 for the suspensory and expandable group in respect ($P=0.328$) whereas the (180-180) H/Q was -3.13 ± 17.18 vs. -10.51 ± 19.79 ($p=0.174$). Postoperatively, at 3 and 6 months the deficits increased substantially. Two years later, the mean (60-60) H/Q values were -19.06 vs. -12.3 ($P=0.013$)

and the (180-180) H/Q values -10.63 vs. 0 ($P=0.119$). The estimated Tegner level before ACL injury was 7.96 ± 1.43 for the suspensory vs. 7.79 ± 1.61 for the expandable group without any statistical difference with the H/Q ratio at 12 and 24 months ($P=0.743$).

CONCLUSIONS: There were no significant differences in the strength deficits between groups but return to play was still doubtful at one year postoperatively.

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Treatment of acute traumatic Achilles tendon rupture in athletes: a literature review

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BACKGROUND: The Achilles tendon is the largest and most powerful tendon in the human body. It is the most frequently injured tendon, with 11-37 ruptures per 100,000, in general population. 44-83% of ruptures occur in sports activities, mainly in amateur athletes. The purpose of this study was to review the current literature above the treatment of acute traumatic rupture of the Achilles tendon in athletes.

METHODS: For data collection and analysis, a thorough review of literature was performed in PubMed-Medline, Scopus and ScienceDirect databases.

RESULTS: Treatment of rupture can be either conservative or surgical and depends on the surgeon and the patient's preference. Both conservative and surgical treatment requires a long recovery period, 9 to 12 months. In recent years, the functional rehabilitation protocol has been proposed as an alternative to surgical treatment, with encouraging results. Re-rupture rates are estimated at 2.8% to 7% and are comparable to those of surgical therapy. Regarding surgical treatment, the current trends lead to minimally invasive surgeries, which show wound infection rates of 2.4% compared to 4.2% in open surgery. There is disagreement about the timing of postoperative rehabilitation programs and there are no objective criteria for return to play for the injured athlete, who at a rate of 50% does not return to the pre-injury level.

CONCLUSIONS: More research is needed to more effectively address the rupture of the Achilles tendon in athletes, prevent re-ruptures and return to sports at a level similar to the previous one.

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Post-COVID-19 return-to-play: influence of COVID-19 infection of neuromuscular control raises the risk of anterior cruciate ligament injury in professional female volleyballers

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BACKGROUND: Athletes after COVID-19 infection report persistent and residual neuromuscular symptoms even some weeks after the onset of infection. At the return-to-sport, a poor neuromuscular control may cause motion asymmetry and inefficient movement strategies increasing anterior cruciate ligament (ACL) load, particularly in female athletes. This retrospective study aimed at evaluating the influence of COVID-19 on neuromuscular activation of the knee stabilizer muscles in female volleyball athletes.

METHODS: We retrospectively assessed data on female professional players from an Italian volleyball team that all had COVID-19 in January 2021. Before (T0) and after (T1) COVID-19, all athletes underwent a detailed screening consisted of: pre-activation time of Rectus Femoris (RF), Vastus Medialis (VM), Medial Hamstring (MH), and Lateral Hamstring (LH) through surface electromyography (sEMG), muscle mass, through bioimpedentiometry, and lower limb muscle power, through the squat jump height.

RESULTS: We included 10 volleyball athletes, aged 20.54 ± 1.91 years. At T1 was found a significant delay ($P < 0.05$) in the activation time (ms) of RF (426.42 ± 188.23 vs. 151.91 ± 106.19); VM (363.33 ± 192.21 vs. 140.16 ± 95.60); LH (228.58 ± 59.8 vs. 150.08 ± 63.37); MH (230.92 ± 87.63 vs. 203.50 ± 89.29). Moreover, there was a significant decrease ($P < 0.05$) in muscle mass (40.68 ± 3.39 kg vs. 38.46 ± 3.51 kg) and squat jump height (31.25 ± 5.7 cm vs. 30.3 ± 4.55 cm).

CONCLUSIONS: Neuromotor imbalance of the knee stabilizer muscle in female athletes after COVID-19 could determine a deficit of knee stabilization during sport-specific tasks. Physicians should also consider COVID-19 sequelae in terms of low muscle mass and power to propose a neuromuscular training protocol in volleyballers.

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A new trick for faster return to play? Intermittent hypobaric hypoxia accelerates morphofunctional muscle recovery

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BACKGROUND: Muscle regeneration is a complex process involving multiple signaling pathways that can be modulated by different stimuli. We aimed to assess whether an intermittent hypobaric hypoxia (IHH) stimulus could accelerate muscle regeneration after injury.

METHODS: Twenty-two adult male rats were surgically injured in the right gastrocnemius and randomly assigned to two groups: CTRL, recovered in normoxia; and HYPO, exposed to IHH (4,500 m, 4h/day). After 9 days, force properties of injured and left intact muscles were assessed *in vivo* by measuring peak (PF, mN/g) and tetanic force (TF, mN/g) and low frequency fatigue resistance (30 Hz). Fibre-type composition, fibre

cross-sectional area (FCSA) and Collagen I deposition (%) were measured in histological slides, and Akt and mTor protein expression was analyzed by Western Blot.

RESULTS: Nine days after injury, CTRL showed significant functional deficiencies in the injured muscle compared to the contralateral intact gastrocnemius (PF: 43 ± 12 vs. 51 ± 6 , $P = 0.049$; TF: 142 ± 44 vs. 179 ± 27 , $P = 0.024$) and lower resistance to fatigue ($P = 0.038$). However, HYPO presented a full recovery in all force parameters. No significant differences were observed in FCSA nor in fibre type proportion. Collagen I deposition in the injury site was lower in HYPO ($P = 0.022$). The ratio pSer473/total Akt was higher in HYPO ($P = 0.050$), while no differences were found in pSer2448/total mTor expression.

CONCLUSIONS: IHH enhanced the synthesis of proteins involved in muscle regeneration and hypertrophy, without altering fibre morphology. Thus, IHH improved muscle regeneration, accelerating the recovery of muscle force and reducing fibrosis.

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Common injuries suffered by aerobic dance instructor

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BACKGROUND: Aerobics is very popular nowadays. In fact, there are different types of aerobics dancing such as Hi-low impact, Taebo, Hip Hop aerobics, Bench or step aerobics, retro, Latin and the most popular at present, Zumba. However, there are questions that lingers in one's mind; how safe is the exercise dance program; how knowledgeable the instructors of the said fitness dance program are. In this research study, the researcher wants to find out the common injuries suffered by aerobics instructor. The objective of this research is to give suggestions and recommendations to all aerobic dance instructor in order to avoid injuries while performing or teaching aerobics dance.

METHODS: The researcher studied local and foreign settings of the aerobic routine programs. She compared the two settings as to the injuries incurred by the Instructors and found out that both settings have almost the same conclusion or outcome regarding the injuries sustained by aerobics dance instructors. The researcher utilized purposive sampling in the selection of the respondents including 40 male and 60 female instructors teaching Hi-Low impact, Step aero, Taebo, Zumba. Some of the questionnaires were personally delivered while some were sent through e-mail and messenger. Retrieval of the questionnaires did not pose difficulty on the part of the researcher since she is also affiliated with different fitness association.

RESULTS: The researcher study has found out that

there are 3 types of common injuries suffered by aerobic instructors namely: direct, indirect and overuse injuries which usually take place while performing aerobics. The aerobics instructors “seldom” suffered direct injuries. It also showed that they “often” suffered indirect injuries while “seldom” suffered overused injuries. Since the study showed that there are aerobic dance instructors who still suffered the 3 types of injuries, the researches formulated recommendations.

CONCLUSIONS: This research study develops strategies and technique in improving aerobic dance routine to lessen or totally eliminate injuries while performing such activities.

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Knee sanguine effusions in sports trauma (haemarthrosis)

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BACKGROUND: The blood collection in the athlete's knee without suffering injuries of the soft tissues represents a dangerous potential to the future of the athlete. The operational and rehabilitative problems mean that the operative phase must have specific attention to have excellent results both for recovery and for good joint functioning. Particular attention must be paid to the hematoma, to decide whether the best solution for the damage is the operation or rehabilitation. The cases studied try to take into consideration a large margin of athletes who have had Haemarthrosis problems. Both surgical and non-surgical aspects have been studied in these athletes. In addition, secondary damage to the ligament structures of the knee was also considered.

METHODS: The study period involves the years from 2010-2020. All of them comprising of competitive athletes with regular activities and training involving a timeframe from 3 to 10 years. The average age of the injured athletes was 23.4 years, the youngest of them 14 years whereas the eldest 28.7 years. The study material involves cases comprising of 13 men and 3 women.

RESULTS: Depending on the side of the injured knee: 1) The right knee was injured on 12 cases 75%, 2) whereas the left knee on 4 cases, 25%.

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A comparison in strength and plyometric ability in the lower limb of athletes having ACLR with lateral extra-articular iliotibial band tenodesis when compared with isolated ACLR surgery. A biomechanical study

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BACKGROUND: There has been resurgence in interest in lateral, extra-articular soft tissue procedures (LETS) to augment ACLR to reduce the residual laxity that may be present post isolated ACLR and improve surgical outcomes. Adding a LETS procedure to an isolated ACLR surgery adds to the surgical morbidity and raises the concern of decreasing maximal quadriceps and hamstring strength and reducing lower limb reactive strength. Our study objective was to identify differences in maximal quadriceps and hamstring strength and reactive strength between athletes who undergo isolated ACLR and those who had ACLR with LETS surgery.

METHODS: This is a retrospective comparison analysis of 120 athletes who underwent isolated ACLR or ACLR with LETS. All athletes completed their isokinetic and 3D motion capture assessments between 6 and 8 months post-operatively in our Laboratory. Each athlete's isokinetic scores alongside their reactive strength assessment results were documented and analysed.

RESULTS: There was no statistically significant difference between the two groups for quadriceps and hamstring limb symmetry index (LSI) ($P=0.871$; $P=0.134$) and one of the reactive strength markers ($P=0.55$). However there was a significant difference between groups in hamstring strength of the injured leg ($P=0.03$) and two of the reactive strength index markers ($P=0.025$; $P=0.032$).

CONCLUSIONS: We observed no statistically significant difference between groups for LSI between uninjured and injured limbs however there were significant differences in hamstring strength and reactive strength. This is of clinical relevance for surgical decision making regarding augmenting ACLR with LETS.

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Dynamic knee valgus screening with kinect camera during physical activity - A corrigible predisposing factor for acl rupture

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BACKGROUND: The dynamic knee valgus occurs during physical activity when the knees collapse to the medial side, because the muscular system of lower limb is not enough strong to stabilize the hips and knees. Knee valgus position is a major predisposing factor for anterior cruciate ligament rupture since shear forces overload the ligaments of the knee. The single leg squat test is a widely used lower-limb test in movement pattern screening, which helps to assess the injury risk of lower-limb.

METHODS: A new valgus evaluation method was applied in this study with Kinect Azure during single

leg squat. Knee lateral shift was determined by “knee over foot” to “knee medial to foot” position shift in 22 healthy subjects. Kinect validity and accuracy were tested by OptiTrack and MVN Xsens motion capture systems.

RESULTS: The average difference in case of pelvis vertical movement between Kinect and OptiTrack is 1.3 ± 0.7 cm, the difference between knee lateral-medial movements is 0.7 ± 0.3 cm. The rate of dynamic valgus was expressed at 15%-30% squat depth. The well-defined squat depth proves the comparability between subjects.

CONCLUSIONS: A 2% valgus-shift at 15% squat depth is suggested as a threshold for determining dynamic instability, since subjects who were over this mark showed extensive knee valgus at lower depths while those who were under 2% remained in this neutral range. The current study proves that the Kinect is a low-cost, user-friendly motion capture device; moreover it is able to evaluate the dynamic knee valgus

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Differences in muscle strength and contractile response of knee flexion and extension muscles in competitive swimmers

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BACKGROUND: Legs-only swim training and dry-land strength programs are common in swimming in order to enhance performance during competition. In fact, a number of studies have indicated the supporting role of the leg kick in increasing swimming velocity. Therefore, the purpose of this study was to compare knee flexion and extension muscle function between male swimmers and healthy men.

METHODS: Five male swimmers and five healthy men participated in this study. Muscle strength of knee flexion and extension was recorded by BIODEX SYSTEM 4 (Sakai Medical) at two speeds (60 deg/sec and 180 deg/sec). The measurement values were the maximum torque (Nm/kg), of knee flexor and extensor and the knee flexor/extensor ratio (F/E ratio). Muscle contraction properties were measured using Tensiomyography-100 (TMG), and the test muscles were vastus medialis, vastus lateralis, rectus femoris, semitendinosus (ST), and biceps femoris. The TMG index was used contraction time (Tc), delay time, and maximum displacement. Mann-Whitney U test was conducted to compare the measurement items between groups.

RESULTS: Swimmers showed significantly lower values F/E ratio of 60 deg/sec ($P < 0.05$), knee flexor strength of 180 deg/sec ($P < 0.01$), and Tc of ST ($P < 0.05$) compared with healthy adults.

CONCLUSIONS: Although there are no reports describing the optimum F/E ratio with the occurrence of injuries in swimmers, values approaching 60% are generally accepted for injury prevention during dynamic movements. The low values of knee flexion strength and delayed contraction time in swimmers may be cause the injury during land training.

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Characteristics of complex systems in sports injury rehabilitation: examples and implications for practice

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BACKGROUND: There is a growing recognition most sporting environments are complex adaptive systems. This acknowledgement extends to sports injury, and is reflected in the individual responses of athletes to both injury and rehabilitation protocols. Complex systems are open systems consisting of many components that can interact among themselves and the environment. New forms of behaviors and patterns often emerge as a result. Consequently, practitioners are encouraged to gain an understanding of the complex systems approach and view return to sport (RTS) decisions through this lens, to improve decision-making in rehabilitation.

METHODS: Building on previous literature, the 16 common features of complex systems are explained and with adaptation to the context of RTS.

RESULTS: The features of complex systems could be related to RTS on three levels, namely individual, organizational and environmental level. The 16 features are feedback, emergence, self-organization, levers and hubs, non-linearity, domains of stability, adaptation, path dependency, tipping point, and change over time, open system, unpredictability, unknowns, distributed control, nested system and multiple scales and levels. For example, feedback refers to how the units within a complex system interact and how the output may be fed back into the system as a new output. This could be seen when rehabilitation training may lead to positive tissue adaptation in the injured athlete but may also lead to negative feedback when the training intensity exceeds the capacity.

CONCLUSIONS: Practitioners should be critical to the result of discrete RTS tests when assessing the information for RTS decisions to avoid missing out on the full picture. Moving forward to the operational level, the use of computational and simulation-based techniques should be considered.

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Assessment of the activity levels of patients with anterior cruciate ligament (ACL) reconstruction: a study with 13.2 years follow-up

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BACKGROUND: Every year 3% of amateur athletes and up to 15% of professional athletes suffer anterior cruciate ligament (ACL) injury. Thirty-five percent of these patients do not return to their previous level of performance after ACL reconstruction. The aim of this study is to evaluate activity levels in patients who underwent ACL reconstruction with a minimum of 10 years follow-up.

METHODS: The Tegner Activity Scale, the Lysholm, the KOOS and the IKDC questionnaires were used to assess activity levels. Correlations with age at the time of surgery, body mass index (BMI), sex, and concomitant meniscal tears were investigated.

RESULTS: In total, 106 patients (16♀ and 90♂) with a mean age of 27.4 years at the time of surgery were included in the study. The mean post-op follow-up was 13.2 years. Forty-three patients had a concomitant meniscal injury. Three patients suffered an ACL re-rupture. At follow-up, 70.4% of patients stated that they were able to take part in sports without any difficulty. Age at the time of surgery was significantly correlated with activity levels ($P=0.014$). No significant correlation was found when sex and BMI were examined. Patients who underwent meniscal suturing had statistically significant better results compared to patients who underwent meniscectomy in KOOS Daily activities ($P=0.026$) and Sports activities ($P=0.007$) sub-section.

CONCLUSIONS: ACL reconstruction gave the opportunity to most patients to return to high levels of performance in sports and daily activities. In cases of concomitant meniscal tears, meniscal repair provided improved activity outcomes.

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Isokinetic assessment of knee muscle imbalances and isokinetic characteristics of the knee during fatigue after anterior cruciate ligament reconstruction

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BACKGROUND: The aim of this study was to compare different methods for calculation of the torque ratio of the knee flexors and extensors in healthy

athletes and athletes after anterior cruciate ligament reconstruction. We also examined the isokinetic strength and activity of the knee extensors and the flexors during fatigue in healthy and anterior cruciate ligament reconstructed individuals (ACLr).

METHODS: Thirteen healthy athletes (age 28.84 ± 1.72 ys) and thirteen basketball players after ACLr (age 29.84 ± 1.21 ys), performed two fatigue protocols for the knee extensors and flexors until the isometric torque decreased to 50% of the maximal isometric torque.

Also, twelve healthy individuals (age 28.08 ± 3.23 ys) and ten individuals after anterior cruciate ligament reconstruction (ACLr) performed maximal concentric and eccentric trials of the knee extensors and flexors at three different angles and angular velocities (60, 120 and $180^\circ/s$).

RESULTS: The results showed that healthy individuals needed more repetitions in order to reach the 50% of the maximal isometric torque. Analysis of variance showed that Qecc:Hcon ratio, was significantly lower in ACLr compared with healthy individuals only using values at 30° .

CONCLUSIONS: The mechanisms of muscle activation in repetitive attempts were not affected by the ACL reconstruction. The use of exercise programs that improves fatigue ability is important in order to avoid a new ACL injury. Muscle imbalance evaluation after anterior cruciate ligament reconstruction, using values at 30° knee flexion maybe is more important than the other calculation methods.

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The impact of anterior cruciate ligament reconstruction (ACLr) in patients' quality of life: a study with minimum 10 years follow-up

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BACKGROUND: The anterior cruciate ligament (ACL) tear is one of the most common injuries in sports. Recovery from ACL rupture often affects quality of life and may be related with prolonged duration of symptoms or osteoarthritis. In the current study, we examined the quality of life in patients who underwent ACL reconstruction, (ACLr) with a minimum of 10 years follow-up.

METHODS: Patients' quality of life was evaluated with the KOOS-QOL (Quality of life) subsection and the EQ-5D-5L questionnaire and correlated with age at the time of surgery, sex, body mass index (BMI) and concomitant meniscal injury.

RESULTS: In total, 106 patients (90♂ and 16♀) who underwent ACLr, with an average follow-up period of 13,2 years were included in the study. Mean age at the time of surgery was 27.4 years. A concomitant meniscal tear was observed in 43 patients. At follow-

up, 64.4% reported that they had altered, even at a minimum rate, their everyday life activities. Twenty-five patients (23.3%) experienced at least mild pain and at the same time little (N.=12), moderate (N.=8), or severe (N.=2) anxiety or depression. Patients who underwent meniscal suturing featured significantly better results in KOOS-QOL (P=0.019). No statistically significant correlation was found, when gender, BMI and age at the time of surgery were examined.

CONCLUSIONS: Pain and restriction of activities has immediate consequences in patients' quality of life. Therefore, the development of strategies, which will allow personalized participation in activities, reinforce feelings of satisfaction, and improve quality of life, is necessary.

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Rectus femoris' degloving at football: is there a symptom?

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BACKGROUND: Rectus femoris (RF) injuries are common in many sports, especially football. Their strains are the second most common thigh muscle strains (after hamstrings), commonly performing kick. RF has unique characteristics- a muscle-within-a-muscle configuration- and a double tendinous origin with long intramuscular extension of the indirect tendon. The separation between the indirect and direct tendons results in dissociation of the inner muscle belly from the outer belly and in some cases results in retraction of the inner muscle belly- the degloving injury. We present the case of a 13 years male elite football player.

METHODS: On a training day he presents to the health department with a tumefaction on the left anterior thigh, without pain or any other signs or symptoms- was able to play a full match two days later.

RESULTS: On the follow-up evaluation he was still completely asymptomatic but the bulge on his proximal thigh was still visible when requesting isometric contraction. We performed an MRI that showed an intramuscular degloving injury: myotendinous junction's injury on the indirect tendon, with complete rupture of central intramuscular aponeurosis of the left RF-16mm of craniocaudal diameter and 12x6mm of transverse diameters. After discussion we decided to halt training and start rehabilitation. After 6 weeks he returned to full training. During the rehabilitation process and return to play protocol the athlete was always pain free.

CONCLUSIONS: There are few cases reported of this type of injury with its biomechanical implications and the prognosis being unclear. Learning to identify this type of injury is important for those involved in sports medicine.

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Return to play and long-term participation in elite handball players following ACL reconstruction

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BACKGROUND: The consequences of anterior cruciate ligament (ACL) injury and reconstruction in handball players are understudied. The aim of the present study is to present the effects of ACL reconstruction exclusively on handball players regarding return to play.

METHODS: Fourteen knees with an ACL tear in twelve patients were included in the study. Nine injuries occurred during games and 5 injuries during training. The mechanism of injury was non-contact in of cases. All cases were treated with a hamstrings autograft.

RESULTS: The athletes returned to unrestricted full team training in a mean of 7.7 months. Return to competitive play was achieved in twelve of the fourteen cases (in a mean time of 9.6 months post-operatively). Nine of the athletes that returned to play reached the same level of competition as before injury. At a mean follow-up of 37.1 months post-operatively, of the players included in the study and of those that returned to play were still active players; all playing at their pre-injury competition level. There was one recurrence of an ACL tear, while two athletes (had a contralateral ACL rupture during the follow-up period. All athletes had excellent knee scores at the latest follow-up. IKDC mean score was 94.7Lysholm mean score was 95 EuroQoL mean score was 100, and KOOS mean score was 97.3.

CONCLUSIONS: A high proportion of elite handball players can return to play following ACLR with a low rate of recurrence. However, not all players can stay in the sport for long and this should be kept in mind when an ACL tear occurs.

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The effects of exercise with blood flow restriction (BFR) in the post surgery rehabilitation of anterior cruciate ligament reconstruction patients

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BACKGROUND: The purpose of this study was to examine the effect of exercise with blood flow restriction (BFR) on functional and rapid rehabilitation of patients following anterior cruciate ligament reconstruction (ACLR).

METHODS: The sample of the survey consisted of sixteen patients, which was randomly divided into two exercise groups: a) the control group that applied physical exercise at home or physical therapy b) the experimental group that performed blood flow restriction protocol in addition to the individual rehabilitation program. The intervention program has been implemented with a frequency of two sessions per/week, lasting 30 minutes, for 12 consecutive weeks. Measurements were performed at the beginning and after the completion of the BFR protocol and included an assessment of: a) the function and the pain using the IKDC, KOOS & VAS Scores, b) the muscle atrophy of the injured limb by measuring the perimeter of the quadriceps at 10cm and 20cm near the upper patellar pole, c) the muscle strength deficit through the isokinetic evaluation CYBEX.

RESULTS: According to the results there were a statistically significant improvement in muscle atrophy of the injured leg and the instability between the two limbs for the experimental group.

CONCLUSIONS: In conclusion, this study demonstrates that the addition of BFR interventions to a late postoperative ACL rehabilitation program might lead to a faster recovery after knee arthroscopy.

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Endoscopic curettage and allografting of unicameral bone cysts of the calcaneus in young soccer players

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BACKGROUND: Open curettage with bone graft has been the traditionally suggested surgical treatment for the symptomatic unicameral calcaneal bone cyst. Less invasive endoscopically assisted treatment with curettage and bone grafting with allograft have recently provided less postoperative morbidity. The aim of the present study is to present our experience with this method in young soccer athletes.

METHODS: Between April 2014 and May 2016 three consecutive young soccer players with symptomatic calcaneal bone cysts underwent endoscopic curettage, and percutaneous injection of bone allograft. The mean age was 17.3 (16, 17 and 19 years old), and the mean follow-up was 32.1 (range 24 to 47) months.

RESULTS: Both radiographic and functional follow-up, using the AOFAS score, showed good to excellent results. All lesions were radiographically

healed. Preoperative AOFAS score (max. 100 pts) was 78.6±4.7, improving to 98.0±4.1. The patients returned to their initial level of sports activities within 18.3 (range 17 to 19) weeks after surgery.

CONCLUSIONS: Evidence suggests an earlier return to sports using bone substitutes. However, the present study showed that endoscopic curettage and percutaneous injection of bone allograft is also an excellent treatment option for young athletes with a symptomatic calcaneal bone cyst.

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Lateral quartet following anterior cruciate ligament tears in athletes

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BACKGROUND: Anterior Cruciate Ligament (ACL) tears are often accompanied with a Posterior Lateral Meniscus Root (PLMR) tear on the meniscofemoral ligament's point of adhesion, a lateral femoral condyle (LFC) contusion or a lateral tibial condyle (LTC) contusion. These four elements constitute the Lateral Quartet (LQ). The purpose of this paper is to estimate the occurrence of Lateral Quartet's injuries in patients with ACL tears.

METHODS: The sample was 237 patients that suffered an ACL tear and underwent arthroscopic reconstruction between 2014 and 2016. The information recorded was the frequency and morphology of concurrent lateral meniscus tears (identified arthroscopically) and the frequency of concurrent contusions of the LFC or LTC (identified by MRI). The PLMR tear classification used was the one suggested by Forkel et al. (type I: root avulsion, type II: radial tear, type III: complete detachment of the lateral meniscus posterior horn).

RESULTS: Out of all 237 ACL tears, there were 97 (40.9%) patients with concurrent lateral meniscus (LM) tears. Thirteen of them (5.4%) were PLMR tears. Out of those 13 tears, 4 were classified as type I (all treated with debridement), 6 were classified as type II (2 treated with partial meniscectomy and 4 treated with the all-inside repair technique) and 3 were classified as type III (1 treated with debridement and 2 treated with the all-inside technique). In 216 (91.1%) patients, there was a concurrent LFC contusion while 203 (85.6%) patients had a concurrent LTC contusion. A coexistence of all LQ's injuries was observed in 13 (5.4%) patients.

CONCLUSIONS: LQ's injuries are an existing entity combining three structures of the knee's lateral department that accompanies ACL (4th structure) tears in 5.4% of the cases.

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Sports medicine challenges as an impact of COVID-19 pandemic: an extremely rare injury in response to new training habits during home confinement/isolation

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BACKGROUND: Luxatio erecta (LE) is an unusual injury, accounts only 0.5 % of all shoulder dislocations, while only a few bilateral dislocations cases have been described. Taking into consideration the high rate of complications in these injuries, a carefully performed clinical evaluation and a prompt treatment is essential for a good clinical outcome. A rare case of bilateral LE is presented, as a result of unattended sports activities during pandemic.

METHODS: A 31year old male, noncompetitive athlete presented to the Emergency Department (ED) after an injury of both shoulders, while training in weight lifting at home without any supervision. The clinical presentation with both hands behind the head was typical of bilateral LE. After the clinical evaluation and radiological confirmation; a two-step reduction was performed by the ED physicians.

RESULTS: Following a successful reduction maneuvers, both upper limbs were evaluated for any neurological deficit, other concomitant injury and post reduction radiographs with no obvious fracture were obtained to confirm the clinically suspected reduction.

CONCLUSIONS: LE is a rare dislocation, usually following distinctive mechanisms of injury. Thus, gyms were closed during pandemic and millions of young active people were forced to stay at home, the restriction of practices and the essential equipment seems to affect the risk of injury, and may alter the injury patterns.

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Systematic review of distal biceps tendon rupture in athletes: treatment and rehabilitation

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BACKGROUND: Distal biceps tendon rupture (DBTR) causes functionally significant loss of strength and endurance of biceps brachii muscle. This injury results in athlete's performance impairment and delayed, if achieved, return to pre-injury level. The purpose of the present study was to review the treatment methods and rehabilitation protocols of the injured athletes reported in the data literature and to study their impact in return to sports (RTS).

METHODS: MEDLINE, Cochrane, Web of Science and Scopus online databases were searched. Studies published on DBTR treatment and rehabilitation in athletes until 30 June of 2021 were identified. A quantitative synthesis of functional outcome and return to pre-injury sport activity was performed to compare each management strategy.

RESULTS: Seventeen (17) articles were identified. Surgical treatment was followed in all athletes, except for 2 cases. DBTR reattachment was achieved using sutures, anchors, interference screw or endobutton after a one- or two- incision procedure. Postoperatively, in most cases gradual range of motion (ROM) and strengthening exercises followed a small period of immobilization. Specific rehabilitation protocols were followed in 4 athletes. After rehabilitation, the ROM was similar to the un-injured side in most cases. Only 1 athlete did not return to pre-injury sport activity. RTS was achieved within 10 months, except for 1 case.

CONCLUSIONS: Surgical treatment was followed in most cases of athletes with DBTR with high return to pre-injury activity rate, regardless of the surgical technique or the rehabilitation protocol.

Ethical and legal aspects in Sports Medicine

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Understood or overlooked: elite athletes' interpretation of their right to safe sport

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BACKGROUND: Recent egregious cases of systematic sexual abuse of athletes in elite international sport demonstrate that athletes are situated at the intersection between their sport and human rights. Recently, the World Players Association put forth a Universal Declaration of Players Rights. Last year, the International Olympic Committee's (IOC) Athletes Commission endorsed an Athletes Rights and Responsibility Declaration. Little is understood as to whether athletes actually see themselves as rights-holders in the context of sports and, if they did, would they be willing to call on sporting institutions to better respect, protect, and promote their right to Safe Sport. The current study explored athletes' knowledge and understanding of their human rights within a sporting context.

METHODS: A mixed methods research approach that incorporated a pilot survey and focus-group interviews of global elite athletes.

RESULTS: We found that athletes value and comprehend their human rights within the sporting context, but feel constrained in their ability to enact their rights within the sporting landscape. Almost half of the athletes surveyed said they feared repercussions should they speak up and exercise their right to safe sport.

CONCLUSIONS: We argue that there is a critical disconnect between the capacity and power of athletes to pursue their human rights within sport. To address intentional violence in sport, there is a pressing need for sporting institutions within the Olympic Movement and the IOC itself, to become human rights duty bearers and to continue building the capacity and power of athletes as rights-holders.

Tendinopathies in Sports Medicine

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Mid-term follow-up of platelet-rich plasma injections for refractory epicondylitis

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BACKGROUND: Lateral and medial epicondylitis, more commonly known as Tennis and Golfer's elbow, can cause chronic pain and significant functional impairment in working-age patients. For patients with refractory epicondylitis, platelet rich plasma (PRP) may be used as an alternative, or bridge to surgical intervention. The current study aims to assess the mid-term outcomes of ultrasound guided PRP injections for patients with refractory epicondylitis.

METHODS: Seventy-seven (77) patients who were treated with PRP for refractory epicondylitis were included in the study. The mean age of patients was 50.3 years (range 36-70), with 30% males and 70% females. The Oxford Elbow Score (OES) and progression to surgery were used to assess the mid-term outcomes.

RESULTS: The mean follow-up duration was 2.1 years (range 1.0-4.2). Post-procedure OES was recorded for thirty-three patients; of them 31 patients (94.0%) demonstrated an improvement in their OES at mid-term follow-up compared to their pre-op score. The mean change in OES was +16 (range -7 to +34), 81.8% exhibited a minimally important change (MIC) in OES of greater than 8.2 points. Of all seventy-seven patients, seventeen (22.1%) underwent open release and twenty-seven (35.1%) patients were lost to follow-up.

CONCLUSIONS: Ultrasound guided PRP injections can be an effective treatment for refractory epicondylitis and may prevent the need for surgery.

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Ultrasound guided platelet rich plasma application versus corticosteroid injections for the treatment of lateral epicondylitis in amateur male tennis players: a prospective controlled randomized comparative clinical study

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BACKGROUND: The purpose of this study was to evaluate and compare the effectiveness of ultrasound (US) guided platelet rich plasma (PRP) injections versus US guided corticosteroid injections (CSI) in the treatment of lateral epicondylitis (LE) in amateur male tennis players (AMTP).

METHODS: Between January 2016 and December 2017, 12 AMTP with LE were enrolled and randomized into two groups (A and B). Group A (study group) patients received US guided PRP injection treatment. Group B (control group) patients received US guided CSI treatment. Their clinical outcomes were evaluated using the Visual Analogue Scale (VAS) of pain, the Mayo Elbow Performance Score (MEPS) and the presence or absence of complications at four, 12, and 24 weeks post-injection. The level of significance was set at $P < 0.05$.

RESULTS: Both groups showed improved scores (VAS and MEPS) compared to the pre-injection period, but patients in group A had a statistically significant ($P < 0.05$) decrease in VAS score and a significantly increased MEPS at the last follow-up (24 weeks post-injection). No complications were reported.

CONCLUSIONS: In conclusion, AMTP with LE present better and longer lasting clinical results when treated with US guided PRP injections compared to those with CSI. Further studies are needed to optimize the technical preparation of PRP, the sample concentration, the number of injections and the time intervals between them, in order to achieve the maximum desired results.

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Plasma-rich platelets (PRP) injections and refractory Achilles tendinopathy

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BACKGROUND: Chronic Achilles tendinopathy is responsible for a severe reduction in physical performance and persistent pain. In-particular, platelet-rich

plasma (PRP) injections is a widely used way to provide a local regenerative stimulus for tendon healing.

The aim of the study is to document the mid-term results after treating Achilles tendinopathy with injections of PRP.

METHODS: Twenty-two patients (mean age: 43,8 years; 18 men and 4 women) affected by chronic mid-portion Achilles tendinopathy refractory to previous treatments were enrolled. Patients were treated with three intratendinous injections of PRP at 2-week intervals. Patients were prospectively evaluated at baseline, 3, 6 and up to a mean of 38 months of follow-up (minimum 30 months), using the following tools: VISA-A, EQ-VAS for general health and Tegner scores.

RESULTS: The VISA-A score showed a significant improvement: the baseline score of $48,3 \pm 17,6$ increased to $61,8 \pm 18,6$ at 3 months, with a further improvement at 6 months ($83,2 \pm 16,8$) and stable results at 3 years. The EQ-VAS score also showed a similar positive trend. An evaluation of the activity level confirmed these findings, showing a significant improvement in the Tegner score over time. The longer duration of symptoms before treatment associated with a slower return to sport

CONCLUSIONS: PRP injections produced good overall results for the treatment of chronic recalcitrant Achilles tendinopathy with a stable outcome up to a medium-term follow-up. Longer symptom duration was related with a more difficult return to sporting activity.

The athlete's shoulder, elbow, wrist, hip, knee, ankle and foot

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What are the main risk factors for lower-extremity running-related injuries? A retrospective survey based on 3669 respondents

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BACKGROUND: Many studies attempt to identify the risk factors for running-related injuries (RRI), but these are not yet well established. The objective is to investigate the risk factors of RRI.

METHODS: The retrospective online survey-based study among population of runners injured and non-injured. Participants have to be at least 18 years old and have to practice running at least for 12 months. The online survey included 41 questions with five main categories: personal characteristics – daily life-

style – training and running characteristics – practice of others sports activities and prevention habits.

RESULTS: Amongst the 3669 runners, 1852 (50.5%) reported at least one injury over the last 12 months. Overuse injury were largely represented (60.6%). The variables associated with RRI which remained significant in the fully-adjusted model were: previous injury (OR=1.63, IC 95%=1.42-1.47), competition running (OR=1.62, IC 95%=1.26-2.09), more than 2 hours running per week (OR=1.30, IC 95%=1.03-1.65), mileage (>20 km/week) (OR=1.25, IC 95%=1.01-1.55) and speed training (OR=1.23, IC 95%=1.06-1.48). Univariate analysis revealed other variables associated with more RRI: Trail runners (*versus* road runners, $P<0.001$), men (*versus* women, $P<0.001$), higher age ($P<0.001$), >2 running session /week ($P<0.001$).

CONCLUSIONS: Previous injury remains the most relevant RRI risk factor. Many training characteristics seem to be involved but still have to be confirmed in view of conflicting data in literature. Trail runners are more at risk of RRI. Further research would help to understand better RRI and to prevent them.

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Arthroscopic repair or reconstruction of anterior talo fibular ligament (ATFL) and calcaneo fibular ligament (CFL)

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BACKGROUND: Lateral ankle sprains are frequent in sports. Unfortunately, 40% of acute sprains result in chronic ankle instability. We present our results with surgical treatment of chronic ankle instability in elite athletes.

METHODS: 2 athletes, with chronic ankle instability have been treated by ATFL arthroscopic repair and 4 others with ATFL and CFL anatomical reconstruction using a gracilis' autograft. The choice of surgical technique was dependent on their ligamentous injuries. Patient functional satisfaction and AOFAS score were used to evaluate the results.

RESULTS: We observed a 30 points average increase of AOFAS score post-operatively with functional satisfaction in all of our patients. Return to competition was between 4.5 to 6 months. ATFL arthroscopic repair has a higher complication rate than an open procedure but the significant AOFAS score increases and the higher satisfaction rate, make it procedure to consider for lateral ankle instability. Concerning ATFL and CFL arthroscopic reconstructions, the complication rate is similar to an open procedure. The AOFAS score is significantly improved and there is an excellent satisfaction rate as well.

CONCLUSIONS: Residual ankle instability 3 months after an ankle sprain that was treated conservatively and chronic ankle instability are the correct indications.

Lateral ankle arthroscopic repair or reconstruction has a high rate of patient satisfaction and after the learning curve the complication rate decreases.

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Shoulder injuries in sportsmen and their treatment

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BACKGROUND: It is usually difficult to recognize the severity of a shoulder sports injury. Early assessment is essential for appropriate treatment. After history of injury has been taken, one can focus on the specific clinical examination other diagnostic procedure.

METHODS: During 10 years (2008-2018) we had 835 patients with different shoulder injuries. Operative treatment procedure where: arthroscopic stabilization (anterior, posterior and multidirectional); biceps tenodesis; subscapularis and pectoralis repair; RC repair; SAD; AC stabilization; distal clavicle excision±CC ligament reconstruction; Mumford procedure; SLAP repair; cartilage debridement and revascularization; n. supra-scapularis release.

RESULTS: 7% of the sportsman must stop professional career because of their injuries, 11% continued with sports, but not at same level as before and 82% of them continued their professional sports life at the same level. According pain VAS scale we have improvement from 5 to 12, satisfaction score from 11 to 87 percent and possibility to play at previous level to 82 percent.

CONCLUSIONS: Shoulder injuries in young athletes, ten years ago, were reason to stop their career and ruined their dreams. With development of shoulder surgery, especially arthroscopic procedure, we can help them to come back to the normal sports life and continue at the same level of competition, as before the injuries. The majority of throwing injuries respond well to a carefully designed rehabilitation program. Athletes who do not improve within 6 months are candidates for surgical repair. The procedure is planned so as to minimize the amount of surgical trauma and thereby to facilitate an early return to sport.

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Functional results after surgical treatment of proximal humeral fractures with phylos plate

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BACKGROUND: Fractures of the proximal end of the humerus are complex. Proper treatment of these fractures requires a good knowledge of the shoulder joint anatomy, mechanics of movement, classification of proximal humeral fractures and various surgical techniques. The aim of our study was to assess the functional result of proximal humeral fractures (Neer III and IV), after open reduction with a locking Phylos plate.

METHODS: The study was performed in the period from 2014-2016. Only patients with Neer III and IV fractures were included, 20 patients were classified as Neer III and 8 patients were classified as Neer IV). Standard X-rays and CT scans were used. All patients were surgically treated with PHILOS (Proximal humeral internal locking system).

RESULTS: Follow-up was done on the 1st, 3rd and 6th month. At the 6th month follow-up, the functional outcome was tested with Constant and Murley questionnaire, as an indicator of the impact of impairment on the type and level of disability.

CONCLUSIONS: To guarantee great recuperation of patients with proximal humeral fractures surgically treated with PHILOS plate it is vital to have great knowledge of the shoulder joint anatomy, exact surgical procedure and early physical treatment.

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Does bone regrow after notchplasty in anterior cruciate ligament reconstruction? A prospective ct study with two-year follow-up

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BACKGROUND: During notchplasty in anterior cruciate ligament (ACL) reconstruction, bone is excised from the lateral and roof area of the notch to widen the intercondylar space and avoid notch-graft impingement in extension. This study aimed to determine the possibility of late narrowing of the notch due to bone regrowth after a 2-mm notchplasty using computed tomography (CT) analysis.

METHODS: Two axial CT image levels were used: the anterior outlet and the anterior one-eighth level of the notch. The maximum notch height (MNH) and width, (MNW), the notch width at one- and two-thirds of the pre-operative notch mid-width height, the maximum condylar width (MCW), and the surface area of the lateral half of the notch were measured pre-operatively, one week and two years post-operatively in patients undergoing single-bundle anatomic ACL reconstruction with hamstrings graft.

RESULTS: Twenty patients were included (mean age 28 ± 7.3 years; mean follow-up 24.2 ± 3.3 months). At the anterior outlet, MNW increased by 1.9 ± 1.7 mm one week post-operatively and narrowed by 0.3 ± 1.1 mm at the final follow-up; MNH increased 1.7 ± 1.9 mm and narrowed 0.8 ± 1.8 mm respectively. At the anterior one-eighth, MNW increased by 1.1 ± 1.7 mm one week post-operatively and narrowed by 0.1 ± 1.1 mm at the final follow-up; MNH increased 1.2 ± 1.5 mm and narrowed 0.5 ± 1.5 mm respectively. Differences between pre- and post-operative measurements were significant, and differences between post-operative and final follow-up non-significant. The same applied for MNW to MCW ratio, indicating no narrowing of the notch post-operatively.

CONCLUSIONS: Notch size-shape, after a 2-mm notchplasty, does not change significantly in stable knees during the first two years after anatomic ACL reconstruction.

Sports Cardiology: prevention and rehabilitation

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The distribution of corrected QT interval and its associated factors among school athletes

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BACKGROUND: Junior athletes are facing sudden deaths with alarming prevalence due to cardiac diseases. For early detection of these diseases, corrected QT Interval (QTc) acts as a major predictive factor. The current study was conducted to assess the distribution of the QTc interval and its associated factors among school athletes.

METHODS: The study was conducted using the Routine Pre-participation Evaluation Forms and Electro Cardio Graphs (ECG) of school athletes attending to the Sports Medicine Clinics at the District General Hospital Matara and Kurunegala.

RESULTS: According to the traditional Bazett formula, the mean QTc interval value was 443.7 (CI $442.5-444.9$). The mean QTc interval in Fridericia formula was 425.5 (CI $424.1-426.9$), in Framingham formula was 424.9 (CI $423.6-426.2$) and in Hodges formula was 429.7 (CI $419.6-439.8$). Therefore, QTc intervals from Bazett formula was significantly higher ($P<0.001$) than QTc interval from all the other formulae. QTc intervals of females were significantly ($P<0.05$) higher than the QTc intervals of males. Age ($\beta=1.281$), male gender ($\beta=-2.462$) and BMI (Body Mass Index) ($\beta=-0.206$) were significant predictors ($P<0.001$) in predicting QTc interval by Bazett formula. However, Engagement in Cadet and Cricket were significant predictors of QTc interval by the Fridericia, Framingham and Hodges formulae.

CONCLUSIONS: Age, gender and BMI should be considered when interpreting QTc interval. The association between the specific sport activity and QTc Interval should be further studied. More research is warranted to establish national level reference values for QTc interval.

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Former athletes: are they healthy?

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BACKGROUND: Growing evidence suggest that masters athletes may have higher coronary artery calcium scores compared with sedentary individuals, but little is known about peculiarities in clinical presentation of acute coronary syndrome (ACS) in middle-aged and older adults had engaged in moderate sport activity in the youth.

METHODS: We studied 28 patients (8 females) admitted to noninvasive cardiology department with ACS. 10 males [$M\pm m$; 67.3 ± 4.2 (43-88) yrs;] and 4 females [69.2 ± 4.8 (60-81) yrs] reported different sport activity for at least 5 yrs, 10 males and 4 females admitted in the same time served as case-control group.

RESULTS: Former female-athletes had higher systolic ($P=0.023$) and diastolic ($P=0.015$) blood pressure (BP) and higher low density lipoprotein cholesterol (3.9 ± 0.2 vs. 2.8 ± 0.3 mmol/L; $P=0.015$), 2 females were obese. No difference was found in enzymes, glucose, electrolytes, ECG and EchoCG parameters. Left ventricular (LV) contractility had tendency to be better ($P=0.07$), only 1 female was discharged with non ST-elevation myocardial infarction (non-STEMI).

In males BMI (27.0 ± 1.8 and 27.1 ± 1.1 kg/m²), heart rate, BP, Killip class and main comorbidities did not differ, except low back pain was higher in former athletes. End-diastolic ($P=0.017$) and end systolic volume were significantly lesser, there was tendency to lower LV mass index ($P=0.07$) and bigger heart rate achieved at exercise testing ($P=0.063$). Only one runner had elevated LVED diameter and reduced ejection fraction, 5 of 10 athletes were diagnosed with unstable angina and none - with non-STEMI.

CONCLUSIONS: Physical activity in the youth slightly positively impact on clinical presentation of ACS in the middle-aged and older individuals.

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Coronary calcium contrasting longevity in endurance athletes: no harm to the heart. A narrative review

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BACKGROUND: Over years, there has been a controversial discussion whether vigorous highly intensive endurance training can lead to heart damage in athletes. With the application of coronary calcium determination in endurance athletes, the question arose whether intensive training may favor atherosclerosis. In contrast, several studies show a significantly longer life expectancy in highly trained athletes.

METHODS: Cardiological journals (ACC, AHA, ESC), sports cardiology, radiology and epidemiology publications were reviewed in addition to a research (PubMed, BISP-Surf and Google scholar).

RESULTS: Diagnostic methods for coronary calcification show differences in the properties of coronary plaques in heart patients compared to endurance athletes. Athletes have, if at all, a different composition of plaques (e.g. with Ramada spectroscopy) as observed in healthy aging individuals. CAC analysis show, that plaques in athletes' arteries are more dense, firmer, more stable and have a firm "cap" thus reducing the risk of plaque rupture. The fitter the athlete, the less, if at all, unstable or atherosclerotic plaques are seen. Four major studies show that in endurance athletes, life expectancy is extended by 3-8 years, corresponding to cardiorespiratory fitness increasing life expectancy. As such, high-intensity training does not harm the heart

CONCLUSIONS: Different approaches to analyse harm to the heart by intensive endurance sports convincingly prove that cardiac endangerment from this point of view does not exist in athletes. This is confirmed by many studies with extended longevity of athletes and by a current prospective long-term study using CAC and computer tomography in endurance athletes.

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Cardiac magnetic resonance imaging in professional athletes after COVID-19 infection: is there a reason to be worried about?

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BACKGROUND: Myocardial inflammation is an important extrapulmonary manifestation of COVID-19. The purpose of this study was to evaluate the presence, extent and impact of myocardial inflammation in professional athletes after COVID-19 infection.

METHODS: In this observational cohort study, cardiac magnetic resonance, using standardized and unified imaging protocols, was performed on 20 professional

athletes in UHC Bežanijska kosa, Belgrade, Serbia. The participants were eligible for the study after 4 weeks and up to 3 months from the positive swab test.

RESULTS: Of the 20 included professional athletes, 12 were asymptomatic, while 2 requested hospitalization. The mean participant's age was 24. Four participants had symptoms after the infection (mostly fatigue and palpitations). All participants had preserved ejection fraction. Fourteen participants (70%) had signs of myocardial inflammation. Myocardial edema on T2 and STIR sequences was present in only 1 participant. The most dominant finding was the subepicardial and mesocardial LGE phenomenon (9 participants), which affected less than 5% of the myocardium, mostly present in the septum, anterior-lateral, and inferior-lateral segments. Five participants had prolonged T2 mapping time (mean value was 64ms), while 7 participants had prolonged values of native T1 time (mean value was 1156ms). Pericardial involvement was present in 8 participants (40%).

CONCLUSIONS: The changes that can indicate myocardial inflammation in professional athletes after COVID-19 infection are common, although the typical signs of acute myocarditis are rare and usually do not affect global systolic function. Pericardial involvement is a significant finding in a larger group of participants.

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Holter monitoring in young men having elevated office blood pressure and different history of leisure time physical activity

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BACKGROUND: Moderate physical activity (PA) positively influences blood pressure (BP) and circadian pattern in interventions' studies, but little is known how long this effect lasts.

METHODS: We aimed to compare Holter monitoring results in 132 young men aged (M±m) 21.2±0.3 (19-25) years were divided in three groups: reported leisure time PA 2-5 times/week (A; N.=25), have finished their training 1-3 year before (FA; N.=34) and reported sedentary lifestyle (S; N.=73).

RESULTS: 14/25 males were engaged in power training, 6 – in sport games and 5 – in endurance training. The types of PA in 2nd group were similar. No difference was found in body mass index (25.2±0.7 vs. 26.6±0.8 kg/m²) between A and FA, but S men were heavier (27.2±0.6 kg/m²; P=0.019). Diurnal heart rate (HR) in A was lower (80.3±2.1 vs. 90.6±1.9 in FA (P=0.0006) and 91.6±1.1 bpm in S (P=0.00025), like nocturnal HR (55.7±1.8; 63.3±1.5; 63.0±0.8 bpm; P=0.0025). Systolic BP in the day was lower in A (139.0±2.5 mmHg) than in S (144.7±1.4 mmHg; P=0.024), but not in the FA (142.2±1.7 mmHg). Diastolic BP demonstrated the same pattern. Only tendency exists to lower nocturnal systolic BP in A, whereas diastolic BP was lower

both in A and FA. Also only A had greater power of high frequency band in heart rate variability (HRV) spectrum both in the day and night.

CONCLUSIONS: Despite predominantly power sport activity, heart rate and BP in A were lower. Only A but not FA had better HRV spectrum.

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Electrocardiographic (ECG) repolarization abnormalities as cardiac adaptation to training in a non-black athlete

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BACKGROUND: Electrocardiographic (ECG) interpretation in athletes may sometimes be really challenging. There are certain ECG patterns that are resented as really abnormal on first look but they have been interpreted as normal adaptations to exercise in athletes. A case of such an ambiguous ECG pattern in an athlete is described.

METHODS: A 17-year-old male, Caucasian, semi-professional soccer player was referred to our center for further evaluation due to an abnormal ECG in the setting of his annual pre-participation screening.

RESULTS: The ECG demonstrated J point elevation and convex ST segment elevation followed by T-wave inversion in V1-V4. Neither history of preceded infection nor symptoms suggestive of myocarditis were present. During investigation, neither echocardiography nor cardiac magnetic resonance revealed any abnormal findings. Our center recommended avoidance of any athletic activity for two months and re-evaluation afterwards. Surprisingly, at the re-evaluation visit the ECG was normal, indicating that these abnormalities represented athlete's heart adaptations and not any kind of cardiomyopathy.

CONCLUSIONS: The above case confirms that the ECG pattern of T-wave inversion confined to the anterior leads and preceded by ST elevation may be a normal finding, not only in black, but also in non-black athletes. Moreover, the aforementioned case signifies the usefulness of detraining in discriminating athlete's heart from cardiomyopathy, in case of uncertainty, in line with the last European guidelines for hypertrophic cardiomyopathy.

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Subclinical apical hypertrophic cardiomyopathy in a professional athlete

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BACKGROUND: Apical hypertrophic cardiomyopathy (HCM) has a prevalence of 2% in Western Countries and 25% in Asian Countries. Although it is presented with a more benign course than the rest HCM population, there is an increased risk for arrhythmias and sudden cardiac events. A case of apical HCM in an athlete is described.

METHODS: A 23-year-old African/American professional soccer athlete was referred for our center from a district hospital for further investigation due to an abnormal ECG on his pre-participation screening.

RESULTS: His ECG presented repolarization abnormalities with ST-segment elevation in V2, V3 and negative T waves in I, II, III, aVF, V4-V6 along with signs of left ventricular hypertrophy. A year ago he had an abnormal ECG, but a normal echocardiogram then. His family history was negative for cardiomyopathy and sudden death. The clinical examination was normal but the echocardiogram revealed apical HCM. The cardiac MRI confirmed the diagnosis. Avoidance of competitive sports was recommended. One year after the diagnosis the athlete remains asymptomatic.

CONCLUSIONS: Professional athletes are a special subgroup of population which may have special ECG patterns and morphological characteristics. Further investigation is indicated in order to timely diagnose conditions that may pose a risk for adverse cardiovascular events.

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Trans-thoracic echocardiographic evaluation of young athletes during pre-participation screening: preliminary results

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BACKGROUND: The aim of pre-participation screening (PPS) is the identification of cardiovascular abnormalities predisposing to sport-related sudden cardiac death (SCD). Our project had the objective of implementing PPS with trans-thoracic echocardiography (TTE) in order to perform a better cardiovascular screening and risk stratification in competitive and non-competitive athletes.

METHODS: After a signed informed consent by their parents, competitive and non-competitive athletes aged 8-16 years undergoing PPS who had never performed a TTE before, have been included in our study. TTE has been performed by 2 Specialists in Cardiology, with extensive experience in Sports Cardiology, and evaluated together with the Sports Medicine physician. The positive findings were interpreted by a supervisor with long experience in Pediatric Cardiology. Subjects

in which a heart abnormality has been suspected have been addressed to a pediatric Center of Excellence for the appropriate clinical management and follow-up.

RESULTS: We screened 159 (81 male and 78 female) young athletes (mean age 12.3 ± 2.3 years). None of the athletes reported a positive family history for congenital heart disease or SCD. TTS was able to detect: 1 bicuspid aortic valve, 6 ostium secundum atrial septal defects, 3 left ventricles with increased dimensions, 6 mild valvular insufficiencies, 2 mild right ventricular hypertrabeculations. None of these young athletes had electrocardiographic abnormalities.

CONCLUSIONS: TTE screening, in the context of PPS, has been able to identify some cardiological conditions that needed further investigation and/or follow-up. In our opinion, this would be of paramount importance in order to reduce cardiovascular risk associated with sports participation and SCD especially in young athletes who have never performed TTS in their life.

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The cardiovascular risk factors prevalence among adult male amateur athletes

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BACKGROUND: In comparison to elite athletes, amateurs are not obligated to regular medical examination. They are often engage in trainings at high or very high volumes. Unrecognized health problems can lead to exercise-related cardiovascular events including sudden cardiac death (SCD). The aim of the study was to assess the prevalence of cardiovascular risk factors among adult amateur athletes.

METHODS: An anonymous questionnaire survey was conducted in February 2020 both online and in paper form in 176 males of mean aged 26.5 ± 8.6 years. The inclusion criteria were age >18 years, regular physical activity at least 150 minutes per week from a minimum 6 months. Exclusion criteria were: practicing sport professionally and lack of participant's agreement. Training intensity was assessed according to Borg CR-10 scale.

RESULTS: The study group performed trainings of hard or very hard intensity in 95% of athletes. Mean body mass index was 23.8 ± 3.1 kg/m². Hypertension was recognized in 10 (5.7%), mental disorders in 13 (7.4%), smoking in 23 (13%), positive family history of coronary artery disease in 13 (7.4%) of respondents. Resting blood pressure was declared as normal in 105 (60%), elevated in 16 (9%) and unknown in 55 (31%) athletes. Total cholesterol level was normal in 75 (42.6%), elevated in 13 (7.3%) and unknown in 89 (50.1%) respondents.

CONCLUSIONS: The prevalence of cardiovascular risk factor in men - amateur athletes is probably underestimated because of lack of medical supervision over amateur athletes.

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Training-related symptoms of cardiovascular system in amateur athletes

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BACKGROUND: There is observed a different reaction of blood pressure (BP) and heart rate (HR) during static and dynamic exercise. Power sport disciplines, especially of high intensity, may be contraindicated in individuals with cardiovascular diseases. The aim of the current study was to evaluate the incidence of cardiovascular symptoms in highly trained amateur athletes.

METHODS: The study group consisted of 280 females (47%) and males (63%) amateur athletes of endurance and power sport disciplines of mean age 27.5 ± 9.5 years. An anonymous questionnaire survey was conducted both online and in paper form. The inclusion criteria were age over 18 years, regular trainings for a minimum 6 months. Exclusion criteria were: practicing sport professionally and lack of participant's agreement. Training intensity was assessed according to Borg CR-10 scale.

RESULTS: Training intensity was assessed as hard or very hard in 269 (96%) of respondents. A total of 91(33%) of athletes reported the occurrence of symptoms during trainings, such as headaches in 41 (15%), pre-syncope in 28 (10%), syncope in 5 (2%), palpitations in 20 (7%), chest pain in 23 (8%) and nosebleed in 15 (5%). Among strength training group more common were pre-syncope ($P=0.012$) and nosebleed ($P=0.028$). However, chest pain was reported more often by endurance athletes ($P=0.027$). Only 28 (13%) of strength athletes consulted their physician, in comparison to 48 (36%) endurance athletes ($P=0.004$).

CONCLUSIONS: High rate of training-related symptoms in amateur athletes may indicate on underlying cardiovascular diseases and regular medical examination in this group is needed.

Prevention, treatment and rehabilitation of cartilage damage in sports medicine

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Steroid injections during COVID-19 pandemic: an observational study from musculoskeletal clinic

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BACKGROUND: At the beginning of the COVID 19 pandemic, largely due to still unknown response

to steroid injections (SI) in COVID 19 patients, several professional bodies, supporting doctors delivering musculoskeletal (MSK) care, advised to limit and even avoid SI in certain groups of patients. The current study determines whether SI affects susceptibility to COVID 19 at the time when infection rates are rising.

METHODS: All patients who consented for a SI were followed up at 4-8 weeks after injection. They were asked whether they had been diagnosed with or had any symptoms of COVID 19 at any time after the injection.

RESULTS: During the study period, the reported seven-day rates of infection in Essex county raised from 105.7 to 1068.9 per 100 000 population. 208 patients had SI. 196 patients were available for follow-up. Mean age was 60.7 years. Mean body mass index was 29.5kg/m². 63.3% of patients were female and 36.7% male. The commonest sites of injections were shoulder (46%), knee (16.3%), and greater trochanter (12.2%). The most used dose of corticosteroid was 40mg (78.6%). 3 patients (1.53%) were diagnosed with COVID 19 infection during the study period. Time from the injection to the diagnosis of COVID 19 infection was 41, 27, and 19 days. None of the patients required hospital admission.

CONCLUSIONS: Administering SI during rising COVID 19 infection rates was not detrimental to the patient's outcome. Patient screening, informed consent, use of personal protective equipment, injecting minimally required dose of steroid will mitigate the risks of infection following the SI during pandemic.

Sports injuries in children and adolescence

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Ischio pubic osteochondritis (Van Neck Odeleberg), as a rare confusing diagnosis of hip pain in children

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BACKGROUND: The ischiopubic synchondrosis (IPS) is a temporary joint between the ischium and pubic bone. It ossifies during maturation, usually until early adolescence. Asymmetrical closure of the synchondrosis is common and presents with enlargement in radiological examination. Clinical symptoms are pain and limping. It is confused with infection, tumor or stress fracture, with inappropriate treatment. We want to draw attention to this rare condition. We describe the rare osteochondritis of the pubic synchondrosis, with the elements of chronic inflammation of a growing epiphysis.

METHODS: We present 3 children, ages 7-12 years old that had pain in the hip region.

RESULTS: All patients had an initial inappropriate diagnosis as muscle strain. Their symptoms remained and were further evaluated. Careful clinical examination showed the exact area of pain, with normal hip joint movements. Radiological examination showed a sclerotic homogenous enlargement in the ischio-pubic region, with absent periosteal reaction. MRI examination revealed edema of the affected bone, with minimal elements of soft tissue involvement, with absent periosteal reaction. The bone scan had a positive uptake. One child, because of synchronous respiratory infection, was initially mistaken as osteomyelitis, treated with IV antibiotics. The proper diagnosis was established in 3 weeks. Treatment is resting, until sustenance of pain. Diagnosis is based on clinical examination with a combination of the radiological investigation. It requires plain Xray, MRI and bone scan, to exclude infection, malignancy or stress fractures.

CONCLUSIONS: Children with pain in the hip region always require a complete assessment from a pediatric orthopaedic surgeon.

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Epidemiological and radiological study of adolescent athletes with spondylolysis

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BACKGROUND: Spondylolysis is one of the most common reasons for lower back pain in teenagers who exercise regularly. This study focuses on the radiological findings of spondylolysis in adolescent athletes and how these can determine the underlying pathogenesis.

METHODS: Between October 2017 and May 2018 we reviewed adolescent athletes with spondylolysis. The sample consists of 15 adolescents with spondylolysis or bone marrow edema of pars interarticularis. We measured the sagittal balance and the angles which can affect it, such as the sacral slope, the pelvic incidence, the pelvic tilt, the lumbar lordosis, the L5 slope and the Sacral Table Angle (STA) in comparison to healthy individuals.

RESULTS: Sacral slope (37.21° to 31.14° in normal adolescents) and pelvic incidence (53.43° to 47.11°) were observed to be increased in athletes with spondylolysis relative to the healthy population. Pelvic tilt, Lumbar lordosis and the Inclination of the L5 vertebra did not have a statistically significant difference between the two different samples. The Sacral table angle was significantly lower in the group of athletes with spondylolysis (95.58° to 99.65° in normal adolescents).

CONCLUSIONS: Pelvic incidence and sacral slope are elevated, whereas Sacral table angle is significantly

lower in adolescent patients with spondylolysis than in the healthy population. Low STA in the majority of patients is established at birth and remains low by indirectly increasing the sacral slope angle. Consequently, this appears to increase pelvic incidence. In conclusion, STA is an important factor for the occurrence of spondylolysis in the L5 vertebra in adolescent athletes.

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Menstrual irregularities in correlation with risk of eating disorders among adolescent athletes and non-athletes

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BACKGROUND: The prevalence of menstrual disturbances, among exercising women and girls, has been reported as high as 60%. Eating disorders (ED) are increasingly common condition and some of the most prevalent disorders in adolescence, often taking a chronic and disabling course. The present study was designed to determine the prevalence of menstrual irregularities in correlation of risk of ED and training volume among adolescent athletes and non-athletes.

METHODS: 273 Slovenian female adolescents, 150 athletes and 123 non-athletes, aged between 15-17 years, volunteered to participate. Athletes were enrolled in 19 sport disciplines, 114 in individual and 36 in team sports. Menstrual status, eating habits and training volume were evaluated with specific questionnaire. Body composition was measured with bio-electrical impedance machine InBody 230, with tetra polar eight-point tactile electrodes. T-test, Chi-square and Pearson chi-square exact significance values were used to determine group differences and correlations.

RESULTS: There was a high prevalence of overall menstrual irregularities (35.2%). Oligomenorrhea was the most prevalent, 73.9% of all cases with menstrual irregularities. We found no significant difference in the overall menstrual irregularities' occurrence between groups. The age at menarche occurred later and the prevalence of primary amenorrhea was higher in athletes than in non-athletes.

CONCLUSIONS: Training volume and body composition parameters are correlated with menstrual irregularities among athletes, but not non-athletes. Considerably more work will need to be done to determine the influence of genetic factors, body type and sport specifics on menstrual irregularities and ED.

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Playground fractures of the paediatric distal humerus: is our non-dominant extremity less resistant to acute fall-induced injuries?

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BACKGROUND: The most common surgically treated fractures in children of 6-14 years of age are Gartland type III and IV supracondylar humerus fractures (SCHF). Such fractures are treated by percutaneous pinning and more frequently occur in playgrounds due to falls on an outstretched elbow or due to a direct blow to the elbow, while trampolining, cycling, or skateboarding. The morphological and biomechanical characteristics of the olecranon, compared to those of the distal part of humerus, as well as the presence of an uneven distribution of the elbow ossification centers, pathobiomechanically facilitate fractures in this specific area. The current study aims to identify the non-dominant hand's elbow as less resistant to fall injuries.

METHODS: Two hundred and thirteen (213) (118 male and 95 female) right-handed children aged between 6-14 years were retrospectively studied during a 5-year period (07/2015-07/2020). They had been admitted to the hospital and treated surgically for injuries sustained while falling backwards onto the outstretched hand with elbow hyperextension. Traumatic injuries from direct blow of the elbow were ruled out.

RESULTS: The majority of children had a SCHF GIII/IV fracture (77.46%) and the rest of them (13.6%) a lateral condyle fracture and a medial condyle fracture (8.9%). The left side was the dominant side. The ratio in the supracondylar traumatic fractures frequency to the non-dominant elbow is approximately 2:1 and extends to 3:1 in fractures of the lateral condyle.

CONCLUSIONS: Appropriate biomechanical and mathematical models are necessary for the documentation and establishment of school exercise programs aiming to prevent such injuries.

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Contribution of the brachioradialis muscle to the radial deviation of S-H II distal radius fractures in school-aged children. Pronated or supinated forearm immobilization should be advised after closed reduction?

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BACKGROUND: Salter-Harris (S-H) II classification are the most common fractures of the distal metaphysis of the radius in children 8-12 years of age. They occur during sports, with boys tending to be affected more often than girls. Closed reduction, with or without percutaneous osteosynthesis, is needed for their treatment. Radial deviation is commonly observed due to the emergence of a topographic correspondence between the fracture line and the brachioradialis muscle inser-

tion, which extends distally and dorsally 17-28mm from the radial styloid process of the radius. This indicates that the muscle's contraction is the factor that causes radial deviation.

METHODS: Twenty (20) (18 male and 2 female) pediatric patients of age ranging from 5.5-14 years were reviewed between March and April 2020. Falling forward onto the outstretched elbow with the forearm in pronation and wrist in dorsiflexion was the injury mechanism. The distance of the fracture line (radial margin) from the styloid process apex was calculated using anteroposterior radiograph, and the results were estimated using the inch scale ruler.

RESULTS: The distance of the fracture line (radial margin) from the styloid process apex was 17-29.99mm for the majority of the patients (70%). Only 6 patients (30%) had a mean distance over the 30mm from the top of the radial styloid process.

CONCLUSIONS: The brachioradialis muscle contraction is the main cause of radial deviation in S-H II distal radius fractures. Therefore, immobilization in supination (BRM relaxed), rather than pronation (BRM contracted), with the ipsilateral elbow in 90 degrees flexion should be their treatment, in order for the forces applied by this muscle to the fracture fragment to be minimized.

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Overall and specific burden of injuries according to maturity status and timing: a two-decade study with 110 growth curves in an elite football academy

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BACKGROUND: Maturation is a potential risk factor for injuries in elite academy football players; however, available data on this topic has provided limited evidence due to methodological limitations. This study aimed to build on these limitations by using growth-curves to calculate age at peak height velocity (PHV) and investigate how maturity status and timing are associated with injury burden.

METHODS: Injury and growth data were prospectively collected from 2000-2020 in an elite football academy. Longitudinal height records for 110 individuals were fitted with the Super-Imposition by Translation and Rotation model to calculate age at PHV. Players were clustered according to maturity status (pre-, circa-, post-PHV, and adult) and timing (early, on-time, late). Overall and specific injury burden (days lost/player-season) and rate ratios for comparisons between groups were calculated.

RESULTS: Pre-PHV players had 3.2-, 3.7-, and 5.5-times lower overall burden compared with circa-PHV, post-PHV, and adult players, respectively. Concerning specific injuries, growth-related injuries were more burdensome circa-PHV, while muscle and joint/ligament injuries had a higher impact post-PHV and in adults. Injuries in on-time maturers were twice more burdensome pre-PHV compared with late maturers, due to higher impact of growth-related injuries and knee joint/ligament injuries. In adult players, however, injuries were less burdensome for early maturers than on-time and late maturers. Besides, joint/ligament injuries of adult late maturers were 4.5-times more burdensome than those of early maturers.

CONCLUSIONS: Football academies should regularly assess the maturity status and timing of young football players, as the impact of injuries varies with maturation status and timing.

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Injury burden in players with fast, average and slow peak height velocity: a two-decade study with 124 growth curves in an elite football academy

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BACKGROUND: The adolescent growth spurt has been associated with increased injury risk in academy football players, being injuries more burdensome in circa- and post-PHV (peak height velocity). This research aimed to describe how growth speed at PHV affects overall/specific injury burden at circa- and post-PHV in elite academy football players.

METHODS: Injuries and growth data were prospectively collected by the medical staff in elite academy football players from 2000-2020. Longitudinal height records for 124 players were fitted with Super-Imposition by Translation and Rotation (SITAR) model to estimate the age and growth speed (cm/year) at PHV. Players were clustered according to maturity status (circa- and post-PHV) and growth speed at PHV according to the percentile (fast [>75 th], average [25-75th] and slow [<75 th]). Overall and specific injury burden (days lost/player-season) and rate ratios for comparisons between groups were calculated.

RESULTS: In circa-PHV, players with fast PHV had 2.6- and 3.3-times higher overall burden compared with players with average and slow PHV, respectively. Besides, growth-related injuries were 4.13- (*vs.* average) and 2.93-times (*vs.* slow) more burdensome in players with fast PHV. Moreover, anterior inferior

iliac spine osteochondrosis were 8 times more burdensome in fast group *vs.* average PHV players at circa-PHV. Significant differences were found at post-PHV, being injuries in average PHV players more burdensome compared with players with slow PHV.

CONCLUSIONS: Football academies should longitudinally assess player's height and PHV. Management of the maturity-related risk factors might help improve the success of player development programs and protect the health of young football players.

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Injury burden according to skeletal maturity status in U14 elite academy football players: a 9-season prospective study

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BACKGROUND: Maturation progresses at different times and different rates between individuals. Thus, differences in maturity status exist among players in the same chronological age-based category, especially in U14s. This study described injury burden according to skeletal maturity status in U14 elite academy football players.

METHODS: From 2011-2020 injuries and individual exposure (match and training) were prospectively recorded in 183 male U14 elite academy football players. Skeletal age (SA) was assessed using Tanner-Whitehouse 2 method. Skeletal maturity status [SA minus chronological age (CA)] was classified as follows: early (SA-CA > 0.5 years), on-time (SA-CA \pm 0.5) and late (SA-CA < -0.5). Overall and specific injury burden (days lost/1000h) and rate ratios for comparisons between groups were calculated.

RESULTS: Overall injury burden was 2.8-times larger (3.6-times in trainings) in early *vs.* late maturers. Growth-related injuries were the most burdensome injuries in all groups. Despite not finding significant differences, distal growth-related injuries (*e.g.*, Sever's disease) were more burdensome in late maturers, while spondylolysis was more burdensome in early maturers. Muscle injuries of early maturers were 4-times more burdensome than in on-time and late maturers. Besides, joint/ligament injuries in late maturers were 7- and 12- times less burdensome than in on-time and late maturers, respectively. Significant differences between groups were not found in matches.

CONCLUSIONS: Our results showed different injury patterns according to skeletal maturity status. Hence, regular monitoring of maturity seems crucial to detect potential injuries that cause the greatest disruption, and facilitate design of targeted injury prevention programs.

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Ramp lesions might be more common in ACL-deficient knees in children and adolescents

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BACKGROUND: Ramp lesions are common in ACL deficient knees. Diagnosis of these lesions are somehow difficult and underestimated. Ramp lesions and their failure to be addressed might be associated with residual knee pain, instability and failure of the reconstruction after ACL has been already reconstructed. The aim of this presentation is to evaluate the prevalence of ramp lesion in children and adolescent population in ACL-deficient knees and correlate this with presurgery MRI findings.

METHODS: Children and adolescents who underwent ACL-reconstruction in our clinic during February 2018 till February 2021 were prospectively evaluated. MRI presence of ramp lesions was recorded in every ACL deficient knee. An anterior approach and an intercondylar one were used during arthroscopy to evaluate the presence or not of ramp lesion. These were recorded by another author "blinded". All ACL reconstruction was performed by the same surgeon. Finally, the MRI and arthroscopic findings were matched and correlated.

RESULTS: Twenty-eight (28) patients were evaluated. Median age was 14 yo \pm 1,5 (12-17). Anterior approach revealed no ramp lesions, while 7 ramp lesions were present and spotted through the intercondylar approach. MRI revealed all 7 of these lesions. MRI with the knee in flexion helped a lot to reveal them all.

CONCLUSIONS: The prevalence of ramp lesions in ACL-deficient knees in children and adolescent population is similar or might be a little higher than in adults. During the arthroscopy, systematic inspection through an intercondylar approach and repair through a posteromedial arthroscopic incision is mandatory in order to fully address this pathology.

Exercise Physiology and high-performance athletes

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Physiological responses in gymnastics competition under socially prescribed perfectionism

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BACKGROUND: The current study analyzes the physiological responses (cortisol, heart rate, skin conductance) to acute psychological stress during a

visualization of competition, under the influence of pressure for perfection exerted by parents, and pressure for perfection exercised by the coach.

METHODS: Artistic gymnasts (3 males and 3 females) with an age ranging from 13 to 15 years participated, who were present in 4 sessions for data collection of salivary cortisol, heart rate and skin conductance levels. The first session collected the data in a resting situation, considered the baseline. The remaining three sessions included mental imagery; session two to create mental images and live the last one gymnastic competition; the third session highlights the pressure for perfection created by the coach (PPC) in the same competition; and the fourth highlights the pressure for perfection created by parents (PPP) at the same competition.

RESULTS: The visualization of competitive situation causes an increase in salivary cortisol was within the normal daytime level. The physiological changes were greater in those gymnasts who perceived high PPC and PPP. However, for some gymnasts the situation was considered threatening (decrease in skin conductance, and small increases in heart rate), and for others was challenging (increase in skin conductance and heart rate).

CONCLUSIONS: The pressure for perfection integrates a link for the different physiological responses in competition.

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The low dose caffeine ingestion has the most ergogenic effect on intermittent exercise performance

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BACKGROUND: Caffeine is widely used by athletes for improving exercise performance. However, there has been no consistent response to caffeine with intermittent exercise performance that imitated intermittent athletic games, and it is unknown which dose was the most ergogenic to intermittent exercise. The purpose of the present cross-over, double-blind study was to investigate the effects of low, moderate, and high doses of caffeine ingestion on intermittent exercise performance.

METHODS: Ten active males performed a familiarization session and four experimental trials. Subjects ingested capsules of placebo or caffeine (3, 6 or 9 mg/kg body mass) 60 min before exercise, rested quietly, and then performed cycling. The exercise protocol was a 2×30 min intermittent cycling, which consisted of a 5 s maximal power pedaling (body weight×0.075 kp) every minute separated by 25 s unloaded pedaling (80 rpm) and rest (30 s). Mean and peak power output, heart rate (HR), rating of perceived exertion (RPE) were measured.

RESULTS: Only the 3 mg/kg dose of caffeine significantly enhanced peak and mean power output. Doses of caffeine to increase HR were 6 and 9 mg/kg. None of the doses of caffeine investigated affected RPE.

CONCLUSIONS: These results indicated that ingestion of low dose caffeine had greater effects on inter-

mittent exercise performance than moderate and high doses of caffeine. We suggest that low-dose caffeine may be a selective supplement in enhancing intermittent athletic games, such as soccer and rugby.

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The relationship between antimullerian hormone levels and menstrual function in women doing sports

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BACKGROUND: Although regular exercise has some positive effects on body function, it is well known that also can cause luteal phase defects and amenorrhea. Antimullerian hormone (AMH) is a peptide and its levels are high in women who do not have regular menstruation. AMH level increase can be used for the diagnosis of ovulatory dysfunction. The aim of our study was to investigate the risk of menstrual dysfunction in women who do team sports and to investigate whether the level of antimullerian hormone (AMH) is higher in female athletes with menstrual irregularity.

METHODS: 41 female athletes, who played basketball and volleyball professionally, participated in the study. A cross-sectional study was performed. Menstrual cycle status of the participants was questioned. Blood samples were taken from all individuals to investigate AMH levels.

RESULTS: Athletes had insignificantly more irregularities than control group (P=0.10). 17 female athletes had menstrual irregularities, while women in the control group had 10 irregularities. The AMH levels of athletes with menstrual irregularities were higher compared to the athletes without menstrual irregularities (4.12±3.15, 3.63±2.32 respectively; P=0.781).

CONCLUSIONS: Menstrual irregularity was higher in basketball and volleyball athletes in our study. Although not statistically significant, it is clearly seen that the level of AMH tends to be high in those who exercise regularly and have menstrual irregularities. Therefore, it can be suggested to use AMH level, which shows ovarian reserve, for diagnosis and follow-up in athletes with amenorrhea.

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Older and recent hypotheses about the causes and trigger mechanisms of exercise-induced bronchoconstriction

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BACKGROUND: Exercise-induced bronchoconstriction (EIB) describes the transient and reversible narrowing of the airway that is observed during intense exercise in people with or without asthma. The prevalence of EIB is estimated to be 5-20% in general population, 50-90% in asthmatic patients and 30-70% in elite athletes. The purpose of this paper was to present the older and recent theories about the causes and mechanisms of EIB.

METHODS: The data was collected from recent studies (2015-2020) from international databases (PubMed, Cochrane Library).

RESULTS: Intense exercise causes hyperventilation and the excess air must be humidified and warmed by the athlete's respiratory system. In 1984, the osmotic hypothesis was introduced as a possible mechanism that causes EIB, in an effort to combine the earlier hypotheses of airway cooling and airway rewarming (or thermal hypothesis). The most recent considerations for the mechanisms of EIB are based upon the osmotic hypothesis. They also report that the water loss of the airway during intense exercise seems to cause the release of inflammatory mediators (such as histamine, tryptase and cysteinyl leukotrienes) and the epithelial shedding inside the airway (possibly linked to a decrease in prostaglandin E2 synthesis) resulting in EIB. EIB also appears more in certain sports including indoor pool, winter and long-duration sports.

CONCLUSIONS: Additional research is needed concerning the release of particular inflammatory mediators and EIB. The preference of EIB towards certain sports and environments could be the basis for future studies about the mechanisms of EIB.

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Understanding and enhancing elite running performance – Kenyathlon: a multidisciplinary approach

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BACKGROUND: Coming from their repeated success in international events, Kenyan middle and long-distance runners have been a major research interest over the past years. The Kenyathlon aims to better understand the multitude of factors that may explain the Kenyan running phenomenon, as this will have widespread implications for the many stakeholders involved in elite sport.

METHODS: Seven elite male Kenyan runners (age: 22.7±3.2 years; weight: 59.9±4.8 kg; height: 174±5 cm)

were recruited and a variety of submaximal and maximal laboratory (adidas AG, Herzogenaurach, Germany) based tests, including treadmill and overground assessments for running economy and biomechanical analysis, have been conducted to evaluate anatomical, physiological, and biomechanical parameters impacting running performance. The impact of different running shoe designs on numerous performance metrics, including running economy, and perception is also examined and compared to amateur runners.

RESULTS: The measured maximal aerobic capacity of the elite runners participating in the Kenyathlon was 74.3±5.6 mL/kg/min. When determining the impact of running shoe design including stiff element components such as the carbon fibre rods/plates on running economy, the results revealed a large inter-subject variability in both elite (ranging from -11.2% to +11.0% difference compared to a non-technology shoe) and amateur (ranging from -9.7% to +1.1% compared to a non-technology shoe) runners.

CONCLUSIONS: Factors, including inter-individual variability in responses impacting the running economy benefits of a new generation of shoes are beginning to emerge with new considerations for all stakeholders involved.

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The effect of wearing a surgical mask during maximal exercise test on cardiopulmonary exercise test parameters

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BACKGROUND: Wearing face mask is recommended to prevent the spread of Covid-19 infection. The effect of surgical mask on cardiopulmonary exercise capacity is unclear.

METHODS: This prospective study quantitated the effects of wearing no mask (nm), a surgical mask (sm) in 30 healthy adults (age 23.1±3.5 years, BMI 22.46±2.72 kg/m²). Participants completed two (with and without a surgical face mask) maximal cardiopulmonary exercise tests (CPETs) on a treadmill following the Bruce protocol. Heart rate, blood pressure, oxygen saturation were measured.

RESULTS: Data showed that wearing a surgical face mask led to a significant reduction in maximum oxygen consumption (VO₂max) (nm 42.07±8.84, sm 38.03±6.68 (P<0.001)), minute ventilation (nm 101.41±29.84, sm 83.27±19.93, (P<0.001)). Exercising with a surgical mask was associated with a significant increase in end-tidal carbon dioxide (PEtCO₂) levels (nm 39.07±4.60, sm 42.31±5.15 (P<0.001)). Wearing face masks had no effect on exercise time, blood pressure, maximal heart rate and oxygen saturation.

CONCLUSIONS: Our findings demonstrate that

maximal aerobic exercise can be safely performed by healthy individuals with a surgical mask. Nonetheless, cardiopulmonary exercise capacity and ventilation are reduced by surgical masks. These data are important for recommendations on wearing face masks during physical exercise.

The impact of physical activities in elderly

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Dose-effect association between physical activity and body composition of the elderly in China

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BACKGROUND: World Health Organization (WHO) recommended the elderly should have at least 75 vigorous or 150 moderate intensity minutes per week (600 MET min/week) of physical activity (PA). The current research is to quantify the accurate dose-response association between leisure time physical activity (LTPA) and bone and muscle of the elderly in China and find the threshold that will improve different body composition index.

METHODS: We sampled the LTPA of 2651 males and 4212 females of old people in China and divided subjects into 7 LTPA level groups. We measured subjects' bone density Z-score and muscle mass respectively by ultrasonic bone densitometer and Body Composition Analyzer.

RESULTS: Compared with males reporting no LTPA, we observed a 0.43 unit higher Z-score among males who performing less than the minimum recommendation (REC) of WHO, which is 0-1 REC; a 0.52 unit higher at 1-2 REC; a 0.63 unit higher at 2-4 REC; A highest threshold for bone density benefit occurred at 4-6 REC. More than 6 REC, the benefit slow down, but Z-score is also higher than baseline. The similar trend occurred in females. About muscle mass, despite the benefit begin decreasing at 4-6 REC, it is also higher than baseline. Even the LTPA exceed 10 REC, muscle mass is also 1.96 kg higher than baseline in males and 4.31kg higher in females.

CONCLUSIONS: In elderly of China, whether it is male or female, 4-6 REC is the best amount of LTPA to improve bone and muscle mass.

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Implant failure in modular total hip replacement (THR) prosthesis: two cases of an uncommon complication

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BACKGROUND: Implant failure is an uncommon complication of joint replacement surgery. It leads in revision surgery earlier than expected, associated with potential local and general complications and often has a clinical outcome lower than the primary surgery. The presentation of two patients with "interchangeable neck" fracture of the same type of modular total hip replacement (THR) prosthesis is referred.

METHODS: Two male patients in their sixties, body mass index (BMI) 30.39 and 29.57, four and eight years after a modular THR respectively, with a long 8° varus "interchangeable neck" had a fracture of the "neck" piece of the prosthesis after a minor injury. The first one had a "neck" made of Co-Cr, the second made of Ti and both times the implant failure was attributed to implant fatigue. They both had a stable femoral stem and acetabular cup prosthesis. It should be noted that the second patient was four weeks after a heart valve procedure.

RESULTS: They were both treated surgically with revision THR surgery. Both times, a Wagner type of proximal femoral osteotomy was used, which was then fixed using multi-braided cerclage wiring. Both patients had an uneventful rehabilitation and a good clinical outcome.

CONCLUSIONS: Modularity in THR prosthesis is a valuable advantage. However, in heavy and active male patients it could prove to be a disadvantage, leading to "interchangeable neck" failure particularly when it has a high offset and varus angle. In revision surgery, a Wagner type of proximal femoral osteotomy proved to be of substantial help.

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Intraoperative local infiltration of tranexamic acid in total knee arthroplasty: a comparative study in a tertiary hospital

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BACKGROUND: Total Knee Arthroplasty (TKA) is one of the most common elective interventions of Orthopedic Surgery. It is associated with substantial blood loss and often with a need for transfusion which rarely leads to complications. The use of tranexamic acid (TXA) as a local infiltration seems to reduce blood loss and the need for transfusion.

Our aim is to evaluate the effectiveness and clinical outcome of local infiltration of tranexamic acid intraoperatively in primary TKA.

METHODS: We prospectively allocated the patients undergoing TKA in two groups, regarding TXA local infiltration (yes-no), for a 30-month period, one surgeon-one technique-same implant. We reviewed the patients' notes after 138 primary TKAs comparing

69 cases performed without, to 69 cases performed with TXA localized intraoperative infiltration prior to wound closure. Demographic data, hemoglobin and hematocrit levels postoperatively (days 1st /3rd /5th), transfusion need and number of blood units needed, length of hospital stay and perioperative complications were recorded and compared.

RESULTS: There is a statistically significant difference in the reduction of Hb (P<0.001) - Hct (P<0.001) on the 5th postoperative day between the 2 groups. There is also a statistically significant difference (P<0.009) in the number of blood units used for the patients' transfusion between the two groups. No adverse effect or complication of TXA use was recorded.

CONCLUSIONS: Intraoperative local TXA infiltration into primary TKA is a safe procedure, reducing the amount of blood loss, the need and the number of blood units for patients' transfusion.

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Specific exercise-program applied easily at home improves gait speed and prevents primary sarco-osteopenia in elderly people

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BACKGROUND: Daily regular physical activity prevents osteo-sarcopenia in the elderly population. The current study aimed to investigate the beneficial effect of a particular home exercise program. The focus of this exercise therapy involves the enhancement of the muscle mass of the main muscle groups of the lower extremities, in order to improve the physical activity and to protect from frailty of the elderly.

METHODS: Twenty-one (21) elderly people (18 females and 3 males) aged between 57-74 years with overweight body type were studied (September 2019-December 2019). Particular home exercise therapy for body and lower limbs muscle was applied (20 minutes daily for 3 months). Gait speed and Frax score before and after the training was calculated. **CONCLUSIONS:** Daily non-complicated and brief muscle strengthening exercises for particular muscle groups help to improve the quality of elderly's life.

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Do skeletal muscle quality and acute exercise-induced serum adaptations in older adults depend on fitness status?

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BACKGROUND: Sedentary behavior among older people is one risk factor for cardiovascular disease, immobility and increased all-cause mortality. We aimed to answer the question whether or not circulating and skeletal muscle biomarkers are differentially expressed depending on fitness status in a group of older individuals.

METHODS: Twenty-eight (28) individuals (mean age 73.36±5.46 years) participated in this pilot study. Cardiopulmonary exercise tests (CPX) and resting skeletal muscle biopsy were performed to determine individual physiological performance capacity. Participants were categorized into a high physical fitness (HPF) and low physical fitness group (LPF) depending on peak oxygen uptake (VO₂peak). Serum blood samples were taken before (pre) and after (post) CPX and were examined regarding serum BDNF, HSP70, Kynurenine, Irisin and Il-16. In skeletal muscle tissue, the myosin heavy chain (MyHC) composition and the expression of selected genes were determined.

RESULTS: HPF showed lower body weight/fat and there were positive associations between VO₂peak and VO₂VT1 in HPF and LPF. Increased expression of BDNF and BRCA1 in LPF skeletal muscle was observed, while there were no differences in other examined genes regarding energy metabolism or MyHC isoform composition. Basal serum concentrations of Irisin were higher in HPF compared to LPF with a trend towards higher values in BDNF and HSP70 in HPF. Increases in Il-16 in both groups were observed post.

CONCLUSIONS: Although no association between muscle quality parameters/VO₂peak with fitness status in older people was detected, basal levels of increased Irisin in HPF revealed slightly beneficial molecular serum and muscle adaptations.

Sport medicine physician: medical and legal issues

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Comparison of clinical outcomes between different femoral tunnel positions after anterior cruciate ligament (ACL) reconstruction surgery

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BACKGROUND: It has been shown that the proper placement of ACL graft during the ACL reconstruction (ACLR) surgery significantly improves the clinical outcomes. The current study investigated whether a change in the femoral tunnel position in both axial and

coronal planes can significantly alter the postoperative functional and clinical patients' outcomes.

METHODS: The present comparative, retrospective, single-center study was performed on 44 patients undergone single-bundle ACLR. Radiographic assessments were done to evaluate the tunnel position in coronal and axial planes. Patients were classified into 4 groups based on radiographic data. The time interval between surgery and last visit averaged 23.6 ± 2.2 months (18-30 mos.). Lysholm knee score and Cincinnati score were completed for all patients. Furthermore, the Lachman, anterior drawer and pivot-shift tests were performed.

RESULTS: Of the 44 patients, 9 patients (20.4%) were classified as the low-anterior group, 17 (38.6%) as the low-posterior group and 18 (40.9%) as the high-posterior group. None of the patients were included in high-anterior group. A greater mean Lysholm score (96 ± 3) in low-posterior group was the only significant difference between the three groups ($P < 0.001$).

CONCLUSIONS: Findings of the current study demonstrated that low-posterior placement of the ACL graft through the intercondylar notch, based on both anteroposterior and tunnel-view x-rays, is associated with better clinical outcomes in short-term compared to the routine tunnel placements.

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Sports and exercise medicine in Europe and the advances in the last decade

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BACKGROUND: Sports and Exercise Medicine (SEM) is a professional specialisation of physicians in charge of the healthcare of athletes, functional evaluation and exercise prescription in patients with chronic diseases,

as well as screening and disease prevention. Therefore, knowledge, skills and research activity of SEM specialists must cover a wide spectrum of medicine and a specific professional training is needed. Nevertheless, SEM is currently not a medical speciality in all European countries and internationally not recognised.

METHODS: To understand current situation and training process of SEM-residents in Europe, national SEM-associations were contacted.

RESULTS: Of the 27 EU countries and the United-Kingdom, 4 representatives stated that there is no recognized specialization. Sixteen countries have an independent/recognized specialization, while in the remaining 8 countries professional training courses or medical sub-specializations are proposed and a specific diploma can be obtained. Compared to 2009, SEM has been recognized as specific medical specialization in 6 more countries and various initiatives have engaged in a standardized curriculum and in achieving EU-wide recognition.

CONCLUSIONS: The positive impact of existing SEM-initiatives, its role in public healthcare, and the increasing professionalization of athletes, underline the importance of SEM as an EU-wide specialization. During the past 10 years, SEM has received increasing recognition within Europe and more countries should register in the Internal-Market-Information-system to achieve free movement of professionals in EU. Now is the time for SEM to become a uniform medical speciality, adequately represented in the healthcare systems, which will boost specific education, clinical and socio-economic impact and research progress.

Athlete care and internal medicine

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What should know internal medicine practitioners about former athletes?

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BACKGROUND: Physical activity has undoubtedly beneficial effect to more than 30 pathologies. Long-term impact of sports training during adolescence and youth is studied insufficiently.

METHODS: Forty male (of mean age 52.1 ± 2.6 years) and 32 female (of mean age 52.8 ± 2.5 years) former athletes, participating in national championships (rhythmic gymnastics, athletics, cycling, swimming, wrestling, sport games), had retired for a minimum of five years prior to follow-up ECG examination before treatment in outpatient Sports Medicine and Rehabilitation Centre. Health records were analyzed using registry of Clinical and Diagnostic Centre.

RESULTS: A frequency of 90% of former athletes suffered neck or low back pain, shoulder, knee or hip

pain. A percentage of 42% of younger (19 subjects <50 years) and 29% of older (21 subjects >50 years) males demonstrated incomplete right bundle branch block, 21 and 19% - sinus bradycardia, early repolarization pattern - 11 and 5%, premature ventricular beats - 14% of older males. Atrial fibrillation (AF) had developed only older ones - 24% of males in their 65-70th and 11% of females, 4 of 7 cases were former highly endurance trained athletes. EchoCG has been shown moderate left atrium enlargement. Unique cases of a male and a female with AF experienced type 2 diabetes mellitus. Wide spectrum of comorbidities was seen in the older groups: in males - predominantly cardiovascular and in females - gastrointestinal and hepatobiliary pathology.

CONCLUSIONS: The most common pathology in former athletes was orthopaedic. General practitioners must take into account sports history of patients, especially high intensity endurance training.

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Variation in neuro-biomarkers with marathon running: association of neuron specific enolase with sodium lowering and hyponatraemia in the biomarkers after sporting incapacitation study (BASIS)

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BACKGROUND: To investigate changes in neuro-biomarkers in incapacitated runners affected by exertional heat illness (EHI) and healthy marathon finishers (control group).

METHODS: Blood was sampled upon cessation of marathon running (T0) in 79 healthy controls (26.2 miles completed) and eight cases of EHI (22.4±5.5 miles at point of incapacity). Controls were also sampled beforehand (B) and, in a subgroup of 18 runners, the day following the marathon (T24). Processed samples were analyzed for the encephalopathy surrogates neuron specific enolase (NSE), for the S100 calcium-binding protein B (S100B), for the serum sodium (sNa) and for the creatinine kinase (CK).

RESULTS: From B to T0, control group showed decreased sNa (142 [140, 144] vs. 140 [139, 142] mmol.L⁻¹, P<0.0001) and increased NSE (3.17 [2.68, 3.92] vs. 4.26 [3.48, 5.01] umol.L⁻¹, P<0.0001), S100B (21.3 [13.6, 30.9] vs. 59.3 [42.0, 83.2] ng.L⁻¹, P<0.0001) and CK (84.4 [58.8, 115.6] vs. 343.5 [195.4, 508.9] IU.L⁻¹, P<0.0001). sNa was lower in cases than controls (138 vs. 142, P<0.0001), with 3 cases demonstrating moderate/severe hyponatremia. Cases also showed significantly higher NSE (10.33 vs. 4.24, P<0.0001), but no difference in S100B versus controls. NSE at T24 varied with serum Na at T0 (r²=0.39, P=0.0054), whereas S100B at T0 varied with CK at T24 (r²=0.44, P=0.0028).

CONCLUSIONS: Encephalopathy biomarkers are

increased with marathon running. NSE associated with EHI, suggesting genuine neuronal injury, whereas S100B related to subsequent CK rise, consistent with muscle release. The sNa may influence tendency to encephalopathy with running, by indirectly predisposing EHI or through direct brain injury.

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Case report: Post-COVID-19-symptom exacerbation after vaccination

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BACKGROUND: COVID-19 is an infectious disease caused by the SARS coronavirus 2 and affects millions of people worldwide. Post-COVID-19 is a symptom complex that is diagnosed for patients who suffer from long-lasting sequelae (e.g. fatigue, dyspnoea) which negatively affects performance and life quality. A case of a female 36-year-old and former athletically active patient who shows severe symptoms of Post-COVID-19 is described.

METHODS: Complex immunological examinations were carried out (eg. TNF-Alpha, interleucine-panel) and the impact of COVID-19-vaccination on the general health and convalescence was examined. Imaging diagnostics (e.g. echocardiography with strain analysis, cardiac MRI) were performed.

RESULTS: COVID-19 vaccination led to a marked deterioration of the general condition. For example, fatigue and neurological symptoms increased significantly. Vaccination led to an exacerbation of symptoms.

CONCLUSIONS: In contrast to the public opinion, COVID-19-vaccination may support increased deterioration of the general health in former active and young COVID-19 patients, enhancing symptoms of decreased exercise performance, increased cytokine response and neurological impairment. The vaccination impact in this susceptible post-COVID-group needs further evaluation.

Indications and contraindication for sports participation

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Hemophilia and sport participation. Data from Apulia region survey

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BACKGROUND: Regular physical activity can increase joint stability and function, reduce the risk of injury, and improve quality of life in persons with haemophilia (PwH). However, appropriate physical activity and sport are not always adequately encouraged in

the overall management of PwH. The fear of bleeding and trauma prevents doctors from recommending sport participation. Indeed, PwHs in adequate prophylactic pharmacological treatment do not present a higher risk of bleeding than the general population. Rather, constant training must be encouraged to prevent injuries related to the disease or not.

METHODS: We conducted a survey in Apulia Region (South Italy) addressed simultaneously to a cohort of Hematologists/Pediatricians experts (HEP) in haemophilia care and Sports Medicine Doctors (SMD) to evaluate their point of views in sports access for PwHs.

RESULTS: Data of survey revealed that 1 patient out of 3 (93 of the 300 patients in care) asks to HEP, during the periodic check-up visit, advices on practicing a sporting activity and 16% of them actually practicing it. Of these, 98% practice sports as amateur and only 2% are engaged in competitive activities. Data also showed that 71% of PwHs contacts SMD and 67% of them ask for advices to start physical activity. 20% of patients who referred to SMD have the possibility to participate in competitive sports. Swimming is considered the best recommended sport: selected by 67% of HEP and by 93% of SMD. Other sports recommended are athletics, racket sports (tennis, badminton, table tennis) and fencing. All respondents not recommend contact sports (boxing, martial arts, football, basketball, rugby, motor racing and motorcycling) even if, in HEP, is not clear the meaning of contact sport because a lot of them advising cycling. Finally, for competitive activities, 80% of SMD required other clinical investigations before release physical.

CONCLUSIONS: Lack of protocols and poorly defined guidelines on the access and practice of motor activities in PwHs, different points of view among HEP and SMD on the importance of the benefits deriving from regular physical activity are the issues that emerged from the survey conceived on the Apulian region. HEP should be considered sport activity for the global wellness of PwH although a careful evaluation of joint status and therapies compliance must be taken into account for the choice of sport. In addition, for competitive activities, the role of multidisciplinary team (HEP, SMD but also cardiologist, orthopedist and physiatrist) is crucial.

Life style integrated physical activity

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Cardiorespiratory fitness, heart rate variability and cognitive function in the middle of the learning in medical school

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BACKGROUND: Cardiorespiratory fitness (CRF) served as a mark of adaptive reserve of organism is

widely used in clinical and sport medicine settings, but little is known about its impact on cognitive function in University students. The aim of the study was to obtain correlation between VO_{2max} using Danish step test and autonomic and psychophysiological parameters in 4th year medical students.

METHODS: Ninety-six (96) girls and 50 young men (of mean age 21.7 ± 2.0 and 21.6 ± 0.6 years) in autumn 2019 underwent heart rate variability (HRV) assessment (3 min. ECG recording in sitting and standing position) and comprehensive psychophysiological evaluation (9 tests and 45-item behavior, hygiene and social questionnaire).

RESULTS: Danish step test has been done online <https://www.health-calc.com/fitness-tests/the-danish-step-test> by himself at home. No difference was found between girls and young men (VO_{2max} was 36.8 ± 7.8 ml/kg/min in girls and 41.5 ± 12.3 ml/kg/min in young men). Correlation analysis revealed no relation with HRV in time and frequency domains in girls, but there was borderline correlation with RMSSD in young men in supine ($r=0.27$; $P=0.05$) and significant - with pNN50% in orthostasis ($r=0.35$; $P=0.02$). Important associations exist between fitness and cognitive function: in girls - with visual working memory ($r=0.25$; $P=0.015$) and attention ($r=-0.22$; $P=0.04$), in young men - with processing speed in two verbal tests ($r=0.35$). Also in girls and boys screen time was lesser, and in boys - less probability to be smoker and spirits use.

CONCLUSIONS: CRF positively impacts on cognitive function and behavior in contemporary medical students and need to be promoted.

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Age-related differences in aerobic capacity and neuromuscular performance in male endurance runners

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BACKGROUND: The objective of the present study was to compare aerobic capacity and neuromuscular performance between young adults runners and older, more experienced runners.

METHODS: Twenty-four (24) runners, were divided into 2 groups G30 (mean age 35.93 ± 2.27 ; mean years of running experience 7.07 ± 2.95 ; mean height 1.77 ± 0.05 m; mean weight 74.84 ± 6.17 kg) and G50 (mean age 53.36 ± 2.65 ; mean years of running experience 16.93 ± 9.74 ; mean height 1.74 ± 0.06 m; mean weight 76.94 ± 10.64 kg). VO_{2max} ($ml \cdot kg^{-1} \cdot min^{-1}$), running economy allometrically scaled to body mass ($kcal \cdot kg^{-0.75} \cdot km^{-1}$), isokinetic peak torque at $60^\circ \cdot s^{-1}$ and average power at $180^\circ \cdot s^{-1}$ (Nm) of the knee extensor muscles were measured.

RESULTS: In the G50, a significant reduction in the mean values of VO_{2max} (53.56 ± 11.41 ; $P < 0.01$; $d = 1.16$; CI95% 3.68 to 18.70), peak torque (167.90 ± 32.39 ;

$P < 0.01$; $d = 1.08$; CI95% 9.03 to 54.63), and average power (207.19 ± 38.36 ; $P < 0.0$; $d = 1.17$; CI95% 13.39 to 66.94) was observed compared to the G30 VO_2max (64.75 ± 7.53), peak torque (199.73 ± 25.95), and average power (247.35 ± 30.07). The values of the running economy are worse in G50 (3.85 ± 0.24 ; $P < 0.05$; $d = -0.80$; CI95% -0.52 to -0.01) compared to G30 (3.58 ± 0.39).

CONCLUSIONS: The results of the current study indicated that there is a significant decrease of similar magnitude of VO_2max , isokinetic peak torque, and power. Running economy also was significantly worse in G50, but the effect size of the difference was lower.

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Nutrition in medical students: impact of physical activity

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BACKGROUND: Nutrition is essential for good health and plays a crucial role in optimizing training sessions in elite athletes. Insufficient data exist about nutrition in University students according their habitual physical activity (PA).

METHODS: In two consecutive academic years, all medical students attended Tula State University (106 girls and 56 boys in year 2017 and 106 girls and 49 boys in 2018) completed diet and PA questionnaires. Macro- and micronutrients consumption was accessed with 24-hour dietary recall method; analysis was performed on 97 nutrients using program "Healthy eating".

RESULTS: A percentage of 45% of the girls and 56% of the boys in 2017 and 42% and 65% in 2018 reported leisure time PA. Despite the daily energy intake did not differ, insufficient protein consumption was seen in 75% of the girls with low PA and in 47% of the girls with moderate PA ($P = 0.022$) in 2017, and in 51% and 38% of the girls in 2018. Tryptophan, lysine and leucine were the scarcest essential amino acids in both genders. Positive trend exists in 2018 in fat and salt intake in PA boys. Iron intake was more balanced in PA students of both genders. At the same time, all students demonstrated insufficient amount of phospholipids and dietary fibers consumption. It may be due to low fruit and vegetables intake.

CONCLUSIONS: A daily diet in students with moderate PA was slightly more balanced. Education is needed to improve dietary behavior in medical students.

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Anxiety, depression, attitude, and self-perception of health according to declared physical activity levels in Chileans during confinement due to COVID-19 pandemic

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BACKGROUND: Confinement has decreased physical and mental health and the attitude towards performing more physical activity (PA). Therefore, higher mental and physical health problems can significantly impact diminishing PA in people. The current study aims to compare the PA level due to confinement in Chileans according to anxiety, depression, self-perception of health, and PA intention once the pandemic ends.

METHODS: Ninety-seven (97) males and 183 females (of mean age 36.3 ± 12.2) participated in July 2020. International Physical Activity Questionnaire (IPAQ-short form) and an *ad-hoc* questionnaire Likert-type were applied to know the level of self-perception of health and PA intention once pandemic ends. The Spanish version of the Hospital Anxiety and Depression Scale (HADS) were also used. Mean anxiety, depression, self-perception, and PA intention were compared via ANOVA followed by post hoc Bonferroni's test for pairwise comparisons.

RESULTS: People who declared a lower level of PA were more depressive ($P < .001$) and indicated less intention of PA ($P < .001$) once the pandemic ends than people who indicated moderated and higher levels of PA. Moreover, people who declared a higher level of PA indicated better self-perception of health ($P < .001$) than people who declared a lower level of PA.

CONCLUSIONS: It is necessary to promote strategies that increase PA during the pandemic to avoid mental health problems and enhance the health perception.

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Physical activity in the youth and women' cardiovascular health in the middle age

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BACKGROUND: According WHO guidelines on physical activity (PA) and sedentary behavior children and adolescents should do at least an average of 60 minutes per day of moderate to vigorous-intensity, mostly aerobic, PA across the week and limit sedentary behavior. The aim of the study was to examine long term effect of regular PA on cardiovascular health determined by Holter monitoring.

METHODS: Thirty-four (34) women underwent ambulatory Holter monitoring (ECG+ blood pressure (BP) + breathing): 17 women mean aged 47.8 ± 3.6 (24-75) years were engaged in different types of PA for minimum 5 years during adolescence, data of 17 women mean aged 47.3 ± 3.1 (29-73) years served as case-control. All patients were university staff.

RESULTS: No difference was found in body mass index (26.8 ± 1.2 vs. 28.1 ± 1.5 kg/m²) and in the reason

for examination. Heart rate (HR) and systolic blood pressure (BP) at the day (125.3 ± 3.5 vs. 131.8 ± 4.6 mm Hg) and night were slightly lower, but diastolic BP was significantly lower in women with sports history (62.0 ± 2.3 vs. 70.6 ± 4.0 mm Hg; $P=0.041$). Also tendency to better breathing regularity (apnea /hypopnea index) exists. HR variability analysis revealed greater relative high frequency power at the day (nHF%; 30.3 ± 5.7 vs. $19.3 \pm 1.0\%$; $P=0.0068$), and tendency to greater nHF% at night (37.4 ± 3.2 vs. $30.8 \pm 2.6\%$; $P=0.062$).

CONCLUSIONS: Despite cardiovascular disease risk factors (excessive weight) and tendency to BP elevation middle-aged women with sport history had greater functional adaptive reserves (parasympathetic drive) may be due to optimal PA value in the youth.

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Physical activity level, motivation & knowledge amidst movement restriction for COVID-19 pandemic among Malaysian adults

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BACKGROUND: Covid-19 pandemic was declared as a public health emergency of international concern by WHO since 30 January 2020. Many countries were forced to take drastic countermeasures, such as lockdown or movement restriction of the general public to prevent the disease spread. The present study aims to assess the physical activity (PA) level, and its correlation with PA motivation and knowledge during the movement restriction due to Covid-19 outbreak.

METHODS: A cross-sectional online survey was conducted as the Malaysian government implemented movement restriction during Covid-19 outbreak. Subjects were recruited through universal sampling from the website, email and social media. The self-reported validated questionnaire consisted of socio-demographic data, short form of International PA Questionnaire, PA and Leisure Motivation Scale, and PA Knowledge.

RESULTS: Nine hundred and sixty-seven (967) subjects participated in the current study. The PA level reduced significantly from 2746.5 [$1582.0-4971.0$] (median [25-75 interquartile range]) to 960.0 [$198.0-2423.0$] MET-minutes/week ($P<0.01$) during the movement restriction. The sitting time increased significantly from 240.0 [$60.0-360.0$] to 300.0 [$120.0-500.0$] minutes ($P<0.01$). There was significant reduction in PA level for different marital status and household occupant ($P<0.05$). There was a weak positive correlation between the changes in PA level during movement restriction and PA motivation ($r = .146$, $P<0.01$), but no correlation with PA knowledge.

CONCLUSIONS: Movement restriction during COVID-19 outbreak significantly reduced overall PA

level and increased sitting time that could attribute to low motivation level. Further study that explores other factors is suggested to maintain physically active despite movement restriction during COVID-19 outbreak.

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A multicomponent workplace wellness program in sedentary office workers (healworkers): exercise and healthy habits

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BACKGROUND: The social and economic implications of a “sedentary” and “unhealthy” worker have been dramatically increased during the last decades.

The purpose of the present study was to examine the effectiveness of a 6-month multicomponent workplace wellness program on health indices, functional capacity, physical fitness, healthy habits and productivity in sedentary office-workers.

METHODS: Seventy (70) office-workers were randomly assigned to either an intervention group (IG; N.=35) or a control group (CG; N.=35). The IG participated, every working day (during the work shift), in a 6-month supervised intervention consisted of combined training program (flexibility, strength, balance, aerobic) and educational activities concerning ergonomics, exercise, health, nutrition and healthy habits. The CG did not participate in any intervention. Health indices (body composition, lipidemic profile, blood pressure, respiratory function, musculoskeletal pains), functional capacity (flexibility, balance), physical fitness (strength, cardiorespiratory fitness), healthy habits (eating habits, smoking, alcohol consumption) and productivity indices were measured before and after the completion of the intervention.

RESULTS: IG significantly ($P<0.001$) increased lean body mass (4%), respiratory function (4.5%-5.5%), cervical, handgrip, back and leg strength (15%-30%), functional capacity (25%-70%), water, fruits and vegetables consumption (10-30%); while significantly ($P<0.001$) decreased body fat (8%), blood pressure (5%-8.5%), lipidemic profile (30-45%), heart rate (15%), musculoskeletal pains and productivity indices (40%-95%) as well as beverage, fast food, dessert, smoking and alcohol consumption (15-30%). In CG, all the above variables did not change.

CONCLUSIONS: The program “HealPWorkers” may be safely and effectively used, as a “best practice”, for the improvement of worker’s overall health.

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Chair-based workplace training program, in a hospital environment, for promotion of workers physical and mental health

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BACKGROUND: The demanding and exhausting working hours, the “bad” working conditions and the unsuitable working environment that prevail in hospitals affect both physical and mental health of workers. Regular physical activity (PA) can contribute decisively to improving life quality, and consequently, to increasing productivity of healthcare professionals. The purpose of the current study was to examine the effectiveness of a daily short-term (6-week) workplace training program on health indices, overall fitness and functional capacity, subjective vitality and life satisfaction in healthcare professionals.

METHODS: Forty (40) health professionals (40-55years) working in a hospital environment divided into 2 groups: training (TG) and control group (CG). TG performed a 6-week supervised concurrent chair-based training program (stretching, strength, balance exercises, aerobic dance; 5 days/week, 30-40 min/day, 2 workouts/day lasted 15-20 min) in the hospital environment. Health indices (body composition, blood pressure, and respiratory function), functional capacity (flexibility, balance), physical fitness (strength, cardio-respiratory fitness), subjective vitality and life satisfaction (Candril scale) were measured before and after the program completion.

RESULTS: TG significantly ($P<0.001$) increased lean body mass (3%), respiratory function (3.5-4.5%), functional capacity (18-40%), lower and upper limbs maximal strength (10-20%), subjective vitality and life satisfaction (10-25%); while significantly ($P<0.001$) decreased body fat and circumferences (3.5-5.5%), blood pressure (3.5-5.5%) and heart rate during submaximal step test (14%). In CG, all the above variables did not change.

CONCLUSIONS: A short-term workplace concurrent training program may be widely used, in the hospital environment, for promotion of physical and mental health of healthcare providers.

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Association of evening physical activity with quality and quantity of sleep in adolescents: moderating effect of sport participation

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BACKGROUND: The aim of the present observational study is to investigate the association between physical activity (PA) performed in evening hours with quality and quantity of subsequent sleep in adolescents stratified by participation in organized sport.

METHODS: This investigation as a part of the CROPALS study included 123 adolescents (mean age=15.6 years, SD=0.4) with valid objective data on both sleep and PA assessed by the SenseWear Pro3 Armband™ activity and sleep monitor (BodyMedia Inc). PA energy expenditure (PAEE) recorded between 6 and 12 p.m. on each day across school week (Monday-Thursday)

was extracted. The sleep parameters examined were: total sleep time as an indicator of sleep quantity, and sleep efficiency (SE), sleep onset latency (SOL), wake after sleep onset (WASO) as markers of sleep quality. The hypothesis that the association between evening PAEE and sleep parameters is moderated by sports participation was tested by multilevel modeling for repeated measures using MLWIN.

RESULTS: In athletes, higher PAEE after 9 p.m. was accompanied with higher WASO ($P=0,028$) and lower SE ($P=0,019$). For every 100 kilocalories expend, SE receded by 1,4 %. In non-athletes PAEE after 9 p.m. was accompanied only with slightly longer SOL ($P=0,037$). For every 100 kilocalories expand, SOL prolonged by 3,1 minutes. Conversely, PA performed between 6-9 p.m. in athletes and non-athletes did not interfere with any of the sleep parameters.

CONCLUSIONS: PA after 9 p.m. impaired sleep quality in both athletic and non-athletic adolescents. Hence, both groups would benefit from scheduling PA earlier during the evening.

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Physical activity as a predictor of the level of stress and quality of sleep during COVID-19 lockdown

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BACKGROUND: The government restrictions introduced to prevent the spread of the virus SARS-CoV-2 significantly disturbed the daily functioning of people, thereby influencing healthy behaviours. The present study evaluates the correlations between physical activity (PA), level of stress (LS) and quality of sleep (GS) during COVID-19 pandemic lockdown.

METHODS: An online survey concerning PA, stress and sleep assessment was distributed during the governmental lockdown in April 2020 among all adults aged 18 years and over. The final data was collected from the 1959 respondents. The study was performed using: International PA Questionnaire-Short Form (IPAQ-SF), Perceived Stress Scale (PSS) and Pittsburgh Sleep Quality Index (PSQI).

RESULTS: Almost half of the respondents performed only 60 min of PA daily what indicated a low level of PA. Most of the participants had moderate or high level of stress and reported poor quality of sleep. People with low LS performed about 85.1 min/day of walking (WPA), 40.9 min/day of moderate PA (MPA) or 52.6 min/day of vigorous PA (VPA). People with good QS performed 82.9 min/day of WPA, 43.6 min/day MPA and 40.5 min/day VPA.

CONCLUSIONS: The volume of daily PA may be

a predictor of the level of stress and sleep quality in adults during COVID-19 pandemic lockdown. The optimal daily dose of PA to retain a low level of stress and good quality of sleep is at least 70 min per day of different intensities.

Sport participation and chronic diseases

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Moderate exercise intervention on the inflammatory bowel disease in mice: based on intestinal microecological balance

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BACKGROUND: Intestinal microbes are involved in various diseases' development. Inflammatory bowel disease (IBD) is a typical case of intestinal microbial imbalance. The current study explores the intervention exercise (IE) effect on IBD in mice, and analyzes its impact on intestinal microflora characteristics related to the IBD treatment.

METHODS: Thirty-four (34) SPF male C57BL/6 mice (4-6 weeks old) were randomly divided into 4 groups, and IBD mice models were induced by oral administration of 5% DSS. Intervention of a 6-week step-incremental medium-low-intensity moderate treadmill exercise was performed. Disease Activity Index, Intestinal Histopathology, Host Immune Expression and Metagenomics Analysis of characteristic changes of intestinal microflora were measured.

RESULTS: Exercise restored the epithelial cells tightness, reduced disease activity and histological damage scores. In DSS-induced IBD mice, serum TNF- α was associated with Bacteroidetes ($r=-0.933$, $P<0.05$) and Saccharichaceae phylum ($r=-0.885$, $P<0.05$). Serum IL-1 β was positively correlated with Erysipelotrichaceae in IBD mice ($r=0.939$, $P<0.05$). After 6 weeks of IE, serum IL-1 β ($P<0.001$), IL-10 ($P<0.01$) and IL-18 ($P<0.05$) were significantly reduced in IBD mice. Exercise significantly reduced intestinal hyperplasia ($P<0.05$) and increased Saccharibacteria ($P<0.01$). The intestinal flora of IBD mice was enriched by exercise.

CONCLUSIONS: Moderate treadmill exercise has a good repair effect on colonic epithelial damage in IBD mice, which may alter the diversity of intestinal microflora and characteristic dominant communities to inhibit the inflammatory response and its mechanism of intervention in IBD, related to the innate immunity of exercise-activated intestinal tract. Thus, a community with characteristic advantages can be used as a targeted intervention community for the IBD treatment.

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Arthroscopically assisted Elmslie-Trillat surgery for the treatment of severe chronic lateral patellar instability: long term results

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BACKGROUND: Chronic patellar instability could be a cause of malfunction and debilitation in young patients-athletes. Usually, the aetiology is multifactorial and no consensus exists about management even among knee surgeons. Assessment of 10-year experience (by the same surgeon) on patients treated surgically with arthroscopically assisted Elmslie-Trillat procedure is presented.

METHODS: Retrospectively, patients treated with arthroscopically-assisted Elmslie-Trillat procedure (period 2008-2018) were examined. Clinical and radiological data were collected and the patients had a phone interview about subjective outcome and satisfaction. Early and late complications were collected and particular attention was paid to recurrent patella instability.

RESULTS: Eight patients were treated with arthroscopically-assisted Elmslie-Trillat procedure during the last 10 years by the same surgeon, with a mean follow-up of 4.2 years (0.8-9.7). Two patients had a history of a previous failed medial patellofemoral ligament reconstruction and one a chronic neurological degenerative disease. Two patients had an immediate postoperative haemarthrosis and needed draining via a paracentesis, one patient developed tibial tubercle pseudarthrosis with associated failure of screw fixation and needed re-operation. None had recurrent patellar instability. All patients had a substantial improvement in work and sport activities.

CONCLUSIONS: The treatment choice in chronic patellar instability is often a dilemma for the clinician. Arthroscopically-assisted Elmslie-Trillat procedure is a suggested option without major complications and high level of satisfaction for both surgeon and patient, when appropriate indications and technique are applied.

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The effect of regular exercise on life quality and cognitive function in patients with multiple sclerosis

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BACKGROUND: The adoption of a sedentary lifestyle is common in Multiple Sclerosis (MS) patients. This deteriorates physical performance and may exacerbate the MS symptoms. It is known that regular exercises positively affect cognitive function and life quality. Our aim was to show that regular exercises improve cognitive dysfunction, fatigue, sleep and quality of life in Multiple Sclerosis patients

METHODS: Fifty-three relapsing remitting MS patients with EDSS scores 4 and below were included in the study. The patients were randomly divided into three groups as aerobic exercise group (AG), strength exercise group (SG) and control group. Patients in exercise group performed exercise programs 3 days/week for 3 months. Aerobic capacity and strength measurements, balance tests were performed. MSQoL54 quality of life, fatigue effect scale and PSQI scales were filled by patients. BICAMS scale was used to assess cognitive function. All scales and analyzes were repeated before and after the study.

RESULTS: Statistically significant increases were found in VO_2 max (AG: $P<0.001$, SG: $P=0.003$) and strength values (back strength; AG: $P=0.002$, SG: $P<0.001$, leg strength; AG: $P<0.001$, SG: $P<0.001$). There were statistically significant improvements in cognitive function, sleep and quality of life in exercise groups. Balance values were improved significantly in aerobic group only. Fatigue scores of all groups decreased significantly in according to the fatigue effect scale.

CONCLUSIONS: Our study shows that the progression of MS and complications related to the disease can be prevented by regular exercise.

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Autonomic modulation of heart rate in wheelchair competitive athletes

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BACKGROUND: It is well-established that exercise has positive effect on cardiovascular health shifting cardiac autonomic control toward greater vagal modulation. The present study aimed to assess frequency domain heart rate variability (HRV) parameters at rest and in response to postural provocations in healthy individuals and in individuals with complete spinal cord injury (SCI) below T6 level. Additional goal, was to assess differences in HRV parameters between sedentary and wheelchair competitive athletes with SCI.

METHODS: Twenty eight (28) individuals with complete thoracic SCI and 16 healthy individuals were recruited for the study. The individuals with SCI were further divided into two subgroups according to the participation in competitive wheelchair sports. The Low Frequency (LF), High Frequency (HF) powers and the LF/HF ratio of HRV were measured from con-

tinuous electrocardiogram (ECG) recordings using a fast Fourier transformation.

RESULTS: A significant decrease in all calculated HRV parameters in individuals with SCI was found compared to controls, in both supine and sitting positions. The change in HF, LF and LF/HF following provocation was significantly greater in controls as compared with the SCI group. Interestingly, between SCI individuals, wheelchair athletes presented lower parasympathetic modulation than sedentary individuals.

CONCLUSIONS: the study's results are in line with the hypothesis that impaired autonomic modulation is present even in individuals with SCI below the cardiac autonomic innervation. However, wheelchair athletes failed to demonstrate better cardiac parasympathetic modulation. The regular use of a standing frame by the sedentary individuals and the inappropriate training programs by the wheelchair athletes could explain this paradox.

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Thyroidopathies and participation in physical activity

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BACKGROUND: Thyroid gland disorders are among others one of the most common endocrine conditions evaluated and treated by physicians. Regarding the relationship between the function of the gland and the physical activity, different types of exercise are recommended. Disorders in normal function of the gland could have harmful effects on athletes. This is due to the fact that these disorders cause alterations on the normal heart rate and bone architecture, central muscle weakness, seldom and rhabdomyolysis.

METHODS: The scientific papers that were reviewed refer to the period of 1888 until today and fulfilled the following requirements: 1) qualitative analysis of the results of the intervention, 2) patients with thyroid disease, 3) available comparative group or a control group, and 4) published in the English language.

RESULTS: In total (158) studies were reviewed, regarded the exercise effect on patients with thyroid disease with or without thyroidectomy. The significance of the results was evaluated individually and overall for each type of intervention. Cardiovascular, metabolic, neuromuscular, psychiatric, gastrointestinal, autoimmune diseases and gene mutations were found to be related to thyroid disease and participation in physical activity.

CONCLUSIONS: Some types of thyroid disease allow

the participation in moderate-intensity physical activity, while other types are an absolute contraindication to participation. Further research is deemed necessary to investigate the type and intensity of physical activity indicated, before and after thyroidectomy, as there are no clear conclusions due to the lack of research data.

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Ehealth: towards achieving combination of sports participation and chronic diseases

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BACKGROUND: Europe is faced with the challenge of providing affordable, fair, quality and sustainable health programme to all its citizens. Principally, the potential to enhance the life quality for individuals with chronic diseases through physical activity (sports participation and exercise) is an important factor behind the challenge. Moreover, under the COVID-19 pandemic, the importance of keeping the individuals with chronic diseases at home via eHealth, by monitoring, advising and providing them with a holistic well-being health programme which amongst others includes physical exercise, is one of the key challenges to the community of sports. Although, the search was not exhaustive, it is hoped that it contributes as a comprehensive resource into the implementations of for the benefit of holistic primary health programmes.

METHODS: The literature review was conducted in PubMed, Cochrane library and Scopus in February - May 2020. Also, data were obtained and elaborated from the Eurostat and OECD databases.

RESULTS: The safeguarding of the environment that promotes smart technologies, endorses synergies, implements a national plan through local adaptation, shall encourage patients, carers and healthcare professionals to fully exploit the benefits of telehealth and artificial intelligence as a new type of personalized health-approach, contributing dynamically to the development of an integrated active health programme.

CONCLUSIONS: Policy making at European and national level needs to be based on the rapid transformation of a Citizens' eHealth Monitoring Map as a means of cost-effective interoperability for individuals with chronic diseases, in alignment of eHealth and health strategies across Europe.

Sport equipment, health and performance

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A national survey of the frequency of injury and mouthguard use in elite greek futsal players

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BACKGROUND: Futsal is a sport that may lead in frequent injuries.

The purpose of the current survey study is to record the frequency of serious injuries in elite Greek futsal players, as well as the use of mouthguards from them.

METHODS: A fifteen-item questionnaire was answered from sixty-three (N.=63) elite Greek futsal players. Questions were closed and concerned the frequency of injuries, their type, as well as the use of mouthguards.

RESULTS: Half of the players reported a serious injury during exercise, the most common of which were heavy sprain, with anterior cruciate ligament (ACL) and meniscus rupture following. Sixty percent (60%) of the players had an affected quality of their lifestyle due to injury. A frequency of 43% of the players did not consider having an oral injury possible, 30% were not aware of the existence of the mouthguard, while only 5% of the players used a mouthguard before. However, 80% of the players believe that the use of a mouthguard could prevent the oral injury.

CONCLUSIONS: Futsal might provoke a series of serious injury. The commonest injury was the sprain. There is a huge amount of misinformation among players regarding the use of mouthguards.

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Effects of blood flow restriction during resistance exercise on muscle strength and metabolic, hormonal and perceptual responses in healthy adults: a systematic review and meta-analysis

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Blood flow restriction (BFR) training is an effective alternative modality to high load resistance training (HLRT) inducing positive physiological adaptations in healthy adults, including: improvements in muscle strength and muscle mass; stimulation of growth factors (growth hormone, insulin-like growth factor-1) and inflammatory myokines (IL-6). The purpose of this systematic review and meta-analysis is to investigate the effects of low load resistance training (LLRT) with BFR *versus* HLRT without BFR on 1) muscle strength and muscle mass, 2) inflammation and growth factors and 3) perceptual responses to resistance exercise in healthy adults.

Four electronic databases (PubMed, EMBASE, Web of Science, SportDiscus) will be used to retrieve published randomized controlled studies using

BFR during resistance training. Criteria for inclusion are interventions that utilize LLRT with BFR versus HLRT without BFR in healthy participants. All studies will be cross-referenced and reviewed by 3 experts. Primary outcome measures include: muscle strength and muscle mass, and secondary outcomes include: inflammatory, growth factors and perceptual responses. Hedges g effect size will be calculated for each outcome and pooled using the inverse heterogeneity model. Heterogeneity will be assessed using Q with an alpha level of 0.10, and inconsistency using I^2 . Two-tailed z -alpha values of 0.05 and non-overlapping 95% confidence intervals will be considered statistically significant. The risk of bias will be assessed using the revised Cochrane Risk of Bias instrument for randomized controlled trials, and the strength of evidence using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) instrument.

This study was preregistered on PROSPERO (CRD42021246633).

Assessment of high performance athletes. The contribution of science for health and performance

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Retrospective analysis of iron screening in elite Welsh athletes

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BACKGROUND: Iron deficiency (ID) is common amongst elite athletes, and has been shown to affect athletic performance. Therefore, it has become routine for elite athletes to be subject to annual screening. The objective of the current work was to review current data literature to update the guidelines for the ID screening and review the impact of applying the updated parameters on retrospective data.

METHODS: Since 2015, data has been collected from 61 (33 female and 28 male) medal winning athletes through a screening program at Sport Wales. A literature review was conducted and a consensus amongst staff led to the creation of a 2018 guideline for the ID screening. The newly defined parameters for iron levels were tested against the retrospective iron data.

RESULTS: The literature review led to guidelines modification and updating. Serum ferritin was concluded to be the single best investigation for ID. Twenty-five (25) athletes (41%) had been ID at some point in the last 3 years, with 64% of females experiencing ID (Ferritin <50 ug/L). Gymnasts had the highest rates of ID.

CONCLUSIONS: All stages of ID affect athletic per-

formance. A percentage of 41% of elite Welsh athletes have been ID during routine screening over the past 3 years. The updated guidelines recommend a higher value for ID anemia; to differentiate between males and females; for iron studies to be done in the fasted state and for serum ferritin to be measured alongside CRP.

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What makes an outstanding athletic capability? An activation likelihood estimation (ALE) meta-analysis of elite athlete's brain morphology

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BACKGROUND: Published studies proved that the reorganization performed in athlete brain morphology, yet remains controversial. It is unknown if this reorganization is positive or negative, as well as it is obscure in which brain areas, the reorganization happened. The current research clarifies the motor training-related morphology reorganization pattern in elite athletes' brain.

METHODS: Web of science, PubMed and EBSCO were searched through September 2005. Articles were included in this meta-analysis if they fulfilled study criteria and important information was then extracted from included literature by two authors independently. Coordinate-based activation likelihood estimation (ALE) method was used to conduct a quantified meta-analysis of 14 fMRI studies in which gray matter plasticity changes of elite athletes were reported by means of expert-novice paradigm and voxel-based morphometry.

RESULTS: Fourteen studies with 119 foci were included. The meta-analysis results showed significant clusters located in cerebellar cullen, parahippocampal gyrus, thalamus, declive, cerebellar posterior cingulate, lingual gyrus and cerebellar lingual where the plasticity change of expert athletes' gray matter was positive. On the other hand, no cluster was significant for negative plasticity change. (FWE correction, $P < 0.05$)

CONCLUSIONS: Elite athletes showed positive plasticity change mainly in the cerebellum anterior lobe (culmen and lingual) and in the limbic system (parahippocampal gyrus, thalamus and posterior cingulate). Present findings provided a deeper insight into neuroplasticity changes in response to long term motor training and supreme motor performance.

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Integrating training and off-training activities substantially alters training volume and load analysis in elite rowers

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BACKGROUND: Training studies traditionally focus on the relationship between scheduled training (TRAIN) and performance outcome. To the best of our knowledge, this is the first study integrating activities outside of scheduled training *i.e.*, off-training (OFF) to total training (TOTAL). The contribution of OFF on performance was evaluated.

METHODS: TRAIN and OFF of eight elite rowers were monitored with multisensory smartwatches for 30–45 weeks. Changes in the endurance training status were assessed with four ergometer tests. Based on 1-Hz-sampling of heart rate (HR) during TRAIN and OFF (> 60% peak heart rate), the volume, session count, intensity, training impulse (TRIMP), and training intensity distribution were calculated.

RESULTS: OFF altered volume, TRIMP, and session count by 19%, 11%, and 41% ($P < 0.001$). Training intensity distribution did not change on a group level, but individual analysis revealed meaningful changes in 3% of all valid weeks. A frequency of 31% of the weekly volume was exercised <60% of maximum HR. Low to moderate intensities dominated during OFF with 87% (95% CI [79, 95]); however, in some weeks high intensity training $\geq 88\%$ of maximum HR amounted to 21 min•wk⁻¹ (95% CI [4, 45]). No effect of OFF on changes in training status was found.

CONCLUSIONS: The OFF integration substantially altered volume, TRIMP, and session count in a range that is often regarded to be sufficient to discriminate between groups in intervention studies. OFF should therefore be considered for analyses of training to illuminate the probably relevant blind spot of OFF and to better understand adaptation in trained and untrained populations.

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Limits of agreement when assessing biceps femoris long head muscle architecture using long and short ultrasound probes

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BACKGROUND: Research examining muscle architecture often uses two-dimensional (2D) B-mode ultrasonography to assess muscle thickness (MT), pennation angle (PA) and fascicle length (FL). Extrapolation methods are required to estimate the FL of some muscles, such as the biceps femoris long head (BFLH), which are longer than the ultrasound probe. The aim of the present study was to assess the agreement between extrapolation and direct measurement of muscle architecture.

METHODS: Direct measurements were taken from 12 BFLH ultrasound (US) scans obtained using a 9 cm long probe in which the full FL was visible, and

an extrapolation method was used on the same images with the width cropped to the central 4.5 cm. All images were digitised five times in a random order to examine test-retest reliability. Mean values for each set of five repeat digitisations were used to examine limits of agreement.

RESULTS: Limits of agreement showed clear bias towards larger values when using the extrapolated method for MT (+1.7 mm), PA (+0.62 degrees), and FL (+6.8 mm). Follow-up t-tests showed that these differences had associated p-values below 0.016. Test-retest reliability was excellent for all parameters (ICC (2,k) > 0.994) with a low standard error of measurement (MT=0.1 mm; PA=0.13-0.17 degrees; FL=0.6-0.9 mm).

CONCLUSIONS: Measuring muscle architecture by extrapolation of cropped ultrasound images led to an overestimation of MT, PA, and FL compared with a direct measurement of the full FL. Wherever possible, direct measurement of the full FL should be made, and future research should focus on improving extrapolation methods.

Obesity and diabetes and sports and exercise medicine

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The relationship of VO₂ peak and the blood lactate transition threshold with metabolic syndrome and its component disorders

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BACKGROUND: Improvements in cardiorespiratory fitness attenuate the risk for metabolic syndrome (MetS). However, the determinants of cardiorespiratory fitness measurements such as VO₂ peak and anaerobic threshold (AT) have not been investigated in persons with MetS. The aim of the present study was to compare VO₂ peak and AT between subjects with and without MetS and to investigate determinants of cardiorespiratory fitness and its effects on the odds for MetS and its individual components.

METHODS: Thirty one (31) males with MetS and 24 healthy male participants each performed a VO₂ peak and a blood lactate transition thresholds (BLTT) test. Waist circumference, BMI, blood pressure, fasting plasma triglyceride, total cholesterol, HDL-cholesterol, glucose and insulin levels were measured. Separate multivariable linear regression models were developed in which VO₂ peak, AT and the components of MetS were used as the dependent variables, whilst a multivariable logistic regression model was used for MetS.

RESULTS: The VO₂ peak (median [interquartile range]) was lower in subjects with MetS compared to

controls (27.9 [23.0, 31.0] vs. 35.0 [32.0, 45.0] ml.min⁻¹.kg⁻¹; P<0.0001). Multivariable regression analysis demonstrated that there was a bi-directional association between MetS and VO₂ peak that was mediated by waist circumference and blood pressure. The VO₂ peak was a strong negative determinant of waist circumference (β =-0.36, P<0.0001), but not of BMI (β =0.13, P=0.21).

CONCLUSIONS: A higher VO₂ peak is associated with a lower odds ratio for MetS, which is related to greater cardiorespiratory fitness in a cyclical relationship that is mediated by blood pressure and waist circumference. A higher VO₂ peak is specifically associated with lower waist circumference, and vice versa, possibly by effects on visceral fat.

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Effect of school-based adolescent obesity intervention on physical fitness: the MyBFF@school

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BACKGROUND: The prevalence of overweight and obesity in adolescents has continued to rise remarkably over the past decade despite numerous efforts. My Body is Fit and Fabulous at School (MyBFF@school) is a school-based multifaceted intervention designed to combat adolescent obesity. The study aimed to determine the effectiveness of this program on physical fitness and enjoyment level in the overweight and obese adolescents.

METHODS: A multistage randomized control trial involving 1041 overweight and obese adolescents aged between 13 to 16 years was conducted. The intervention focused on outdoor physical activity (small-sided games), nutrition and psychological education. The control group followed the existing school curriculum. The outcome was physical fitness and enjoyment level that measured at baseline, 3 and 6 months later.

RESULTS: Most participants had baseline physical fitness of above-average level. Boys had higher physical fitness level (68.89±5.51) than girls (68.04±4.46) (P<0.05). The physical fitness for the intervention group increased significantly from baseline to 3 months but declined significantly at 6 months (P<0.001). The control group showed significant improvement in physical fitness from baseline to 6 months (P<0.001). Both groups showed a significant reduction in enjoyment level at 6 months with the control had greater decline than the intervention group. There was no significant difference in physical fitness and enjoyment level between the two groups.

CONCLUSIONS: MyBFF@school program improved physical fitness in overweight and obese adolescents for a short term. Future studies should focus on designing intervention that could sustain the long term positive effects.

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Impact of bariatric surgery on respiratory function and maximal aerobic capacity

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BACKGROUND: Obesity has adverse effects on physical fitness and respiratory function, which can be improved after bariatric surgery (BS), but some indicators are still controversial. The purpose of this study is to evaluate the impact of postoperative respiratory function changes and aerobic exercise capacity.

METHODS: 29 obesity subjects were compared to 29 sex-, age- and height-matched health controls. All subjects performed body composition determined by dual-energy X-ray absorptiometry, spirometry and lung diffusion, cardiopulmonary exercise testing on cycling. Within the obesity subjects 13 underwent BS and were re-tested 6 months after surgery.

RESULTS: Obese subjects had lower specific VO₂peak, slow vital capacity (SVC), forced vital capacity (FVC), forced expiratory volume in one-second (FEV1), lung diffusion capacity for carbon monoxide (DL_{CO}) and pulmonary capillary blood volume (Vc) corrected by hemoglobin and alveolar volume (VA). Weight loss six months after BS, the specific VO₂peak, SVC, FVC, FEV1, VA and Dm were improved. There was negatively relationship between the changes in visceral adipose tissue (VAT) and the changes in the indicators of respiratory function (SVC, FVC, DL_{NO}/DL_{CO}, Dm/Vc).

CONCLUSIONS: The aerobic exercise capacity of obese patients was improved six months after BS with an increase in specific VO₂peak and unchanged absolute VO₂peak. The lower spirometry and diffusion function in obese patients improved after BS with unchanged ventilation effectiveness. The reduction of visceral fat post-operative directly benefited the improvement of lung function, including lung diffusion.

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The effect of high-intensity interval training on mitochondrial function in obese/overweight adults: a systematic review and meta-analysis

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BACKGROUND: High-intensity interval training (HIIT) has been shown to increase aerobic capacity [maximal oxygen uptake (VO_{2max})], with the mitochondrial adaptations being one of the main causes. At the same time, obesity is an epidemic worldwide characterized by mitochondrial dysfunction, while exercise is considered an effective remedy. The purpose of this study was to examine the effect of HIIT on mitochondrial function of obese/overweight adults.

METHODS: The databases used were PubMed, Scopus, CENTRAL and Web of Science. Inclusion criteria were the following: (1) a HIIT exercise protocol, (2) training duration ≥ 2 weeks and ≥ 6 sessions per exercise program, (3) participants' BMI ≥ 25 kg/m², (4) examination of at least one of the mitochondrial outcomes Cytochrome c Oxidase IV (COX-IV), or Citrate Synthase (CS), and (5) human trials. We performed a series of continuous meta-analyses to calculate mean differences, using a random-effect model, in the RevMan 5.4 software.

RESULTS: Of the 1974 studies initially retrieved, 21 were included in the meta-analysis, with a total sample size of 301 participants. The average training period was 9.76 weeks, consisting of 3 sessions per week. The effect estimates showed that HIIT increases COX-IV [+0.79 (95% CI: 0.49-1.08); $P < 0.00001$; N=137], CS [+0.86 (95% CI: 0.56-1.16); $P < 0.00001$; N=200], and VO_{2max} [+3.54 (95% CI: 2.00-5.08); $P < 0.00001$; N=243].

CONCLUSIONS: HIIT improves mitochondrial function of obese/overweight individuals, enhancing in this way their metabolic profile.

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Integrated concurrent aerobic and strength training is an effective strategy for the improvement of obese individual's overall health

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BACKGROUND: Obese individuals present different cardiovascular, neuromuscular and metabolic adaptations during and after an acute bout of exercise compared with individuals with normal body mass. These differences could influence the long-term training adaptations of obese individuals during aerobic and resistance exercise. The purpose of this study was to examine the long-term adaptations (3 months, 3days/week) of a concurrent training program in selected indices of health, functional capacity and physical fitness in obese individuals.

METHODS: 36 middle-aged obese (BMI >30) females were assigned to either a training (TG; N=18)

or a control group (CG; N=18). The TG performed a 3-month integrated concurrent training program (aerobic dance and calisthenics exercises were altered in a predetermined order during the program). The CG did not participate in any training. Health indices (body composition/circumferences, blood pressure, respiratory function), functional capacity (flexibility, balance), physical fitness (strength, aerobic capacity) were measured before and after training.

RESULTS: TG significantly ($P < 0.001$) increased lean body mass (4.2%), respiratory function (2.8-3.5%), lower limbs functional capacity (19-39%) and upper limbs muscle strength (10.5-76%); while significantly ($P < 0.001$) decreased body fat (10.7%), body circumferences (4.5-6.5%), blood pressure (3.5-5.5%), heart rate and rate of perceived exertion during submaximal exercise (14-24%). In CG, all the above variables did not change. Furthermore, a great percentage of obese females (95%) reported high levels of enjoyment.

CONCLUSIONS: Integrated concurrent training is an enjoyable exercise modality that may be safely and effectively used for counteracting the detrimental effects of obesity on health, functional capacity and physical fitness.

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Skeletal maturation is associated with obesity in male adolescents: results from a portuguese cross-sectional study

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BACKGROUND: The ankle is one of the most common sites of injury among soccer players. There is evidence that the incidence of ankle injuries can be reduced by improving proprioception and ankle stability via balance exercises. The current meta-analysis evaluated the effectiveness of injury prevention programs (IPPs) that include balance exercises in ankle injury prevention.

METHODS: Two investigators independently searched for relevant studies published during the period 1985-2021 using the online databases Cochrane Library, PubMed, Web of Science, and PEDro. The keywords used were 'balance training', 'proprioceptive training', 'neuromuscular training', 'injury prevention programs', 'FIFA', 'ankle injury', 'soccer', and variations of these search terms. Included studies had to be randomized controlled trials using IPPs that included balance exercises for soccer players with the primary outcome being ankle injury rate. There were no restrictions of age or playing level. The random-effects model was used in analyzing the extracted data by the Comprehensive Meta-Analysis software version 3.

RESULTS: The pooled results of IPPs that include balance exercises among 4,959 soccer players showed 36% ankle injury reduction per 1000 h of exposure

compared to the control group with an injury risk ratio [IRR] of 0.64 (95% confidence interval [CI] 0.54–0.77, $P < 0.001$). Moreover, isolated balance exercises showed 42% ankle injury reduction [IRR 0.58; 95% CI = 0.41–0.84, $P = 0.004$].

CONCLUSIONS: The current meta-analysis demonstrated that IPPs that included balance exercises decreased the risk of ankle injuries, particularly among male soccer players.

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Differential responses of mitochondrial biogenesis and vascular angiogenesis factors to a single bout of exercise in the myocardium of diabetic and non-diabetic rats

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BACKGROUND: Diabetic cardiomyopathy exhibits reduced cardiac function in association with impaired mitochondrial function, vascularization, and increased oxidative stress. It is unknown if the diabetic heart would benefit similarly to exercise training as the non-diabetic heart. This study aimed to investigate whether there were different molecular responses of the mitochondrial biogenesis and angiogenic factors to a single bout of exercise in the normal and diabetic heart.

METHODS: Thirty-five (35) rats were randomly assigned into one of four groups: 1- Non-diabetic control (CS; n 8); 2- Diabetic exercise (DIEX; n 9); 3- Sedentary diabetic (DIS; n 9); and 4- Non-diabetic exercise (CEX; n 9) groups. Diabetes was induced using streptozotocin (STZ). DIEX and CEX completed a 60-min of treadmill running after one week of running habituation. Left ventricle was obtained after 1.5 h of exercise cessation. Real-time PCR was used to quantify of the mRNA expression of PGC-1 α , vascular endothelial growth factor (VEGF), thrombospondin (TSP-1), and hypoxia-inducible factor 1 α (HIF-1 α). VEGF to TSP-1 ratio was measured using the semi quantitative PCR. Lipid peroxidation was measured using the thiobarbituric acid assay.

RESULTS: STZ-induced diabetic rats showed a significant body weight reduction in DIS ($P = 0.01$) but not DIEX ($P = 0.2$), while CEX and CS increased their BW ($P > 0.01$). Heart weight to body weight ratio was higher in DIEX compared to all three groups ($P < 0.005$). CEX and DIEX expressed higher THb1 mRNA relative to CS and DIS ($P < 0.005$ for all comparisons). The sedentary groups CS and DIS were similar ($P = 0.7$). %VEGF to TSP-1 was higher in DIS compared to all groups ($P < 0.05$ for all). PGC-1 α mRNA was similar among CEX, DIEX and DIS ($P > 0.05$ for all), and higher than CS ($P < 0.01$). No other differences were detected.

CONCLUSIONS: DIEX and CEX showed similar molecular responses of mitochondrial biogenesis

and angiogenic factors to a single session of exercise. This suggests that diabetic heart may similarly benefit from regular exercise training as the normal heart. However, more studies are warranted to examine if those molecular responses would be translated to similar mitochondrial function and vascularization level in both hearts with exercise training

Other

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Complications after reconstruction of isolated ACL injuries: a prospective study of 958 cases with 2 years follow-up

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BACKGROUND: The rate of complications or adverse events following an anterior cruciate ligament (ACL) reconstruction is underestimated. Aim of the study was to describe the 2-year complications and adverse events following an ACL reconstruction and analyze them on the basis of the graft type.

METHODS: From 2000-2012, 958 patients with an isolated ACL injury were operated. ACL reconstruction was performed with the medial portal technique for the femoral tunnel and the use of bone-patellar tendon-bone and hamstrings-graft. Patients were reviewed at 6 weeks, 3, 6 and 24 months after ACL reconstruction with plain-radiographs and KT-1000 measurements.

RESULTS: Of 958 patients enrolled, 147 (15%) were lost at the last follow-up. The 2 groups were similar regarding the mean age at the time of surgery and preoperative anterior laxity. The main complications were: anterior knee pain (AKP) (131/811, 16%), stiffness (73/811, 9%), secondary meniscal lesions (59/811, 7.2%), pain due to fixation (79/811, 9%), ACL re-rupture (43/811, 5.3%), contralateral ACL ruptures (24/811, 3%), patella fractures (3/811), infections and thrombo-embolic complications (9/811, 1%).

CONCLUSIONS: The results of ACL reconstructions are good and there were no major complications. The overall rate of complications in a 2-year period time following surgery was 39%.

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Futsal injuries: a systematic review

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BACKGROUND: Futsal is a sport that may lead in frequent injuries due to restricted area it is played in and the sudden change of the athletes' direction. The aim of the current systematic review is to highlight the accumulated knowledge concerning injuries associated with futsal.

METHODS: Data has been retrieved from original scientific papers published in Pubmed and Cochran Library using search terms "futsal" AND "injury".

RESULTS: The systematic investigation concluded that 24 papers would provide data concerning injuries and sports including the Futsal. After careful selection, the total of these papers, 12 were directly focusing on futsal players and thus assessed as suitable for the review, and the other 12 were excluded due to irrelevant data to the topic. The futsal players presented high risk of serious injuries, some of which are extremely rare in other sports. An interesting finding was that the plethora of injuries occurred in non-contact cases. The majority of the injuries occurred in the lower extremity, especially in the ankle and knee. The severity of the injuries was not related to the age, experience, gender or player's position. Moreover, right-footed players had more ipsilateral injuries than left-footed. Finally, the injuries occurred more frequently in the second half of the game, and particularly in the last quarter.

CONCLUSIONS: Futsal might increase the risk of injury. Evidence indicates that futsal players reported serious injuries in the ankle and knee. So, there is a great demand for special training programs in order to prevent those injuries.

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Serum neutrophil gelatinase associated lipocalin and neuron specific enolase are highly discriminative for exertional heat illness in the biomarkers after sporting incapacity study (BASIS)

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BACKGROUND: To assess biomarkers for exertional heat illness (EHI) detection and investigate endotoxaemia

in runner participants of the Brighton Marathon.

METHODS: Eight collapsed runners referred for medical care of EHI had blood drawn close to the point of incapacity (completed marathon distance 22.4±5.5 miles), with consent affirmed retrospectively. 79 healthy runner controls were recruited prospectively and underwent blood sampling at rested baseline and following completion of the same marathon (26.2 miles). Samples were analysed for markers of renal stress (neutrophil gelatinase associated lipocalin, NGAL; kidney-injury molecule-1, KIM-1) and encephalopathy (S100 calcium-binding protein B, S100B; neuron specific enolase, NSE). Additional assay of intestinal fatty acid binding-protein (IFAB-P) as a marker of endotoxaemia was performed for all cases, plus a sub-sample (N.=24) of controls.

RESULTS: Between EHI cases and successful finishers, differences existed in NGAL (182.5 [118.7, 200.00] ug.L⁻¹ vs. 52.44 [46.36, 63.80, P<0.0001], NSE (10.33 [6.37, 20.00] vs. 4.24 [3.49, 4.99] u.g.L⁻¹, P<0.0106) and IFAB-P (20,000 [20,000, 20,000] ng.L⁻¹ vs. 2195 [175, 3005], P<0.0001), but not KIM-1 or S100B. On analysis by Receiver Operating Characteristics curve (EHI cases vs. controls), Area-Under-the-Curve (P<0.005) was 0.99, 0.92 and 0.86 for NGAL, NSE and IFAB-P.

CONCLUSIONS: EHI and endotoxaemia from marathon running are associated with elevated NGAL and NSE. This may reflect systemic inflammation and risk of organ injury mediated by occult endotoxin leakage/failed clearance. These biomarkers should be further investigated to assess their potential for early detection and prognostication of EHI during prolonged endurance exercise.

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Dental erosion associated with intensive and recreational swimming in chlorinated swimming pools: a systematic review

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BACKGROUND: Dental erosion is the pathologic chronic diminution of dental hard tissues due to chemical effect of extrinsic and/or intrinsic acids without bacterial involvement. The purpose of the systematic review is to underline current evidence for dental erosion in swimmers due to exposure in chlorinated swimming pools. The accumulated knowledge is further discussed.

METHODS: Data has been retrieved from original scientific papers and case reports published in well-established sources including the Dental School Library of National and Kapodistrian University of

Athens. Additional research has been conducted in PubMed and Medline using search terms: “dental” OR “enamel” AND “erosion” AND “swimming pool”. References list from detected papers were also searched to reveal further relevant data.

RESULTS: The systematic investigation concluded that 21 papers would provide data concerning dental erosion, either as prevalence detection to relevant age groups, or directly linked to swimmers in chlorinated swimming pools. After careful selection the total of these papers, 11 were directly focusing on swimmers and thus assessed as suitable for the review, 9 were relatively important and 2 case reports were excluded. In all 11 mentioned papers, the swimmers either intensive or recreational demonstrated dental erosion of variable severity.

CONCLUSIONS: Swimming in a chlorinated swimming pool might increase the risk of dental erosion. Evidence indicates that frequency and duration of swimming sessions are correlated with the prevalence and severity of dental erosion. Further well-designed clinical studies are needed to fortify the suggestion that chlorinated water in swimming pools composes an aggravating factor for dental erosion.

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2 Cases of reverse hill-sachs lesions after posterior dislocation of the shoulder treated with modified McLaughlin and posterior bankart repair

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BACKGROUND: Reverse Hill-Sachs in a patient with posterior shoulder dislocation is not commonly seen. Diagnosis could be missed and surgical treatment as well as postoperative management is a challenge for the clinician.

This article presents 2 cases of reverse Hill-Sachs lesions after posterior dislocation of the shoulder treated with modified McLaughlin and Posterior Bankart Repair.

METHODS: A 30-year-old man with an acute posterior dislocation of the shoulder after a grand mal seizure. And a 52-year-old man with a 4-month history of locked traumatic posterior fracture-dislocation of the shoulder. Imaging showed reverse Hill-Sachs lesions, and articular defects of 45% and 50% of the humeral head respectively and fracture of the humeral neck in the second case. In the first case the patient was treated initially with a modified Mc Loughlin procedure; however postoperatively humeral head was still not centred in glenoid. The patient was operated again having an arthroscopic posterior Bankart repair a few days later. In the second case the same procedure was performed in one stage.

RESULTS: The patients started early postoperative mobilisation, and in his one-year postoperatively clinically

and radiologically there is an excellent outcome.

CONCLUSIONS: “Filling” the impaction fracture with the modified Mc Loughlin procedure could be insufficient in substantial reverse Hill Sachs lesions after posterior shoulder dislocation. Reverse Bankart lesion needs repair as well for centring humeral head in glenoid. Both together, filling and centring effect ensure safer mobilisation and better outcome for our patients.

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The lifestyle behaviours and motivation among malaysian professional footballer during COVID-19 pandemic

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BACKGROUND: Covid-19 has impacted the world tremendously with 146,236,400 cases and 3,099,461 deaths worldwide to date. Malaysia has faced 387,535 cases and 1,415 deaths so far. The Movement Control Order (MCO) that was imposed during escalating outbreak of Covid-19 in Malaysia on 18th March 2020 limited physical and sports activities, including team sports such as football. This study aims to determine the correlation between lifestyle behaviors and motivation during MCO in Malaysian professional male footballers.

METHODS: A total of 136 professional male footballers from Klang Valley, Malaysia, were recruited using the universal sampling method. This study focuses on the correlation between the physical activity, eating behavior, sleep quality, and motivation of footballers during MCO. The data gathered through validated questionnaires were analyzed through Linear Regression and Pearson Correlation. The reliability of the data was measured through Cronbach’s alpha.

RESULTS: The Chronbach’s alpha was 0.80. Regression analysis showed that physical activity, eating behavior and sleep quality was affected by the sports motivation of the footballers with a significant R-Squared ($P < 0.001$). The independent and dependent variables showed a significant correlation, representing a strong positive relationship between the variables ($P < 0.05$).

CONCLUSIONS: This study showed that the sports motivation of the footballers highly influenced their lifestyle behaviors during the Covid-19 pandemic. Future studies should investigate the impact of mental health on the lifestyle behavior of footballers, especially during the fluctuation of the Covid-19 pandemic.

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Meniscal root tear repair: preliminary results of transtibial pull-out repair

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BACKGROUND: During the recent years, the importance of meniscal root tears has been recognized as a keystone of the proper function of the knee joint. The purpose of this study is to present our experience with the posterior medial meniscus root tears, concerning the diagnostic approach, the indications, the repair and the preliminary results.

METHODS: During 2018-2020 we treated operatively 19 posterior medial meniscal tears and 13 are available with a minimum of 6 months follow-up. There are 7 men and 6 women with a mean age of 49 years. All the tears considered chronic with no or minimal traumatic event. All the patients met certain MRI and x-ray criteria (no arthritic changes). There was no any age limit. We used transosseous suture repair, with a pair of sutures passed through the meniscus and tied over a button on the anteromedial tibia. Postoperatively we followed the patient clinically, with X-rays and MRI (in 8 patients).

RESULTS: With a mean follow-up of 19 months, 12 patients experienced improvement in their symptoms. They returned to a good functional level of daily and sport activities after a mean of 8 months. The mean IKDC score went from 37,9 preoperatively to 62 postoperatively. x-ray and MRI showed no deterioration in degenerative changes and minimal reduction of meniscal extrusion.

CONCLUSIONS: Tears of posterior root of medial meniscus is a challenging clinical problem. Meniscal root repair demonstrates a high rate of clinical improvement and protection of the knee.

METHODS: 4 males and 1 female weightlifters mean age 20.6, with disastrous dorsal perilunate dislocation, volar perilunate dislocation of the wrist were included in this study and operated by a single surgeon. A clinical examination, Check X-rays, 3D-CT and MRI scans were used for the diagnosis. All of them experienced a combined dorsal and volar approaches and carpal tunnel release respectively. An open reduction and internal fixation with K-wires and mini anchors for stabilizing the bones of the wrist. Splintage for 8 weeks, calcium and vitamine D were used, as well.

RESULTS: The first weightlifter was operated 3hours after the initial injury. Two of them after a week and the other one after a month. The last one after 6 months, 1 won the Golden European Medal, 1 won the National Golden Medal. The Rest 3 weightlifters participated successfully to National Championship. Two athletes developed sympathetic dystrophy, no osteonecrosis and osteoarthritis signs were observed, so far. There was some residential stiffness in 1 of them.

CONCLUSIONS: The early surgical combined intervention with the proper stabilization with K-wires and ligamentous reconstruction promise the satisfactory results. The proper physiotherapy has supported with in combination with medication can optimize their satisfactory return in their sport.

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The results of the surgical treatment for disastrous dorsal & volar perilunate dislocations in elite weightlifters of hellenic national weightlifting team, after heavyweights impaction on their wrist. 20 years study

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BACKGROUND: The perilunate dislocation is a high energy injury with poor functional outcomes. This kind of injury is often missed due to profound radiographic & physical examination findings. That could be even 25% missed cases. The elite weightlifters face this carrier threatening injury whereas the athletes may be presenting a cute wrist swelling deformation of the joint. The aim of this study is to define the clinical outcomes between the different surgical methods that we use for each of the 5 elite weightlifters (4males and 1 female) of the Hellenic National Weightlifting team after the weights impacted on their wrist.

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The importance of the COVID-19 protocol at international wrestling competitions

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BACKGROUND: Due to the pandemic around the world, there are a number of difficulties in hosting a multi-day international sports event. Most athletes train in teams and has physical contact even in individual sports. However, in case of contact sports the possibility of transmission prevails exponentially, which is why the most important thing is to minimize transmission. The screening and immediate isolation of potentially infected people are equally important. Before the European Wrestling Olympic Qualifying Competition, there was a need of a pre-determined, professional protocol.

METHODS: 281 competitors attended from 37 countries. The criterion to enter Hungary were the PCR test, epidemiological and symptomatic negativity within 72 hours. At accreditation, we performed a PCR

and an Antigen rapid test. Upon departure a negative PCR test or a certificate issued after the end of the quarantine period was required. Competitors with a PCR positive but negative history and producing a negative rapid test were re-sampled.

RESULTS: In total, 1,500 PCR tests and 1,250 rapid tests were performed. One of the Antigen rapid tests performed at the accreditation proved to be positive. The PCR tests taken on arrival, 21 were positive and they were immediately detected and isolated in an external hotel. Meanwhile, on departure 7 PCR tests were positive.

CONCLUSIONS: The current study shows that the mentioned protocol was successful. Furthermore, the bubble was successful, 1.8% of the PCR tests performed were positive, and more than half of these had either undergone or been vaccinated.

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Exercise promotes endothelial progenitor cell mobilization in patients with cardiovascular disease. A systematic review and meta-analysis

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BACKGROUND: Exercise stimulates endothelial progenitor cell (EPC) mobilization, promotes the normal endothelial function and reduces the risk of cardiovascular disease. The type of exercise to mobilize EPCs into the circulation, however, needs to be clarified. The aim of this meta-analysis is to define the type of exercise required to mobilize EPCs in patients with cardiovascular disease.

METHODS: Search was conducted on Medline, Embase and Cochrane Library of Controlled Trials databases. Studies were included with at least one of the following eligibility criteria: a) measurements of EPC mobilization and b) measurements of exercise interventions in cardiovascular disease patients. Furthermore, studies were also included that defined EPCs by different combination markers (CD34+/CD133+/CD45-/VEGFR₂⁺). The quantitative analysis was presented with forest and funnel plots and a random effect inverse variance used with the effect measures of the standard mean difference (StdMD) standard deviation. The primary outcome measure was EPCs (EPCs% or EPCs, cells/ml) before and after exercise training.

RESULTS: Sixteen studies with 479 patients and 216 control participants were included. EPCs were increased following continuous exercise training StdMD: 1.28 (95% Confidence Interval: 0.66-1.9, P<0.001).

Interval training with limited and contradictory reports on EPC mobilization failed to show statistical differences, (P>0.05).

CONCLUSIONS: Continuous exercise training triggers EPC mobilization. More studies are needed, however, to define the effectiveness of interval training and the balance between intensity and duration that is required to stimulate EPC mobilization in patients with cardiovascular disease.

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All-inside anterior cruciate ligament reconstruction versus reconstruction with fixed femoral loop and tibial screw fixation: a prospective study

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BACKGROUND: All-inside technique needs less graft length and its dual-suspensory mechanism has been reported to have better biomechanical outcomes. The purpose of the present study was to compare all-inside anterior cruciate ligament (ACL) reconstruction technique with standard technique.

METHODS: Between January 2012 and July 2018 we enrolled 100 patients (16-45 years old) with complete ACL tear without meniscal tear and randomly allocated them into 2 groups: Group A (50 patients) were treated with all-inside ACL reconstruction technique (femoral socket through the anteromedial portal, tibial socket with retrograde drilling) and group B (50) with standard technique (anteromedial portal fixed femoral loop and full tibial tunnel with bioabsorbable interference screw fixation). All surgical procedures were performed by the same surgeon. For both groups autograft hamstrings were used (group A: semitendinosus triple N.=23 or quadruple N.=27, group B: semitendinosus and gracilis).

RESULTS: In group A, 4 cases were converted to full-tibial tunnel and 2 early graft failures 1-month post-operatively were recorded. In group B, 1 case of infection immediate post-operatively and one case of bone resorption at the cortex of the tibial screw fixation presented 19 months post-operatively were recorded. Post-operative pain was less in all-inside group (P=0.039). No differences were observed in Lysholm (P=0.645) and IKDC (P=0.723) scores, clinical examination (Lachman, pivot shift test) or KT-1000 measurements (P=0.635). All-inside technique had increased operative time by 20 minutes.

CONCLUSIONS: Our results indicate that all-inside is comparable to the standard ACL reconstruction technique regarding complications, clinical and patient reported outcomes after two years and also presents less post-operative pain.

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Where do we stand with sport-related concussion (SRC) prevention and management? An international survey among field stakeholders

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BACKGROUND: Sport-related concussions (SRC) received increasing interest over the past decades. Education and prevention among all field (physicians, coaches and athletes) stakeholders are key aspects for their appropriate management.

The current investigation concerns on an international survey among field Stakeholders.

METHODS: An online survey was sent to athletes, sports healthcare professionals, and coaches through the ReFORM network. The survey was designed to assess the current state of knowledge and practice regarding SRC (diagnosis, treatment and return to play) within the French-speaking sports community.

RESULTS: A total of 1704 participants (48% of athletes, 33% of coaches and 19% of healthcare professionals) took part in the survey. The volunteers derived from France (35%), Canada (32%) and Belgium (12%). The preliminary analysis reported a SRC knowledge self-assessment as "good" or "excellent" in 87% of healthcare professionals and in 69% of coaches; while more than 40% of athletes rated their knowledge as "poor" or "no knowledge". Only 17% of athletes reported knowing about a SRC education program in their setting against 63% for healthcare professionals and 45% for coaches. A percentage of 54% of the coaches do not feel having sufficient professional resources to correctly manage SRC over the return to sports. Some discrepancies between reported knowledge and actual practice were highlighted notably regarding the mechanisms, the detection and the acute management of SRC.

CONCLUSIONS: Despite an apparent increasing attention around SRC, the reported current practices in French speaking communities highlight some weaknesses in knowledge that are translated into practice. These preliminary results open the path to tailored education programs.

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Fitness diving study about 12000 expertises

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BACKGROUND: The current study investigates the fitness status about diving.

METHODS: A retrospective study was performed on the electronic records of medical examinations for ability to dive; those studies were performed at NMECA for over 6 years. From January 2009 to May 2016, electronic records of past divers at the NMECA for the first medical exam and yearly exams were checked thoroughly and all records of those who were found unfit to dive. The data was used to assess the reasons for unfitness.

RESULTS: During the same period, 12013 divers were appraised at NMECA as part of the ability to dive. We found that 97.17% were able to dive and 2.83% were unable. Regarding those who were unfit by specialty; dentistry came first with 19%, followed by ophthalmology and Musculoskeletal by 15% each and cardiovascular reason only 09%.

CONCLUSIONS: The most important aspect of this study is the large number of those involved and its homogeneity. Given the highly selective admission criteria of divers; this study confirms most of the data known in the literature, especially a high rate of normal qualifying exam for diving.

of the current study was to investigate the association between PhA and JP.

METHODS: One hundred and ninety-two (192) junior athletes were recruited for the current study. All athletes underwent a sports medical check-up, which included body composition and the jump performance test. Body composition was measured using InBody S10 (InBody co., Korea), a BIA device. Whole-body PhA(W-PhA), trunk PhA(T-PhA), left lower limb PhA (Lt-L-PhA), right lower limb PhA (Rt-L-PhA) were extracted from the measurement values. Counter movement jump height (CMJ) and squat jump height (SJ) were measured using OPTOJUMP next (MICROGATE co., Italy). Pearson's correlation coefficient was used for statistical analyses between PhA and CMJ or SJ. Level of significance was set at $P < 0.05$

RESULTS: All PhA scores significantly correlated with CMJ and SJ (CMJ *vs.* W-PhA: $r=0.57$, T-PhA: $r=0.44$, Lt-L-PhA: $r=0.52$, Rt-L-PhA: $r=0.49$) (SJ *vs.* W-PhA: $r=0.51$, T-PhA: $r=0.39$, Lt-L-PhA: $r=0.48$, Rt-L-PhA: $r=0.45$).

CONCLUSIONS: PhA was correlated with jump height which is one of the representing values of instantaneous power. Our results suggest that PhA quantifies the performance of athletes, at least their instantaneous power. A longitudinal study to confirm variation among individuals is warranted in the future.

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Relationship between bioelectrical impedance phase angle and jump performance in junior athletes

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BACKGROUND: Phase angle (PhA), measured using bioelectrical impedance analysis (BIA), is an index of the ratio between extracellular and intracellular water, body cell mass, and cellular integrity. The aforementioned parameters are important for athletic performance. However, the relationship between PhA and jump performance (JP) is currently unclear. The purpose

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Structural cardiac abnormalities screening in young athletes: an observational study

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BACKGROUND: In Sports Medicine, echocardiography can provide useful data regarding pre-participation screening and analysis of the cardiac adaptation induced by exercise. However, the application of echocardiography as a pre-participation screening and the prevalence of valve heart disease remain controversial. Importantly, cardiac structural changes can be missed out and the role of physical training on their progression is not clarified. In the current study, we sought to evaluate the frequency of valve and atrial defects in competitive athletes through the systematic use of echocardiography.

METHODS: Participants in competitive athletic programs and professional athletes underwent a complete

screening including family and personal medical history, physical examination, electrocardiography, exercise testing, and echocardiography.

RESULTS: In 848 consecutive athletes of mean age 25.1 ± 10.3 years, 74.5% were males. The frequency of valve defects was respectively: Mild Mitral Regurgitation 10.5%; Moderate Mitral Regurgitation 0.3%; Mild Aortic Insufficiency 6%; Moderate Aortic Insufficiency 0.3%; Atrial Septal Defect 1.2%. In 0.2% was revealed a moderate to severe right to left atrial shunt. In 0.3% a bicuspid aortic valve was found. Athletes presenting Atrial Septal Defect were older: 30.6 ± 4.6 years *vs.* 24.9 ± 0.49 $P=0.04$ and no significant differences appeared regarding the gender. Of note, athletes presenting Valve or Atrial Septal Defect required more frequently Holter ECG monitoring regarding atrial or ventricular arrhythmias: 35.5% *vs.* 7.2% $P<0.0001$.

CONCLUSIONS: Mitral regurgitation, Aortic Insufficiency and Atrial Septal Defects are not unusual among athletes and future research is needed to evaluate the effect of exercise training on these abnormalities.

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Usefulness of magnetic resonance imaging for early expectation of crowned dense syndrome mistaken for sprain: a case report

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BACKGROUND: Crowned dense syndrome (CDS) is a rare disorder, but known cause of acute neck pain on rotation. Computed tomography (CT) scan is the choice to diagnosis of CDS, however magnetic resonance imaging (MRI) is generally not sensitive. In this report, the authors investigated the early expectation before occurrence of CDS and the change of calcification in the periodontoid process after symptom improvement.

METHODS: A 68-year-old male presented with acute posterior neck pain for 1 week after swimming. His condition was diagnosed as sprain; however physical therapy was not effective to reduce the symptom. Laboratory investigations revealed raised erythrocyte sedimentation rate and C-reactive protein. CT scan revealed crown-like calcific deposits around periodontoid process and ligament. MRI showed hypointense signal of retro-odontoid mass with bony erosion. Prednisolone, non-steroidal anti-inflammatory drugs were commenced and a Philadelphia collar was positioned as the diagnosis of CDS. The symptoms and laboratory findings dramatically resolved. Follow-up CT scan and MRI, 1 year later showed a similar sized and dense calcification remaining.

RESULTS: Fifteen (15) years ago the patient's neck pain was diagnosed only as protruded C3-C4 intervertebral disc according to MRI. The follow-up MRI findings after 9 years later were reviewed for the presence of hypointense signal of retro-odontoid mass with bony erosion already despite of no pain.

CONCLUSIONS: Even though MRI is not gold standard for the CDS diagnosis, it may offer the aid of early expectation. Also the calcified mass surround the odontoid may not be absorbed quickly regardless of symptom improvement.

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Positive ergometric stress test in asymptomatic and very low-profile master athletes: role of multislice computed tomography angiography (MSCTA) scan in diagnostic workup to exclude coronary artery disease

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BACKGROUND: ST segment abnormalities during ECG stress test suggest possible presence of coronary artery disease (CAD) and are a cause of ineligibility for competitive sports. However, the ECG may present false positives, *i.e.* subjects with ST depression but without underlying heart disease.

METHODS: In our center, for the past two years, 8033 master athletes underwent pre-participation evaluation.

RESULTS: Of these, 37 (29 male and 8 female of mean age $53,3 \pm 7,9$ years, who played mainly high-intensity sports), all asymptomatic and without cardiovascular risk factors, showed pathological ST segment depression during ECG stress test; the maximal exercise test (ET) with Bruce protocol performed later confirmed a possible exercise-induced myocardial ischemia. The patients were referred to coronary MSCTA scan, which excluded presence of CAD in 32 of them (86%). In 3 subjects revealed myocardial bridge and 2 showed significant one-vessel CAD. Given the outcome of the MSCTA scan, the absence of other signs and symptoms and risk factors, the 32 athletes have obtained competitive sports eligibility, in according to Italians Sports Cardiologists guidelines (COCIS) and current Italian laws. In subsequent checks, ST segment depression during ET remained constant in the absence of symptoms indicative of CAD.

CONCLUSIONS: The MSCTA scan plays a fundamental role in the diagnostic workup in the master athletes without risk factors and with maximal ET doubtful for inducible myocardial ischemia, excluding the presence of CAD, and highlights the importance of a multidisciplinary approach between sports medicine, cardiology and radiology to ensure safe sports practice for patients.

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The value of the electrocardiogram (ECG) in the pre-athletic test in school teenagers of Kozani

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BACKGROUND: Although the use of a standard history and physical examination focusing on the cardiovascular system (CV) for the preparation of the examination (PPE) of athletes, the addition of electrocardiogram (ECG) was controversial. To investigate the ECG value as a prognostic indicator in young adolescents before starting sports activities.

METHODS: 658 ECGs were obtained from adolescents of the last class of the Lyceum, schools of Kozani during the 3 years 2016-2019 (54% men, average age 17 years) representing 5 sports.

RESULTS: 72% of women had a normal ECG, only 28% of men did. Incomplete right limb block (RBBB) (11%), right axis deviation (RAD) (14%) and atrial fibrillation (2%) were the 3 most common minor abnormalities. The Sokolow-Lyon criteria for left ventricular hypertrophy (LVH) were found at 54%. However, only 22% had a Romhilt-Estes score \geq 4. The reversal of the T waves at V2 to V3 occurred at 9% and only 7 men had abnormal Q waves. 43 students (6.5%) were judged to have clearly abnormal ECG findings that may be related to conditions such as hypertrophic cardiomyopathy or arrhythmogenic right ventricular dysplasia/cardiomyopathy. Further exploratory testing was planned for these athletes.

CONCLUSIONS: Mass ECG testing can be achieved within the collective setting using volunteers when the appropriate equipment is available. However, the rate of secondary testing suggests the need to evaluate the cost-effectiveness of mass testing and the development of new ECG interpretation algorithms specifically for athletes.

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Factors related with hamstrings muscles strength in soccer players

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BACKGROUND: In soccer, the hamstrings are significantly active and overloaded. The strength of this specific muscle group can be measured by Nordic Tests. To investigate the existence of any correlation between hamstrings muscles and players' position, minutes played and distance ran in matches and their body habitus.

METHODS: Hamstrings' strength data were collected via the Nordboard device from 18 players of the U17 team of PAOK football club, aged 15-17 years. Moreover, data were collected from the players' GPS during the winter season of 2019 and the players' weight and height was recorded.

RESULTS: The analysis showed that the total average strength of the hamstrings in relation to the position of the players did not differ significantly ($P=0.416$). There was no correlation between the strength and minutes played ($R^2=0.034$) or total distance that the players ran during the matches ($R^2=0.024$). As for hamstrings strength and weight of the players, there seems to be a positive correlation, in which for every extra kilo the power increases by 10.5 N ($R=0.56$, $R^2=0.32$, $P=0.054$). The players' height was not correlated to hamstrings strength ($R=0.025$, $R^2=0$, $P=0.937$).

CONCLUSIONS: The hamstrings' strength is not affected by the player's position, minutes of participation, distance run and height, but it is marginally related to the weight of the players.

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Pre-participation anthropometric parameters of U13 and U16 footballers during the COVID-19 pandemic

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BACKGROUND: The COVID-19 pandemic has an impact on the development of a new standard of sports participation and the level of physical activity among athletes. The study's goal is to investigate the impact of the COVID-19 pandemic on anthropometric changes at pre-participation evaluations of athletes in football schools in the Prishtina region.

METHODS: The body weight (BW), height, and body mass index (BMI) of 399 U13 (9-11 years old) and U16 (13-15 years old) athletes from the 2019/2020 season who underwent systematic pre-participation examinations at the National Sports Medicine Center in Prishtina were tracked. The measurements were taken prior to the beginning of the autumn 2019/20, spring 2019/20, autumn 2020/21, and spring 2020/21 seasons. The criterion for inclusion in the study was regular participation in the 2019/20 and 2020/21 football seasons.

RESULTS: In the autumn season 2020/21, U13 athletes had a higher BW and height than in the spring and autumn seasons 2019/20 ($P<0.05$). In the autumn season 2020/21, U16 athletes had higher BW, height, and BMI than in the spring and autumn seasons 2019/20 ($P<0.05$).

CONCLUSIONS: When compared to the previous

year, the BW and height of U13 and U16 footballers were significantly higher at the start of the autumn 2020/21 season. The combination of restrictive measures to prevent pandemic spread and a lack of regular sports activity has resulted in increased weight among U13 and U16 athletes, as well as an increased risk of sports injuries and poorer sport performance.

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Evaluation of trunk asymmetry in school children and adolescent

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BACKGROUND: We aim to determine the frequency of structural and nonstructural scoliosis in children and evaluate the relationship between sportive activity and nonstructural scoliosis.

METHODS: Three hundred and fourteen (314) children and adolescents (149 boys and 165 girls) between the ages of 8-16 were evaluated with forward bending test and the angle of trunk rotation (ATR) was measured with scoliometer. Children were grouped by their participation or nonparticipation in sports. Those with ATR \geq 7 were referred to our clinic. The bending test was performed in both standing and sitting forward bending position. Radiographic and leg length inequality were also evaluated.

RESULTS: Girls were significantly asymmetrical compared to boys (X² = 7.685; P=0.021). In 10 children, with the scoliometer readings were 7° or more. 8 screened-positive children participated in the hospital-based diagnostic stage. Structural scoliosis was found in 4 subjects. Nonstructural scoliosis was found to in other 4 subjects. Out of 4 subjects with nonstructural scoliosis 3 subjects were found to participate in high-intensity sports for more than 5 years.

CONCLUSIONS: Trunk asymmetry can be a sign of structural scoliosis or it can be detected in cases related to functional disorders. Especially in athletic population, repetitive asymmetric motion patterns can cause an increase in the frequency of this nonstructural scoliosis. It may be important for physicians – especially sports physicians – to evaluate adolescent athletes with trunk asymmetries in terms of functional disorders.

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The impact of COL3A1, ACE and MB genetic variants on athletic performance and injury

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BACKGROUND: The human genome is littered with unique genes that may have been important to physi-

cal performance and risk of musculoskeletal injuries. The aim of the current study was to investigate COL3A1 (G>A, rs1800255), ACE (rs1799752, I/D), MB (A>G, rs7293) polymorphisms in Lithuanian professional athletes.

METHODS: A total of 180 Lithuanian elite athletes and 255 non-athletes controls were genotyped using PCR, Real-time PCR, and restriction fragment length polymorphism methods.

RESULTS: Significant differences in genotypes distribution were observed between the total athletes and control groups (ACE II/ID/DD: 28/47/26% vs. 25/37/38%; P=0.01; MB AA/AG/GG: 19/64/16% vs. 27/45/27%; P=0.0004; COL3A1 GG/GA/AA: 63/34.9/2.1% vs. 60.6/30/9.4%; P=0.019). The MB AG genotype is more prevalent in athletes, who are more likely to harbor this genotype compared to controls. Regarding the ACE variant, genotypes distribution differed significantly among sprint/power-oriented athletes (II/ID/DD: 41/39/20%; I allele 60%) and endurance athletes (II/ID/DD: 21/48/31%; I – 45%; P=0.034), and controls (I – 43%, P=0.016). Having the risk-related ACE II genotype increases chances by 2.94 times (95% CI: 1.07-8.07) of being in sprint/power sport. The proportion of COL3A1 risk-related genotype (AA), observed in controls (9.4%) was larger than in all athletes (2.1%), especially in sprint/power athletes group (1.3%) (P<0.05). The odds ratio of athlete harboring COL3A1 AA genotypes compared to control was 0.2 (95%CI: 0.05-0.61, P=0.012).

CONCLUSIONS: The ACE II and COL3A1 AA genotypes predisposes towards increased risk of developing muscle damage in sprint/power sports. Further investigations are required to clarify the effect of other genetic variants at risk of injuries in sport.

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ACE and ACTN3 genetic variants in European elite strength and power athletes

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BACKGROUND: The high-intensity performance of elite strength/power athletes (such as powerlifters, weightlifters, throwers) is influenced by genetic components and environmental factors. The angiotensin-converting enzyme (ACE) and the alpha-actinin-3 (ACTN3) genes are two of the most studied “sports genes” and have been associated with physical performance phenotypes. The aim of this case-control study was to investigate the association of ACE [I/D] and ACTN3 [R577X] polymorphisms with strength/power athletes’ status in two cohorts of European athletes.

METHODS: The European cohort from Lithuania and Russia (161 athletes-87 weightlifters, 60 powerlifters, 14 throwers and 1,202 controls) were genot-

typed for ACE and ACTN3 polymorphisms. Genotyping was performed by polymerase chain reaction and/or restriction fragment length polymorphism analysis method. The statistical software package R v.3.2.1 was used.

RESULTS: Statistically significant differences in ACTN3 [R577X] allele/genotype distribution were not observed in the whole cohort of athletes nor between analyzed groups separately when compared with controls. However, ACE I allele was more frequent in the athlete group compared to the controls (53.7% vs. 47.2%). The odds ratio for athletes compared to control of the heterozygous ACE ID genotype was 2.35 (95%CI 1.10-5.06) in Lithuanian cohort and, the ACE II genotype was 1.71 (95%CI 1.01-2.92) in Russian cohort.

CONCLUSIONS: The ACTN3 [R577X] polymorphism is not associated with strength/power athletic status in two cohorts of European athletes. Calculated odds ratio indicates that the ACE ID genotype is no doubt the better predictor for Lithuanian athletes and ACE II genotype for Russian strength/power athletes.

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Influence of the MCT1-T1470A genetic polymorphism (RS1049434) on repeated sprint ability and blood lactate accumulation: a pilot study

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BACKGROUND: Based on the known relationship between blood lactate accumulation, the mutant minor MCT1 A1470T polymorphism (rs1049434) T allele (Asp-490) and the assumption that the football players with greater lactate transport rates have a higher capacity to maintain their performance at intense effort levels, we hypothesized that the MCT1 A1470T (Glu490Asp) polymorphism could influence the repeated sprint ability (RSA) in football players. The present investigates the influence of MCT1 A1470T polymorphism on RSA performance and lactate accumulation after RSA test.

METHODS: Twenty-six (26) elite Italian football players of mean age: 17.7±0.78 years; mean height 179.2±7.40 cm; and mean weight: 72.1±5.38 kg performed an RSA test obtaining lactate measurements at 1st, 3rd, 5th, 7th, and 10th minute post-exercise. Genomic DNA was extracted from buccal epithelium using a standard protocol.

RESULTS: Significant differences between genetic groups were found in the two final sprint time of the RSA test. The carriers of the major A-allele (Glu490) in the dominant model showed a significantly lower sprint time compared to footballers with the T/T (Asp/Asp) genotype (5th Sprint time: AA + AT = 4.60 sec vs. TT = 4.97 sec, 95% CI= 0.07-0.67, P = 0.022; 6th Sprint: AA + AT = 4.56sec vs. TT = 4.87sec, 95% CI= 0.05-0.57, P = 0.033).

CONCLUSIONS: The Glu490Asp polymorphism was associated with RSA performance. The current findings suggest that the major A-allele (Glu490) presence is favorable for RSA performance in football players.

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Knee osteoarthritis (KOA) and histopathological changes of cruciate ligaments

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BACKGROUND: Osteoarthritis disease, as well as the anterior and posterior cruciate ligaments' (ACL and PCL) structure has been widely studied. The purpose of the present study was to investigate the APC and PCL histopathological changes in knee osteoarthritis (KOA) and their correlation with the bone and biomechanical changes in KOA.

METHODS: Fifty (50) patients (24 male of mean age 71 ±5.93 years, mean height 162.04±7.54, mean weight 72.10±6.64 Kg) with KOA were investigated. The research lasted 2 years (2010-2012). All participants suffered from KOA and were included in a randomized study examined in the outpatient clinics of the University General Hospital of Ioannina. The tools for the current study were the Visual Analogue Scale (VAS), Classification Osteoarthritis (X-Rays), Classification Osteoarthritis (articular cartilage intraoperative), Haematoxylin, eosin, Alcian blue, medical history, Elastica von Gieson and Gomori, goniometer.

RESULTS: The following negative correlations were recorded between:

varus and ACL myxoid ($r=-0,254$, $P=0,075$)

VAS Scale and ACL myxoid ($r=-0,246$, $P=0,085$)

pain duration and ACL myxoid ($r=-0,249$, $P=0,081$)

B-l scale and ACL myxoid ($r=-0,244$, $P=0,088$)

pain duration and PCL myxoid ($r=-0,284$, $P=0,058$)

BL scale and PCL loosening ($r=-0,249$, $P=0,081$) and

varus and ACL muroid ($r=-0,274$, $P=0,054$)

CONCLUSIONS: The study showed negative correlation between varus and myxoid ACL and the greater ACL degeneration. It is obvious that further investigation is required, regarding the exact correlation between the biomechanical changes in an osteoarthritic knee and the ACL and PCL histological appearances.

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Exercise prescription for better health for woman over 50

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BACKGROUND: Physical activity (PA) has been recognized as powerful tool to improve somatic and mental health in all age, gender and patient populations. PA absence is more likely to be found in woman and especially in woman over 50 years of age. In the current study we aimed to summarize the recommendations for exercise for better health for woman over 50 years.

METHODS: Suitable exercises for all mentioned fitness modalities will be presented.

RESULTS: A complete and most effective plan for exercise should be consisted of several exercising modalities which will improve the cardiorespiratory functions, muscular strength, flexibility, mobility and balance. The recommended physical activity dose for woman over 50 is same as for all adults, range 18 to 64, at least 150 minutes of moderate-intensity aerobic activities. Aerobic sessions should be in cluster of 10 minutes minimum, 30 minutes per day, 5 times in a week. Strength training should be performed 2-3 days per week, involving all major groups, performing in 2-4 sets with individually dosed loading. Flexibility, mobility and balance exercises are necessary for improving ligamentous apparatus, range of motion in all joints and function of vestibular system.

CONCLUSIONS: Exercise prescription can first target individual health status and current fitness and nutritional status. The physician should monitor periodically the progress; provide encouragement and consolation regarding the volume of PA.

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Effect of concurrent resistance and aerobic training on the serum adiponectin expression in multiple sclerosis: a case study

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BACKGROUND: Adapted exercise is one of the most effective non-pharmacological tools able to improve several functional, cognitive and psychological parameters in Multiple Sclerosis (MS) patients, in

association with increased Quality of life (QoL) and decreased disease severity. Despite the biomolecular pathways are at present unknown, some studies indicated a positive association among lower BMI, low-levels serum adipokines expression and decreased MS severity. The aim of the current study was to evaluate the effect of 16-week concurrent resistance and aerobic training on BMI, serum adiponectin expression and QoL in a volunteer with chronic-progressive multiple sclerosis.

METHODS: The female volunteer (38 years; 4 EDSS) performed 16 weeks of concurrent training (50 minutes), twice a week at moderate intensity. BMI, QoL (45MSQOL) were evaluated Before (T0), after 16w training (T1); serum Adiponectin concentration and oligomers expression were determined at same time. All parameters were evaluated 6 months after the end of training (T2).

RESULTS: A reduction in BMI (-0.9%) and FAT (-2.6%), and an increase of QoL perceived after training associated to the reduced expression in serum adiponectin and oligomers, in particular in High Molecular Weight (HMW) oligomers, the most biologically active, were found. The positive effects are also associated to improvement in clinical markers associated to MS (3.5 EDSS); the effects decreased at T2.

CONCLUSIONS: Despite the limitations of a case study, this represent a good starting point to understand the positive influence of exercise in MS and the relationship with serum adiponectin modulation.

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Sarc-calf is a better instrument than Sarc-F for screening of Sarcopenia?

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BACKGROUND: Sarcopenia is the loss of mass, strength and muscle function. Because of the high cost of diagnostics, the use of screening tools is an alternative to reduce expenses. The current study compares the agreement between Sarc-F and Sarc-calf with the gold standard of evaluation of sarcopenia.

METHODS: The Sarc-F questionnaire proposed by Malmstrom and Morley (2013) was used. To this questionnaire, the calf perimeter (Sarc-calf) proposed by Barbosa-Silva et al. (2016) was added. The evaluation of sarcopenia was performed using the protocol proposed by the Consensus of the European Group of Sarcopenia in the Elderly (EWGSOP, 2009) which assesses handgrip strength, walking speed and lean mass. Bland-Altman was analyzed to verify the degree of agreement between the screening questionnaires with the diagnosis of sarcopenia.

RESULTS: Both questionnaires were efficient for the evaluation of sarcopenia in the elderly. However, the Sarc-F presented more plausible values when compared to the gold standard method. A bias not significantly greater than zero (-0.065) and a limit of agreement (95%) were observed significantly acceptable (-0.96 - 0.83). For Sarc-calf, a bias far from zero (-0.36) and a minimum and maximum agreement limit, more dispersed of 95% (-1.4-0.73) were observed.

CONCLUSIONS: These findings demonstrate that Sarc-F has a higher level of agreement than Sarc-calf when compared to the gold standard. Sarc-F may be a more appropriate applicability method for these evaluated elderly.

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Leisure time physical activity in young men - Undergraduate medical students

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BACKGROUND: Undergraduate medical students must be physically active and have good health for postgraduate training. But little is known about benefit of leisure time sports for students 5 month later the ending of physical education curricula. The purpose of the study was to investigate physiological and psychological parameters in 4th year medical students according habitual physical activity.

METHODS: Fifty-one (51) young men (of mean age 21.6±0.6 years) in autumn 2019, while attending the rehabilitation medicine practical course, completed some express tests. Thirty (30) students (58.8%) reported leisure time physical activity 5-6 hours per week: 7 young men – endurance training (jogging or swimming), 8 – sport games, 10 – strength training, 5 – coordination discipline (gymnastics, karate, dance), and 21 – only every day walking.

RESULTS: No difference was found between active and sedentary students except lower heart rate (HR; 73.3±9.7 vs. 78.5±2.2 bpm, P=0.03). Impaired cardiovascular reactivity on 20 squats test was seen in 20 of 30 active and in 14 of 21 students with low physical activity. Students engaged in strength training had bigger HR than coordination sports ones, and greater arousal (28.5±6.5 vs. 12.1±4.3%; P=0.027) than endurance athletes. Tendency to greater systolic blood pressure existed in endurance athletes comparing soccer players. Morning chronotype significantly more often was seen in both groups with slightly lower apathy score - sport games and coordination sports. Breath-holding test revealed no differences.

CONCLUSIONS: Two third of healthy male-students demonstrated impaired cardiovascular reactivity. Differences found between sport groups require further study.

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Case report: efficacy of aerobic exercise after evaluation with cardiopulmonary test in patients with previous severe SARS COV2 pneumonia

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BACKGROUND: The gold standard for evaluation of exercise tolerance is the cardiopulmonary test which, even in patients suffering from COVID-19 outcomes, represents the ideal tool for assessing deficits in the post-acute phase. Our clinical case is represented by 61-year-old man, healthy, subjected to orotracheal intubation, admitted to our intensive cardiorespiratory rehabilitation department, then outpatient rehabilitation.

METHODS: We subjected the patient to the maximal cardiopulmonary test (test 1) using a ramp cycle ergometer protocol evaluating maximal oxygen consumption, carbon dioxide ventilation slope, oxygen pulse, anaerobic ventilatory threshold and ventilator equivalents at threshold, and respiratory reserve. After first 60 days aerobic endurance training we reassessed the patient with the cardiopulmonary test (test 2) to analyze the results of the therapy and assess whether the deficit was predominantly peripheral or cardiorespiratory.

RESULTS: Peak VO₂ at Test 1 was 15 mL/kg/min, slope VE/VCO₂ was 28.7, VO₂/hr was 10.8, Ve/VCO₂ at threshold was 32.4, and BR 55 and SAV was identified at 38% of peak VO₂. Peak VO₂ on test 2 was 18.6 mL/kg/min, slope Ve/vco₂ was 32, VO₂/hr was 12.6, Ve/VCO₂ at threshold was 33, BR was 53, SAV was identified at 45% of peak VO₂.

CONCLUSIONS: Based on the results of cardiopulmonary test before and after training, it seems that aerobic exercise was highly effective. The level of effort tolerance obtained, in our opinion, is not achievable with drugs or other rehabilitation techniques.

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A longitudinal prospective study on the influence of lifestyle behaviours on selected cardiometabolic parameters in men

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BACKGROUND: Healthy lifestyle, including regular physical activity (PA), is a crucial factor preventing

atherosclerosis and metabolic disorders. The current study aims to examine the influence of healthy behaviors on metabolic parameters during a 30-years prospective observation in men.

METHODS: Seventy-three (73) male subjects attending the Department of Preventive and Sports Medicine, Medical University of Lodz in the years 1985-201 (of mean age $66,9 \pm 9,6$ years; mean observation period 30,3 years) were investigated. During the baseline and next follow-ups, all subjects participated in a questionnaire interview, physical examination and additional tests (biochemical, anthropometric, maximal exercise test, endothelial function). PA level was measured by calculating the weekly leisure-time energy expenditure (EE).

RESULTS: In the last follow-up (2018-2019) men had significant higher values of waist circumference, and glucose and LDL-C concentration ($P < 0,001$), body mass index and blood pressure ($P < 0,01$) as compared to the initial values. Positive changes were observed in HDL-C and TG ($P < 0,01$ and $P < 0,05$; respectively). Concentrations of hsCRP and homocysteine significantly decreased in the years 2011-2019 ($P < 0,05$). The endothelial function was stable in the years 2011- 2019. The most beneficial results concerned subjects who maintained stable EE > 2750 kcal/week. They had significantly lower waist circumference ($P < 0,01$), glycaemia ($P < 0,01$), insulin ($P < 0,01$), HOMA-IR index ($P < 0,01$) and 6 times lower incidence of metabolic syndrome in comparison to less active.

CONCLUSIONS: A long-time appropriate lifestyle, high PA level, maintaining proper weight and healthy nutrition affects stabilization or even improvement of many health parameters, significantly decreasing a cardiometabolic risk and contribute to successful ageing.

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Motor competence estimation and identification of motor difficulties of school-age children

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BACKGROUND: Motor competence (MC) refers to the development of fundamental movement skills corresponding to ontogenetic development. Expert studies have shown a secular decline in their level, accompanied by a decline in health-oriented fitness. The relationship between skills and physical activity (PA) is considered reciprocal. The aim of the current study was to estimate MC level in a Czech school children sample and identify children with motor impairments.

METHODS: One hundred and ninety-five (195) Czech school children (110 girls, and 85 boys) of mean age $11,96 \pm 1,96$ years were studied. To estimate an

MC, the Bruininks-Oseretsky Test of Motor Proficiency Second Edition- a complete form, was used.

RESULTS AND CONCLUSIONS: Our total motor composite (TMC) results correspond to a secular reduction in MC. The results show that the group's MC is in the lower part of the average level in TMC (standard score $45,4 \pm 11,7$). The overall percentage of children whose TMC is above the 15th percentile of the population is 64.6%. In terms of gender, 41.2% of boys and 30.9% of girls do not meet the standard. On average, the weakest performance was recorded in the area of fine manual control. Sixty-nine (69) children had below-average result of TMC ($TMC \leq 15^{\text{th}}$ percentile) and 24 children (12.3%) had well-below average results ($TMC \leq 5^{\text{th}}$ percentile). These children are highly likely to develop a developmental coordination disorder.

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The effects of active short-term holidays on metabolic parameters and adipokines

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BACKGROUND: The East Tyrolean Health Tourism Study is an open comparative study. One of its objectives was to depict the effects of a one-week vacation with different activities on metabolism and various adipokines in healthy vacationers.

METHODS: Fifty-two healthy vacationers spending one week in East Tyrol participated in two types of vacation activities (golf *vs.* Nordic walking or e-biking [nw&eb]). In the first group 30 subjects played golf for 33,5 hours per week, and in the nw&eb group 22 engaged in nordic walking or e-biking for 14,2 hours per week. Various metabolic parameters and adipokines were measured by routine methods one day before and after the stay.

RESULTS: In both groups we noted similar trends and significant changes of metabolic parameters and adipokines. In the nw&eb group we noticed significant decreases in adiponectin and leptin (-11% and -19%, respectively) associated with a mean loss of body weight of 1,0 kg (-1,2%). In the golf group there were significant decreases of irisin (-10,5%) and FGF-21 (-29%) and an increase of omentin (+11%). No significant changes of betatrophin and resistin were found in any group.

CONCLUSIONS: Just one week of vacation with an activity program for several hours per week leads to favourable effects on anthropometric and metabolic parameters known to be involved in the pathophysiology of the metabolic syndrome. The changes differed in their magnitude and significance, depending on the activity group, *i.e.* the intensity and duration of exercise, and weight loss.

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Cardiovascular benefit of physical exercise in postmenopause

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BACKGROUND: The menopause status in women can increase the risk of cardiovascular disease (CVD). Myocardial steatosis, fat accumulation in epicardial adipose tissue, hypertension, and dyslipidemia lead to more cardiovascular risk in women after menopause including weight gain and atherogenic changes in serum lipid profiles. The purpose was to examine the influence of moderate physical activity on the lipid profile in postmenopausal women.

METHODS: Thirty-two (32) postmenopausal women were examined before and after 3 months of walking 3 km per day. Lipids level (HDL-CH, LDL-CH, triglycerides and total cholesterol) were measured before and after physical activity. They were determined with standard colorimetric- spectrophotometric method.

RESULTS: Statistical analysis has shown that moderate physical activity in post-menopausal women within a three-month significantly decreased the level of LDL cholesterol: from 3.5 ± 1.6 to 2.6 ± 0.9 ($P<0.05$), but significantly increased the HDL cholesterol level: from 1.2 ± 0.3 to 1.6 ± 0.4 ($P<0.001$). Index of atherosclerosis (LDL-CH/HDL-CH) also shows the significant decrease: from 2.7 ± 0.3 to 1.6 ± 0.4 ($P<0.05$). However, there was no statistical significance in the level of triglycerides and total cholesterol.

CONCLUSIONS: The moderate-intensity physical activity can improve blood lipid profiles, so it can reduce the risk of atherogenic changes and heart disease in postmenopausal women.

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Determining speed and stride length of runners using an ultrawide bandwidth local positioning system equipped with an inertial measurement unit

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BACKGROUND: Global Positioning System (GPS) wearables may not feasibly measure speed (stride frequency x stride length) due to signal deflection. An alternative method includes Local Positioning System (LPS) and an Inertial Measurement Unit (IMU). Compare speed and stride length from LPS/IMU to motion capture (MOCAP).

METHODS: Kinematic data was obtained from 90

participants over ten meters. MOCAP retro-reflective markers were placed on each heel and the sacrum. Ultrawide bandwidth radio emitting LPS consisted of a hub and IMU, placed on the sacrum. Participants performed three trials of a self-selected walk, run and sprint speed. Speed from MOCAP was change in sacrum marker's anterior-posterior position. Stride length from MOCAP was difference between heel marker's vertical minima at ipsilateral heel strikes. Speed from LPS was difference in radio frequency waves' distance.

Stride length from LPS was difference in anterior-posterior position (strides segmented from local peaks in the superior-inferior direction of the IMU data). Maximum speed in last stride and stride length were used in Bland-Altman plots.

RESULTS: 45 (5.56%) speed trials and 46 (5.68%) stride lengths fell outside the limits of agreement in the Bland Altman plots. Speed and stride length showed a large scatter between MOCAP and LPS data.

CONCLUSIONS: An LPS may not be a valid method to determine speed and stride length. Additional data processing methods, for example machine learning, should be explored to determine if efficacy can be improved.

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The relationship between sport activity load and skeletal robusticity in young elite athletes

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BACKGROUND: In 2020, our research team introduced new bone mineral reference values about young athletes. In the present analysis, the aim was to study whether the bone mineral parameters of young athletes differ by the type of sports with different mechanical load in the studied age group.

METHODS: DEXA was used for the total body measurements of bone mineral in 1540 athletes aged between 11 and 20 years. The bone mineral parameters of each athlete were converted to z-scores relative to age- and gender-specific reference values specified by the DEXA software.

RESULTS: An outstanding musculoskeletal robusticity of male wrestlers, pentathletes and cyclers could be observed in the studied sports: wrestlers had significantly ($P<0,001$) more developed musculoskeletal robusticity and bone mineral density than the age-group average among elite athletes, while pentathletes and cyclers had worse bone mineral parameters than the reference level for their age-group among elite athletes. In case of female athletes, the rhythmic gymnasts' and pentathletes' bone mineral parameters differed significantly ($P<0,001$) from the players' average parameters of the studied elite athletes: their

average skeletal robusticity both in the trunk and the extremities lagged behind the age-group mean values for elite athletes.

CONCLUSIONS: It is of high importance to study the bone mineral parameters in young elite athletes of sports characterized by variation in impact forces. The skeletal development of cyclers, pentathletes and rhythmic gymnasts should be monitored more frequently, since their bone development lags behind not only their age-peer elite athletes' bone development but also the population-based reference values.

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Noncoding RNAs-associated ceRNA networks involved in the amelioration of skeletal muscle aging after whey protein supplementation

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BACKGROUND: Whey protein has been reported to be an impactful supplement to ameliorate skeletal muscle aging for a long time. However, whether whey protein could contribute to muscle aging amelioration by posttranscriptional modulation remains unclear.

METHODS: Nineteen-month-old mice orally received whey protein supplementation (1.0 g/kg/bw/day, whey protein group) or deionized water (the control group) for three months. Differential ncRNAs and mRNAs in quadriceps were identified by RNA-seq. Construction of noncoding RNAs (ncRNAs)-associated competing endogenous RNA (ceRNA) networks as well as Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) enrichment analyses were also carried out subsequently. Meanwhile, ultrasound measurement, H&E staining, myofiber cross-sectional area measurement, western blotting, and RT-qPCR were performed in the quadriceps.

RESULTS: Whey protein supplementation for three months increased quadriceps-body weight ratio, and improved the histological and ultrasonographic characteristics of aging in muscle. Moreover, the levels of Myog, Myf4, Myf5 and MyoD1 were all significantly elevated in quadriceps. The expression of 90 lncRNAs, 334 mRNAs, 6 circRNAs and 52 miRNAs were significantly up or down-regulated in quadriceps after whey protein supplementation. Furthermore, ncRNAs-associated networks and GO and KEGG enrichment analyses revealed whey protein may influence muscle aging process through selected ncRNAs-associated ceRNA networks.

CONCLUSIONS: Posttranscriptional modulation could be a significant way to ameliorate skeletal muscle aging after whey protein supplementation. The selected ncRNAs-associated ceRNA networks may provide new insight for the underlying mechanism and profound therapeutic target for skeletal muscle aging.

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Higher pyruvate levels induced by chronic high dose of leucine supplementation might be associated with gut microbiota for muscle aging amelioration

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BACKGROUND: Muscle aging would increase the risks of falls and fractures, disability, poor quality of life, and even mortality in elder people. Dozens of previous excellent studies demonstrated that there might be complex and close relationships among leucine supplementation, gut microbiota and muscle aging, which would provide a promising direction for ameliorating muscle aging but still need further investigation.

METHODS: Nineteen-month-old mice were received low and high doses of leucine (500 and 1250 mg/kg-d) supplementation for 3 months. Mice feces in each group before and after leucine supplementation were collected for baseline and endpoint gut microbiota analysis by 16S rDNA amplicon sequencing. Meantime, ultrasound measurement, H&E staining, CSA measurement and western blotting were performed in quadriceps. Pyruvate levels were detected in feces and quadriceps.

RESULTS: No significant differences in muscle mass and thickness as well as myofiber size but improvement in muscle of histology and ultrasonography were observed after both low and high dose of leucine supplementation. No notable difference of gut microbiota was observed in baseline groups, while the *Firmicutes-Bacteroidetes* ratio was significantly decreased in high-leucine group. *Prevotella* turned to be the first dominant genus after leucine intake, and *Paraprevotella* was markedly increased in high-leucine group, compared with that of control and low-leucine groups. Pyruvate levels were significantly elevated in feces but had a slight increasing trend in muscle after high dose of leucine supplementation. AMPK α /SIRT1/PGC-1 α pathway was activated to promote muscle protein synthesis and suppress fatty acid synthesis.

CONCLUSIONS: Chronic high dose of leucine supplementation changed gut microbiota composition and increased pyruvate levels in feces and muscle, relating to ameliorate muscle aging *via* fatty acid synthesis suppression and muscle protein synthesis promotion, which provides a novel direction for alleviating muscle aging.

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Dietary pattern in undergraduate physical education students

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BACKGROUND: Nutrition can play a crucial role in optimizing training sessions, recovery and metabolic adaptation. The aim of the study was to examine the dietary pattern in the 3rd year physical education students.

METHODS: Quantitative dietary assessment was carried out using a 24 h dietary recall in 12 males and 8 females (mean age 20.2±1.2 years). All students reported training session 5 times/week in different sports disciplines besides university classes. Deficiency or excess content of nutrients was determined as ±20% from calculated value taking into account physical activity.

RESULTS: All participants were divided into 2 groups: endurance sports (athletics, cycling, and swimming, cross country skiing; N.=12) and sport games (soccer, volleyball, basketball, hockey; N.=8). The 42% of endurance athletes reported protein deficiency *vs.* 25% of sport games ones, includes both essential and nonessential amino acids. Excessive fat consumption was seen in 33% of endurance and in 66% of sport games athletes. No difference was found in carbohydrates consumption. 82% of all athletes had calcium deficiency may be due to frequent absence of dairy. 75% and 67% of endurance athletes and 50% and 25% of sport games ones had zinc and iron deficiency.

CONCLUSIONS: Dietary pattern in undergraduate physical education students is predominantly unbalanced. Athletes need to be educated on the healthy dietary pattern. The limitation of our study is small number of participants.

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The modification of red blood cells surface molecules expression following erythropoiesis stimulating agents administration

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BACKGROUND: The identification of analytical methods aimed to detect the abuse of erythropoiesis stimulating agents (ESAs) is still one of the greatest challenges in anti-doping strategies. Different indirect models have been proposed, most of them based on the cellular parameters analysis, as well as on biohu-

morals markers with the aim of increasing the sensibility and specificity of the actually applied mathematical models. Previous studies demonstrated that the ESAs administration is able to modify the expression of some cell surface markers (CD35, CD71 and CD59). The objective of the present study was to analyze the expression of several red blood cells (RBC) surface molecules in a pool of blood samples deriving from healthy donors (HD) and anemic patients undergoing rHuEpo therapy (AP).

METHODS: Venous blood samples were collected from 16 HD and 24 AP. Samples were labeled with specific antibodies for the RBC surface markers of interest CD35, CD59, CD71, CD235a. Readings were performed using a BD FACScan.

RESULTS: No statistically significant differences were present in the CD35, CD59 and CD71 expression between HD and AP. The staining with Acridine Orange demonstrated a statistically significant increased fluorescence in AP when compared to HD. CD 235a showed a trend towards an increased expression in AP.

CONCLUSIONS: Our preliminary results confirmed that ESAs administration is able to significantly modify the expression of certain RBC surface molecules and that this analytical approach may add specificity and sensibility to current used blood doping detection methods.

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The effect of different dose of peptide compound nutrient on acute exercise

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BACKGROUND: Plant-derived small molecular peptide, a nutrition supplement, has a positive effect on anti-fatigue. However, it is unclear which dose of peptide compound nutrient (PCN) is the best. This research explored the effect of different doses of PCN on exercise performance in mice.

METHODS: C57BL/6 mice were randomly divided into five groups (6 per group): Control (G0, water), Pure Peptide (G1, peptide of soybean protein 220 mg/kg.BW), Low Dose (G2, PCN 110 mg/kg.BW), Medium Dose (G3, PCN 220 mg/kg.BW), High Dose (G4, PCN 440 mg/kg.BW). All mice tested maximum oxygen intake (VO_{2max}, TSE Systems) after fed for thirty consecutive days (once per day). Besides, we monitored respiratory recovery for 24 h after exhaustive exercise in all mice.

RESULTS: Compared to G0: (1) In VO_{2max}, G1 increased 27.4%, G3 increased 8.9%, G4 increased 16.9%, but there was no significant difference in respiratory quotient; (2) in VO_{2max} speed (m/min), G1 (32.4±0.5 *vs.* 26.0±0.4, P<0.01) and G4 (30.4±1.4 *vs.* 26.0±0.4, P<0.01) increased; (3) in exhaustive time (s), G1

(1392±101.3 vs. 1050±25.7, $P<0.01$) and G4 (1432±77.1 vs. 1050±25.7, $P<0.01$) increased; (4) in respiratory recovery, G1 and G4 shown a better capability.

CONCLUSIONS: G1 and G4 had better exercise performance than others. Therefore, the pure peptide of soybean protein and the high dose of PCN were the optimal nutrition supplements that affect exercise endurance and enhancing anti-fatigue.

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Peptide compound nutrient improves the energy metabolism of muscle in mice

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BACKGROUND: Peptide compound nutrient (PCN), a plant-derived nutrition supplement, regulates various metabolisms and improves health. However, which dose of PCN best enhances energy metabolism is unclear. The current study explored different doses of PCN related to energy metabolism of muscle in mice.

METHODS: C57BL/6 mice were randomly divided into four groups (N.=6 per group): Pure Peptide (G1), Low Dose (G2), Medium Dose (G3), and High Dose (G4). All mice fed by gavage for 30 consecutive days (once per day): G1 fed pure peptide of soybean protein 220 mg/kg.BW; G3, G4, and G5 fed PCN 110 mg/kg.BW, 220 mg/kg.BW, and 440 mg/kg.BW. Then all mice took exhaustive exercise and tested respiratory chain complex II and IV (RCCII, RCCIV), Mn superoxide dismutase (Mn-SOD), ATPase, and AMPK mRNA expression in mitochondria of quadriceps femoris.

RESULTS: Compared to G1: (1) in RCCIV, G4 increased 134.5% (460.94±171.14 vs. 196.51±37.47 pg/mL, $P<0.05$); (2) in Mn-SOD, G4 increased 134.4% (769.79±285.67 vs. 328.41±62.54 pg/mL, $P<0.05$); (3) in AMPK mRNA expression, G4 increased 81.5% (1.48±0.43 vs. 0.81±0.09, $P<0.05$). Besides, there was no statistical significance in RCCII and ATPase.

CONCLUSIONS: The high dose of PCN has better effect on energy metabolism of muscle than the pure peptide of soybean protein.

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Skeletal muscle steroidogenesis: effects of oxidative stress and tadalafil exposure in C2C12 myotubes

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BACKGROUND: It has been reported that physical exercise, both acute and resistance, can modulate protein expression and enzymatic activity of dehydrosteroid-dehydrogenase enzymes responsible for the total testosterone (TT) and dihydrotestosterone (DHT) production. In order to augment the anabolic effect of exercise, athletes unwisely use drugs to increase their physical efficiency during sport performance. Among the substances not prohibited taken by athletes the phosphodiesterase 5 (PDE5i) tadalafil is often used as performance enhancer-drug. A possible influence on hormones secretion of tadalafil in *in vivo* studies was reported. The aim of the study is to evaluate the ability of tadalafil to influence the production of anabolic androgenic steroids, TT and DHT by skeletal muscle, alone or in combination with hydrogen peroxide to mimic an oxidative insult.

METHODS: To this end, we investigate the effect of tadalafil administration at different concentrations alone or in combination with hydrogen peroxide on TT and DHT levels in the mouse C2C12 cell line, a well-known model for *in vitro* skeletal muscle studies.

RESULTS: Our preliminary results in C2C12 myotubes evidence a modulation dose and time dependent in both TT and DHT levels in media culture after H₂O₂ and tadalafil administration. No synergistic effect in combined treatments seems to be induced.

CONCLUSIONS: Our study will allow better understanding: 1) the direct action of the muscle on the formation and hormonal secretion before and after physical exercise, independently from the gonads' activity 2) the possible influence of PDE5i in muscle steroidogenesis.

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Protein supplement products contain lower actual protein-content than declared on labels

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BACKGROUND: The use of protein supplements is popular among athletes worldwide. Manufacturers may be taking advantage of sparsely regulated industry, by adding less protein, than claimed on the labels. Assessment to verify and validate protein content in commercially available products may be inadequate. The aim of this study was to quantify for the actual protein content, in commercially available protein supplements products using the Bradford, Lowry and Bicinchoninic Acid protein assays, respectively, and correlate the actual protein content declared on product label.

METHODS: Protein supplement products (N.=21) were purchased from various retail stores in Johannesburg. Protein supplement product selection was informed by the top selling products and the available research budget. The principle for protein

detection, in each of the respective assay, is on dye-binding to the protein.

RESULTS: Actual protein contents analyzed by BCA were statistically different in ($P < 0.05$) 95% of the products. About 10% of the products assessed by Lowry assay had marginally higher protein content, differing by 2% and 3% respectively. Bradford assay had protein content which was lower to that stated on labels with analyzed content varying between 2% to 4%.

CONCLUSIONS: The multi-protein assay approach used to verify the 'actual protein' in this study is a viable strategy to compare the content declared on the label. Results in this study revealed that protein supplements have lower protein content than claimed on labels. This warrants for an improvement in terms of regulation, vigilance and effective enforcement capacity specifically relating to monitoring protein content in supplements products.

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Creatine and caffeine co-administration as ergogenic aid in athletes: a systematic review

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BACKGROUND: Creatine is one of the most widely used ergogenic dietary supplements worldwide. Caffeine may also improve muscle endurance and performance by multiple mechanisms. The aim of this systematic review was to evaluate the ergogenic aid in exercise, when creatine and caffeine are combined, and discuss the potential implications for athletic performance.

METHODS: A systematic search was carried out on the following databases: PubMed, Google Scholar, and Scopus. Selection criteria included full-text English studies, investigating the ergogenic role of creatine and caffeine in athletes.

RESULTS: Fifty six studies were identified in the first screening. Pooling criteria were met by seventeen studies that provided evidence for the ergogenic role of creatine and caffeine in athletes. Both substances are widely used, are safe, have a proven ergogenic effect and do not affect the pharmacokinetics of each other when co-administered. The ergogenic effect of creatine occurs in short-term sports of high intensity while ergogenic action of caffeine occurs in endurance or anaerobic exercise. Evidence also demonstrates that prior creatine loading does not influence the ergogenic effect of acute caffeine supplementation. Co-administration of the two substances affects the distribution of body fluids. Creatine moves water intracellularly by osmosis, while caffeine has a diuretic effect. These effects may worsen dehydration during exercise, and, therefore, deteriorate athletic performance.

CONCLUSIONS: Based on the evidence currently available, it may be prudent chronic, high-dose caffeine intake for increasing the ergogenic effect of creatine is avoided. Until future controlled research confutes the existence of interference between the ingredients, caffeine intake may be a notable consideration for the formulation of multi-ingredient supplements and effective utilization of creatine loading in athletes. However, more research is needed to determine whether caffeine consistently boosts performance improvements from creatine supplementation.

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Consumption and side effects of nutritional supplements in athletes

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BACKGROUND: The present study investigates the consumption of supplements in athletes and their effects on health profile, with particular attention to cardiological consequences.

METHODS: One thousand ninety hundred and sixteen (1916) athletes, previously evaluated for competitive and amatorial sports, took part (during COVID-19 lockdown) to an online survey about their lifestyle, supplements consumption, family and personal medical history, with particular regards to cardiological symptoms (dyspnoea, chest pain, palpitations and dizziness).

RESULTS: Two hundred and twenty (220) athletes replied to the questionnaire, but 137 athletes (45 female and 92 male) were selected, respecting inclusion criteria (aged 18-25 and training more than 8 hours per week). Of the 137 athletes sampled, 97 (70.8%) were practicing competitive sports and 40 (29.2%) amatorial activities; most of them were playing sport games (38.6%). Moreover, of the 137 athletes selected, 50 (36.5%) declared to use nutritional supplements; 32 (23.4%) referred cardiological symptoms and half of them were supplements users. Moreover, 26 (81%) of symptomatic cases were competitive athletes.

CONCLUSIONS: The present study evidenced that nutritional supplements are often used with a certain amount of superficiality, usually without medical prescriptions and attention to side effects. Many athletes taking supplements reported cardiological symptoms. In order to further investigate these side effects, we are going to expand our sample and to start a clinical follow-up by 24-hour Holter ECGs performed to 4 groups: "users" and "non-users", both divided in 2 subgroups: with and without cardiological symptoms.

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Discriminant validity and relativity of three self-reported scales applied for individuals with chronic ankle instability

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BACKGROUND: The cross-cultural adaptation and validation study of Cumberland Ankle Instability Tool (CAIT), Foot and Ankle Ability Measure (FAAM) and Lower Extremity Functional Scale (LEFS) has been performed in Chinese. However, there is no discriminant validity study of these three scales for CAI in mainland China. The purpose of the current research is to investigate the discriminant validity and relativity of three scales applied for individuals with CAI in Beijing, CHINA.

METHODS: CAI group included 145 participants with a history of ≥ 1 ankle sprain and ≥ 2 episodes of giving-way in the past 6 months. Healthy group included 51 participants with no history of ankle sprains or instability. Copers group included 16 participants with a history of a single ankle sprain and no subsequent instability. One-Way ANOVA was applied to compare the discriminant validity of these scales in three independent groups. Spearman's correlation coefficient was calculated to analyze the correlation among three scales.

RESULTS: The scores in CAI group on CAIT, FAAM and LEFS were significantly different from those of Healthy group ($P=0.000$), 95% CI were respectively (-12.3, -8.64), (-4.58, -1.55), (-5.44, -1.64); The scores in CAI group on CAIT ($P=0.000$, 95% CI(-6.30, -1.38) FAAM ($P=0.001$, 95% CI(-6.30, -1.38) and LEFS ($P=0.003$, 95% CI(-7.31, -1.15) were significantly different from those of Copers group. The correlation coefficients among three scales were in the range 0.559-0.795.

CONCLUSIONS: The CAIT, FAAM and LEFS all showed high sensitivity and good discrimination in CAI individuals. The results with three scales were correlated. But the emphasis of these scales is different; a suitable scale should be selected in clinical practice according to the characteristics of the patient.

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ETHICAL APPROVAL: Ethics committee of sports science experiment, Beijing Sport University (2019093H).

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Chronic posterior knee laxity in a population of over 100 patients: injury characteristics, diagnosis and treatment algorithm

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BACKGROUND: Aim of the current study was to determine the characteristics; clinical and radiological diagnostic methods of posterior cruciate ligament (PCL) isolated and combined knee injuries.

METHODS: One-hundred and twelve (112) patients with a chronic posterior knee laxity were surgically treated. Clinical examination, MRI, Telos™ stress dynamic X-rays, KT-1000 measurements and the IKDC questionnaire were used to diagnose and evaluate these injuries.

RESULTS: Median follow-up was 4.5 years (2-11 years). Thirty-two patients (28.6%) had an isolated posterior laxity, fifty-three (47.3%) a posterior posterolateral laxity, twenty-one (18.7%) a posterior posteromedial laxity and 6 (5.4%) patients had a complex posterior and mediolateral laxity. The mean preoperative value of posterior tibial translation was 13.5mm (SD: 1.4) and the mean postoperative value was 4.4mm (SD: 1.7) as measured with the Telos device. In the cases with a concomitant ACL rupture, the mean preoperative value of anterior tibial translation was 6.5mm (SD: 1.3) and the mean postoperative value was 1.7mm (SD: 0.8). The mean pre- and postoperative IKDC scores were 74.5 (SD: 4.2) and 87.9 (SD: 3.1) respectively. Meniscal and/or cartilage injuries were found in 80 patients (71.4%).

CONCLUSIONS: A high index of suspicion is needed for the chronic posterior knee laxity diagnosis including any concomitant soft tissue, meniscal and cartilage lesion which may have a substantial impact on the treatment outcome.

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Developing a rehabilitation programme and framework of implementation to address anterior knee pain among runners in under-resourced communities

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BACKGROUND: Anterior knee pain (AKP) is a problematic knee injury resulting from overuse, and impact negatively on the life quality of many runners. Runners with AKP in under-resourced poor communities present with poor health outcomes. The current study aims to develop a community-based rehabilitation (CBR) program and framework of implementation for runners with AKP in under-resourced communities.

METHODS: The current paper focused on the use of Delphi technique in building consensus on the development of a suitable CBR intervention. The study was based in South African. Experts in the field of sport medicine were recruited as Delphi participants. A Delphi questionnaire was used to obtain consensus among participants. The process consisted of three

rounds of consensus. Nineteen (19) experts participated in the study.

RESULTS: Thirteen (13) core items for the rehabilitation program were established: education, immediate treatment, soft tissue manipulation, stretching exercises, proximal strengthening exercises, measures for improving posture and gait, core stabilization, warming-up and cooling-down exercises, establishing a balance between running load and tissue capacity, implementing variations in running surfaces and inclines, encouraging the use of appropriate footwear and orthosis, nutritional support, and counselling. Implementation framework included 4 core items: establishment of rehabilitation teams, training of healthcare workers and coaches, implementation of low-level/no-cost services and referrals for further management.

CONCLUSIONS: The study yielded a comprehensive intervention which is focused on addressing the physical and non-physical features of AKP. A further study to test the feasibility of the intervention is recommended.

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Knee pain and brief music interventions in amateur long-distance runners

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BACKGROUND: Knee pain is one of the most common complaints in amateur and professional athletes. The purpose of this research is to examine if knee pain perception and control in amateur adult athletes/long-distance runners can change through a simple passive listening music intervention (rhythmically fast or slow music) that they prefer.

METHODS: Twenty-three (23) non-professional long-distance runners from Northern Greece (with an average age of $M = 60.43$, $SD = 4.90$ years) took part in the study. The 23 participants formed two experimental groups ($N=6$ with a choice of listening to fast rhythmic music with more than 120 beats per minute and $N=6$ with a choice of listening to slow rhythmic music with less than 120 beats per minute); and the rest formed the control group ($N=11$ without listening to any recorded stimulus). The three groups were equal in terms of age, past sports performance, prior pain self-ratings and gender. The intervention consisted of listening to music excerpts, fast for the first experimental group and slow music for the second experimental group for 15 minutes before starting their training. For pain assessment before training, the Knee Pain Questionnaire was used to assess their self-perceived pain as well as after the training.

RESULTS: Statistical analysis of the results with the Kruskal-Wallis non-parametric method showed no difference in the personal perception of knee pain between the three groups. Participants in the exper-

imental group with slow rhythmic music listening showed the same levels of pain perception, compared to people who listened to fast rhythmic music or no music at all.

CONCLUSIONS: The results of this preliminary research show that the use of musical background cannot reduce self-report of knee pain in amateur athletes. Future research should examine in larger samples if other emotional or physical parameters can change due to brief music exposure.

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Prognosis of elite basketball players after an Achilles tendon rupture

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BACKGROUND: Achilles tendon ruptures are a common, potentially career-ending injury for professional basketballers. We review the prognosis of elite basketball players after an Achilles injury and compare their career trajectory with matched counterparts.

METHODS: Data regarding NBA players with a unilateral Achilles tendon rupture were obtained from open registries, while statistically matched players were identified as controls. The primary outcome measure was the Player Efficiency Rating (PER) which is a statistic that evaluates a player's overall in-game contribution. The pre-injury PER (i-PER), the early return-to-play (r-PER) and the post-injury peak PER (p-PER) were analysed.

RESULTS: 12 players met the eligibility criteria (mean i-PER=16.7). 2 players never returned-to-play in the NBA and the mean return-to-play duration was 10 months, a PER drop of 7.2 was seen upon their return. The p-PER was seen at 21 months post-injury and dropped 3.5 PER compared to the i-PER. There was no significant difference between the p-PER of the Achilles ruptured players and their matched controls.

CONCLUSIONS: Achilles tendon ruptures can be career-ending, but most return-to-play in the following season. Although post-injury performance peaks at 2 seasons after the injury, it is significantly worse than the pre-injury level. The post-injury peak performance was comparable to the control group and may be explained by age-related decline. Although their p-PER were similar, athletes have a short career span and a 2-year hiatus is devastating; future research should explore prevention strategies and factors that accelerate return-to-play.

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Risk factors for stress fractures in male athletes

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BACKGROUND: Stress fractures (SF) are common injuries in athletes caused by overuse and repetitive activity. The prevalence and risk factors for SF in male athletes are not well documented as they are assumed to be more common in female athletes. Our study was aimed at establishing the prevalence of SF among male athletes and analyzing the selected risk factors for their occurrence.

METHODS: Ninety-three randomly selected volunteer male athletes from different sports aged 19.2 ± 2.8 years participated in this cross-sectional study. The participants provided information about their demographic data, history of SF, lifestyle risk factors, and completed the Eating attitude test (EAT-26) for identifying eating disorders risk. Crude odds ratios (OR) of the groups with and without history of SF were calculated to assess the association of SF with the studied factors.

RESULTS: A total of 23 (24.7%) of the athletes reported at least one SF in the past, and 23.7% of them have had two or more SF. Most of the injuries (69.6%) were located in the lower extremity, and 60% were in the foot and ankle. The participation in competitions and weight loss of more than 10 kg in the past was identified as the only significant factors associated with SF incidents in male athletes (OR 24.8, 95% CI: 1.4-425.4; OR 153.3, 95% CI: 8.5-2770.6, respectively).

CONCLUSIONS: These results suggest that engagement in competitive sports, which is associated with higher training volume and extreme weight loss practices, should be considered as factors for increased risk of SF in male athletes.

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Neuromuscular pattern alteration in quadriceps in the risk of knee injuries in female volleyball athletes

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BACKGROUND: Knee injuries occur most frequently in landing and cutting movements in sports such as basketball, soccer, and volleyball. In particular, the anterior cruciate ligament (ACL) injury rates are greater in female than in their male counterparts. An alteration in neuromuscular pattern can represent a risk factor for ACL injuries. Aim of the study is to compare the activation time of the quadriceps and hamstrings muscles to assess the risk of ACL injury.

METHODS: After obtained the informed consent, 12 female elite volleyball players (age 25.9 ± 4.9 ; eight 184.9 ± 6 cm) were enrolled. To each athlete were applied an inertial sensor and 4 electrodes on the quadriceps and hamstrings muscles used for the surface electromyography. The athlete resting on 1 leg dropped, from a 32-cm-high platform, on the suspended foot (testing leg). We calculated the activation time of the rectus femoris (RF), vastus medialis (VM),

biceps femoris, and semimembranosus muscles before contact on the ground in comparison with the range of normality.

RESULTS: The athletes showed a significant ($P < 0.5$) VM delayed activation (451.6 ± 204.65 ms) and RF (333 ± 146 ms).

CONCLUSIONS: VM and RF delayed activation in female volleyball athletes determines a deficit of static and dynamic quadriceps varus/valgus stabilization during cutting movements, which is an important risk factor for incurring an ACL injury. This test is suitable for the screening of high-risk athletes and for targeting interventions to correct specific imbalances that may increase the risk of injury.

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Knowledge and management of brain concussion in female youth sector of italian football

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BACKGROUND: Head injuries during sports may lead to complications if underestimated. Female athletes seem to be more susceptible, probably reflecting differences between brain and craniovertebral segments. The current study investigates the awareness about concussion in female youth soccer athletes, comparing knowledge between players with or without a history of concussion, and to evaluate the appropriateness of medical management.

METHODS: Fifty (50) Italian female youth soccer players (of mean age 15.6 ± 0.76 years with a mean experience of 7.78 ± 2.6 years) and 7 members of the staff (of mean age 34.4 ± 13.27 years and mean experience 11.14 ± 12.65 years) were included. A cross-sectional survey was performed using questionnaires about the diagnosis or self-reported symptoms of concussion. The total score regarding the knowledge about concussion was compared between the two groups. For the staff, instead, a survey was conducted to evaluate the level of knowledge and the management of traumas.

RESULTS: 30% of the participants experienced at least one episode of concussion. In 53% of cases, athletes did not report the event to any staff member. No significant difference in the general knowledge was found between the two groups, although athletes with positive history totalized higher scores. As for the staff, it emerged the absence of an official program for the head injury management.

CONCLUSIONS: The findings of the current study suggest the need for targeted interventions to increase knowledge about concussion, not only for young athletes but also for the medical and technical staff. The correct management may significantly reduce the complications' risk, allowing complete recovery and optimal resumption of competitive activity.

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The survey in the situation of an ankle sprain for Chugoku and Shikoku Collegiate American Football player in Japan

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BACKGROUND: In American football (AF) at National Football League (NFL), the ankle sprain is common injury. Hence, it is important to investigate the situation of the ankle sprain in other countries or leagues to prevent ankle sprain in AF players. The purpose of the current survey was to describe the occurrence situation of ankle sprain for collegiate AF players in Japan.

METHODS: A total of 195 Chugoku and Shikoku Collegiate AF players in Japan participated in this survey. The question items were the basic information, the experience of the ankle sprain, the occurrence of ankle sprain and the details (Outbreak play, Offence or Defense, and so on).

RESULTS: Valid answers were obtained from 153 players (79%). Sixty-seven (67) players (44%) had experience of the ankle sprain. The most frequent of outbreak was run play (45%), and the second one was pass play (19%). The occurrence rate of the ankle sprain in the offence was 46%, and in the defense 42%. In offence, the most ankle sprains occurred when players blocked the opponent (39%). In defense, they occurred when players were blocked by the opponent (36%).

CONCLUSIONS: Players who participated in block had a higher frequency of ankle sprains. This result reflects the necessity to turn attention to collegiate AF players who participated in block for prevention of the ankle sprains.

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Combined bursal aspiration and corticosteroid injection for rotator cuff tear patients unresponsive to conservative management: case report

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BACKGROUND: Subacromial-subdeltoid (SASD) bursitis is characterized by bursal distension caused by fluid collection, commonly resulting from rotator cuff tears. Aspiration of the bursal fluid associated with rotator cuff tears tends to be overlooked. The effects of combined bursal aspiration and corticosteroid injection on full-thickness tears of the rotator cuff with SASD bursitis have not been previously reported.

METHODS: Three patients with shoulder pain caused by rotator cuff tears with marked amounts of fluid in the SASD bursa. The patients experienced intractable pain despite prior conservative management, including corticosteroid injection. Physical examination and imaging studies revealed rotator cuff tears with remarkable quantities of fluid in the SASD bursa. The patients underwent ultrasound (US)-guided aspiration of the bursal fluid and intra-articular corticosteroid injection.

RESULTS: All patients experienced reduced shoulder pain for several months.

CONCLUSIONS: Combined aspiration of fluid in the SASD bursa and intra-articular corticosteroid injection in the rotator cuff tear is recommended, especially in cases with untreated shoulder pain unresponsive to previous conservative management.

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A case report of simultaneous bilateral shoulder dislocation during pilates reformer exercise

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BACKGROUND: Shoulder dislocations are the most common type of large joint dislocations in sports and they are mostly associated with violent or uncontrolled muscle contractions. Low-impact exercises, such as Pilates Reformer may also cause these injuries. The objectives of this case report are to highlight the risks of uncontrolled and unsupervised exercise although the exercise itself is considered to be low-impact and safe, and to emphasize the importance of rehabilitation program.

METHODS: A 41 year-old female, bank clerk, had sustained injuries on both shoulders during an unsupervised Pilates Reformer exercise session. Bilateral anterior shoulder dislocation was confirmed with the initial X-rays in emergency department. Spontaneous reduction of right shoulder was observed and then the left side is reduced under general anesthesia. Supervised rehabilitation program was started after ten days of immobilization, and lasted eight weeks with additional home-based exercises which continued till the sixth month.

RESULTS: The patient had full range of motions with satisfactory strength and returned to desk work at the fourth week, and had no symptoms in daily activities at the tenth week. At the sixth month, the patient demonstrated full shoulder range of motion without

pain or apprehension. At two years follow-up there was no complaint or new injury.

CONCLUSIONS: Bilateral shoulder dislocations may occur due to low-impact exercises although these exercises are "so-called safe" under unsupervised conditions. In addition to effective trauma care, well-designed rehabilitation program is essential to accelerate healing and to ensure symptom-free daily life and sporting activities.

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Acute avulsions of adductor longus complex (PLAC): outcomes of reconstruction in athletes

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BACKGROUND: Adductor longus injuries are a common problem in sports resulting in absence from competition and in high re-injury rate. Traumatic adductor longus avulsions may become complex leading often to disruption of pyramidalis-adductor longus-anterior pubic ligament complex (PLAC). We aim to report the clinical outcomes and time to return to play following surgical treatment for PLAC.

METHODS: We included professional athletes that presented with an acute PLAC injury and underwent surgical reconstruction of the complex. Athletes with adductor enthesopathy, hip problems or inguinal disruption were excluded. Demographic data, medical history, clinical examination, isometric strength testing measurements, imaging features and type of sports were recorded. Pain was measured on a VAS scale and the time and level to return to play were documented.

RESULTS: We operated 105 professional male athletes with a mean age at the time of operation 27 years old (\pm SD 7.3). Most often sport was football (61.4%) and rugby (21.1%). All of the athletes sustained the injury during a game and were unable to continue playing. The average pain on a VAS scale was decreased from 10 to 0 and adductor strength was increased considerably. All of the athletes (100%) returned to full training at a mean 12 weeks (\pm SD 3.6) at their previous level of competition.

CONCLUSIONS: PLAC avulsions are severe groin injuries and might be debilitating for the athletes. Surgical reconstruction with anatomical repair of PLAC provides a significant clinical improvement and allows athletes to return to play promptly, at the same level.

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Pyramidalis- linea alba syndrome as a cause of long-standing pubic/ lower abdominal pain in professional athletes; outcomes

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BACKGROUND: Chronic pubic/lower abdominal pain represents a challenging entity in diagnosis and treatment and if persistent may lead to disability in athletes. The aim of this study is to present a new entity, the pyramidalis- linea alba syndrome, and report the return to play outcomes.

METHODS: We included professional athletes with chronic pubic/lower abdominal pain resistant to non-operative treatment. Patients with associate inguinal disruption, osteitis pubis, adductor enthesopathy or hip pathology were excluded. Athletes underwent bilateral pyramidalis muscle release and rectus abdominis fascioplasty. Demographic data and type of sports were noted. Medical history, clinical examination, imaging investigation and strength testing measurements were recorded. All athletes were assessed for pain on a VAS scale and if they returned to sports at the same level as preoperatively.

RESULTS: We assessed 20 male professional athletes (18 football and 2 rugby players) with a mean age 28.8 (SD 7.3) years old. Duration of symptoms was 10.67 months (SD 6.9, 2-24 months). Seven athletes had a pubic cleft injection prior to the surgery with short-term partially improvement of symptoms. The pain was improved and ranged from 0 to 3 postoperatively.

The athletes returned to full training at a mean of 8.3 weeks and to sports at 12 weeks but one athlete elected to stop playing due to ageing.

CONCLUSIONS: Pyramidalis muscle release associated with rectus abdominis fascioplasty is a promising technique when prior non-operative treatment has failed. Athletes have a prompt recovery and return to the same level of sports.

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Nonoperative management for femoroacetabular impingement and parallel groin-related pathologies in athletes: designing the rehabilitation strategy

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BACKGROUND: Femoroacetabular impingement (FAI) related hip pain is frequently present in athletic activities, especially in sports with repetitive hip flexion and rotational movements. The clinical syndrome associated with FAI often coexists with other groin-related pathologies, indicating that many factors affect diagnosis and management. We present our experience implementing a coordinated rehabilitation program, based on the understanding of the clinical

history and physical impairments seen in athletes with FAI.

METHODS: We prospectively evaluated 21 athletes with symptomatic FAI based on the clinical history, physical and radiological examination. Addressing the clinical findings and the potentially modifiable physical impairments, all participants involved in rehabilitation interventions including:

1. An acute/subacute phase of stretching, soft tissue techniques and homeopathic periarticular injections in order to reduce pain, increase soft tissue elasticity and achieve symmetrical ROM.

2. A phase of specific exercise program in order to restore strength and motor control that emphasizes firstly on the deep hip stabilizers, progressing to a global hip, core and trunk muscles' strength and neuromotor control.

3. An education phase focusing on return to play training and tutoring on strategies to reduce provocative positions of hip impingement during specific sports.

RESULTS: The great majority of our participants succeeded full sport activity with mean rehabilitation period of 16 weeks. Only four athletes underwent arthroscopy.

CONCLUSIONS: In sporting populations, hip pathologies frequently related to FAI may have a significant impact on performance. There is no clear recommendation on the most effective management. Our findings support that specifically designed rehabilitation strategies may result in positive outcomes.

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Low back pain: efficacy of physical therapy

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BACKGROUND: Low back pain (LBP) has been divided to specific (SLBP), and non-specific low back pain (NSLBP) only in the last decade. Even with this sub-classification, the source of pain from the lower back in many cases is an unanswered question. In many cases this is due to the complexity of the pain, and multiple factors in disabling LBP that coexist. Many studies tried to investigate the best treatment for LBP but due to poor methodology most of the studies are inconclusive, reinforcing a growing literature that lead to misconception of the management of LBP.

METHODS: Methodology flaws are mainly apparent in participant inclusion criteria, sub-group allocations, poorly mentioned interventions, lack of individualized management, inadequate targeting of exercise type to each individual specific needs, and single "magic" treatments, that don't replicate clinical practice.

RESULTS: In most cases, the noxious stimuli for NSLBP is unknown. However, the consequence of

pain is arthrogenic muscle inhibition which can lead to reduced neural drive to the muscle and/or joint. This in turn can cause loss of strength and endurance of the muscles, altered muscle patterns, altered posture, loss of kinesthesia of low back, and reduced range of movement. These symptoms can be reinforced by patient negative beliefs and psychosocial factors, leading to a chronic condition.

CONCLUSIONS: Treatment should be tailored on the patient clinical presentation identifying the cause of pain, modulating the symptoms while improving altered movement patterns, optimizing functionality, educate the patient for self-care management and changing patient beliefs about their pain.

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Injury epidemiology of ultimate frisbee in Hong Kong

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BACKGROUND: Ultimate Frisbee is a non-contact, self-refereed team sport that is rapidly gaining popularity in Hong Kong. It is a physically demanding competition with a substantial injury risk, but injury epidemiology data is lacking. This study aims to identify and analyze the injury prevalence and risk factors for Ultimate Frisbee players in Hong Kong.

METHODS: Online self-reported surveys were collected from participants through the Hong Kong Ultimate Players' Association (HKUPA). Data was collected on injury type, location, nature, severity and onset with descriptive statistical analysis to differentiate injury characteristic, including injury incidence and rates. Chi-square analyses were performed to compare proportions between sports, gender and injury sites.

RESULTS: Response rate of 75.6% was achieved, of which 59 entries were included for analysis. The injury prevalence is 62.7%, with both men and women having similar incidence (P=0.63). The risk of in-tournament injury was 3 times higher than injuries during training (P<0.001) with lower limb injuries being the most prevalent.

CONCLUSIONS: Our preliminary findings provide evidence that majority of Ultimate injuries involved the lower extremity with injuries occurring more in tournaments than training. This study is an important first step to provide the groundwork for tailoring prevention strategies to minimize injuries in Ultimate Frisbee.

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Asymmetry in trunk muscle thickness: not the key to a cricket fast bowler's performance

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BACKGROUND: Asymmetrical sport-specific adaptation in the morphometry of the trunk muscles and its role in injury prevention have been described in cricket fast bowlers, while the association with bowling performance has not been investigated. The aim of this study was to determine the association between bowling performance and side-to-side differences in trunk muscle thickness in adolescent fast bowlers.

METHODS: In this observational cross-sectional study, bowling performance, namely ball release speed and bowling accuracy, was measured in adolescent fast bowlers. Ultrasound imaging was used to measure the thickness of the external oblique, internal oblique, transversus abdominis and lumbar multifidus muscles.

RESULTS: A total of 46 cricket fast bowlers with a mean age of 15.9 (standard deviation (SD)=1.2) years participated. On the non-dominant side, the external oblique and internal oblique at rest were thicker than on the dominant side, while the transversus abdominis and lumbar multifidus were symmetrical. Weak correlations existed between bowling performance and the side-to-side differences in the thickness of all muscles at rest and in the contracted state, except for the side-to-side difference in external oblique muscle thickness in its contracted state which showed a moderate negative correlation with ball release speed ($\rho=-.455$; $P=.002$).

CONCLUSIONS: Previous studies have found that trunk muscle asymmetry in fast bowlers may be protective against injury. In this study, no definitive relationship could be established between bowling performance and trunk muscle asymmetry. It is important to consider the injury-performance trade-off before implementing injury prevention initiatives.

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Diastasis of pubic symphysis without injury in a man after horseback riding. A rare case presentation

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BACKGROUND: Pelvic ring injuries typically occur following a high velocity force such as vehicle collisions or falls from height. The use of temporary pelvic stabilization systems followed by osteosynthesis can be life-saving for these patients. The purpose of the current study was to describe a rare case of pelvic ring injury in a healthy man without history of high energy damage.

METHODS: A 43-year-old man presented to the Emergency with local pain in pubic symphysis and difficulty walking after horseback riding. The patient did not report any fall or injury during this recreational activity and apart from tachycardia he was hemodynamically stable. Radiological imaging demonstrated an

injury of the pelvic ring APC II with a diastasis of pubic symphysis of 3.6 cm. After a temporary stabilization with pelvic binder, a computed tomography (CT) scan of the pelvis was performed.

RESULTS: A closed reduction and stabilization of pelvic ring with supraacetabular external fixation was performed. Postoperatively the pubic symphysis diastasis was reduced to 1.5 cm. The patient remained in bed for 4 weeks. Gradual mobilization with partial weight bearing was allowed. The external fixation was removed 10 weeks postoperatively and he fully returned to his pre-injury activities without any discomfort 4 months from injury.

CONCLUSIONS: Pelvic ring injuries in young patients without high-energy injury are extremely rare and might be misdiagnosed. As presented in this case, the sudden onset of pain in pubic symphysis combined with difficulty walking after a similar low-energy task, should not be overlooked for pelvic injury.

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Pseudarthrosis after an isolated fibular fracture in an amateur football player. Management with percutaneous osteosynthesis

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BACKGROUND: Fibular fractures with an intact tibia are relatively rare. Pseudarthrosis after a single fibula fracture is an extremely uncommon complication that occurs in less than 0.3% of these fractures. The aim of the current study was to present an infrequent case of pseudarthrosis after an isolated fracture in the fibula proximal diaphysis in a football player which was surgically treated.

METHODS: A 23-year-old man presented to our hospital with persistent pain on the right tibia lateral surface. Eight months ago, he had sustained a solitary fracture in fibula diaphysis after a direct blow to the tibia during a football game, which was conservatively treated. A hypertrophic non-union was identified on radiographs. Initially, a weight-bearing (WB) cast was placed for 1 month. However, no sign of union was visible in the new X-rays whereas symptoms had not subsided. Therefore a percutaneous osteosynthesis was performed with a 3.5 mm lag screw, under fluoroscopy.

RESULTS: Immediate mobilization and partial WB was recommended, postoperatively. At six weeks, full WB was allowed, while at 8 weeks, radiographic imaging displayed complete union. Twelve (12) weeks postoperatively, the patient returned to his pre-injury recreational activities without symptomatology.

CONCLUSIONS: Only few studies in literature report pseudarthrosis as a complication after isolated fibular fractures. In such cases, minimally invasive percutaneous osteosynthesis with a lag screw can offer a successful and definite outcome.

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Physical therapy in the management of athletes with quadriceps muscle contusions

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BACKGROUND: Quadriceps muscle contusion (QMC), as the result of direct force on the thigh anterior or lateral surface, is a common sports injury involving contact athletes. The purpose of the present study is to review the recent data literature regarding the role of physical therapy after a QC injury.

METHODS: A systematic search was conducted on Pubmed, Google Scholar and Scopus databases using as key words ["physical therapy" OR "physiotherapy"] AND ["quadriceps muscle contusion"]. Selection criteria included full-text English studies, investigating the role of physical therapy in the treatment of QMC in young athletes.

RESULTS: Seven studies were identified in the first screening. Pooling criteria were met by 6 studies that provided evidence about the therapeutic role of physical therapy in QMC. Ultrasound therapy is justified due to the analgesic action existence, but it is recommended that be avoided on the first day after injury. Neuromuscular Electrical Stimulation aims to increase angiogenesis in the injured area. LASER treatment is supported to mitigate body's inflammatory response and facilitate the processes involved in muscle regeneration. Diathermy aims to increase the deep tissues' temperature, to enhance tissue healing, to reduce pain, to improve joint stiffness, to increase tissue elasticity and pain threshold regionally and to reduce muscle spasm.

CONCLUSIONS: Physiotherapy may be an effective treatment option in QMC. However, limited literature data are available and, therefore, further research is needed in order more types of physiotherapy, such as hyperbaric oxygen therapy be investigated.

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Plyometrics exercises reduce the incidence of anterior cruciate ligament injury: a meta-analysis

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BACKGROUND: Anterior cruciate ligament (ACL) injury is among the foremost common worldwide athletic injury. There is evidence that plyometric training is one of the preventive method used to decrease the ACL injury risk. The aim of the current study was to assess the efficacy of injury prevention programs (IPPs) that include plyometric exercises in reducing the frequency of ACL injury among athletes.

METHODS: Two investigators independently searched for relevant studies published during the period 1985-2021 using the online databases Cochrane Library, PubMed, Web of Science, and PEDro. The keywords used in the search strategy were 'plyometrics training', 'neuromuscular training', 'injury prevention programs', 'FIFA', 'ACL injury', 'athlete', and variations of these search terms. Included studies had to be randomized controlled trials using IPPs that included plyometrics training for athletes with the primary outcome being ACL injury rate. There were no restrictions of age or playing level. The random-effects model was used in analyzing the extracted data by the Comprehensive Meta-Analysis software version 3.

RESULTS: The pooled results of IPPs that include plyometrics-training exercises among 7,260 athletes showed 60% ACL injury reduction per 1000 h of exposure compared to the control group with an injury risk ratio [IRR] of 0.40 (95%CI 0.26–0.63, P<0.001).

CONCLUSIONS: The present meta-analysis demonstrates that IPPs that include plyometric training decreased the risk of contact and non-contact ACL injury among both male and female athletes.

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Balance exercises reduce the incidence of ankle injury among soccer players: a meta-analysis

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BACKGROUND: The ankle is one of the most common sites of injury among soccer players. There is evidence that the incidence of ankle injuries can be reduced by improving proprioception and ankle stability via balance exercises. The current meta-analysis evaluated the effectiveness of injury prevention programs (IPPs) that include balance exercises in ankle injury prevention.

METHODS: Two investigators independently searched for relevant studies published during the period

1985–2021 using the online databases Cochrane Library, PubMed, Web of Science, and PEDro. The keywords used were 'balance training', 'proprioceptive training', 'neuromuscular training', 'injury prevention programs', 'FIFA', 'ankle injury', 'soccer', and variations of these search terms. Included studies had to be randomized controlled trials using IPPs that included balance exercises for soccer players with the primary outcome being ankle injury rate. There were no restrictions of age or playing level. The random-effects model was used in analyzing the extracted data by the Comprehensive Meta-Analysis software version 3.

RESULTS: The pooled results of IPPs that include balance exercises among 4,959 soccer players showed 36% ankle injury reduction per 1000 h of exposure compared to the control group with an injury risk ratio [IRR] of 0.64 (95% confidence interval [CI] 0.54–0.77, $P < 0.001$). Moreover, isolated balance exercises showed 42% ankle injury reduction [IRR 0.58; 95% CI = 0.41–0.84, $P = 0.004$].

CONCLUSIONS: The current meta-analysis demonstrated that IPPs that included balance exercises decreased the risk of ankle injuries, particularly among male soccer players.

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The effect of weekly training volume (in km) on musculoskeletal injuries in long distance runners

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BACKGROUND: Many people worldwide are involved in long distance running. Despite the beneficial effects, running may be associated with musculoskeletal system injuries. It is estimated that the frequency of musculoskeletal injuries, both in amateur and professional runners, ranges from 30% to 79%. The purpose of the current study was to determine the effect of weekly training volume (in km) on musculoskeletal injuries in long distance runners.

METHODS: The study cohort consisted of 52 (33 male and 19 female) healthy adults who are involved in running, both at amateur and professional level. Data collection was done through electronic questionnaires. Athletes were distributed into 3 study groups according to the training volume; <30 km/week, 30–60 km/week and >60 km/week. Runners' demographics, training history, and running-related injury history were recorded.

RESULTS: Participants with an average of less than

30 km/week had a 1.6 times greater injury risk compared to participants with an average of more than 60 km/week ($P = .05$). No statistically significant difference was found between the runners with an average of 30–60 km/week and the rest of the participants ($P = .542$).

CONCLUSIONS: The protective action of >60 km/week could be attributed to the greater experience and better fitness of runners with a high training volume. Long-distance runners are recommended to run a minimum of 30 km/week to reduce musculoskeletal injuries. Further research is needed to determine a km/week threshold to prevent musculoskeletal injuries, taking into account the training level of runners as well.

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The prevalence and accompanying risk factors of lower extremity injuries in netball: a literature review

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BACKGROUND: Netball is a popular team sport, played in more than 72 countries. Lower extremity injuries are increasingly evident as netball requires high level of physical- and functional fitness, including endurance, strength, speed, power, agility and flexibility. These quick and rapid movements, along with the foot rule in netball warrants a high exposure to lower extremity injuries. The purpose of the current study is to compile a structured overview (literature review) of the frequency of lower extremity injuries in netball and the associated risk factors.

METHODS: A literature search was conducted to capture all applicable articles. A descriptive analysis was undertaken. The search resulted in 150 articles, 118 of which met the inclusion criteria, 6 were concerned with frequency of lower extremity injuries in netball and/or the associated risk factors.

RESULTS: Lower extremity injuries in netball include in majority the ankle joint, followed by the knee joint, which is mainly ligamentous in nature, occurring in seasoned players during match time. Extrinsic- and intrinsic risk factors are evident.

CONCLUSIONS: Available research is limited to netball player loading, activity profiles, analyses of team- and seasonal game performance indicators and functional movement. Very little data is concerned with the prevalence of lower extremity injuries. This study creates awareness of the prevalence of lower extremity injuries in netball. This study further sentience the associated risk factors of utmost importance to reduce the risk of possible injuries, reduce the reoccurrence of injuries and time away from game/play and promote individual- and team performance in netball.

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An acute Achilles tendon rupture case study

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BACKGROUND: A 24years football player, during football game, sustained a twisting, closed, isolated injury (in the phase of landing onto his right ankle). Generally well and fit, with no history of previous injuries and no other risk factors. The case of the athlete's injury is described, as well as the current data literature and guidelines were analyzed regarding clinical examination, required imaging, and appropriate treatment and rehabilitation protocols.

METHODS AND RESULTS: the professional football player was misdiagnosed with lateral ankle sprain and proceeded with physiotherapy program and at the last phase of the rehabilitation sustained a complete Achilles tendon rupture. The rupture was diagnosed clinically and no imaging was required. The rupture was surgically treated and an accelerated rehabilitation program was followed.

— Early diagnosis plays an important role in returning to sport.

— Rehabilitation is a crucial component of treatment and especially accelerated rehabilitation seems to be the most beneficial.

— Early weight bearing combined with early ankle motion exercises was more effective for postoperative recovery than the conventional immobilization or early ankle motion exercises alone.

— The rehabilitation focus was on preventing re-rupture for the first 2 months after injury and improving calf muscle strength for the next 1 month (between 2 months and 3 months after injury). Then, for the following 3 months (between 3 months and 6 months after injury), rehabilitation efforts were directed towards a return to sports through vigorous strengthening and proprioceptive exercises.

CONCLUSIONS: Furthermore, during rehabilitation, care was taken not to cause ankle hyperdorsiflexion to prevent calf muscle weakness.

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A comparison of hamstrings flexibility between dominant and non-dominant leg in elite women soccer players

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BACKGROUND: Muscular tightness is frequently postulated as an intrinsic risk factor for a muscle injury in soccer. Further Hamstring flexibility measurements are of clinical relevance of motoring recovery after such injury. Most female soccer players have a favoured foot for kicking the ball, and this preference may lead to asymmetry in the strength and flexibility of lower extremities. The current study was designed to determine whether asymmetry in flexibility is present in the legs of female soccer players.

METHODS: Fifty-nine (59) elite soccer players (of mean age 21.3±16; mean height 1.65±0.17 m; mean body mass 59,5±30 kg) were studied. Hamstrings' flexibility was measured with Passive Knee Extension Test (PKE), Active Knee Extension Test (AKE), Straight Leg Raise Test (SLR) and Askling Test, using the EasyAngle digital goniometer. All tests were performed in supine position. The measurements were made at the preparation period before the beginning of the championship.

RESULTS: A significant difference of flexibility between dominant and non-dominant leg was found in SLR test (P=0.031) and PKE test (P=0.013) with the dominant leg to have greater flexibility. No significant difference (P>0.05) was found between muscle elasticity in AKE and Askling test. There was no main effect of sports age and different soccer positions of hamstring flexibility in female soccer players.

CONCLUSIONS: The current study identified greater hamstring flexibility at the dominant leg when was tested with the two passive tests (SLR, PKE) than with the active ones. It seems that sports age and soccer positions did not influence hamstrings' flexibility neither on dominant nor on non-dominant leg. We can conclude that the choice of the test is important for the results.

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Multiple injuries during training in a cycling athlete

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BACKGROUND: Multiple injuries during training should be promptly evaluated and managed not to pose a risk for an athlete's life. A case of multiple injuries during training in a cycling athlete will be presented here.

METHODS: A 57-year-old semi-professional cycling athlete had an accident during training that when his bike slipped while on increased speed and he

crashed on the floor. Due to the impact of the injury his helmet was broken, however at presentation he just complained of pain on his left hemithorax and left shoulder.

RESULTS: Initial X-rays showed fractures in three ribs on the left side and the acromioclavicular joint dislocation. Careful palpation revealed also subcutaneous emphysema on the left hemithorax. The chest X-ray that followed some hours after the patient's arrival because of worsening dyspnea showed a large left pneumothorax. Immediate cardiothoracic evaluation and chest tube insertion was performed successfully. He was discharged the day after with no further complications. Four weeks after the accident he was electively operated for the acromioclavicular joint dislocation by applying the Minimally Invasive Acromioclavicular Joint Reconstruction (MINAR) technique. The superior acromioclavicular ligament was sutured back in position with an excellent final result. He returned to his previous level of activities after one month.

CONCLUSIONS: Multiple high-force injuries during training should be carefully evaluated and effectively managed in order to avoid complications that could threaten an athlete's life.

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Posttraumatic superficial vein thrombophlebitis of the lower limb: a report of two cases

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BACKGROUND: Trauma is a predisposing factor for superficial vein thrombophlebitis (SVT) although the exact pathophysiologic mechanism remains unclear. Two cases of posttraumatic SVT of the small and great saphenous veins (SSN and GSV) of the lower limb in young male athletes are presented.

METHODS: The first patient, an 18-year-old basketball player, was injured during cycling training from the bicycle's rudder in the left calf. The second patient, a 22-year-old football player, was injured during a football match after a direct kick from an opponent in the right calf. Both patients complained of pain located in the posterior and medial calf surface, respectively.

RESULTS: The basketball player's clinical examination revealed tenderness during pressure at the SSV course. Ultrasound (U/S) and magnetic resonance imaging of the injured area demonstrated SSV throm-

bosis extending from the Achilles' tendon to the popliteal fossa. The football player presented with a palpable, painful mass at the inner lower third of the calf. U/S imaging revealed a GSV thrombus 28x5x6 mm in size. Both athletes were managed with physical activity avoidance, low-molecular-weight heparin, non-steroidal anti-inflammatory drugs and compression stockings. During follow-up gradual improvement of symptoms and total clinical remission was recorded.

CONCLUSIONS: The current case series highlights the background of posttraumatic SVT in athletes. This is a useful tool for the differential diagnosis of calf strains and Achilles' tendon partial tears, as well as for the comprehension of the possible relationship of these complications with deep venous thrombosis.

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Double and single leg balance test in healthy and anterior cruciate reconstructed individuals

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BACKGROUND: Balance training and evaluation are very important elements of the recovery, which follows an anterior cruciate ligament (ACL) reconstruction (1, 3). Balance evaluation in double and single leg stance includes the recording of the movement of the center of pressure (COP), using pressure platform (2). The aim of the study was to examine double and single leg stance in twenty healthy (age 26.75±2.37 ys) and fourteen ACLr (age 24.37±3.50 ys) individuals basketball players.

METHODS: All participants performed single-leg and double-leg balance tests with both opened and closed eyes. The center of pressure (COP) was recorded using a pressure platform, Comex, (Footchecker, Loran Engineering S.r.l., Bologna – Italy). Total Cop Path, Cop velocity, Sway Area and Sway Ellipse were measured to examine balance ability. It was used factor analysis 2x2 and variance analysis with repeated measures to examine the effect of vision (opened-closed eyes) and group (healthy-ACLRs) on balance variables. Significance level was defined as P<0.05.

RESULTS: There was no significant interaction between "vision" (eyes open-closed) and "group" (healthy-ACLR) for all variables during normal quiet stance (NQS) and one leg stance (OLS) for both right and left leg (P>0.05). During OLS the results indicated statistical significant effect of "vision" for the same variables for both legs (right-left).

CONCLUSIONS: This supports the hypothesis that rehabilitation, with proprioceptive and agility training, is an important component in restoring the functional stability in the anterior cruciate ligament-reconstructed knee.

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Median nerve compression due to intraperineurium hematoma after a cyclist's fall on his wrist

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BACKGROUND: Wrist trauma after falling from a bicycle is a very rare case. Bones and ligaments may often be affected. The main symptoms are pain, restriction of the range of motion (ROM) and occasionally numbness in the area innervated by the median nerve (MN) in acute post-traumatic period.

METHODS: A case of a 30-year-old cyclist wrist trauma is presented. He suffered from pain at his wrist and restriction of the ROM. An X-ray performed on the day of trauma was normal. Initially, a splint was placed and NSAIDs were prescribed for 10 days. However, the symptoms did not improve. For the next month, the patient was suffering from pain and experiencing numbness at his 4 fingers during the night. MRI findings showed only soft tissue swelling in the area. An electromyography was performed which revealed pressure on the MN in the wrist area. MN surgical decompression was decided.

RESULTS: The MN was not compressed enough but was severely edematous. Hematoma in the perineurium was also detected. For all the above reasons, it was decided to cut the perineurium to drain the hematoma. The first postoperative day the symptoms subsided. One month later there was no numbness.

CONCLUSIONS: The clinician should think about MN compression due to a hematoma in perineurium after a wrist trauma. Surgical treatment is necessary and efficient when symptoms sustain.

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Intramuscular degloving injury of the rectus femoris muscle: management of a unique lesion pattern - Case report of a youth football player

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BACKGROUND: The most commonly injured muscle of the quadriceps complex is the rectus femoris. Its configuration makes it susceptible to an uncommon type of injury whereby the inner bipennate intramuscular portion of the indirect myotendinous complex is separated from the surrounding outer unipennate muscle's portion. The current case is referred to an intramuscular degloving injury of the rectus femoris muscle and its management.

METHODS: A 16-year-old male football player presented with swelling of his right anterior thigh with no previous known traumatic event or specific mechanism of injury. On physical examination, he had a mass located at the proximal region of the anterior compartment of his right thigh and pain elicited with stretching of the quadriceps and resisted extension of the right knee. On muscular strength testing, the power of the right quadriceps was 15% less compared with his left thigh on leg extension. The ultrasound (US) examination of the right thigh showed a tear and proximal retraction of the indirect head of the right rectus femoris muscle, associated with an intramuscular hematoma between both heads. These findings were suggestive of an intramuscular degloving injury that was later confirmed by MRI findings.

RESULTS: After US-guided evacuation of the hematoma, a progressive muscular training program based on common strength and conditioning guidelines was designed for an estimated period of 8 weeks. The athlete had fully recovered and was able to perform at his pre-injury level without any setbacks or symptoms' recurrence.

CONCLUSIONS: The current case highlights the importance of an accurate diagnosis and properly structured conservative treatment in the recovery of athletes suffering from this unique injury pattern.

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Knee infection after anterior cruciate ligament (ACL) reconstruction: a distinctive *Serratia marcescens* case

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BACKGROUND: Postoperative infection after arthroscopic anterior cruciate ligament (ACL) reconstruction is quite rare (0.3-1.7%). This infection may have severe complications, such as graft failure, hyaline cartilage loss and arthrofibrosis. *Serratia Marcescens* (SM) can be an unlikely pathogen in post ACL reconstruction infections. The current case is referred to the clinical manifestations of a patient, being initially febrile without local symptoms and negative cultures. It is unknown if SM infections can be indolent.

METHODS: A 42-year-old Caucasian male underwent an ACL reconstruction after a sport injury.

RESULTS: After 15 days, he had 38 °C fever, without other local symptom, except of a CRP of high value (11.4). Diagnostic paracentesis showed absence of microorganisms. The patient started antibiotic coverage. A normal clinical image persisted for 6 days when a painless knee effusion was observed and a CRP of 10. After 2 days, the symptoms worsened and a new paracentesis identified the SM. An immediate arthroscopic evaluation was performed with graft and materials' removal and new antibiotics administration.

Slow attenuation started after 10 days of intravenous antibiotics and the CRP decreased at the value of 0.37. The patient is readmitted for fever ($<39^{\circ}\text{C}$) 2 weeks later, with no significant clinical findings other than a stiff lump on femur lateral surface. No remarkable laboratory changes were observed (CRP: 1.28 and ESR: 28). A new paracentesis, general synovial fluid analysis and a knee MRI were performed with lack of pathological findings. The patient underwent granulation tissue removal from the lateral femur, possibly due to graft remnants.

CONCLUSIONS: The current clinical presentation could be explained by microbial colonization of suture material of the femoral button that had not spread into the joint, initially. This possibility should be taken into account in postoperative fever without septic arthritis signs.

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Physiological effects of acupuncture after sport injury for athletes

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BACKGROUND: Acupuncture and its physiological effects and specific benefits have perhaps been the most studied physical medical therapy in world history. Not only does acupuncture have a rich history of thousands of years of data accumulation on clinical effectiveness, modern science has sought to understand and measure the acupuncture effects, not only with outcome measures, but also with the metabolic and physiological effects evident from acupuncture stimulation. The use of acupuncture in the treatment of sports injuries for athletes is not new, but its physiological responses after injury and potential has never been fully established as a certain studies. There are scientific evidences that acupuncture works by accelerating the self-healing capacity which result in activation of the cardiovascular, endocrine, immune and central nervous system. To identify the physiological effects of acupuncture after sport injury for athletes.

METHODS: The study was performed on one group consisted of 10 athletes with different injuries. Data were analyzed with pain measures and measures analysis of endorphins, cytokines, and hormones.

RESULTS: The result showed improvement in study group parameters in **pain decrease and the comparison** with the first and second measurement of endorphins, cytokines, and cortisol hormone analysis. The improvement percentage was 2.05% for endorphins, 2.25% for cytokines and 2.64% for cortisol.

CONCLUSIONS: The study demonstrated that acupuncture is an effective physical treatment for a variety of sports injuries to improve the degree of pain decrease and to improve the (endorphin, cytokines, cortisol) hormones' increase.

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Elite female athletes: to take care of the menstrual disorders to prevent the stress fractures especially in certain sports

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BACKGROUND: The objective of the current study is to evaluate the impact on bone mineral density of menstrual disorders in French Elite athletes, according to the types of sport.

METHODS: Observational cohort study, concerning elite athletes, training in the National Institute of Sport. In a first phase, a questionnaire was filled out by them, including the history of menstrual disorders, stress fractures and eating disorders. In a 2nd phase, a dual energy X-ray absorptiometry was proposed according to the female athlete triad consensus. Athletes were divided into three groups: first group practicing weight class sports, second swimming and synchronized swimming, third long distance running.

Statistical analysis: test Mann Withney and Kruskall Wallis were used to the quantitative data, a significance level was set at 0.05 to compare 2 groups and at 0.025 to compare 3 groups.

RESULTS: Forty-six (46) athletes were included, the mean age 21.2 years, a mean of 19 hours of training per week. 34 athletes (8%) presented menstrual disorders and 19 (6%) an amenorrhea. The group athletes 1 presented significantly more menstrual disorders than group 2 ($P=0.05$), group 2 more than group 3 ($P=0.013$). Among the athletes with menstrual disorders, Z score in spinal region was higher in the group 1 *versus* group 2 ($P=0.017$) and *versus* group 3 ($P=0.017$).

CONCLUSIONS: The results highlight the necessity to look after the menstrual disorders systematically and specially in certain group of sports at risk, to prevent a low bone density and stress fractures.

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The FIFA 11+ shoulder injury prevention program was effective in reducing upper extremity injuries among soccer goalkeepers: a randomized controlled trial

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BACKGROUND: To reduce upper extremity injuries, the FIFA 11+ Shoulder Injury Prevention Program (FIFA 11+S) was developed. The purpose of the current study was to assess the effectiveness of the FIFA 11+S program in reducing the incidence of upper extremity injuries among soccer goalkeepers.

METHODS: Seven hundred and twenty-six goalkeepers, were randomly assigned to the experimental group (N.=379) or control group (N.=386). The experimental group was instructed to perform the FIFA 11+S program before all training sessions for one season (6 months). The control group was instructed to continue their usual warm-up routine. Primary outcomes included the incidence of upper extremity injury, mechanism, type, and severity of injury.

RESULTS: Fifty injuries (0.62 injuries/1000 exposure hours) were reported in the experimental group, and 122 injuries were reported in the control group (1.94 injuries/1000 hours). The FIFA 11+S program reduced the total number of upper extremity injuries by 68% (IRR = 0.32 [0.27–0.34]) more than the usual warm-up. The FIFA 11+ S program reduced the incidence of contact injury (IRR = 0.30 [0.25–0.31]), non-contact injury (IRR = 0.40[0.35–0.43]), initial injury (IRR = 0.34 [0.29–0.36]), recurrent injury (IRR = 0.20 [0.17–0.21]), and overuse injury (IRR = 0.40 [0.35–0.43]). Participants in the experimental group demonstrated a significant decrease in injuries of minor (IRR = 0.32 [0.27–0.34]) and moderate severity (IRR = 0.33 [0.29–0.35]), compared with the control group.

CONCLUSIONS: The FIFA 11+S program resulted in 50% less upper extremity injuries among goalkeepers, compared to a regular warm-up.

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Effectiveness of the FIFA 11+ referees injury prevention program in reducing injury rates in male amateur soccer referees: a randomized controlled trial

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BACKGROUND: The FIFA 11+ Referees Injury Prevention Program is a structured warm-up program specially designed to prevent injuries in soccer ref-

erees. However, its effectiveness has yet to be fully documented in the literature. The purpose of this study was to investigate the effectiveness of the FIFA 11+ Referees Program in reducing injury rates among referees.

METHODS: Two hundred male referees (age, 31.6±4.1 years) participated in this study. Participants were randomly allocated to the experimental and control groups. The experimental group performed the FIFA 11+ Referees Program as a warm-up during training sessions at least twice a week, and the control group performed their usual warm-ups. The participants were followed up for one season. The outcome measures were the incidence of overall injury, initial injury, recurrent injury, injury mechanism, and injury severity (primary), and the rate of adherence to the intervention program (secondary).

RESULTS: A total of 24 injuries were reported among 100 referees in the control group in 16606 hours of exposure (1.45 injuries/1000 exposure hours), and a total of nine injuries were reported across 100 referees within the experimental group in 17834 exposure hours (0.50 injuries/1000 exposure hours). The Injury Risk Ratio (IRR) was 0.35 (95% CI 0.26 to 0.45).

CONCLUSIONS: The FIFA 11+ Referees Program effectively reduced injuries in the experimental group by 65% compared to the control group. This study established evidence that the FIFA 11+ Referees Program is effective in reducing the incidence of injury in male referees.

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The prevalence and incidence of injuries among female cricket players: a systematic review and meta-analyses

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BACKGROUND: The objective of the systematic review is to describe the prevalence and incidence of injuries among female cricket players.

METHODS: A systematic review and meta-analyses were conducted according to Joanna Briggs Institute (JBI) and PRISMA guidelines. MEDLINE, SPORTDiscus, Physiotherapy Evidence Database (PEDro), EBSCOhost

MasterFILE Premier, EBSCOhost CINAHL Complete, ProQuest Health and Medical Complete, SCOPUS, Science Direct and grey literature databases were systematically searched from inception to August 2020.

RESULTS: A total of 3,349 studies were found after duplicates removed and 20 studies met the inclusion criteria. Full-text articles which met the inclusion criteria were critically appraised and extracted using JBI SUMARI software. Meta-analyses were conducted for injury incidence rate (injury IR) and injury prevalence proportions (injury PP). The random effects model and the I^2 statistic was used to assess the heterogeneity. The weighted injury IR was 72.1 (95% CI 30.4-113.8) per 1,000 player hours and scored low heterogeneity. The injury PP was 63.1% (95% CI 47.7-78.5) and scored low heterogeneity. The most prevalent body regions injured were the shoulder, knee, and ankle, foot and toes, and injuries to these areas were most frequently sustained by fast bowlers. Injuries to the hand, wrist and fingers had the highest incidence compared to other body areas and injuries to these areas were most frequently sustained by fielders.

CONCLUSIONS: The quantitative findings from this study will provide stakeholders (including players, coaches, clinicians, administrators and policymakers) with level 1 evidence to implement injury prevention and appropriate female cricket players management strategies.

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Treatment of chronic patellar tendinopathy in athletes with multiple platelet rich plasma injections: a five-year experience

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BACKGROUND: Chronic patellar tendinopathy (CPT) is one of the most common injuries in sports. In this study we present our five-year experience in using multiple platelet-rich plasma (PRP) injections for the treatment of CPT in athletes.

METHODS: Between 2011 and 2016, a total of 38 athletes with CPT presented and treated in our hospital. All of them received 3 consecutive ultrasound (US) – guided PRP injections by the same interventional radiologist at 10-day time intervals. Clinical outcomes were evaluated using the Visual Analogue Scale (VAS) of pain, the Victorian Institute of Sport Assessment – Patella (VISA-P) Questionnaire and the American Knee Society Score (AKSS) before and at 4, 12 and 24 weeks post-injections (p.i.). Patellar tendon condition

and healing were assessed ultrasonographically before and 3 months after treatment (a.t.).

RESULTS: At the final follow (24-week) follow-up, there was a significant clinical improvement of all patients, comparing with their pre-treatment condition. The mean VAS reduced from 7.5 to 0.7, the mean VISA-P increased from 36 to 95 and the mean AKSS increased from 56 to 97. Ultrasonographically, 3 months p.i. there was a complete patellar tendon healing in all cases. After an intense physiotherapy program, 34 patients returned to their sporting activities within 6 months a.t., while 4 patients experienced mild discomfort during recovery and their return lasted longer. No complications were reported.

CONCLUSIONS: Treatment of CPT with multiple PRP injections is an easy and safe procedure with excellent clinical, functional and imaging results.

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Tendon neuroplastic training for lateral elbow tendinopathy of a recreational tennis athlete

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BACKGROUND: Lateral elbow tendinopathy, a complex condition, with multiple changes at muscle, kinetic chain tendon and brain level. Rehabilitation should address on complex corticospinal and neuromuscular adaptations associated with persistent pain. A prescription of tendon neuroplastic training (TNT) exercise, a method for motor drive training using external pacing with a metronome for muscle strengthening could be beneficial. The purpose of this case study is to describe the rehabilitation of a patient with clinical diagnosis of lateral elbow tendinopathy using TNT in addition to the traditional rehabilitation protocol.

METHODS: Recreational male tennis athlete, 25 years old, suffering from right elbow lateral pain for the last 4 months. During clinical assessment, Cozen's and Mill's test were both positive. He marked his pain level as 7 on VAS scale. He followed a 4 weeks rehabilitation protocol in our rehabilitation center with isometric and isotonic wrist extensors strengthening using an external pacing by metronome. Patient was assessed at the beginning and at the end of the rehabilitation protocol and at a scheduled follow-up appointment, four weeks later.

RESULTS: Pain level was significantly reduced from the very first week. After 4 weeks rehabilitation treatment pain was 1/10 on VAS, Cozen's test negative but still Mill's test positive. On 8th week, there was no pain, and Cozen's and Mill's test were both negative.

CONCLUSIONS: This case describes a rehabilitation protocol for lateral elbow tendinopathy using TNT, a combination of resistance exercise and metronome-based training, with positive results.

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Jumper's knee, a multifactorial approach - A case report

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BACKGROUND: Patellar tendinopathy – “jumper's knee” – is an overuse injury that is characterized as a degenerative tendinopathy and commonest at the deep part of tendon attachment to the inferior pole of the patella. A multifactorial approach is recommended with load management and strengthening of knee flexors and extensors, as with possible adjuvant invasive approach.

METHODS: We present a case of an 18 years old high jump athlete with left patellar tendinopathy, confirmed clinically and by ultrasound. He underwent in a knee extensors *vs.* flexors isokinetic evaluation – with a high deficit in peak torque (30%) at low speed rate (60°/sec) – to address the best possible physiotherapy and loading management. He managed workload and enters in a muscular strengthening program for 2 weeks. Then he underwent a posterior paratenon needling and hydrodistension with lidocaine 2% and 6cc of saline solution guided by ultrasound.

RESULTS: After multidisciplinary approach he resume with progressive workload achieving the same performance he had before the injury (4 weeks total) with total function and pain free.

CONCLUSIONS: Patellar tendinopathy is a common cause of pain in jumpers and must be managed accordingly to the level of pain, loss of function and performance impairment. Accordingly he can continue the competition or he must stop to access his condition. A multifactorial and individualized approach must be taken in order to optimise the outcome and restore function and performance.

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Dose-response relationships between physical activity level and sarcopenia in postmenopausal women

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BACKGROUND: To explore the relationship between physical activity (PA) level and sarcopenia in postmenopausal women.

METHODS: We selected subjects from postmenopausal women in Jurong. The sarcopenia was diagnosed according to the Asian Working Group for Sarcopenia Criteria. Referring to the PA questionnaire by the Disease Control and Prevention Center of

Jurong and according to PA index (PAI), the physical activity level (PAL) was divided into “Low” (PAI<1.4), “Moderate” (1.4≤PAI<1.6) and “High” (1.6≤PAI). SPSS22.0 was used for testing. Logistic regression analysis was conducted with sarcopenia (0=“No”, 1=“Yes”) as the dependent variable and PA level as the independent variable to distinguish the effects of different levels of PA on sarcopenia.

RESULTS: There were 885 subjects in this study, including 35 patients with sarcopenia, and the detection rate was 3.95%. According to t-test and chi-square test, there were significant differences in age, weight, BMI, appendicular skeletal muscle index, grip strength, gait speed and PAL between the sarcopenia group and the non-sarcopenia group (P<0.05). The dummy variable was referred to as “Low” PAL. According to the logistic regression, “Moderate” PAL and “High” PAL individuals had lower risk of sarcopenia (OR=0.134, 95%CI: 0.018-0.990 and OR=0.263, 95%CI: 0.035-1.953) compared to “Low” PAL in postmenopausal women (P<0.05).

CONCLUSIONS: PA can significantly reduce the risk of sarcopenia in postmenopausal women. The effect of moderate levels of physical activity on sarcopenia is better than that of PA high levels.

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Plyometrics training on rowing performance in para-rower: case report

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BACKGROUND: Para-rowing was added to the World Rowing Championships in 2002 and the Summer Paralympics in 2008. Plyometrics exercises are used for power training or force rate development. Plyometric training (PIT) is used by some rowing coaches; there's been little research to date about its effectiveness. There is no information on PIT or its impact on rowing performance in para-rowing. The current case report examines the PIT effect on rowing performance in para-rower.

METHODS: The participant (age: 46 years, height: 1.60 m, and body mass: 55 kg) was a well-trained male para-rower, did not have any injury, was in good health, trained ~30 h per week. Participant was assigned to perform 4-weeks of upper body PIT for 30 minutes before practice on the water 3 days per week. Rowing performance was assessed through a 500-meter rowing time trial and peak rowing power on a rowing ergometer.

RESULTS: Data of the study showed that 500-meter rowing time trial and peak rowing power were changed over the 4-week upper body PIT (P>0.05).

CONCLUSIONS: The results demonstrate that the 4-week upper body PIT can be used for improved rowing performance in para-rowing.

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Comparison of integrated periodized and traditional periodized program on 2000 m rowing ergometer performance in para rowers

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BACKGROUND: There are many key components for success in sports. The training plan is one of the key factors in improving an athlete's performance. The purpose of this study was to compare the integrated periodized and traditional periodized training program on 2,000 m rowing ergometer performance in the para rower.

METHODS: Eight para rowers (4 male and 4 female) volunteered to participate in the study. During a 12-week training period, one group of athletes (2 men and 2 women) performed integrated periodization (IP) training (vary training load and volume with psychology and biomechanics factor). The other group of athletes (2 men and 2 women) performed the traditional periodization (TP) program. Participants performed rowing 8 sessions per week. Performance variables tested include a 2000mrowing ergometer time, power output, stroke rate, and heart rate.

RESULTS: The rowing performance improved in both modes of training. However, times to 2,000 meters and the power output of the integrated periodization training were statistically significantly better than traditional periodization training. There were no statistically significant differences in stroke rate and heart rate during a 12-week training period.

CONCLUSIONS: These findings suggest that IP may be more effective than TP for improving the performance of para rowers.

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Gender differences in approach speed and accuracy of class T61-64 paralympic long jumpers with lower extremity amputation

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BACKGROUND: Gender differences are present in performance (SEFF), approach-run speed (VAPP) and accuracy (TTB) of elite able-bodied long jumpers. The

purpose of the study was to examine if the same differences apply between male and female long jumpers with lower extremity amputation.

METHODS: The approach run of the long jump finalists (9 male and 12 female) in the 2012 London Paralympics was analyzed. Ten athletes had transfemoral amputation (Class T63) and 11 transtibial amputation (Class T64). VAPP and the distance of its occurrence from the take-off board (SVmax) were measured via Stalker ATS 5.02 radar (Applied Concepts Inc., USA; sampling frequency: 48Hz). TTB was assessed with a Casio EX-F1 camera (Casio Computer Co. Ltd., Japan; sampling frequency: 300fps) and the APAS WIZARD 14.1.0.5 software (Ariel Dynamics Inc., USA). Possible gender differences were checked with an Independent Samples *t*-test (SPSS v.25, IBM Corp., USA).

RESULTS: No significant ($P > .05$) gender differences were found for TTB and SVmax (0.16 ± 0.23 m *vs.* 0.09 ± 0.03 m and 7.11 ± 4.43 m and 5.72 ± 2.20 m for males and females, respectively). Males had significantly ($P < .05$) larger values than females for SEFF (5.76 ± 1.03 m *vs.* 4.31 ± 0.68 m) and VAPP (8.10 ± 1.03 m/s *vs.* 6.91 ± 0.62 m/s).

CONCLUSIONS: Unlike able-bodied athletes, no gender differences were observed in the spatial parameters of the approach in Paralympic long jumpers with lower extremity amputation. In conclusion, the finding that males had larger SEFF may be attributed to their higher VAPP, which is the single most significant determinant of long jump performance.

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Visual biofeedback training using Kinovea in wheelchair basketball athletes

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BACKGROUND: In wheelchair athletes, the high prevalence of shoulder pathology is due to the increased demand on the upper limbs not only during manual wheelchair use, but also in air sports. The current study investigated biomechanics of the upper limb kinematic and stroke propulsion patterns by visual biofeedback training with Kinovea® following the Consortium for Spinal Cord Medicine Guidelines.

METHODS: A team of 10 wheelchair basketball athletes was followed for the whole sport season to carry out a pre-workout protocol following the Guidelines for the preservation of upper limb function of the Consortium for Spinal Cord Medicine to improve the kinematic of the upper limb and the stroke propulsion pattern. Using Kinovea®, freeware video analysis software, the athletes underwent visual biofeedback training. We monitored the athletes with the kinematic analysis coupled with sEMG and G-sensor and the self-administered Kerlan-Jobe Orthopaedic Clinic (KJOC) Shoulder and Elbow questionnaire at the beginning (T0) and the end (T1) of the sport season.

RESULTS: Better biomechanics in stroke patterns

were achieved at T1 with a higher KJOCSE score. Scapulo-thoracic joint kinematic range of motion during abduction and extra-rotation of the gleno-humeral joint were significantly increased ($P < .05$) at T1.

CONCLUSIONS: Visual biofeedback training using Kinovea® is an easy, economic and worldwide available tool for sport professionals. Visual biofeedback helps avoiding abrupt changes in direction and no extra hand movement during the propulsion pattern means less stress on tendons and ligaments. A significant improvement of the shoulder kinematic following the guidelines is a protection factor from shoulder injuries.

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Neurovascular anatomic relationships to arthroscopic posterior and trans-septal portals in different knee positions

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BACKGROUND: To define the anatomic relationship between the neural structures and standard posterior arthroscopic portals and between the popliteal artery (PA) and posterior, as well as trans-septal portals in different knee positions.

METHODS: Seventeen (17) fresh-frozen cadaveric knees were used to establish the posterolateral, posteromedial, and transeptal portals at 90° of knee flexion. The PA was revealed using a shaver placed through the posteromedial portal and the distance from the portals was measured. Then, the specimens were dissected. The distance from a needle, blade, and cannula in each portal site to the adjacent neural structures was measured at 30°, 90°, and 120°.

RESULTS: The mean distance from all the portals to the PA was significantly smaller at 30°. The mean distance from the posterolateral portal to the common peroneal nerve at 90° of flexion was significantly greater. The mean distance between the posteromedial portal and the inferior infrapatellar branch of the saphenous nerve at 30° of flexion was smaller. The mean distance from the posteromedial portal to the sartorial branch of the saphenous nerve at 30° was significantly smaller.

CONCLUSIONS: The position of 90° is safe to establish posterior and transeptal arthroscopic portals. The position of 120° is safe to establish posteromedial and transeptal portals. The position of 30° is not recommended.

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Arthroscopic treatment of localized pigmented villonodular synovitis of the knee

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BACKGROUND: To review the outcome of the arthroscopic treatment of localized pigmented villonodular synovitis of the knee and to determine the recurrence rate with clinical and magnetic resonance imaging evaluation at midterm follow-up.

METHODS: Forty (40) consecutive patients diagnosed with localized pigmented villonodular synovitis of the knee were treated arthroscopically between 2000 and 2018. Clinical assessment was made with the Lysholm Knee Scale, and radiologic assessment was done by plain radiographs and magnetic resonance imaging. Recurrence rate of the disease was also estimated.

RESULTS: The average follow-up was 96 months (range 24-144). The median age of the patients was 46 years (range 23-71). Symptoms were: knee discomfort (100%), swelling (90%), locking (50%), pain (10%) and palpable mass (15%). The nodules were localized in the gutters (45%), in suprapatellar pouch (26%), in patellar fat pad (13%), in knee's posterior compartment (13%) and in the femoral notch (9%). The median Lysholm Knee Score was 56.5 (range 53-60) and 85.5 (83-88) preoperatively and at final follow-up, respectively. No postoperative complications occurred.

CONCLUSIONS: Arthroscopy is a safe and effective procedure for the treatment of localized pigmented villonodular synovitis of the knee. Magnetic resonance imaging is essential to diagnose this pathologic condition and to define accurately its localization and treatment strategy.

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The effects of vibration as an exercise modality on shoulder girdle muscle activation and timing

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BACKGROUND: There is an interest within elite sport in understanding the impact of a vibrating platform as an adjunct to exercise in the training and rehabilitation of throwing athletes. However, there has been no comprehensive evaluation of its impact on the rotator cuff muscles and the timing of shoulder muscle recruitment. The current study investigates the effects of vibration on shoulder girdle muscles.

METHODS: Twenty (20) healthy participants were recruited with EMG recorded from 15 shoulder girdle muscles. Isometric shoulder flexion at 25% maximal voluntary contraction was performed in three testing scenarios [no vibration; whole body vibration (WBV); and arm vibration (AV)]. A press up and triceps dips with and without vibration were also performed. Muscular recruitment was assessed pre- and post-vibration exposure.

RESULTS: Activation of the anterior deltoid ($P=0.002$), serratus anterior ($P=0.004$), and rotator cuff muscles ($P=0.004-0.022$) occurred significantly earlier following exposure to vibration. Significantly greater activation was seen in the anterior, middle and posterior deltoid, upper, middle and lower trapezius, serratus anterior, teres major, latissimus dorsi, supraspinatus, and infraspinatus when the isometric contraction was performed with either WBV and/or AV ($P<0.001-0.040$). Similarly, increased activation was also demonstrated during the press up and triceps dips when performed with vibration.

CONCLUSIONS: The use of vibration as an adjunct to exercise provokes a near global increase in shoulder muscle activation. Furthermore, exposure to vibration alters muscular recruitment improving readiness for movement. This has potential implications within elite sport for both training and game preparation.

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A case of a snowboarder's fracture misdiagnosis mimicking ankle sprain

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BACKGROUND: Fracture of the lateral process of the talus is a rare lesion commonly described in snowboarding injuries. This entity is often misdiagnosed as a severe ankle sprain. A case of a snowboarder's fracture misdiagnosis mimicking ankle sprain is described.

METHODS: A 26-year-old male patient was admitted to author's emergency department complaining for severe ankle sprain after a trauma during snowboarding 10 days before. He was already counseled for ankle sprain after the initial radiographic evaluation.

RESULTS: The radiographic evaluation disclosed a non-displaced (<2 mm) fracture of the lateral process of the talus. Conservative treatment was decided and a plaster was placed for 6 weeks.

CONCLUSIONS: Tenderness in palpation to the anterolateral side of the ankle is usually due to sprain of the anterior talofibular ligament. Although, in rare cases pain in the same region may be due to fracture of the lateral process of the talus. Diagnosis can be settled on the basis of suspicion, duration of the symptoms and in many cases on computed tomography images. History of snowboarding is helpful, but not pathognomonic. In many cases the initial radiograms are not indicative and computed tomography is necessary. Fractures of the lateral process of the talus are uncommon but important injuries that may result in significant disability in cases of missed diagnosis or delayed or inadequate treatment. Early diagnosis and timely management of these fractures help to avoid long-term complications, including malunion or nonunion. Pain to the anterolateral side of the ankle accompanied with inability to weight bear should raise the suspicion for this rare injury.

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Acute effects of whole-body vibration on upper Quarter Y Balance Test and shoulder girdle muscle activity

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BACKGROUND: The Upper Quarter Y Balance Test (UQYBT) is used as an index of dynamic stability of upper limb. Whole-body vibration (WBV) applied to upper limb has been reported to increase muscle activity (Grant et al., 2019). We previously reported WBV increased the UQYBT score, but the effects of muscle activity are unclear. The purpose of this study was to examine the acute effects of WBV on shoulder girdle muscle activity during UQYBT.

METHODS: Eight males participated in this study. We measured muscle activities in the infraspinatus (ISP), serratus anterior (SA), and upper and lower trapezius (UT, LT) during UQYBT in the medial, superolateral, and inferolateral directions. Participants placed both hands on the vibration platform while in the push-up position during the WBV intervention protocols, which were applied at 0 and 50 Hz. The intervention was comprised 6 sets \times 30 seconds with 30 seconds rest between sets. The UQYBT score and muscle activity were collected before and after the intervention.

RESULTS: The UQYBT score increased at 50Hz ($90.4\pm 2.3\%$ vs. $93.0\pm 2.1\%$, $P<0.01$) but did not change at 0Hz ($91.8\pm 3.0\%$ vs. $91.2\pm 3.7\%$, $P=0.47$). At 50 Hz, muscle activity significantly increased in all directions for ISP (medial; 29.6%, superolateral; 18.1%, inferolateral; 38.3%), and only in the medial direction for SA (16.2%) and LT (37.7%). At 0 Hz, significant increases were only observed in the medial direction for ISP (14.8%) and UT (16.4%).

CONCLUSIONS: This study suggested WBV increased muscle activities which stabilized the scapula and improved dynamic stability of the upper limbs.

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The relationship between performance in single-leg stance balance tests and the intrinsic foot muscles' morphology and hardness

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BACKGROUND: Previous studies have showed that the ability of force production of intrinsic foot muscles affect athletic performance, balance ability, and foot posture. Investigating the relationship between thickness, cross-sectional areas (CSA) and hardness

of foot muscles and performance in balance tasks may help us understand the factors causing or resulting in a lack of balance related to foot structures. Therefore, we examined the relationship between performance in single-leg stance balance tasks, morphology and hardness of the intrinsic foot muscles.

METHODS: Nine healthy males without exercise habits participated. Thickness, CSA and stiffness of the abductor hallucis (AbH), flexor digitorum brevis (FDB) and flexor hallucis brevis (FHB) muscles were measured using an ultrasonography device (Hitachi Aloka Medical). Balance assessments during single-leg stance were carried out using Biodex Balance Systems (Biodex Medical Systems) and assessed the overall stability index (OSI), anteroposterior and mediolateral stability index (APSI and MLSI).

RESULTS: The CSA of the AbH was negatively correlated with OSI ($r = -0.612$, $P < 0.05$). Hardness of the AbH was correlated with APSI ($r = 0.624$, $P < 0.05$). CSA of the FDB was correlated with OSI ($r = 0.733$, $P < 0.05$).

CONCLUSIONS: Larger CSA and higher hardness of the AbH, and smaller CSA of the FDB were related to better performance in single-leg stance balance tasks. Understanding the factors causing or resulting in a balance deficit can help us develop better training or treatment strategies.

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Epidemiology of patients presenting with gout to large county hospital, 2016-2018

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BACKGROUND: Undifferentiated acute monoarticular joint pain is common in the Emergency Department (ED). We characterized the epidemiological, clinical, and diagnostic findings of patients presenting with a diagnosis of gout.

METHODS: This was a single urban center retrospective review of patients who presented for a single ED visit with joint pain with a primary diagnosis of gout (January 2016 - December 2018). We excluded septic arthritis diagnosis due to the small sample. 22,173 patients with monoarticular joint pain complaints were analyzed. Descriptive and summary statistics were performed.

RESULTS: Ninety-five (95) patients of mean age 56 years were included. Among them, 77% were male and 67% were African American. The most common comorbidity was diabetes mellitus (26%). The great toe was most commonly affected (64%). Patients most commonly reported pain (94%), swelling (76%). Clinicians most commonly documented tenderness (78%), edema (77%). 46% of patients received plain radiographs, of which only 18% demonstrated radiographic findings of gout. Arthrocentesis was conducted

on 10% of the cases, of which (78%) had monosodium urate crystals in synovial fluid. Prescriptions included non-opioid analgesics (57%), opioids (9%) and steroids (9%).

CONCLUSIONS: Gout may present atypically to the ED. Only (0.4%) of ED cases were diagnosed with gout. Gout was often diagnosed and treated based on history and physical examination. There was a high use of non-opioid and opioid analgesics. Future research should evaluate optimal diagnosis and management strategies for patients presenting to the ED with gout.

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Functional results of talus fractures after surgical treatment - One year follow-up after surgical treatment

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BACKGROUND: Talus fractures are not so common, and they account about 0.1% of all fractures. If anatomical reduction is not achieved, the percentage of postoperative aseptic osteonecrosis and posttraumatic osteoarthritis increases exponentially. The purpose of this study was to evaluate and compare short- and medium-term functional outcomes in patients with talus fractures in which open reduction and internal fixation were performed.

METHODS: At the University Clinic of Traumatology in the period from 2018 to 2021, 18 patients with talus fractures were surgically treated. Including and excluding factors were determined. All patients signed a written consent to participate in the study and the study was approved by the Ethics Committee of the Medical Faculty.

RESULTS: All patients underwent open reduction and fixation was done with screws or a reconstructive plate. All patients underwent follow-up on the 14th postoperative day, 3rd, 6th month and one year after surgery. One year after surgery follow-up was performed and were made objective and functional testing of joint function. For this purpose we chose Kitaoka score unified by the American Orthopedic Society for Foot and Ankle. This injury is very rare for large studies to be presented and compared. However, all major studies from trauma referral centers lead to the same conclusion, and that is that the treatment of these fractures is complex. The achievement of anatomical reduction is important for a better outcome.

CONCLUSIONS: A protocol for treating post-traumatic osteoarthritis should be introduced, given it's high incidence despite satisfactory surgical technique.

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Facing the groin pain challenge an anatomical dictionary facilitating interprofessional collaboration

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BACKGROUND: Groin pain is not only a diagnostic challenge but also a terminology enigma. It is true, although not widely perceived, that the words used to describe a medical condition influence patients' perspective on which treatment they should receive but also physicians' final decision on which treatment to provide. Despite the Doha agreement on terminology in groin pain, published in 2015, tricky terms like "sports hernia" or "athletic pubalgia" are still being used to describe a wide variety of pathology in the area.

METHODS: Electronic databases (PubMed and MEDLINE) were searched for articles published after the Doha agreement (2016-2020) and containing one of the following terms in their title: "sports hernia", "sportsman hernia", "sportsman groin", "athletic pubalgia" and "Gilmore's groin". The anatomical structures reported in each article were recorded. Using 3D human-anatomy software, an anatomical dictionary was created, matching each term to the relevant anatomical structure.

RESULTS: Database search revealed 45 relevant articles. The anatomical dictionary is available to download by scanning the QR code on the poster. Each term is accompanied by relevant 3D anatomy images. Proper use of each term is highlighted by also reporting past misuse of the term.

CONCLUSIONS: Groin pain's dark reputation is not only due to the complex anatomy of the area but also to the confusing nomenclature used. The current study will help coaches, physiotherapists, physicians, and sports' professionals to make a step forward in inter-professional communication, which will be eventually beneficial for athletes who experience groin pain.

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Arthroscopic posterior cruciate ligament reconstruction using autografts and allografts, follow-up 7-14 years

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BACKGROUND: The posterior cruciate ligament (PCL) is one of the four major ligaments of the knee. The purpose is to compare outcomes between the usage of allografts *vs.* autografts for PCLR.

METHODS: Between the years 2006-2020, we opera-

ted on 138 knees with isolated ACL ruptures, and only 9 with PCL ruptures. Six of the latter had isolated PCL ruptures and 3 had combined ACL and PCL ruptures. In all patients we performed the same technique, using Smith and Nephew implants, and Acufer guide drill. In the patients with combined ACL-PCL rupture we used a hamstring autograft from the ipsilateral leg for the ACLR, whereas for the PCL we used an Achilles tendon fresh frozen allograft.

RESULTS: The posterior stability of the knee was examined with the KT2000 arthrometer for all cases. The average range of motion was from 0-10 to 130-140 degrees. The Lysholm score range was from 63-84. One patient had poor results. The autografts gave better compared to the allografts in posterior laxity test.

CONCLUSIONS: The best choice of PCL graft still remains controversial. Allografts advantages are elimination of postoperative donor site morbidity, no weakening of the flexor apparatus, and shorter operative time. Both groups had satisfactory clinical outcomes. The current study is limited by the relatively small number of patients.

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Different fixation techniques for anterior cruciate ligament reconstruction using hamstrings: a 5 year follow-up

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BACKGROUND: Graft fixation devices withstand not only the physiologic forces but also facilitate the biological incorporation of the graft construct. The purpose of the current study was to evaluate if different fixation devices have different clinical implications.

METHODS: One hundred and four (104) patients were followed up for 5 years. In group A, extracortical femoral graft fixation with RetroButton device (Arthrex, Inc), was used in 49 patients. In group B the TransFix device (Arthrex,) was used for transcondylar femoral fixation in 31 patients. The third group included 24 patients and an aperture fixation with the AperFix device (Cayenne Medical) was used.

RESULTS: All patients in the 3 groups had functionally normal or near normal IKDC, Lysholm and Tegner scores. The average subjective IKDC knee form scores at 5 years were 87±10 in group A, 88±10 in group B and 86±11 in group C and KT1000 differences were 2.4±1.5 mm in group A, 2.1±1.5 in group B and 2.5±1.9 in group C. Tunnel enlargement in all three groups was more significant at the femoral tunnels than the tibial tunnels.

CONCLUSIONS: According to the current study, the different techniques yielded satisfactory results in almost 90% of patients in all groups. We did not find a significant correlation between tunnel wide-

ning and clinical outcome. We have not been able to establish any superiority of one fixation technique over the other.

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Intraoperative correlation of magnetic resonance imaging (MRI) findings with arthroscopic findings in shoulder labral tears

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BACKGROUND: Shoulder instability is common in young active individuals. Accurate diagnostic imaging of the shoulder labrum is essential, as history and examination alone can be unreliable. Imaging modalities can aid early surgical correction to ensure optimal functional outcomes and help avoid unnecessary interventions. The study compared the detection rate of magnetic resonance imaging (MRI) in shoulder labrum tears with intraoperative arthroscopic findings in young active patients.

METHODS: Retrospective cases analysis was performed between May 2018 and May 2021. Twenty-eight (28) male patients presented with shoulder instability and needed an MRI and subsequent shoulder arthroscopy. Their age ranged from 18 to 40 years. Shoulder arthroscopic findings served as the standard of reference for comparison with pre-operative MRI findings.

RESULTS: In 20 out of 28 patients, MRI findings were confirmed with arthroscopy. Six patients were found to have labral lesions in different locations than those suggested by the MRI. Two patients had labral lesions that were not visible in MRI; however the imaging was suggestive of shoulder pathology (increased joint fluid). Overall shoulder MRI has 92% sensitivity for labral tear detection and 71% of accuracy concerning labral tear position.

CONCLUSIONS: Our study showed that although there is a discrepancy between MRI and arthroscopy in detecting labral tear position, MRI is fairly accurate as a guide for pre-operative arthroscopic planning. MR arthrogram may be increase accuracy, however, is not routinely necessary in managing the patients.

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Effectiveness of instrument assisted soft tissue mobilization of the posterior functional line on rounded shoulders posture and shoulders range of motion and strength

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BACKGROUND: Purpose of the current study is to evaluate the effect of posterior functional line (PFL) tissues mobilization, combined with exercise, on forward (rounded) shoulder posture and shoulder range of motion (ROM) and strength.

METHODS: Nineteen adult men with bilateral shoulder frontal inclination were randomly divided into 2 groups. In group A, the participants underwent instrument assisted soft tissue mobilization on the dominant shoulder. In group B, the same intervention concerned the lumbar and gluteal region contralateral of the dominant upper limb. For the first 4 weeks, the interventions were performed once per week. During that time, and for a further 4 weeks, the participants performed an exercise program at home 3 times per week. The same investigator assessed shoulders' angle, ROM and strength before the intervention, at the end of week 6 and week 8.

RESULTS: The forward shoulder posture was improved to a similar degree in both groups, as did the shoulder ROM apart from active internal rotation in which group A had a significantly greater improvement. The strength improved the same in both groups, except for the shoulder flexors which presented a significantly greater improvement in group A. The external rotators' strength showed no improvement in both groups.

CONCLUSIONS: The instrument assisted soft tissue mobilization of the lumbar and gluteal region of the PFL was found to contribute to the shoulder posture correction comparable to the soft tissue mobilization of the shoulder region. These findings enhance the theory of the PFL myofascial continuum existence.

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The anterior oblique ligament description in the knee anteromedial compartment

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BACKGROUND: To describe a ligamentous structure in the anteromedial region of the knee identified in a series of anatomical dissections of cadaveric specimens.

METHODS: Sixteen (16) cadaveric knees were dissected to study the medial compartment. Exclusion criteria were signs of trauma or osteoarthritis, previous surgery and poor preservation state. The main structures of this region were identified during medial dissection. After releasing the superficial medial collateral ligament (sMCL) of the tibia, Anterior Oblique Ligament (AOL), was isolated. The morphology of the structure and its relationship with anatomical parameters were determined. For the statistical analysis, the means and standard deviations were calculated

for continuous variables. 95% confidence interval was defined as significant. Student's *t*-tests were used.

RESULTS: After dissection a distinct ligamentous structure (AOL) was found in the medial region of the knee. This structure was found in 100% of the cases, was extracapsularly and originated in medial epicondyle, obliquely toward the tibia. When crossing the joint, the ligament presented a fan-shaped opening. The AOL had a mean thickness of 6.83 ± 1.34 mm at its femoral origin and 13.06 ± 1.91 at its tibial insertion. It had a significantly ($P=0.0009$) longer mean length with the knee at 90° of flexion (33.82 ± 9.50 mm) than with the knee in total extension (26.56 ± 9.48 mm), indicating that the ligament is tensioned in flexion.

CONCLUSIONS: A structure was identified in the anteromedial compartment of the knee with a ligamentous appearance originating in the medial femoral epicondyle and with tibial insertion anterior to the sMCL.

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Bone contusion on the medial compartment is a predictive factor for more associated injuries after acl rupture

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BACKGROUND: The study determines the frequency of bone contusion and associated injuries, observed in patients with anterior cruciate ligament (ACL) rupture.

METHODS: Seventy two (72) patients with an ACL rupture were enrolled in our prospective study. Magnetic resonance images (MRI) and arthroscopic findings of all patients were examined in order to detect bone contusions and associated injuries, such as menisci lesions and medial collateral ligament (MCL) injury. ACL rupture and menisci lesions were also established with knee arthroscopy. Correlation between bone contusions and menisci lesions or MCL injury was performed. Statistical packet STATA 8.0 was used for data analysis and significance was set at $P < 0.05$.

RESULTS: Fifty eight (80.5%) patients presented with associated bone contusions observed on magnetic resonance imaging (MRI). Lateral aspect of the tibia plateau (71%) and lateral femoral condyle (69%) were the most common sites with contusions. Medial compartment was associated with contusions of medial aspect of the tibia plateau and medial femoral condyle in 25% and 22% of patients, respectively. The frequency of lateral meniscus ($P=0.022$), medial meniscus ($P=0.036$) and MCL ($P=0.05$) injuries, significantly increased in patients with bone contusions of medial and lateral compartments compared to those with bone contusions on lateral only compartment or without bone contusions.

CONCLUSIONS: Bone contusion on the medial compartment is a predictive factor for more associated injuries, seen after ACL rupture and it suggest a higher energy trauma.

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Predictors of high energy knee injury in patients with anterior cruciate ligament (ACL) rupture

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BACKGROUND: The current study determines the frequency of associated injuries, observed in patients with anterior cruciate ligament (ACL) rupture and to find out predictors of high energy trauma.

METHODS: Seventy two (72) patients with an ACL rupture were enrolled in our prospective study. Magnetic resonance images (MRI) and arthroscopic findings of all patients were examined in order to detect bone contusions, menisci lesions and medial collateral ligament (MCL) injury. ACL rupture and menisci lesions were also established with knee arthroscopy. Correlation between bone contusions and menisci lesions or MCL injury was performed. Statistical packet STATA 8.0 was used for data analysis and significance was set at $P < 0.05$.

RESULTS: Fifty eight (80.5%) patients presented with associated bone contusions observed on MRI. Lateral aspect of the tibia plateau (71%) and lateral femoral condyle (69%) were the most common sites with contusions. Medial compartment was associated with contusions of medial aspect of the tibia plateau and medial femoral condyle in 25% and 22% of patients respectively.

The frequency of lateral meniscus ($P=0.022$), medial meniscus ($P=0.036$) and MCL ($P=0.05$) injuries, significantly increased in patients with bone contusions of medial and lateral compartments compared to those with bone contusions on lateral only compartment or without bone contusions.

CONCLUSIONS: Bone contusion on the medial compartment is a predictive factor for more associated injuries, seen after ACL rupture and it suggest a higher energy trauma.

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The importance of the flounce sign for the medial meniscus injury prediction

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BACKGROUND: The current study evaluates the importance of the flounce sign (a fold in the inner edge of the medial meniscus) in predicting medial meniscus tears.

METHODS: Seventy-eight (78) patients who underwent knee arthroscopy surgery enrolled in this prospective study. All patients were arthroscopically evaluated for the absence or the presence of the arthroscopic meniscal flounce sign and the findings

were correlated to the frequency of ruptured or intact medial meniscus. Accuracy tests of the absence or presence of frounce sign for prediction of meniscal tear or intact meniscus were calculated.

RESULTS: The absence of the meniscal frounce sign had sensitivity, specificity and positive predictive value of an abnormal medial meniscus of 94.6%, 96.2%, 97.3%, respectively. On the other hand, the presence of the meniscal frounce sign had a sensitivity, specificity and positive predictive value of a normal medial meniscus of 86.7%, 95.1%, and 96.8%, respectively.

CONCLUSIONS: The absence of the arthroscopic meniscal frounce sign is a strong predictor of the presence of occult medial meniscus tears.

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Usefulness of arthro weight-bearing magnetic resonance imaging (MRI) in the hip disorders diagnosis: a clinical case of a professional soccer player

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BACKGROUND: The weight bearing MRI (WB-MR) allows in a static and dynamic fashion to better understand joint kinematics in painful positions and to detect load-induced pathological modifications. The case of a professional soccer player who had been complaining of hip pain for about 20 months is presented.

METHODS: The athlete came to our observation with a 20-months history of left groin and buttocks pain resistant to several infiltrative therapies and individualized rehabilitation. He underwent paramagnetic contrast infiltration under ultrasound (US) guidance and high field Arthro MRI (1.5 T) of the left hip using T1 suppressed multiplanar sequences; WB-MRI with dedicated low field equipment in the axial and coronal planes, with dynamic orthomorphic and external-rotation sequences, was added to complete the imaging assessment.

RESULTS: High field MRI showed partial fissuring of the anterior superior acetabular labrum and femoral neck deformity with moderate marginal osteophytosis. Clinostatic MRI documented fibrosis of both the quadratus femoris (QF) and piriformis muscles (PF) with posterior impingement. Dynamic WB MRI showed insertional fibrosis of the psoas tendon, QF fibrosis with reduced ischiofemoral space (IFS) and impingement on the ischial femoral nerve. At 4 months follow-up after the arthroplasty treatment, MRI in clinostatism and hip external rotation, revealed further QF fibrosis and posterior impingement on the ischiatic nerve with reduced IFS and psoas bursitis.

CONCLUSIONS: WB-MRI allows highlighting several hip disorders that may appear in different ways depending on patient's posture and load and can't frequently be diagnosed with conventional clinostatic MRI study.

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Cardiopulmonary exercise test to evaluate functional efficiency changes after cardiac rehabilitation in males

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BACKGROUND: The fundamental element of the musculoskeletal system is the muscle which from a functional point of view is a motor (chemical energy transformer into mechanical energy-work) with a variable efficiency. Functional efficiency is the result of the relationship between two components: the work done by the subject and the corresponding energy expenditure expressed by the oxygen consumption necessary to perform that work. The aim of the current study was to compare the estimated functional efficiency with the cardiopulmonary exercise test (CPET) before and after cardiac rehabilitation (CR).

METHODS: 1990 male patients of mean age 65.6 years (range 45-83 years), enrolled in a CR program of 3 months (12 weeks) with training sessions tri weekly lasting 60 minutes. All patients performed an initial CPET at enrollment and a final CPET at the RC end. The sustained workload and the corresponding oxygen consumption were measured and collected data were statistically analyzed.

RESULTS: The mean oxygen consumption (VO₂) sustained before and after the rehabilitation cycle were 14.56±4.96 and 15.95±3.74, respectively. The mean work load before and after the rehabilitation cycle were 89.31±19.24 and 98.97±20.82, respectively. Patients after CR underwent a significantly greater workload with a less significant change in oxygen consumption.

CONCLUSIONS: in cardiac patients, functional efficiency improves significantly after CR, reflecting an improvement in the oxygen transport chain and better oxygen use by the muscles.

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Myocardial bridge in sportsmen: importance of a multi-parameter assessment

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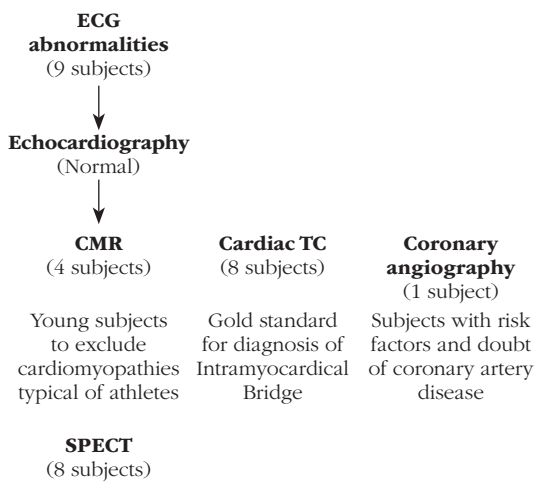
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BACKGROUND: The intramyocardial bridge is defined as an anatomical variant of a segment of an epicardial coronary artery that presents an intramural course through the myocardium (tunneled coronary artery). Although it is a benign condition, myocardial bridge has recently been associated with cases of acute coro-

nary syndrome, ischemia, arrhythmias, up to sudden cardiac death (SCD). Regarding the practice of sport, this congenital anomaly was a cause of ineligibility for competitive sports according to the 2009 Italian cardiological guidelines (COCIS). From 2017, with the new updated COCIS guidelines, subjects with a myocardial bridge that is not long (less than 10 mm) and not deep (less than 30 mm), asymptomatic and without evidence of inducible ischemia to SPECT or coronary angiography, can get competitive sport clearance.

METHODS: The aim of the current study, conducted between 2015 and 2019 on 9 subjects (7males and 2 females) was to propose a diagnostic flow-chart and a multidisciplinary and multiparametric approach that allows to evaluate the risk of inducible ischemia and malignant arrhythmias in athletes.

RESULTS: Nine (9) subjects had abnormalities on ECG, but normal echocardiography. Eight subjects followed a cardiac CT (gold standard for the diagnosis of intramyocardial bridge), 4 subjects followed a cardiovascular magnetic resonance (CMR) to exclude cardiomyopathy cases and 1 subject followed coronary angiography to ensure coronary artery disease.



CONCLUSIONS: excluding the presence of inducible ischemia to SPECT, 6 subjects get competitive sport clearance according to the new COCIS guidelines confirming the frequent benignity of the myocardial bridge which must be assessed with a precise diagnostic process.

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Coronary artery disease in athletes: a case report

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BACKGROUND: Despite the proven benefits of regular physical exercise, and although sportsmen are the paradigm of healthy individuals, the athletes' population is not risk-free and can suffer severe

clinical conditions including coronary artery disease (CAD) and sudden cardiac death (SCD). Identification of athletes with higher cardiovascular risk is a crucial goal of pre-participation screening.

METHODS: In this report, we discuss the case of a 79-year old male. He was a cyclist, who performed a visit to the sports doctor to have issued a certificate for competitive fitness. He was dyslipidemic, hypertensive, diabetic and he reported no symptoms. The patient's ECG revealed an advanced second-degree atrioventricular block. **For this reason, he was admitted to the emergency department and he underwent urgent coronary angiography and a temporary Pacemaker.**

RESULTS: Indeed, a diagnosis of bivasal coronary artery disease was made, and for the first time the patient was subjected to angioplasty of the anterior descending branch and circumflex branch. Subsequently, for the persistence of bradyarrhythmia, he was subjected to a definitive Pacemaker implant.

CONCLUSIONS: The benefits of exercise in the overall population are multiple and indisputable, but in athletes with cardiovascular disease exercise can also be associated with adverse clinical events, including SCD. In veterans, a growing group of athletes, CAD is the most common cause of SCD. Detection of sub-clinical CAD should be the main objective of veteran athlete screening, since the performance of classical cardiovascular risk stratification based on clinical factors appears to be suboptimal.

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A difficult path: anomalous aortic origin of a coronary artery and sports participation

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BACKGROUND: The true prevalence of congenital coronary anomalies that may predispose to pathology in the general population is difficult to determine. Multiple studies quantify its prevalence as 0,1%-1%, with the anomalous aortic origin of a coronary artery (AAOCA) oscillating between 0,1%-0,7%. In most studies the interarterial anomalous aortic origin of the right coronary artery (AAORCA) is 3-6 times more common than the interarterial anomalous aortic origin of the left coronary artery. The pathophysiology leading to sudden cardiac death (SCD) is unknown, although certain factors may predispose to ischemia or arrhythmias. The risk of SCD appears to increase with high-intensity competitive sports with sports participation restriction being the most common non-surgical strategy for the AAOCA when the diagnosis of interarterial AAOCA is made. We present the case of a 20 yo professional cyclist that was referred to us after the finding of an AOORCA after routine exams.

METHODS: The patient was completely asymptomatic with no family history of SCD or heart disease.

The clinical examination was fully normal, and he had no personal history of any illness.

RESULTS: The angioCT documented the AAORCA from the left coronary sinus. He performed an MRI with dobutamine stress that documented morpho-functional findings compatible with cardiac adaptations to high-intensity sports, with no fibrosis or late gadolinium enhancement. Both exercise stress echocardiography, electrocardiogram had no pathological findings. We decided to perform a cardiopulmonary exercise test- with high VO₂max and no alteration in the O₂ pulse.

CONCLUSIONS: Considering the current clinical guidelines, we opted for a favourable opinion regarding sports participation with a shared decision with the athlete and annual follow-up.

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Cardiac screening of athletes for the sudden cardiac death prevention: a case of Brugada syndrome

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BACKGROUND: The Brugada syndrome (BrS) is an inherited disorder associated with the risk of ventricular fibrillation and sudden cardiac death in a structurally normal heart. The purpose of this case report is to underline the importance of screening in athletes attempts, in order to reduce the incidence of sudden death during sports by identifying susceptible individuals.

METHODS: In this report, we discuss the case of a 47-year-old male. He was a tennis player who performed a visit to the sports doctor to have issued a certificate for competitive fitness. He had no familiar history of sudden death or syncope. The patient's ECG revealed J-point elevation and ST-segment elevation in the right precordial leads V1 and V2 positioned in the second, third, or fourth intercostal space, showing classic type II "saddleback" morphology in V2 and BrS was suspected. Hence, the patient underwent Holter ECG monitoring with evidence of spontaneous type 1 Brugada pattern ("coved" morphology), as well as frequent ventricular ectopic beats with left branch block morphology.

RESULTS: Indeed, a diagnosis of Brugada syndrome was made. Antiarrhythmic prophylaxis therapy with hydroquinidine was initiated and the patient was suspended from competitive activity with a three-month follow-up.

CONCLUSIONS: Athletic pre-participation screening is essential for minimizing the risk for sudden cardiac death in athletes participating in either competitive or leisure sporting activities. So, in young athletes with BrS, exercise practice may worsen the ST abnormalities, promoting potentially malignant arrhythmias.

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Acute low back pain in young professional male athletes: resolution and treatment

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BACKGROUND: The current study aims to evaluate cases with acute low back pain (ALBP) in young professional athletes.

METHODS: In 10 young, professional male patients (range of age 20-40, mean age 32) an evaluation of ALBP was performed with the following tools:

- 1) Clinical Examination
- 2) Radiological Evaluation (CT and MRI images)
- 3) Combination of pharmacological treatment with diclofenac sodium and piroxicam.

RESULTS: The results were satisfactory in 8 cases (80%) with pain relief and return to the daily activities (work, walk and sports activity). Only in 2 cases (20%) pain and arm weakness was reported.

CONCLUSIONS: More patients are needed to conclude to safe results, although it seems that the combination of clinical and radiological exams plus the appropriate treatment has a quite good final outcome.

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Osteoporotic cervical and thoracic spine fractures in patients with amateur athletic activity: radiological evaluation

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BACKGROUND: The aim of the current work is to present the radiological evaluation of cervical and thoracic vertebrae fractures in patients with amateur athletic activity.

METHODS: Twenty (20) elderly consecutive patients (10 female and 10 male of mean age 60 years) were evaluated for cervical and thoracic osteoporotic fractures with computed tomography (CT) scan, magnetic resonance imaging (MRI) and X ray images.

RESULTS: Sixteen (16) patients (80%) presented osteoporotic fractures with the necessity of conservative treatment, 4 of them (20%) had osteoporotic fractures with the necessity of surgical intervention and 5 of them (25%) had fractures also in the lumbar spinal compartment, as well as in the pelvic compartment. In all of them clinical and radiological evaluation were performed.

CONCLUSIONS: Radiological evaluation remains essential in order to plan the optimal treatment.

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Cranio-maxillo-facial injuries in professional jockeys

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BACKGROUND: Professional horse racing is an activity known for its high risk of injury. Craniomaxillofacial injury (CMFI) in jockeys appears to be one of the main causes of retirement or even death. The current study describes the epidemiology and classification of CMFI in professional jockeys.

METHODS: Data supplied by the French racing authority, about injuries that occurred during professional horse races from 2005 to 2019 in France, were analyzed. In addition, a PRISMA systematic review of the recent English literature was performed on PubMed, Science Direct, and Cochrane Library online databases.

RESULTS: In flat horse racing, the injury rate was 0.6 to 1.8 per 1,000 rides. The craniomaxillofacial (CMF) region was involved in 11.96-27.63% of the cases. Incidence rate of concussions was 14-23 per 1,000 jockey-years. In jump horse racing, the injury rate was 5.1-15.8 per 1,000 rides, involving the CMF region in 10.6-26.7% of the cases. Incidence rate of concussions was 90 to 154 per 1,000 jockey-years.

CONCLUSIONS: The current study highlights the high risk of CMFI in jockeys. Improvements in helmet design, considering the head impact conditions, such as oblique velocity vector and angular acceleration, could be of some interest to offer better protection of the face and more efficiency in the prevention of concussions. More research is needed to implement preventive measures with jockey's gear, racetrack environment, rules of races, and the organization of the rescue teams at the racecourses.

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Arthroscopic retrograde osteochondral autograft transplantation for cartilage tibial plateau lesions: a prospective study

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BACKGROUND: To present a detailed description of arthroscopic retrograde osteochondral autograft transplantation of the tibial plateau as well as to provide its advantages and disadvantages in comparison with other techniques.

METHODS: Four (4) patients suffering from tibial plateau cartilage lesions underwent surgery. In each case, the lesions were caused by sports injuries. There were 3 lateral and 1 medial tibial plateau defects. The International Knee Documentation Committee (IKDC) score and Knee injury and Osteoarthritis Outcome

Score (KOOS) were recorded preoperatively and postoperatively. Radiological assessment was made by plain radiographs, CT arthroscans, and MRI.

RESULTS: The mean follow-up was 55 months (range, 52-60). The mean preoperative IKDC score was 53.5 (range, 37-66), while the mean postoperative IKDC score at final follow-up was 95.4 (range, 93.1-97.7). Regarding the KOOS calculation, there was significant improvement concerning each parameter after surgery. All patients were satisfied with the surgical procedure and returned to their previous activity level. Postoperative imaging showed very good adaptation and incorporation of the osteochondral autografts.

CONCLUSIONS: Treatment of tibial plateau cartilage defects with arthroscopic retrograde osteochondral autograft transplantation could be performed on a routine basis in clinical practice. The results were encouraging and showed good incorporation of the graft, a minimal failure rate, and satisfactory functional outcomes of patients.

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Tibial tuberosity fracture along with patellar tendon rupture in adolescents. A rare injury that should not be overlooked

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BACKGROUND: Combination of tibial tuberosity fracture along with patellar tendon rupture is a rare and complex injury that requires proper diagnosis and treatment. The current case is referred to a rare combined injury of tibial tuberosity fracture along with a patellar tendon rupture in an adolescent.

METHODS: We present a case of a 15-year-old boy who presented to our Emergency Department (ED) with acute knee pain and inability to actively extend the knee after jumping during a basketball game.

RESULTS: Absence of knee extensor mechanism and presence of patella alta, along with high index of suspicion for combined bone and tendon injury in adolescents, led to proper diagnosis and operative management.

CONCLUSIONS: Similar cases described in the literature are also discussed to raise physician awareness for the present described rare entity and avoid thus misdiagnosis and improper treatment.

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Posttraumatic clinical outcome differences between surgical and conservative treatment of displaced tibial eminence fractures in school-aged adolescents

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BACKGROUND: Tibial eminence fractures (TEF) are relatively rare and occur when a bone fragment is detached from the anterior cruciate ligament (ACL) insertion site. They occur more often in children 8-15 years old, as a result of falling from a bicycle, during motorcycling, skiing and other sports activities. Meyers and McKeever classified TEF as non-displaced (type I), partially displaced with intact posterior cortex (type II) and fully displaced (type III). Type III is subdivided into type IIIa (without rotation) and IIIb (with rotation). Zaricznyj revised this classification to include the comminuted fractures of the detached bone fragment (type IV). Although conservative treatment is recommended for type I fractures, a field of controversy is how to treat type II fractures. The current study investigates the outcome differences between displaced type II TEF treated either with closed reduction or operatively (open reduction and internal osteosynthesis and/or arthroscopically assisted).

METHODS: Eighteen (18) adolescents (12 boys & 6 girls) with type II TEF treated during the period June 2002- March 2020. Following up lasts for one year at least X-rays, soft tissue ultrasound and clinical tools were used.

RESULTS: Patients surgically treated had better results than those conservatively treated regarding to objective findings, such as arthrofibrosis, difference in tibial anterior translation between wounded and healthy limb and muscle strength measurement with simple dynamometer at 45 and 90 degree knee flexion.

CONCLUSIONS: Safer conclusions about how to treat type II TEF will come from multicenter level 1 studies.

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An uncommon skateboard knee injury in a teenager

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BACKGROUND: Proximal tibial physeal injuries are quite rare but with very serious complications, and frequently cannot be diagnosed initially, which leads to mistreatment. CT may be needful to diagnose those fractures and our purpose is to highlight that.

METHODS: A 14 year old skateboarder who suffer a proximal tibial physeal injury when forces of hyperflexion and valgus alignment applied to his knee during the uncontrolled landing of the lower limb to the ground. The patient was suffering from pain, mass edema without hemarthrosis, decreased range of motion of the injured knee. The extensor mechanism of the knee was intact.

RESULTS: Initial X-rays. The fracture is not clearly depicted. In CT- Ogden type IV proximal tibial fracture Post-Surgery X-rays. Closed Reduction Percutaneous

Pining (CRPP) was carried out. After the surgery a long leg cast was placed for 6 weeks.

CONCLUSIONS: Injury to the proximal tibial epiphysis, while rare, may present various and serious complications to the growing skeleton. Many times CT scan is absolutely necessary to diagnose and treat these fractures properly and we have to perform it without hesitation.

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A case report of trochleoplasty: thick flap technique. A reliable procedure to restore normal patellofemoral joint biomechanics

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BACKGROUND: Trochleoplasty is a procedure that aims for the restoration of normal anatomy and biomechanics of the patellofemoral joint. It is to be performed in cases of trochlea dysplasia. Four types of trochlea dysplasia have been described by Henry Dejour. Types B and D are almost always best indications for trochleoplasty.

METHODS: A female athlete -long jumper- of 18y.o. presented in our office claiming at least ten patella dislocations, the first being at the age of 10. No improvement was noted with all rehabilitation and muscle strengthening that she had followed. Her clinical examination revealed patella maltracking, pain and subluxation. A new set of X-rays (true profile, en face), MRI and CT was immediately scheduled. Her presurgery measurements were: Trochlea dysplasia grade C, TT-TG: 27 mm, TT-PCL: 20 mm, Caton-Deschamps: 1, 35. Also, medial patellofemoral ligament (MPFL) deficiency was noted and permanent patella maltracking. Long-leg scanogram was also performed which revealed no abnormalities. A trochleoplasty (Dejour/ Thick flap technique), TT transfer (medialization and distalization) and MPFL reconstruction was performed.

RESULTS: Her immediate postoperative result was excellent. On the first day she could passively bend her knee (on a PCM) at 50 degrees. We used a knee brace (0-30) in order to protect the trochleoplasty. Physiotherapy was immediately started postsurgery. The patient was non-weight bearing for two weeks and then she begun partial-weight bearing. At six weeks the patient was able to fully weight bear.

CONCLUSIONS: Trochleoplasty is a reliable and valuable procedure that can be used safely today in order to address complex PFJ pathology.

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Extreme sport injuries (ESI) in adolescents

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BACKGROUND: Extreme sport activities, such as mountain biking, rock climbing, in-line-skating etc., are gaining popularity among adolescents. They are often associated with injuries which may severely affect the growing musculoskeletal system. The aim of this study is to analyze the long term results of these injuries.

METHODS: Twenty-eight (28) adolescents (22 boys and 9 girls) with mean age of 12.7 years were injured during in-line skating (ILS) 8/28, mountain biking (MB) 17/28 and parkour (P) 3/28. They sustained fractures of the upper and lower extremities (clavicle, olecranon, radial head, distal forearm, humerus, pelvic and ankle). All fractures (except clavicle and pelvis) were treated operatively.

RESULTS: All fractures resulted in bony consolidation. Severe restriction from athletic performances was noticed in all patients. The mean follow-up time was 5.6 years. Damage-control orthopaedics was implemented in two P polytrauma patients. One ILS patient had premature physal closure of the distal tibia which resulted in various ankle deformities. All elbow fractures maintained restriction of forearm pronation-supination.

CONCLUSIONS: Extreme sport injuries are by definition high-energy injuries. Immediate medical care is usually deteriorated and is depending from the distance from organized trauma centers. Parkour is associated with polytrauma injuries and could be a life threatening activity. Growth plate injuries could cause deformities that influence adult life and lead to osteoarthritis. Our limited experience in ESI points out the importance of early and proper care. Prevention strategies are extremely important in adventure and extreme sports in order to avoid complications in adult life.

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A case of a runner athlete suffering from nonunion of hallux sesamoid fracture treated with platelet rich plasma (PRP)

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BACKGROUND: Platelet rich plasma (PRP) is increasingly utilized in orthopedic practice for enhancing healing of difficult musculoskeletal trauma cases. PRP injection at nonunion site can probably promote fracture healing.

METHODS: A 16-year-old male runner athlete with a neglected hallux sesamoid fracture due to forceful foot impact was unsuccessfully treated conservatively with foot immobilization and partial weight bearing. Radiologic nonunion of the fracture, as well as pain during running persisted. Twenty ml of peripheral whole blood were withdrawn from the patient and added to a standard PRP preparation apparatus. A PRP fraction of 3 ml was injected under image intensification into the nonunion site. The foot was immobilized in a cast and immediate partial weight bearing was permitted.

RESULTS: Progressive callus formation was evident in serial X-ray examinations and fracture union was

obtained at 12 weeks. At that time the patient was able to painlessly walk, run and participate to athlete activities.

CONCLUSIONS: PRP injection is a minimally invasive, well tolerated method with promising potential in promoting healing and could be considered in difficult fracture cases.

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Prevention of exertional heat illness in children athletes using knowledge of neurological response

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BACKGROUND: Exertional heat illness (EHI) is one of the leading causes of death in young athletes and continues to increase in many locations as a consequence of climate change. Children athletes are more vulnerable to EHI than adults, even a single episode of hyperthermia may cause neurological and cognitive dysfunction. The purpose of the study is to advance our understanding about children athlete health in the heat and how to prevent occurrence of the EHI.

METHODS: A systematic search (2011-2021) of the PubMed, Science Direct, EBSCO, Scopus, UpToDate and Clinical Key was performed by using key terms: children athletes, exertional heat illness, thermoregulation, neurological examination.

RESULTS: The search yielded up to 840 records. After screening of the titles and abstracts, 156 records met the criteria. Selected studies presented EHI managing with risk factor reducing, treatment plans and guidelines, especially addressing football as one of the higher risk sports for EHI. Information on neurological response to heat in children athlete is insufficient and alerts discussions about earlier neurological assessment tools to evaluate heat developed changes before the risk of the EHI symptoms increases.

CONCLUSIONS: EHI presents ranging from exercise associated muscle cramps till exertional heat stroke. The nerve cells of the cerebellum and cerebral cortex are particularly vulnerable to heat. There is need for neurological assessment development - starting as precise children athletes' movement and behavior observation already in active game time to indicate abnormal response to heat and prevent EHI.

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Between game variation of running performance in an elite greek soccer team

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BACKGROUND: The assessment of between-match variation in physical performance of elite soccer players during a season represents the range of their specific physical requirements. The aim of the present study was to examine the between-game variation of running performance of an elite Greek soccer team during the competitive season.

METHODS: Twenty-eight (28) Super League matches played by a professional soccer team were collected during a season using global positioning system (GPS) technology. Maximum speed (MS), number of sprints (NrSP), total distance (TD), high (HSR), medium (MSR), low (LSR), very low (VLSR) and walking (WSR) speed distances were analyzed. Between game variability was quantified using the coefficient of variation (CV).

RESULTS: The between game variation (CV) reported low for TD and became higher with the increase of speed distances.

CONCLUSIONS: These findings suggest that more intense the running activity the greater the between-game variation. These data broaden our knowledge on the range of elite players' running requirements during the Greek championship.

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Associations between volleyball performance characteristics and properties of knee reflex and Hoffmann reflex of lower extremity muscles

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BACKGROUND: Exercise training of lower limb muscles can alter Knee tendon reflex (KR) and Hoffmann reflex (HR). However, few data exist regarding female athletes. This study examined potential relationships between volleyball training-associated performance characteristics and properties of KH and HR in females.

METHODS: Nine volleyball players (age: 22±3 yrs, BMI:21±3 kg/m², body fat:20±5%) and nine age- and sex-matched non-athletes serving as control group (20±1 yrs, BMI:21±2 kg/m², body fat:22±5%) participated in this study. KH and soleus HR (amplitude, latency), as well as sit & reach (S&R), handgrip strength (HS), countermovement jump (CMJ) using one or both legs, and long jump (LJ) were assessed. Wilcoxon Signed-rank test and Spearman correlation coefficient were used for statistics.

RESULTS: For both reflexes, similar values (P>0.05) of amplitude (A) (AKR: 1.19±0.60mV, AHR:0.41±0.14mV) and latency (L) (LKR:21.38±1.10ms, LHR:31.76±2.51ms) were measured in athletes vs.

controls (AKR:1.66±0.80mV, AHR:0.49±0.19mV, LKR:21.11±1.30ms, LHR:30.10±2.27ms). In athletes, CMJ and HS were higher compared to controls (P<0.01), while KR latency showed positive correlation with CMJ using the non-dominant leg (P<0.05) and tendency to positive correlation with LJ (P=0.09). HR latency showed positive correlation with CMJ using both legs (P<0.05), negative correlation with S&R (P<0.01), and tendency to positive correlation with LJ (P=0.07). In the control group, interestingly, the correlation between HR latency and CMJ using both legs was highly linear ($\rho=1$, P<0.01).

CONCLUSIONS: Performance characteristics of volleyball female athletes may be associated with properties of lower extremity reflexes, suggesting potential athletic performance implications.

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Isokinetic measurements of knee flexion and extension between genders

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BACKGROUND: The purpose of this study was to examine possible differences in various isokinetic indexes at the knee joint between males and females.

METHODS: Twenty seven healthy recreational athletes, volunteered to participate in the study. Eleven men (24.3 ±5.81 years) and seventeen women (21.35±1.53 years) performed ipsilateral concentric (CON) isokinetic testing at 12°/s, 60°/s, 180°/s and 300°/s. The peak torque (PT), the angle peak torque (AngPT), Hamstring/Quadriceps (H/Q) ratio, isokinetic endurance, isometric endurance at 50% and 75% of maximal voluntary isometric contraction (MVC) were used for analysis. Moreover, the blood pressure, and heart rate (HR), were measured for the isometric and isokinetic endurance.

RESULTS: There were significant differences (P<0.05) in PT between genders, with women displaying lower levels at both knee extension and flexion, in all angular velocities. Additionally, women were observed to have smaller angles of PT in knee flexion at all angular velocities, and in knee extension, at 12°/s and 300°/s. No significant differences (P>0.05) were found at H/Q ratio between genders. However, women showed significant lower isokinetic endurance in comparison to men (P>0.05). While the time of isometric endurance at 50% of MVC was similar for both genders, there was a reduction of time at 75% of MVC in women. The blood pressure was increased significantly (P>0.05) in men compared to women in isometric endurance. The men appear to recover faster than women, when the HR was recorded 5 minutes after the test.

CONCLUSIONS: Significant differences were observed between genders in PT, AngPT, isokinetic endurance, and isometric endurance, with women exhibiting reduced levels of strength in comparison with men.

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Interval training to exhaustion and blood coagulation in elite adolescent soccer players

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BACKGROUND: Yo-Yo intermittent recovery level 2 (YYIR2) test is widely used to evaluate an athlete's ability to perform intense intermittent exercise with a high rate of aerobic and anaerobic energy turnover. It is well known that acute exercise induces several hematological changes which are linked to the intensity and the volume of exercise. Our aim was to examine the effects of interval training to exhaustion (YYIR2 Test), on specific coagulation parameters.

METHODS: Twenty-two young male elite football players (age 16±3 years, BMI: 22.3±1.7, Fat: 10.1±3.2%) were guided and motivated to perform the YYIR2 test until exhaustion. The test was executed in the morning after 48 hours of rest and the players were instructed to have a full breakfast 3 hours before the test. Blood samples were drawn before and immediately after the test for the assessment of: Platelet count (PLT), Prothrombin time (PT), activated partial Thromboplastin time (aPTT), D-Dimers (DD), Fibrinogen (Fib), Factor VIII activity (FVIIIa) and Von Willebrand factor antigen plasma levels (vWf Ag).

RESULTS: Analysis (paired samples t-test), revealed a significant increase in Platelet counts, FVIIIa levels and vWf Ag levels ($P < 0.01$) at the end of the test. In fact, FVIIIa and vWf Ag levels almost doubled at the end of the test compared to baseline. No significant changes were found in Fibrinogen PT, aPTT and D-Dimer levels ($P > 0.01$).

CONCLUSIONS: Interval training to exhaustion caused a significant increase of PLTs, FVIIIa and vWf Ag levels probably due to shear stress-induced endothelial activation.

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Acute and chronic exercise-induced changes of selected hematological blood parameters in elite soccer players

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BACKGROUND: Acute and chronic exercise induces several alterations in blood parameters. Our aim in this study was to approach the alterations in specific hematological parameters, after intense intermittent training to exhaustion and after 10 weeks of training.

METHODS: Twenty-four elite soccer players (mean age 23±3 years, BMI: 22.5±1.9, Fat: 7.8±3.4%), participated in this study. Blood tests were drawn twice on the first day of training (before and immediately after YoYo Intermittent Recovery Test Level 2) and after 10 weeks of pre-season preparation training. White Blood Cells (WBC), WBC sub populations and their measurements of volume (V), conductivity (C), and 5-angle Scatter light laser (AL), platelets (PLT), Fibrinogen (Fib), D-Dimer (DD), factor VIII activity (FVIII), von Willebrand factor antigen (vWf Ag) and high sensitivity C-reactive protein (hs-CRP) were measured at all times.

RESULTS: *Acute effects:* WBC, neutrophils, and PLTs counts, FVIII activity, and vWf antigen plasma levels, were significantly higher at the end of the test ($P < 0.003$). *Chronic effects:* Neutrophils and Eosinophils C and S were significantly decreased ($P < 0.003$). Lymphocytes V, C, S were also found decreased at the end of the study ($P < 0.003$). No changes were found on Macrocytes C, V and S.

CONCLUSIONS: Intense acute exercise seems to significantly affect several physiological body functions such as Hematopoiesis (increases granulocytopenesis) and endothelial function (increases the release of FVIII and vWfAg from endothelium). Chronic exercise seems to influence the morphological properties of WBC sub-populations, membrane, and granules. This may indicate a possible index for training evaluation

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The effects of community based group exercise program in frail older adults: 24 weeks prospective study

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BACKGROUND: Frailty is a highly prevalent condition in older adults and increased the risk of disability, morbidity and mortality. Exercise is important intervention to prevent and treat the frailty syndrome. To determine the effects of supervised community based group exercise (SCGE) program in frail older adults by assessing multiple aspects of frailty including muscle strength, whole body and local muscle mass, physical activity, fear for fall, balance function, gait function and depressive mood.

METHODS: Twenty-two (22) physically frail older females (of mean age 76.3±4.4 years old, appendicu-

lar skeletal muscle mass index $5.8 \pm 0.5 \text{ kg/m}^2$, cross sectional area of rectus femoris $417 \pm 58 \text{ mm}^2$, cross-sectional area of multifidus $609 \pm 72 \text{ mm}^2$). 24 weeks exercise program consisted of spine extension stretching, abdominal bracing exercise, extremity stretching exercise, strengthening exercise, balance training and gait training.

RESULTS: Significant improvements were achieved by SCGE in grip and knee extension strength, functional reach, unipedal stand, timed up and go, Berg balance test, fall efficacy scale, gait for short physical performance battery, short-geriatric depression scale, 5 chair stand time and 30seconds chair stand ($P < 0.05$). However, no meaningful improvement was observed in appendicular skeletal muscle mass index, cross sectional areas of rectus femoris and multifidus.

CONCLUSIONS: Frail older people were able to gain significant muscle strength, functions and even improved mood without meaningful increase of muscle mass through 24 weeks of SCGE. These results demonstrate that SCGE is beneficial for physical and mental functions of old people although it is not hard enough to gain additional muscle mass.

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Chronic effects of interval training on cardiorespiratory variables in the elderly

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BACKGROUND: Interval training is an important method for promoting physiological adaptations. The current study analyzes the chronic effects of interval training (IT) on cardiorespiratory variables in the elderly.

METHODS: Sixteen (16) active elderly (mean age 66.6 ± 5.4 years; mean height 1.71 ± 0.05 m; mean weight 78.92 ± 9.1 Kg; mean BMI 27.38 ± 1.4) divided in training (TG) and control groups (CG). The TG performed the IT on a protocol used was 6×4 min. (55 - 60% HR max) and 1 min (70 - 75% HR max), 32 sessions separated by 48-hour. For the CG, there was no applied intervention. The heart rate variability (index RR, LF, HF, and LF/HF ratio), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were analyzed in 10 min resting. Maximum oxygen uptake ($\text{VO}_{2\text{max}}$) was estimated. Both groups (TG and CG) were tested at baseline and retested after 16th and 32nd sessions. ANOVA with repeated measures was applied. Additionally, the effect size (ES) was calculated. GraphPad Prism (7.04) software was used and the significance level was $P < 0.05$.

RESULTS: After the intervention, no difference was observed in the investigated variables ($P > 0.05$) for TG

and CG. After 16th sessions, ES was large for SBP and $\text{VO}_{2\text{max}}$ (-0.86 and 0.82 , respectively) and after 32nd sessions, ES was medium for LF (-0.49) and HF (0.50). ES large was observed for SBP (-1.11), RR (1.36), LF/HF (-0.90) and $\text{VO}_{2\text{max}}$ (1.12).

CONCLUSIONS: The results indicate that IT can be a positive prescription strategy for the elderly.

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Atypical hip fractures bilaterally after long-term bisphosphonate treatment. A case report

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BACKGROUND: Bilateral atypical hip fractures are rarely seen and subtrochanteric region is the most common area where those occur in elderly females. Diagnosis in time could be missed and surgical treatment as well as postoperative management is a challenge for the clinician. A patient with bilateral atypical hip fracture (subcapital and subtrochanteric, respectively), which was treated surgically in the same setting is presented.

METHODS: Female patient 68 years old, was transferred to our hospital after bilateral hip fractures without substantial injury. From the clinical examination and imaging investigation she was found to have: α) subcapital neck of the femur fracture of Right hip, proximal to an old antegrade intramedullary nailing of right femur and β) subtrochanteric fracture of left hip.

From the patient's history, aetiology is attributed to long-term treatment on alendronate for osteoporosis. She was treated surgically bilaterally i) reconstruction intramedullary nailing for the subtrochanteric fracture left hip and ii) removal of previous nail from right femur and hemiarthroplasty for the left hip.

RESULTS: The patient was mobilised early postoperatively, carried on physiotherapy and rehabilitation and two months postoperatively she was independent, using a Zimmer frame and walking with full weight bearing bilaterally.

CONCLUSIONS: Management of patients with atypical hip fractures could be a challenge for clinicians. When they are bilaterally surgical treatment and right decision making is crucial for acceptable outcome.

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A comparison between physical activity program and rowing ergometer exercise program on physical fitness among elderly

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BACKGROUND: An elderly person experiences inevitable physiological changes and an increased risk of both acute and chronic illnesses. Exercise is an important factor that can improve physical fitness in the elderly. The purpose of this study was to compare the effects of physical activity programs and rowing ergometer exercise programs on physical fitness in older adults.

METHODS: The participants were purposive random sampling collected from active lifestyle older adults. They have divided into two groups: 10 subjects were in the physical activity program (rhythmic exercise) and 10 subjects were in the rowing ergometer exercise program (rowing with 60% max HR). The exercise program was set up 5 days per week; each session included a 10-minute warm-up, a 20-minute exercise, and a 10-minute cooling-down period. All participants were tested for body weight, height, body mass index, and physical fitness components included cardiorespiratory endurance, flexibility, and muscular strength before and after 8-weeks.

RESULTS: The results revealed that both groups demonstrated improvement in physical fitness, however, the rowing ergometer exercise program group was statistically significantly higher than the physical activity program group.

CONCLUSIONS: It may be concluded that both methods of exercise programs can improve health-related physical fitness in elderly people.

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Glomerular filtration rate on the elder after maximal and submaximal exercise calculated with creatinine and Cystatin-C

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BACKGROUND: Acute exercise generates changes in the Glomerular Filtration Rate (GFR) (ml/min), which is commonly estimated from serum creatinine (Cr). Cystatin- C (Cys-C) is a new GFR marker. There isn't any research on the comparison of GFR determination estimated with Cr and Cys-C in maximal and submaximal exercise in elder subjects (≥ 65 years). The study compares the GFR estimation with Cr and Cys-C in maximal and submaximal exercise in elders (≥ 65 years).

METHODS: Twenty (20) healthy subjects (mean age 69 ± 4 years) performed 1 maximal (MAXCAP-B) (Taguchi *et. al.* protocol) and 2 submaximal tests (80% and 60%) of Heart Rate Reserve (HRR) on a bicycle for 20 minutes. Cr and Cys-C blood concentrations for estimated GFR were collected before and after the tests. The results of 3 tests were compared. Statistical significance was accepted at $P < 0.05$.

RESULTS: A significant decrease in GFR was observed after exercise in MAXCAP-B (76.7 ± 21.93 ml/min to 67.7 ± 19.1 ml/min), SUBMAX-B 80% (75.1 ± 16.7 ml/min to 68.8 ± 12.1 ml/min) estimated with Cr, and in MAXCAP-B (100.9 ± 21.0 ml/min to 93.8 ± 18.2 ml/min) estimated with Cys-C. The SUBMAX- 60% exercise did not generate any changes in the glomerular filtration rate in neither of the two. Higher values of estimated GFR calculated with Cys-C were observed.

CONCLUSIONS: The results of renal function in maximal and submaximal acute exercise determined by GFR estimation presented a greater sensitivity when calculated with Cr rather than through Cys-C. In GFR calculations with Cys-C a significant overestimation was observed.

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The self-assessed frequency of anemia and use of iron supplements in japanese elite collegiate track & field athletes

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BACKGROUND: Iron deficiency anemia is one of the most prevalent diseases in athletes. Conversely, iron overload due to unnecessary excessive oral or intravenous iron supplementation also has been a serious problem in athletes. The aim of the present study was to elucidate the frequency of anemia and use of iron supplements in Japanese elite collegiate Track & Field (TF) athletes.

METHODS: Five hundred and seventy (570) TF athletes who participated in All-Japan Inter-College Athletics Championship and/or All-Japan Collegiate Women's Ekiden Championship in 2017 were investigated. The discipline was divided to sprinting, middle- and long-distance (MLD), jumping, throwing and combined events. Self-assessed questionnaire about the current and previous history of anemia and use of iron supplements was conducted. No clinical and hematological data were available.

RESULTS: The overall self-assessed incidence of anemia was 40.4%. Females showed higher frequencies incidence (46.2%) than males (32.9%) significantly. A percentage of 25.4% of total athletes reported a use of oral iron supplements and 14.6% of total athletes reported experiences of having intravenous iron supplementations. The analysis by disciplines showed that frequency rate of anemia and iron supplements use was significantly higher in MLD (57.0% and 39.0%) than other disciplines.

CONCLUSIONS: Female collegiate TF athletes showed higher self-assessed incidences of anemia than males. High incidence rate of anemia in MLD runners could contribute to widespread use of iron supplements among them.

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Post-COVID-19: decreased maximum oxygen uptake and oxygen pulse as indicators of severity of disease

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BACKGROUND: COVID-19 is an infectious disease caused by the SARS coronavirus 2 and affects millions of people worldwide. Post-COVID-19 is a symptom complex that is diagnosed for patients who suffer from long-lasting sequelae (e.g. fatigue, dyspnea), which negatively affects performance and life quality. The current investigation aims to find additional characteristic variables by Cardiopulmonary Exercise Testing (CPET) in addition to the National Institute for Health and Care Excellence criteria to objectify the post-COVID-19 diagnosis.

METHODS: Sixty-two (62) patients underwent CPET to assess their aerobic capacity by measuring VO₂peak on a cycle ergometer. A ramp wise incremental test protocol (Start 20/25/30/35/40W depending on the expected fitness, increase 15/20/25/30/35W/min) till voluntary exhaustion was used to assess VO₂peak during CPET utilizing a breath-by-breath metabolic analyzer.

RESULTS: The oxygen pulse (ml O₂/beat) was reduced, as well the VO₂peak compared to the set points by Wassermann (1994) and the subjective performance decrease by the patients. An increased maximal heart rate could not be found which could explain a lower oxygen pulse. Thus, a number of COVID-19 patients differ from healthy people in aerobic capacity kinetics. Furthermore, a few of them claim about inspiratory affliction and the exercise had to be stopped although a metabolic exhaustion was not yet reached.

CONCLUSIONS: Initial results suggest that plateauing of the oxygen pulse in CPET may be a characteristic finding in Post-COVID-19. Furthermore, this can be an indicator for damage in the respiratory chain.

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Mechanism and promotion path of female sports participation behavior based on COM-B model- a case study: "This Girl Can" health campaign in the UK

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BACKGROUND: Physical activity (PA) behavior is an effective way to promote health, but many most women are unable to effectively promote physical and mental health through sports participation, and

to develop behavior change science has a positive effect on women's sports participation behavior. The study analyzes the case of British healthy sports based on the COM-B (capability, opportunity, motivational behavior) model, and explores how the behavior change mechanism affects women's exercise participation behavior.

METHODS: The current study is based on psychological theory and applies a case analysis method to introduce the "This Girl Can" health campaign's online promotional texts, TED reviews, national policy support, and other descriptive explanations of its advertising videos and semantics.

RESULTS: The results of the case analysis show that the barriers to participation of women in sports are manifested as physical weakness, social class, sports facilities, sports human resources, and social culture; in this case, the transformation of women's participation in sports is mainly based on the effectiveness of self-efficacy in breaking women's ability to exercise; the feasibility of social support to provide opportunities for sports participation; the important role of motivation in maintaining women's sports behavior; and the important role of mass media in spreading health belief; the study demonstrates a range of personal and social mechanisms that transform women's sports participation.

CONCLUSIONS: It has important influence and puts forward corresponding strategies for promoting the development of such mechanisms, laying a theoretical foundation for future precision intervention research to enhance women's sports participation.

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Improving lower limb kinematics of subjects with patellofemoral pain syndrome with gluteal muscle activation training

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BACKGROUND: Proximal abnormalities in biomechanics are considered to be an important factor in the development and persistence of patellofemoral pain syndrome (PFPS). Gluteal muscle activation disorders associated with abnormal lower limb movement patterns have been found in subjects with PFPS performing functional activities. However, effective interventions have not been found. The present study investigates whether gluteal activation and functional training can improve pain, functions and lower limb kinematics among subjects with PFPS.

METHODS: Eighteen subjects of mean age of 27.4 years with PFPS participated in an 8-week program with 24 sessions on gluteus muscle activation training for the first 4 weeks and functional movement

training for the last 4 weeks. Pain, functional status and lower limb kinematics were assessed with visual analogue scale, Lower Extremity Functional Scale, and step-down test respectively at baseline, 4 weeks and 8 weeks after intervention. Data were analyzed using repeated-measures ANOVA.

RESULTS: Pain (mean difference [MD] -2.2 points, 95% CI -2.8, -1.6) and lower limb function (MD 4.1 points, 95% CI 1.6, 6.6) had significantly improved. Improvements of pelvic and lower limb kinematics in terms of significant increases in pelvic anterior tilt and hip flexion angles, and significant decreases in knee external rotation angles were observed in the step-down test at the end of the 4th and 8th week after intervention.

CONCLUSIONS: Gluteal activation and functional training significantly improved pain, functions and lower limb kinematics in PFPS subjects.

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The effects of aerobic exercise on iliac arterial morphology in spontaneously hypertensive rats

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BACKGROUND: Aerobic exercise (AE) may help to prevent and treat hypertension. However, how AE helps to the hypertension improvement is not very clear. The current study explored different time of AE affected iliac arterial morphology in spontaneously hypertensive rats (SHR).

METHODS: Rats were randomly divided into 4 groups (8 rats per group): Normal Control (Wistar, NC), Sedentary (SHR, SC), Short Training (SHR, ST) and Long Training (SHR, LT). ST and LT performed 15 weeks of swimming for 45 min and 90 min per day respectively after two weeks of adaptable training. We tested the ratio of the media thickness to the lumen diameter (MT/LD), the ratio of the media area to the lumen diameter (MA/LD) and the ratio of the media area to the lumen area (MA/LA) in the iliac artery.

RESULTS: (1) Compared to NC, SC increased MA/LD (411.249 ± 72.320 vs. 368.075 ± 64.693 , $P < 0.05$); (2) Compared to SC, ST reduced MT/LD (0.189 ± 0.038 vs. 0.227 ± 0.026 , $P < 0.05$), MA/LD (342.216 ± 47.191 vs. 411.249 ± 72.320 , $P < 0.01$) and MA/LA (0.904 ± 0.216 vs. 1.119 ± 0.154 , $P < 0.05$) while LT increased MT/LD (0.265 ± 0.034 vs. 0.227 ± 0.026 , $P < 0.05$) and MA/LA (1.342 ± 0.207 vs. 1.119 ± 0.154 , $P < 0.05$); (3) Compared to ST, LT increased MT/LD (0.265 ± 0.034 vs. 0.189 ± 0.038 , $P < 0.01$) and MA/LA (1.342 ± 0.207 vs. 0.904 ± 0.216 , $P < 0.01$).

CONCLUSIONS: Hypertension induced pathological changes of iliac arterial morphology and 45 min AE for fifteen weeks can effectively relieve it. However, 90 min AE fifteen weeks aggravated the damage.

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Ankle chronic instability in college football players: prevalence and assessment of risk factors

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BACKGROUND: The ankle is an anatomic region with great risk of injury in football players (52%), with the lower part of the ankle being implicated in 59% of the cases. Although most ankle sprains achieve a full recovery, almost 40% of them develop chronic instability. The purpose of the current study was to determine the frequency of chronic ankle instability in college football players, and to define the risk factors involved in order to improve the physician's primary care.

METHODS: A retrospective observational study was performed, in which 128 players from three college football teams were asked to fill out a questionnaire containing the Cumberland Ankle Instability Tool (CAIT). A cut off score of ≤ 25 was considered as ankle instability.

RESULTS: Seventy-eight (78) out of 128 players met the inclusion criteria (previous history of ankle sprains and absence of previous ankle fractures). The current study found a statistically significant correlation between the presence of chronic ankle instability and the number of previous sprains; $P 0.023$ for the right ankle and a $P 0.03$, for the left ankle. Chronic ankle instability has a high prevalence in college football players (61%). Ankles with a history of ≥ 1 sprain were 3 times more likely to have chronic instability.

CONCLUSIONS: Identifying players with higher risk of developing this chronic condition is crucial in the development of an earlier medical approach with better outcomes.

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The influence of different voluntary exercise rats on the expression of HSP70 using exercise intervention

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BACKGROUND: HSP70 is a kind of heat shock protein-related to aging, and its expression decreases with age. Increased expression of HSP70 in skeletal muscle can inhibit lipid peroxidation and protect muscle, while in the liver; it can protect liver cells and reduce liver injury. Exercise voluntariness (EV) refers to the degree of an individual's willingness to exercise spontaneously without being directly stimulated by any external factors. Previous studies only considered the exercise effect on HSP70 expression but ignored individual differences, such as EV. The purpose of this

paper is to explore whether EV affects the effect of exercise intervention (EI) by measuring the expression of HSP70 in different parts of rats.

METHODS: 24 6-week-old SD rats were selected for EV screening by multi-channel spontaneous activity wheel cage system. The rats were isolated in the cage and could move freely. Eight rats were observed in the animal room at 7:00 a.m. every day. Eight days was a cycle. A total of 16 days of wheel screening were conducted to ensure data stability. High, medium and low voluntary exercise rats were selected according to the standard deviation of the average number of wheel circles. According to the EV, they were divided into low voluntary control group, low voluntary exercise group, high voluntary control group and high voluntary exercise group, with 6 rats in each group. The EI program of the exercise group was to run for 30 minutes once a day, 5 days a week, with a running speed of 19 m/min (slope of 10%), lasting for 5 weeks. After EI, HSP70 expression in serum, liver and quadriceps femoris was detected. Two-way ANOVAs were performed to compare the influence of exercise and voluntary factors on HSP70 indicators. LSD test was performed for homogeneity of variance, and Mann-Whitney U test was performed when the indicators did not meet the variance homogeneity test. A Type error rate greater than or equal to 0.05 was chosen as statistical significant.

RESULTS: There was no interaction between EV and EI on HSP70 in serum and liver ($P=0.328, 0.473$). EI could significantly increase the expression of HSP70 in serum ($P=0.037$) and liver ($P=0.001$) regardless of the voluntary level. EV did not affect the expression in serum ($P=0.417$), but the expression in the liver of the high voluntary group was significantly higher than that in the low voluntary group ($P=0.044$). There was an interaction between EV and EI on HSP70 in quadriceps femoris ($P=0.035$). Subsequent tests showed that EI significantly increased the expression of HSP70 in quadriceps femoris in the high voluntary group ($P=0.043$), but did not affect the low voluntary group ($P=0.715$).

CONCLUSIONS: 1. EI can increase the expression of HSP70 in serum and liver of different EV rats, which is beneficial to improve the body's heat tolerance and disease recovery state, but it can only affect HSP70 in quadriceps femoris of high voluntary rats, inhibit lipid peroxidation and provide protection for muscles. 2. The effect of exercise voluntariness on HSP70 in the liver of high exercise voluntary rats is greater than that of low exercise voluntariness, and it is not universal for the population to improve the protective effect of liver cells.

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Increasing inclusivity of para sport categorisation systems does not disadvantage eligible ipc competitors in non-elite settings

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BACKGROUND: The Invictus Games is an international multisport competition for wounded, injured or sick military personnel. Competitor categorization uses a modified version of the International Paralympic Committee (IPC) classification system. The inclusive nature of the Games means some competitors are not IPC eligible, but will compete against others who are.

The aim of the present study was to analyze if non-eligible competitors were at a performance advantage.

METHODS: Retrospective study of competitors with physical impairments competing in swimming, rowing, cycling, and track athletics at the 2018 Invictus Games. Competitors were subdivided according to IPC eligibility. Data collected on sport category, race time/distance, and mean percentage Gold Medal Time (% GMT) calculated for the categories with mixed eligibility competitors.

RESULTS: Of 153 competitors, 144 (94%) were male and 9 (6%) female. Thirty-three competitors (22%) were ineligible for IPC classification. Six of 11 categories reviewed had mixed eligibility competitors. In 5 categories, the mean % GMT for IPC eligible competitors (%GMT_e) was higher than that of ineligible competitors (%GMT_i). The b% GMT_e for IR4, IR5, ISC, IHB2, IRB2 = 71.57, 94.78, 77.80, 77.20, 89.31 respectively. The % GMT_i for IR4, IR5, ISC, IHB2, IRB2 = 56.61, 86.63, 69.72, 67.54, 79.89, respectively.

CONCLUSIONS: To facilitate fair and competitive para-sports, stringent IPC classifications are warranted in elite settings. Such systems may result in the exclusion of individuals from competitive para-sport. The current study demonstrated that in non-elite settings, enabling competitors with functional or pain-based impairments to compete against competitors with verifiable physical impairments does not confer a performance advantage.

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Reproducibility of a visual performance assessment and influence of specific visual training

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BACKGROUND: Sports coaches are constantly looking for new ways to improve the athletes' performance. Recently, more and more athletes started to consult orthometrists to improve their visual performance. The aims of the current study were:

- 1) to assess the reproducibility of a procedure to evaluate an individual's visual skills and
- 2) to analyze the prospective improvements in these skills that a visual training program may bring about.

METHODS: Forty-nine (49) males with no visual impairment were assessed twice (test and retest) for their eye/hand and eye/foot coordination, choice reaction time, anticipation skills and peripheral awareness. Then, 24 top athletes from several sports received twenty visual training sessions (3x1h/week). Their visual skills were assessed just before the start of the training program (pre-test), and a second time at the end of the program (post-test). The assessment procedure was the same as in the first part of this study. The assessment was carried out by means of six tasks performed on the "Wayne Saccadic Fixator".

RESULTS: The test-retest correlation for the 6 tasks was satisfactory. However, the concordance for the distribution of overall scores between the two assessment sessions appeared poor. For the athletes, a highly significant difference between the pre-test and post-test assessment sessions was demonstrated for all skills.

CONCLUSIONS: The test-retest reproducibility of the six tasks was satisfactory, but the results' classification and the overall scoring systems could be improved. Then, all high-performance athletes appeared to show substantial improvement in their visual abilities.

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The effects of transcranial direct current stimulation (TDCS) on endurance parameters in confirmed athletes

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BACKGROUND: Fatigue is a multifactorial phenomenon that limits athletes' performances. Transcranial direct current stimulation (TDCS) could be an interesting option to reduce supraspinal fatigue. However, very little research has been done on the TDCS effects on confirmed athletes. The objective of the present randomized, double-blind, cross-over study is to compare the TDCS effects on endurance performance in athletes.

METHODS: Thirty (30) males (18 to 30 years) were split into 2 groups (TDCS week 1 and sham week 2, or sham week 1 and TDCS week 2). They came twice to undergo a fatiguing protocol (30 maximal concentric repetitions over 100° flexion amplitude at 180°/s).

We measured peak tork and work for both quadriceps and hamstrings in the dominant limb. All were right handed and footed, and had no positive answer on the TSST screening scale.

RESULTS: There were no significant effects of TDCS compared to sham on quadriceps peak tork for the first 10, second 10 and final 10 repetitions or maximal work, nor for first 10 repetitions of hamstring peak

tork and work. However, close to significant effects were seen on the second 10 contractions for peak tork values ($P=0.087$, 4.75%) and significant effects were seen for the peak tork in the final 10 repetitions (7%), the maximal work in the second 10 repetitions (6.4%) and the final 10 repetitions (9%).

CONCLUSIONS: Significant effects on hamstring fatigue were found after TDCS. These effects could be explained by reducing supraspinal fatigue, or by decreasing perceived discomfort felt.

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Acute effect of ischemic preconditioning on performance and hemodynamic responses of crossfit

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BACKGROUND: Ischemic preconditioning (IPC) improves performance in modalities. There isn't evidence in Crossfit. The current study analyzes the acute effect of IPC on performance and hemodynamic responses in CrossFit.

METHODS: twelve (12) men (26.33 ± 4.51 years; 79.9 ± 14.85 kg; 1.76 ± 0.08 m; 25.63 ± 3.36 kg/m²) performed 2 sessions, randomized: a) IPC (3x5 min. 220 mmHg) + 30 min. interval + FRAN; b) SHAM (3x5 min. 20 mmHg) + 30 min. + FRAN. Heart Rate (HR), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP) at rest (rep.) and recovery (rec.) measured in the 1st, 5th, and 10th min. For the analysis of time in the FRAN, one-way ANOVA used, and for HR, SBP and DBP, two-way ANOVA was used. Adopted $P\leq 0.05$.

RESULTS: FRAN time was similar between IPC and SHAM ($P=0.55$). HR decreased in both sessions during the period of rec., in the 1st, 5th, and 10th min. ($P=0.000$). However, with no difference between sessions ($P=0.332$). SBP decreased similarly between sessions during rec. in the 1st, 5th, and 10th min. ($P=0.000$) and in the 1st min. between sessions ($P=0.045$). The DBP showed a difference between rep., 1, 5, and 10 min. times for IPC ($P=0.000$) and SHAM between rep., 1 and 10 min. ($P=0.000$), and between sessions in the 5th min. ($P=0.007$).

CONCLUSIONS: Although it does not improve FRAN performance, IPC improves hemodynamics at times.

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A clinical report of back pain that ended in a pneumothorax after acupuncture

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BACKGROUND: Acupuncture is among the most popular of all complementary therapies for a variety of diseases, although there is no clear scientific evidence of its efficacy. It is an invasive procedure with potentially serious side effects and because its widespread use, safety is important. Pneumothorax is one of the most common rare serious and life threatening complications that may occur. The aim of the current work is to emphasize on acupuncture's risks.

METHODS: A case report of a 19-year-old futsal goalkeeper, as well as a brief literature review was performed regarding the pneumothorax risks after acupuncture. A search for published articles, in English, in the MEDLINE®/PubMed®, under the MeSH terms "acupuncture" and "pneumothorax" was performed.

RESULTS: A 19-year-old futsal goalkeeper, presented to the Emergency Department with pleuritic chest pain following a history of acupuncture treatment for a back pain. Physical examination revealed desaturation and image examination revealed a pneumothorax. He was submitted to conservative treatment. Two days after the pneumothorax resolution the goalkeeper was discharged with reevaluation scheduled in three months.

CONCLUSIONS: Considering acupuncture's popularity, its safety is an important public health issue. Patients should search for accredited acupuncturists, and managed after considering its benefits and potential risks. All clinicians need to be aware of the possibility of adverse events for an early diagnosis.

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Twinning tennis: homophily and performance in doubles tennis

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BACKGROUND: The current study is a first attempt to introduce homophily in group contests and sport medicine literature. The effect of heterogeneity and difference in abilities on high-stakes performance in tournament contexts has been extensively discussed across different social and scientific disciplines (sport medicine, biology, psychology, sociology, and economy). However, not so much attention has been on how homophily and common factors can affect team performance.

METHODS: Data was collected from rankings for male doubles tennis players provided by the Association of Tennis Professionals (ATP). The dataset includes professional male double tennis players

ranked between 2007 and 2019. To evaluate the role of homophily in determining performance, we examined the relationship between ranking points and three different categories of variables: physiological, geographical and style of play factors. We applied three different Multiple Linear Regression Models by comparing common and similar traits in male professional double tennis players.

RESULTS: Players who use opposite hands collected 47.19 points more in the ATP ranking than players using the same hand. Player living in two different cities has 69.51 points more in the ATP ranking than player living in the same city.

CONCLUSIONS: The study gathers more evidence on how common features and similar abilities can affect the probability of winning and therefore improve overall performance. Selecting the right doubles tennis partner is very personal, as each player is an individual entity with his own specific physiological characteristics.

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Kinbia software as an anthropometric monitoring and evaluation method for high performance athletes

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BACKGROUND: Sports performance is linked to the morphological study of the athlete. For a good anthropometric study it is necessary to know the authors' methodology and target study population based on the age, race, gender and level of physical activity the formulas were made for. Over time this concept has been transgressed. Nowadays compartmental fractionation analysis strategies and health indexes are being misused. The aim is to develop software that solves this problem.

METHODS: A bibliographic review of more than one hundred scientific articles was carried out. A customized software "KINBIA" was developed in PHP, with the most significant works.

RESULTS: Software development as a WebApp which is accessible anywhere in the world and device. It allows us to obtain fifteen strategic for the analysis of tetra-compartmental fractionation, with the least error in relation to weight in balance and based on age, gender, race and level of physical activity. Sports performance indexes include muscle-bone, fatty-muscle, heat loss, muscle-fat areas, proportionality, somatotype and others.

CONCLUSIONS: KINBIA is the only software capable of establishing a complete study of the athlete through only twenty-seven anthropometric variables. Its purpose is to improve sports performance based on the morphological characteristics of the athlete. It gives you a professional report.

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Biomarkers for monitoring recovery strategies in professional football players

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BACKGROUND: Saliva analysis is a non-invasive tool to evaluate performance-related biomarkers in football and to optimize post-match recovery. The cortisol is an indicator of stress or physical fatigue and the immunoglobulin A (IgA) is the first defence barrier of our immune system. The current study aims to determine whether top-level footballers face training and matches in the best conditions, based on the assessment of these variables.

METHODS: Cortisol and IgA salivary were taken in the morning in fasting conditions, and also a test about sleep quality. Data has been collected over a season on 1st, 3rd and 4th post-match days. We selected the subjects who played more than 70 minutes in the game. The weekly and daily training load control was monitored by GPS.

RESULTS: The players had different average values in relation to the team average and there is a significant variation of these values from one week to another, which is related to the distribution of training loads. An average individual profile has been created to evaluate player recovery strategies.

CONCLUSIONS: Low values of both parameters are related to poor sleep quality. The evolution of the values taken varies individually from one week to another, depending on the daily schedule of loads and the weekly distribution of these. Similar strategies for weekly load distribution do not change the values.

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Evolution of the phase angle from season to half season in professional soccer players

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BACKGROUND: Multifrequency electrical bioimpedance analysis (BIA) is a double indirect method used to determine the body composition. Phase angle (PA) is an indicator of changes in the quantity and quality of cell mass. The objective of the present study is to know the evolution of AP in professional football players, according to their playing position.

METHODS: A weekly BIA in fasting conditions was performed. The AP has been determined at a frequency of 50 kHz (AP50). Twenty-four (24) players have been evaluated, of which 12 are international players. The team has been divided by playing position. Mean and standard deviation were calculated for the variables.

RESULTS: All playing positions increased PA from

preseason to mid-season. Both at the end of the preseason and in the period coinciding with the matches of the national teams, there is a tendency to reduce the PA, which they later recover.

CONCLUSIONS: During the preseason there is an increase in the AP due to the concentration of training, which decreases just at the beginning of the championship, as the training program is modified. During the season there are different fluctuations in PA associated with modifications in the weekly training structure, as those caused by the calls to go with their national teams (November).

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A functional and biomechanical analysis of the long jump

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BACKGROUND: Long jump is one of most ancient sporting activities, originating from Ancient Greece and still comprises one of the most famous sports. There is no complete, academic functional and biomechanical analysis of the long jump in the current literature. In the current study, our aim was to analyze the long jump by a functional and biomechanical view and to propose a training intervention based on our analysis, that can help athletes achieve best results.

METHODS: The main phases of the sporting activity were analyzed, and all the muscle and joint activations that produce these movements were thoroughly described. Moreover, the joint kinematic values, the centre of mass movements and the mechanical energies were also described. On top of that, we analyzed the biomechanical variables of long jump and the related measurement techniques, as well as the training intervention designed to improve long jump performance (by highlighting how the intervention is in line with the biomechanical principles related to the long jump).

RESULTS AND CONCLUSIONS: The polymetric training program is especially effective because it focuses on enhancing the eccentric-concentric cycle of muscle activity which is a key biomechanical variable in long jump.

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The influence of contact time instructions on drop jump performance in prepubescent and adult females

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BACKGROUND: The more compliant musculotendinous system observed in children does not facilitate a quick transfer from the eccentric to the concentric phase during movement involving the stretch-shortening cycle. This might be a limiting factor for children to perform jumps with lower contact time. However, this issue and the underlying mechanisms have not been investigated in non-trained prepubescent and adult females.

METHODS: Fifteen (15) non-trained women and 13 prepubescent girls performed three squat jumps (SJ), three drop jumps (DJ) from dropping height equal to 100% of their maximum SJ with the instruction "jump as high as you can". The participants performed 10 additional DJs with the instruction "jump faster than the previous jump" from the same height. Jumping height, contact time and knee angle at the deepest point were recorded.

RESULTS: Both groups reduced progressively, during the 10 trials, their contact time and their knee angle at the deepest point following the instruction for a fast jump but with no change in jump height.

CONCLUSIONS: Both groups had the ability to reduce their contact time following the instruction for a fast jump, but this had no positive effect on jumping performance. Previous findings that trained athletes can improve performance under the same conditions indicate that a limiting factor for performance could be training and not age. This might have implications in performance and mechanisms inducing injuries.

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Performance evaluation and adaptability to acute hypoxia in a group of master athletes practicing sports at high altitude

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BACKGROUND: The main problem related to altitude is reduction of partial pressure of oxygen (hypoxia), proportionally to reduction of atmospheric pressure. Above 1500m VO₂max decreases linearly by about 10% for every 1000 m. The current study evaluates the performance and adaptability to acute hypoxia in master athletes practicing high altitude sports residing at low (9) or medium-high altitudes (5).

METHODS: Subjects underwent stress cycle ergometer tests with continuous recording of the eCG, O₂/CO₂ analysis to simulate the conditions of normoxia (O₂ 21%, submaximal protocol) and normobaric hypoxia (simulated altitude 3500 m, O₂ 13.5%, maximal protocol) with AltiTrainer200.

RESULTS: VO₂max in hypoxia (33.46 ml/kg/min) was statistically lower (87.6% +/- 22.4% with P=0.036) than the value calculated indirectly according to Astrand in normoxia. At maximum loads there is a better performance by males than females (VE_{max}: M=1.54 l/kg/min F=1.18 l/kg/min; VO₂max: M=35.02 ml/kg/min, F=30.66 ml/kg/min), and in athletes residing at high altitude compared to athletes resident at sea level (FR: 48.8 acts/min vs. 37.33 acts/min; VO₂max: 34.50 ml/kg/min vs. 32.89 ml/kg/min).

CONCLUSIONS: The data relating to adaptability show that the increase in ventilation is achieved by an increase in the depth of breath in athletes residing at sea level, while athletes residing at altitude respond with an increase in respiratory rate, even in submaximal loads. A better adaptability emerges in females, highlighted by a lower increase in respiratory equivalents for O₂, and a lower decrease in O₂ pulse (3% vs. 10.4%), although the latter was optimal in all athletes (average decrease 7.78%, P=0.0058).

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Moderate-intensity continuous exercise effectively promote the expression of UCP1 in epididymis white adipose tissue

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BACKGROUND: Uncoupling protein 1 (UCP1) can strengthen mitochondrial heat production in adipose tissue, which is important to treatment of metabolic diseases induced by obesity. Exercise can stimulate UCP1 expression, but the effect on different exercise models is indistinct. This study provides a reference for the difference between high-intensity intermittent exercise (HIIT) and moderate-intensity continuous exercise (MICT) in promoting UCP1.

METHODS: C57BL/6J (N.=50) were established obese model (Food=D12492). After 8-week HFD, obese mice (N.=23) were divided into HFD control (H, N.=7), HFD+MICT (HM, N.=8), HFD+HIIT (HH, N.=8). Exercise protocol, HM: 50%-60% VO₂max, 45min, 6times/week, 8 weeks. HH: 90%-100% VO₂max1min + 50%-60% VO₂max2min (one set). According to VHM*45miN.=VHH*THH, calculate the number of set. After an 8-week exercise intervention, eWAT was detached. The mRNA and protein expression of p38 MAPK, PGC-1 α , UCP1 were measured. Data form: Mean \pm SEM; Statistical analysis: one-way ANOVA.

RESULTS: (1) qt-PCR: HM and HH of p38 MAPK mRNA increased (1.19 \pm 0.14 vs. 0.72 \pm 0.08, P<0.01; 1.05 \pm 0.09 vs. 0.72 \pm 0.08, P<0.05); HM of UCP1 mRNA improved (0.54 \pm 0.05 vs. 0.39 \pm 0.04, P<0.05). (2) Western blot: HM and HH of p38 MAPK (1.37 \pm 0.06 vs. 1.00 \pm 0.04, P<0.01; 1.21 \pm 0.05 vs. 1.00 \pm 0.04, P<0.05), HM of UCP1 (1.27 \pm 0.04 vs. 1.00 \pm 0.11, P<0.05) both significantly increased.

CONCLUSIONS: 1) Exercise promotes the expres-

sion of UCP1 and its upstream molecules in eWAT. 2) The effect of MICT on the expression of UCP1 was better than that of HIIT.

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Pulmonary hemodynamic in obesity

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BACKGROUND: Higher prevalence of pulmonary hypertension exists in obesity subjects. Little is known about pulmonary hemodynamics during exercise in obesity population. The current study assesses the pulmonary circulation response to exercise in obese subjects.

METHODS: Seventeen (17) obesity subjects (25% men of mean age: 44±11 years, mean height: 1.7±0.1 m, mean weight: 111±17 kilogram and mean BMI: 38±4 kg/m²) were compared to 17 race-matched healthy control subjects (of mean age: 46±12 years, mean height: 1.7±0.1 m, mean weight: 64±11 kilogram and mean BMI: 22±2 kg/m²). All subjects underwent an incremental exercise stress echocardiography with measurements of the mean pulmonary artery pressure (mPAP), cardiac output (CO), cardiac index (CI) and tricuspid annular plane systolic excursion (TAPSE) at rest and at increasing exercise intensities. Total pulmonary vascular resistance index (PVRI) was calculated as mean PAP/CI and right ventricular-arterial coupling as TAPSE/systolic PAP (sPAP).

RESULTS: At rest, there was no difference in mPAP and PVRI between two groups, but TAPS/sPAP was lower in obesity group. At peak exercise, mPAP was increased in both groups, while PVRI and TAPS/sPAP were decreased. But obesity group had higher mPAP and PVRI, and lower TAPS/sPAP at maximum common exercise level.

CONCLUSIONS: Pulmonary hemodynamic seems preserved at rest in obese patients but with reduced right ventricular-arterial coupling, which was exacerbated at exercise with higher mPAP than in healthy controls. Obesity has a modest impact on pulmonary circulation and right ventricular adaptation at exercise.

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Transient osteoporosis of the hip in long-distance runners: rapid recovery after treatment with alendronate

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BACKGROUND: Transient osteoporosis of the hip (TOH) is a rare self-limiting disorder which leads to acute onset of hip pain and walking disability. The purpose of this study was to evaluate the clinical and radiological outcomes of alendronate application in the treatment of 4 cases of long-distance runners with TOH.

METHODS: Between 2015 and 2017, four Marathon runners with TOH were treated in our hospital. All of them were men with a mean age of 35 (27-44) years and received alendronate (75mg/week) per os (p.o.) and calcium (1000mg)-vitamin D (800 IU) supplements (once daily p.o.). The efficacy of treatment was evaluated using changes in clinical signs and symptoms, visual analogue scale of pain (VAS) and changes in bone marrow edema (BME) in magnetic resonance imaging (MRI). Patients were evaluated weekly until complete remission of TOH.

RESULTS: There was a dramatic clinical improvement in all cases with full recovery from pain and gait disturbance within an average of 2.6 (2-5) weeks. At the latest follow-up VAS score was significantly reduced compared to the pre-treatment period (P<0.05). The post-treatment MRI showed resolution of BME within an average of 11.5 (11-12) weeks and all the patients returned to their sport activities 3 months after initiation of the treatment. No adverse effects or complications were reported.

CONCLUSIONS: The use of alendronate in the treatment of TOH in long-distance runners provides early pain relief, complete BME resolution and their early return to high-level sport activities.

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The combination of local muscle endothermia induced by Human Tecar® with whole body cryotherapy improves daily perceptual muscle pain after repeated sprints

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BACKGROUND: Post-exercise recovery strategies help to eliminate fatigue. Our objective was to investigate the combined effects of local muscle endothermia and Whole Body Cryotherapy (WBC) on the perceptual muscle pain, a sign of fatigue induced by exercise.

METHODS: 10 familiarized and moderate trained subjects performed 4 sessions (one a week) of 2 sets of 6 cycling sprints (RSA), intercepted by 24-h. In randomized order, all subjects were exposed just after

the first RSA set, to 30-min of local muscle endothermia induced by Human Tecar® (HT), 3-min of WBC, WBC+HT and 30-min of placebo (PL). Muscle pain (VAS 1-10) was measured before and after all sets of RSA and after each post-exercise recovery condition.

RESULTS: No significant difference in muscle pain was found before all sessions. RSA induced a significant increase in muscle pain ($P<0.01$). Compared to PL, WBC+HT induced a significant lower muscle pain value 24-h after RSA (3 ± 2.4 vs. 1.6 ± 1.4 , $P<0.05$). Reduction of muscle pain between post-exercise and post-recovery was greater after WBC+HT than PL (-1.2 ± 1.2 vs. -0.5 ± 0.6 , $P<0.01$). Both WBC+HT and HT improved the muscle pain kinetic between the end of recovery and prior to the 24-h-exercise compared to PL (-0.9 ± 1.6 and -0.3 ± 0.8 vs. $+0.5\pm 0.8$, $P<0.05$).

CONCLUSIONS: WBC-HT combination is an effective post-exercise recovery method to improve acute and 24-h muscle pain responses.

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Effect of artistic sports on physical beauty improvement of college girls in China

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BACKGROUND: To explore the impact of artistic sports on physical beauty of college girls, such as shape, physical fitness as well as mind.

METHODS: 310 college girls of Tsinghua University and Qingdao University of Technology in Chia were randomly selected as the subjects. Participants' age, weight, height (mean (SD)) were 20.3 (0.6) yrs, 56.3 (6.5) kg, 1.63 (0.05) m. For 16 weeks of 90-minute artistic sports courses (Aerobics, Rhythmic Gymnastics, Yoga and Aquatic Fitness) weekly, six aspects (body shape, bodily functions, speed, strength, flexibility, endurance) and seven indicators (BMI, vital capacity, standing long jump, sit and reach, 50m sprint, sit-ups and 800-meter run) were tested before and after the course intervention.

RESULTS:

1) BMI (kg/m^2) decreased from 20.5 (2.6) to 19.9 (2.5), with significant changes ($P<0.05$), in which height increased by 0.01m and weight decreased by 1.0kg on average.

2) Standing Long jump (m) increased from 1.8 (0.2) to 1.9 (0.2) significantly ($P<0.05$).

3) Sit-and-reach (cm) increased from 15.8 (5.6) to 18.0 (5.5) significantly ($P<0.01$).

4) Sit-ups (times/min) increased from 35.0 (10.3) to 36.4 (10.1) significantly ($P<0.01$).

5) Lung capacity (ml) increased from 2830.2 (491.0) to 2931.1 (258.1) significantly ($P<0.05$).

6) 50-meter sprint (s) increased from 9.5 (0.6) to 9.6 (0.7), with no significant change ($P>0.05$).

7) 800-meter run (s) changed from 243.3 (21.3) to 246.1 (124.8), with no significant change ($P>0.05$).

CONCLUSIONS:

1) Artistic sports can perfect college girls' figure and improve their physical fitness and quality.

2) With high aesthetic value, artistic sports can stimulate college girls' interest and boost their self-confidence.

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The influence of the trunk tilt and lumbar lordosis angle on choice reaction time in sitting volleyball

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BACKGROUND: Sitting Volleyball (SV) athletes are required to respond quickly to the ball in the sitting position. For quick responses in the standing position, it is desirable to tilt the trunk forward (Howorth, 1946), and the reaction time decreases as the lumbar lordosis angle increases (Fukui et al, 2018). However, there is no research on quick movement in a sitting position. We aimed to clarify the influence of the trunk tilt and lumbar lordosis angle on CRT in the sitting position.

METHODS: Twenty (20) healthy men participated in this study. CRT was measured by Reaction MR. Subjects sat on the center mat 1.5 meters ahead of the lamp. The start positions were set at forward tilt posture (FTP) and backward tilt posture (BTP) with hip and knee joints flexed. They were instructed to move to left or right as soon as possible after light emission. CRT was defined as the time between light emission and hip contact with the left or right mats. The lumbar lordosis angle at the start positions was measured by Spinal Mouse.

RESULTS: CRT was 751.9 \pm 80.9 ms in FTP and 643.8 \pm 43.1 ms in BTP. It was significantly shortened in BTP ($P<0.05$). There was no significant correlation between the CRTs and lumbar lordosis angle.

CONCLUSIONS: It was suggested that moving quicker was possible from the BTP, perhaps because BTP was the posture from which athletes could exert muscular strength more efficiently, particularly the activity of the latissimus dorsi muscle.

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Somatotype's mesomorphic component is related with jump peak power in professional soccer players

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BACKGROUND: Jumping ability describes the level of lower limb muscle strength and constitutes a basic

factor for good performance in soccer. Our aim in this study was to examine the possible relationship between the mesomorphic component of somatotype and jumping ability on elite young soccer players.

METHODS: The study population consisted of 113 young elite male soccer players (mean age: 19 ± 2 years, fat: 7.2 ± 2.3 %, BMI: 22.1 ± 2.3 kg/m²). Players were divided into their field positions for analysis as goalkeepers (15 players), defenders (40 players), midfielders (22 players) and forwards (36 players). Somatotype components were assessed using the Carter Heat somatotyping method. All athletes were instructed to perform 3 trials of squat jumps (SJ) and counter movement jumps (CMJ) on a jump mat (Newtest Oy, Finland) and the maximal height was taken for analysis. Peak power was estimated using the equation proposed by Sayers et al (Peak power (W) = $60.7x$ (jump height cm) + $45.3x$ (body mass [kg])-2055).

RESULTS: Based on their dominant somatotype component, players were characterized as mesomorphs (80 players, 70.8%), ectomorphs (26 players, 23%), endomorphs (1 player, 0.9%) and central (6 players, 5.3%). Analysis revealed a significant positive correlation between the jump peak power (both in SJ and CMJ) and the mesomorphic component of somatotype (Pearson's $r < 0.01$). No significant correlation was found between field position and jumping ability.

CONCLUSIONS: Mesomorph soccer players showed a higher jumping ability, which is a basic factor for good performance in the specific sport.

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Zoledronic acid treatment in bone marrow edema syndrome

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BACKGROUND: Primary bone marrow edema syndrome (BMES) is characterized by the combination of joint pain and distinctive magnetic resonance imaging changes. The aim of this study was to review cases of patients diagnosed with BMES who had been treated with zoledronic acid and discharge with canes.

METHODS: We selected 35 (16 male and 19 female) patients with diagnosis of BMES and with a mean age of 51 years. Most commonly affected site was the knee 23 cases (65.7%), followed by the ankle 8 cases (22.9%) and the hip 4 cases (11.4%). Pain intensity was measured at baseline, 3 and 12 months after treatment with zoledronic acid. MRI changes in bone edema were assessed as grade 0: no change in edema, grade 1: decrease $< 50\%$, grade 2: decrease $> 50\%$, grade 3: disappearance of edema. Functionality was assessed based on whether the patient had returned to his daily activities. Finally, complete response was defined as disappearance of pain, or recovery of daily

life activities and $> 50\%$ decrease on bone edema from baseline on MRI.

RESULTS: 32 out of 35 patients had baseline moderate to severe pain, and 12 months after treatment pain disappeared in 28/35. In those patients with post treatment MRI in the first 3 months (19/35), bone edema had disappeared in 12 patients (34.2%) and the rest of the MRIs showed a reduction of edema greater than 50%. Finally, 28 of 35 patients (80%) had a complete response.

CONCLUSIONS: The present study shows that zoledronic acid may be a reasonable treatment in BMES, as 80% of the treated patients had a complete response but more prospective studies are needed.

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Plyometric training improves physical fitness and body composition of 10-13 year old boys

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BACKGROUND: Plyometric training is considered to be safe and recommended to improve physical fitness for youth. We analyzed the effects of a protocol of plyometric training on physical fitness and body composition of boys aged 10 to 13 years.

METHODS: The sample was randomly assigned to 2 groups: plyometric training group (T, N.=33) and control group (C, N.=24). The groups were similar at physical fitness and body composition. Physical fitness was measured by handgrip strength, flexibility (sit and reach), long jump, and running speed. Anthropometry and body composition were evaluated. Body fat percentage, fat mass (kg) and fat free mass (kg) were estimated using the formula from Slaughter 1988. The progressive plyometric training program consisted in three days per week sets of exercises, during eight weeks.

RESULTS: There was no difference between training group and control group in terms of anthropometry (body weight 34.63 ± 5.315 ; 34.96 ± 5.162 ; $P < 0.510$, body composition (fat mass free 30.02 ± 3.686 , 30.35 ± 3.760 , $P < 0.196$) and physical fitness (sit-ups 18.83 ± 4.650 , 18.79 ± 4.709 , $P < 0.328$) before intervention. After intervention, plyometric training T group showed higher values than C group in body weight 32.42 ± 5.613 , 33.27 ± 5.456 , $P < 0.021$; fat mass free 28.25 ± 4.671 , 29.27 ± 4.656 , $P < 0.002$ and sit-ups 17.85 ± 5.472 , 18.73 ± 5.669 $P < 0.001$.

CONCLUSIONS: The results of the current study demonstrated that eight-week plyometric training program improved some variables of anthropometry, body composition and physical fitness. Hence, coaches and physical education teachers may safely use appropriate supplementary plyometric exercise programs in order to develop physical fitness and body composition variables for youth.

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Relationship between candidate gene with pain (5-HTTLPR & COMT) and moods among ballet dancers

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BACKGROUND: The study investigates the relationship between polymorphism and their anxiety and mood in 5-HTT and COMT, when ballet dancers were placed under stress with injury.

METHODS: Participants were 18 elite-adolescent (Elite) and 16 pro-ballet (Pro) dancers. We administered the psychological questionnaires (STAI; BRUMS) to participants under 4 different stress conditions. The genotypes of 5-HTTLPR and COMT Val158Met were also examined.

RESULTS: The frequencies of genotypes s/s, s/l, l/l were 22, 12, 0, respectively, and those of Met/Met, Met/Val, Val/Val were 7, 23, 4. There was no difference in the distribution of 5-HTTLPR but difference in the one of COMT between Elite and Pro. The Trait-Anxiety of Elite showed higher score than that of Pro in 5-HTTLPR ($P < 0.03$), but no significant association was observed between 5-HTTLPR and STAI. BRUMS were main effects in 5-HTTLPR ($P < 0.05$) and in Pro/Elite groups ($P < 0.01$). Pro's moods were stable with pain and injury than Elite. In Elite, there was significant difference of 'Depression' at Usual and Cast Decision days in COMT (Val/Val vs. Met/Val; $ps < 0.04$), also in 5-HTTLPR and COMT (4 groups; $ps < 0.02$). It was significantly interaction in Pain feeling (4groups x 4times; $P < 0.01$).

CONCLUSIONS: The 5-HTTLPR and COMT has played a crucial role in the background of anxiety and mood with injury. Elite often felt stressed and pained until the period of cast decision or learning choreography; however, their pains of injury were much more near Competition.

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The effect of exercise on glucose metabolism and life quality in patients after pancreas resection

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BACKGROUND: While the frequency of pancreatic operations are increasing, pancreatic resection still remains a challenging operation for the surgeon with high morbidity. The control of glucose during and after the operation still remains an issue, while understanding the quality of life is still insufficient. The objective of this trial is to examine whether exercise has any impact on glucose metabolism and the quality of life.

METHODS: The study was an open label randomized trial clinical trial, registered at the International Standard Randomized Controlled Trial registry (ISRCTN) with number ID ISRCTN1087174. The patients were selected according to the Consolidated Standard of Reporting Trials criteria and the study was approved by the Bioethics and Deontology Committee, Medical School of Aristotle University, Thessaloniki. The common significance level of 0.05 was used in all analyses, while SPSS 22.0 (IBM Corp. Released, 2013) and R (R Core Team, 2018) were used for the statistical analyses.

RESULTS: A total number of 56 patients were assessed for eligibility. Once the allocation and the follow-up were completed, 21 patients in the exercise group and 22 in the control group were analysed. There was no statistical difference between the two groups regarding the morbidity and disease characteristics; however, the quality of life and the control of glucose were superior in the exercise group.

CONCLUSIONS: Exercise has a positive impact on glycaemic control and quality of life in patients after resection of the pancreas.

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Eight answers about Sports Medicine in ancient Greece

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BACKGROUND: Who was the first person in the history of sports medicine to actually combine sports with medicine? Which were the first registered sport injuries? Was exercise prescribed as a medication in Ancient Greece? Was doping known in ancient athletic competitions? Were there any known pain remedies for athletes? How were common sport injuries treated in athletes of this period? Did athletes use protective gear? Was heat-related illness known as a clinical entity? The aim of this study is to answer the above frequently asked questions regarding sports medicine in ancient Greece.

METHODS: Search in PubMed, MEDLINE, Sportdiscus, information analysis and summarizing.

RESULTS: Herodicus is considered the father of sports medicine as he first recognized the imbalance between nutrition and physical activity as a primary cause for many diseases. Along with Hippocrates, they were the first to prescribe discrete amounts of exercise as treatment. Homeric epics contain the first recorded sport injuries, which were mainly maxillofacial injuries, occurred in boxing. In this particular sport and in Pancration, protective gear such as ear guards was commonly used. In many injuries, blood-letting and ointment-soaked wraps were used to reduce edema and alleviate pain. Ancient doping included eating honey to increase glucose levels but also animal testicles to increase testosterone levels. Heat stroke was known by physicians and interestingly this may have been the reason of nude performance in ancient races.

CONCLUSIONS: History repeats itself, that's why a look to the past is always educational.

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Wrist denervation in combination with wrist arthroscopy is the ideal management of the post-traumatic wrist arthritis in athletes

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BACKGROUND: Post traumatic wrist arthritis is the third common form of wrist arthritis and may develop in months to years following a severe wrist injury. Wrist arthritis is associated with severe pain compromising patients' daily activities and performance at work. Wrist denervation has been used as a method of pain relief for patients with wrist arthritis; a method without the complication rate of extensive surgical procedures that aim to correct the underlying pathology. Aim of the study was to assess clinical outcomes in patients who underwent wrist denervation for osteoarthritis related pain relief.

METHODS: Three (3) martial arts athletes and a manual worker who experienced severe wrist pain due to wrist osteoarthritis following injury were included in the study. The clinical outcomes were assessed by comparing the DASH (Disabilities Arm Shoulder and Hand) scores before and after wrist denervation. Release of posterior and anterior interosseous nerves along with the dorsal branches of the ulnar nerve was performed through an incision on the distal forearm, 4 cm proximal to the distal radioulnar joint. During wrist arthroscopy a bone bridge was identified between the styloid process of the radius and the scaphoid bone in two patients, and therefore removal of the osteophytes was performed.

RESULTS: All patients were male with a mean age

48.6 (range: 43-55) years. The mean DASH score improved from 54.4 (range: 54.1-55) pre-operatively to 9.6 (range: 9.1-10.8) within 2 years since wrist denervation, indicating excellent clinical outcomes. All athletes returned to their sport activities within 5 months post-operatively.

CONCLUSIONS: Wrist denervation in combination with wrist arthroscopy has been considered an efficient method in the management of post-traumatic osteoarthritis related wrist pain, allowing patients to return to their daily and sport activities.

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The suprascapular nerve arthroscopic anterior and endoscopic posterior release in elite volleyball players

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BACKGROUND: Volleyball predisposes athletes in suprascapular nerve (SSN) entrapment and shoulder injuries and vice versa, due to extreme shoulder range of movement (ROM) during hitting. SSN entrapment occurs with a frequency 12-30%, but it is often misdiagnosed. Delayed diagnosis results in poor therapeutic outcomes, while athletes experience persistent shoulder pain and dysfunction. Aim of the study was to underline the importance of early diagnosis and surgical intervention of SSN entrapment in volleyball players with simultaneous shoulder overuse syndrome and injuries, where arthroscopic release plays an important role in appropriate treatment and recovery.

METHODS: Professional and elite volleyball players with intra-articular pathology (labral and rotator cuff injuries) and concomitant entrapment of the SSN were included in our study. All patients were treated arthroscopically from January 2005 to November 2015. Diagnosis was made based on clinical examination, X-rays, nerve conduction studies, electromyography (EMG) studies and magnetic resonance imaging (MRI) arthrography. Clinical outcomes were assessed using the pain management VAS score and evaluation of ROM.

RESULTS: Forty volleyball players (8 females, 32 males) were included in the study, with mean age 26 (range: 16-34) years. Conspicuous atrophy of the supraspinatus and/or infraspinatus was noticed. All patients underwent an arthroscopic procedure for treating their main injury and during the procedure SSN release was performed. Definite diagnosis was made intra-operatively. Partial thickness tear and posterior superior labral detachment were identified in 35 patients and anterior dislocation and massive rotator

cuff tear were diagnosed in 5 patients. Anterior SSN decompression was performed in 5 patients, posterior decompression in 23 and mixed SSN decompression in 12 patients. Postoperatively all patients experienced complete pain relief, particularly at the posterior shoulder. Muscle atrophy was significantly improved at 14 months post-operatively. All athletes gradually regained full ROM. 35 patients returned to pre-injury level and were very satisfied, 3 were satisfied and 2 were partially satisfied.

CONCLUSIONS: Arthroscopy to address intra-articular pathology along with simultaneous arthroscopic SSN release in the spinoglenoid and/or suprascapular notch can effectively and safely prevent irreversible muscle wasting which occurs in advanced SSN entrapment in volleyball players and has been associated with patients' high levels of satisfaction.

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The application of ultrasound guided knee arthroscopy for calcified patellar tendinopathy in elite weight lifters

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BACKGROUND: Patellar tendinopathy is commonly observed in Weight Lifters due to overuse injury from deep squatting or knee protraction in snatch and clean and jerk exercises. The repetitive movements predispose to initial tendinitis and subsequently calcification of the patellar tendon in various positions and particularly at its insertion, and are more frequently observed in patients with a history of Osgood-Schlatter disease. Aim of the study was to define the clinical outcomes following the concomitant use of ultrasound scan with knee arthroscopy in the management of calcified patellar tendinopathy.

METHODS: Elite weightlifters with calcified patellar tendinopathy resistant in conservative treatment were included in the study. Clinical examination and Magnetic Resonance Imaging (MRI) were used for diagnosis. All patients underwent arthroscopy by a single surgeon. Arthroscopy was performed under ultrasound guidance. Calcified lesions within the tendon were identified with the use of ultrasound scan intra-operatively and subsequently the lesions were removed arthroscopically. The clinical outcome was assessed by recording and comparing the IKDC score pre- and post-operatively and at a minimum 1-year follow-up post-operatively.

RESULTS: Twelve weightlifters (11 males, 1 female) with mean patient age 24.2 (range: 18-31) years were

included in the study. Three patients had a known history of Osgood-Schlatter disease. The mean IKDC score improved from 26.5% (range: 22.9-29.8%) pre-operatively to 96.8% (range: 85.4-98.9%) postoperatively, indicating excellent clinical outcomes. All patients returned back to full activity within 3 months. One patient, with history of Osgood-Schlatter disease, was required to have a revision operation in a 3-month period.

CONCLUSIONS: Ultra-sound guided knee arthroscopy is a safe and effective method for the management of calcified patellar tendinopathy. Excellent clinical outcomes and satisfying return to sport rate were observed in these athletes at a mean 4-year follow-up time.

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Viridans streptococci are unusual causes of septic arthritis: a unilateral case of septic arthritis of the knee of a basketball player due to *Streptococcus anginosus*

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BACKGROUND: A 28 year-old female basketball player was admitted to the outpatient department of our Orthopaedic Clinic with severe pain in her left knee. Examination revealed increased temperature, redness of the skin overlying the left knee, pain and tenderness. Painful limitation in active and passive movements was observed.

METHODS: The joint was aspirated. White cell count showed 89600/mm³ with 90% PMNs. Gram stain revealed Gram positive cocci and fluid culture yielded *Streptococcus anginosus*. Laboratory investigation showed elevated white blood cell count, erythrocyte sedimentation rate at 120 mm, and C-reactive protein level at 25 mg/dL. Susceptibility testing results showed that the isolate was susceptible to penicillin, cefotaxime, ceftriaxone, teicoplanin, vancomycin, linezolid and daptomycin.

RESULTS: The infection was treated with arthroscopic lavages and debridement and intravenous antibiotic administration of teicoplanin, 400mg twice daily for 3 weeks, followed by oral linezolid, 600mg twice daily for another 3 weeks. The patient was followed up for 3 months and had a full recovery.

CONCLUSIONS: *Streptococcus anginosus* is part of the normal flora of the body, and although it can be a potential pathogen causing mainly abscesses, is an extremely rare cause of septic arthritis. In our case the patient had no underlying condition or predisposing factor for streptococcal arthritis. Prompt diagnosis and management is imperative for complete treatment without sequelae.

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Do we think enough about neuromuscular diseases in athletes with respiratory symptoms?

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BACKGROUND: Neuromuscular diseases (NMD) are a heterogeneous sub-group of neurological diseases where the nerves that control movement are affected. This disease influences the respiratory system with reduced respiratory muscle strength and malfunction of the neurons that control breathing. Accompanying symptoms are fatigue, shortness of breath, dyspnea, and cough.

METHODS: A case study of a 28-year old male professional water polo player with a history of shortness of breath and cough for one year. The symptoms were initially associated with a changed training environment. Afterward, he was examined with suspicion of asthma, but without enough elements.

RESULTS: Physical examination was without pathological changes. Spirometry showed normal ventilation, but with a discretely plated inspiratory part of the flow-volume curve and lower peak expiratory flow (PEF) for his age and the sport he plays. Also, we did a respiratory muscle strength test that shows reduced expiratory (PEmax 62.7%) and inspiratory muscle (PImax 50.8%) strength. We repeated the testing in three months and the result was the same. Genetic and neurological tests are underway.

CONCLUSIONS: How often do we think about NMD? We should not only think of asthma and respiratory disorders in general in our treatment of athletes with chronic respiratory symptoms. It is necessary to carefully look at the spirometry flow-volume curve and plan the further implementation of lung function tests that can show disorders caused by NMD.

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Theory of change workshop: stakeholder engagement in the evaluation of policy implementation

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BACKGROUND: Policies are actions developed and implemented to directly or indirectly achieve specific goals within a society, e.g. behavioural lifestyle change for better health. Researchers and policy makers often lack tools for implementation evaluation of health policies. Policy implementation is where decisions are made and transferred into practice. As stakeholders

collaborate in decision-making and resource allocation and have complex relationships, stakeholder-engaged research is crucial. A "Theory of Change" (ToC) workshop, regarding a successful implementation of "Active City" and "Sustainable Hospitals" will be introduced and conducted as a stakeholder-centred approach (<https://www.healthydietforhealthylife.eu/index.php/news-archive/612-vlog-about-stakeholders-engagement-in-pen>).

METHODS: The ToC approach can be used within an organisation e.g. in hospitals with clinical staff, members from different units to develop a strategy for the implementation of an innovation. On large-scale, it can guide evaluations to bring together stakeholders from different professions and policy levels (e.g. social-cultural, socio-political, political) of a community (e.g. city, county, state). Stakeholders pursuing the same goal can discuss together in a supportive environment.

RESULTS: The collected expert knowledge will be systematically and structurally described in a logic model, a so-called ToC-map. Key factors of the policy implementation process as well as barriers and facilitators will be examined together with stakeholders.

CONCLUSIONS: Participants receive guidance on a participatory evaluation method and basic knowledge on how to conduct a Theory of Change. Following the workshops, an iterative process can be established to monitor and guide the implementation of policies in the chosen area of interest over a long-term period.

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COVID positive testing in Minnesota High School fall and winter sports

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BACKGROUND: To assess the effectiveness of prevention strategies used to allow sports participation.

METHODS: The monthly COVID-19 case population data was used to calculate the number of COVID-19 positive tests per 100,000 high school students for the fall and winter seasons. Self-selected schools voluntarily reported the number of student athletes with a positive test and the number of athletes every 2 weeks for each sport during the fall and winter sports seasons. The COVID-19 positive test rates per 100,000 were calculated and compared by sport for each season.

RESULTS: The community positive testing rate per 100,000 population in the 14 to 17-year-old age groups was 1,298 in the fall and 2,396 in the winter. The number of COVID-19 test positive athletes was 1,500 per 100,000 athlete-seasons during the fall and 2,800 per 100,000 athlete-seasons during the winter, ($\chi^2 = 1.98$, $df=1$, $P=.350$). The number of test positive cases per 100,000 athlete seasons for each sport ranged from 197 (girls alpine skiing) to 4151 (wrestling). The incidence

rates comparing indoor to outdoor sports ($P=.001$) and close contact to physically spaced sports ($P=.023$) were significantly different, and indoor masked to not masked sports ($P=ns$) were not different.

CONCLUSIONS: COVID-19 prevention strategies, including ventilation, physical distancing, and masking are effective for outdoor, individual sports. These athletes have less risk of a COVID-19 positive test compared to age-matched individuals in the community and indoor sports participants in close proximity wearing masks during competition.

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Modulation of neural and kinematic patterns of walking across gradients and directions

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BACKGROUND: The normal variation observed in the human repeated movement patterns (*i.e.*, walking), mostly described as Human Movement Variability (HMV), and has been identified within motor mechanisms and individuals. Thus, HMV can be varied between humans and locomotor conditions. This study aimed to analyze neural and kinematic components to determine HMV across walking conditions and between individuals, as well as whether HMV been influenced by walking directions and gradients.

METHODS: Preliminary findings: Fifteen (15) healthy subjects (11males and 4females; 26years, 1.73m, 68kg) assessed during forward and backward walking at 4 treadmill gradients (-5%, 0%, 5%, 10%). Kinematics measured, using a three dimensional (3D) motion capture/analysis system (Qualisys, Opus 300+). Bilateral 3-joints lower extremities and pelvis model created (3 degrees-of-freedom/ joint). Seven (7)-muscles electromyographical (EMG) excitation recorded (Delsys, Trigno). Principal component analysis used to determine the relative (explained) and absolute variability (latent) of kinematic data. Programming language (R, 3.5.0) utilized for non-negative matrix factorization (NNMF) and bootstrapping analysis. NNMF used for EMG and bootstrapping performed ($N=100$) on individuals' legs kinematics bilaterally, using highest density interval (HDI) and median (M) of P values (89% credible interval). Direction and gradient effect in total variability within walking movement patterns (WMPs) accounted for $M=0$ (HDI=0-0) and $M=0.033$ (HDI=0-0.12) respectively. Complexity of motor control strategies (MCSs) was varied across gradients. Individual differences accounted for 68-80% of data variability.

CONCLUSIONS: Such approach and analyses will assist to identify a wide range of WMPs and associated MCSs of athletes and pathological population, which would be exceptionally welcome in the bioengineering and medicine field.

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Accuracy of predictive equations for resting metabolic rate in male and female athletes

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BACKGROUND: The aim of the present study is to evaluate the accuracy of 6 predictive equations for resting metabolic rate (RMR) in male and female athletes.

METHODS: Fifty-one (51) male and 39 female athletes were used for the purpose of this study. The body composition was measured by bioelectrical impedance analysator (In Body 720, Great Britain) while RMR measurement by indirect calorimetry (Fit Mate, COSMED, Italy). All participants were asked for detailed medical history and were asked to fill questionnaires for their physical activity and nutritional regimen.

RESULTS: All male athletes have higher values for weight, height, body mass index (BMI) and fat free mass (FFM) ($P<0.05$) and significantly lower values for fat mass ($P<0.05$) compared to female athletes. All predictive equations for both genders underestimate the real value for RMR while the Cunningham equation has the smallest mean difference. Athletes tend to have greater amounts of FFM compared to the general population.

CONCLUSIONS: The Cunningham equation accurately predicts RMR in athletic populations as the model is primarily based on FFM. All currently used RMR prediction equations are utilized to predict RMR in athletes; the resultant values will likely be lower than measured RMR.

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The influence of different types of sports disciplines on respiratory function

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BACKGROUND: The aim of the current study was to point out the impact of different sports disciplines on lung function by determining body and functional respiratory parameters.

METHODS: A number of 59 male subjects of age 20 - 27 year old were investigated. This study included subjects who trained regularly and competed in appropriate sports for at least 4 years. The trainings were performed 5-7 times a week, at least 10 hours / week.

RESULTS: Anthropometric parameters indicated better body composition in all parameters compared to the control group, except in the group of tennis players where there was no statistically significant difference in body height in all examined groups, which is consistent with other similar papers. The group of

athletes with endurance (swimming) showed the best results in all examined spirometric parameters. That is probably due to high pulmonary elasticity, intermittent hypoxia between respiratory cycles, which is a stimulus for increased respiratory excursions, as well as to achieve increased muscle pressure in conditions of immersion in water.

CONCLUSIONS: Waterpolo and swimming are sports of choice from an early age to boost lung function.

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Cardiopulmonary exercise test to estimate changes in functional efficiency after cardiac rehabilitation in females

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BACKGROUND: The fundamental element of the locomotor system is the muscle which is a transformer of chemical energy into mechanical energy (work) with a variable efficiency. Functional efficiency is the

result of the relationship between two components: the work done by the subject and the corresponding energy expenditure expressed by the oxygen consumption necessary to perform that work.

The aim of the current study was to compare the estimated functional efficiency with the cardiopulmonary exercise test (CPET) before and after cardiac rehabilitation (CR).

METHODS: Five hundred and seventy (570) female patients of mean age 68.5 ± 9.8 years (range 54-82 years), enrolled in a three-month (12 weeks) CR program with training sessions tri weekly lasting 60 minutes. All patients performed an initial CPET at enrolment and a final CPET at the RC end. The sustained workload and the corresponding oxygen consumption were measured and collected data were statistically analyzed.

RESULTS: The mean oxygen consumption (VO₂) sustained before and after the rehabilitation cycle were 10.78 ± 4.08 and 10.85 ± 3.28 , respectively. The mean work load before and after the rehabilitation cycle were 52.58 ± 16.31 and 60.08 ± 13.30 , respectively. Patients after CR underwent a significantly greater workload with a less significant change in oxygen consumption.

CONCLUSIONS: In cardiac patients, functional efficiency improves significantly after CR, reflecting an improvement in the oxygen transport chain and better oxygen use by the muscles.

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