

**Ss. Cyril and Methodius University in Skopje
Faculty of Physical Education, Sport and Health**



2ND INTERNATIONAL SCIENTIFIC CONFERENCE
RESEARCH IN PHYSICAL EDUCATION, SPORT AND HEALTH

CONFERENCE PROCEEDINGS

Skopje, 03-05, June 2016

2ND INTERNATIONAL SCIENTIFIC CONFERENCE

Research in Physical Education, Sport and Health

Conference Proceedings

Published by

Ss. Cyril and Methodius University in Skopje, Faculty of Physical Education, Sport and Health

Editor

Prof. d-r Vujica Živković (Faculty of Physical Education, Sport and Health, Skopje)

Technical editing – layout

Ass. Prof. d-r Seryozha Gontarev

Printed by: Bomat Graphics

Circulation: 150 copies

CIP - Каталогизација во публикација
Национална и универзитетска библиотека "Св. Климент Охридски", Скопје

796(062)

2-nd International scientific conference Research in physical
education, sport, and health (2 ; 2016 ; Skopje)

Conference proceedings / 2-nd International scientific conference
Research in physical education, sport and health, Skopje, 03-05 June
2016 ; [editor Vujica Živković]. - Skopje : Faculty of Physical
education, sport and health, 2016. - 565 стр. : табели ; 30 см

Библиографија кон трудовите

ISBN 978-9989-2850-6-6

а) Спорт - Собири

COBISS.MK-ID 101436682

2ND INTERNATIONAL SCIENTIFIC CONFERENCE

Research in Physical Education, Sport and Health

Conference Proceedings

Scientific Board

President

Prof.d-r Lence A. Velickovska (Faculty of Physical Education, Sport and Health, Skopje)

Vice - President:

Prof.d-r Milan Naumovski (Faculty of Physical Education, Sport and Health, Skopje)

Members

Domestic Members of the Scientific Board (alphabetically)

Prof. D-r Acevski Jane (Faculty of Forestry, Skopje)

Prof. D-r Ajdinski Goran (Faculty of Philosophy, Skopje)

Prof. D-r Alabakovska Sonja (Faculty of Medicine, Skopje)

Prof. D-r Aleksovska Sonja (Sports Medicine, Skopje)

Prof. D-r Ameti Vullnet (Tetova State University, Tetovo)

Prof. D-r Anastasovski Ivan (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Angelova Biljana (Institute of Economics, Skopje)

Prof. D-r Angjuseva Tanja (Special Hospital "Filip Vtori" – Skopje)

Prof. D-r Antov Slobodan (University Clinic of Cardiology "Ss. Cyril and Methodius", Skopje)

Prof. D-r Barabeev Kiril (University "Goce Delcev", Stip)

Prof. D-r Barakoska Aneta (Faculty of Philosophy, Skopje)

Prof. D-r Benedeti Alberto (Faculty of Dentistry, Skopje)

Prof. D-r Borota – Popovska Mirjana (Institute of Sociological, Political and Juridical Research, Skopje)

Prof. D-r Bucevska Vesna (Faculty of Economics, Skopje)

Prof. D-r Buzarovska Gordana (Faculty of Law, Skopje)

Prof. D-r Corbev Ivan (Faculty of Computer Science and Engineering, Skopje)

Prof. D-r Damovska Lena (Faculty of Philosophy, Skopje)

Prof. D-r Dimitrievski Dragi (Faculty of Agricultural Sciences and Food, Skopje)

Prof. D-r Dragovic Anica (Faculty of Philosophy, Skopje)

Prof. D-r Drakuleski Ljubomir (Faculty of Philosophy, Skopje)

Prof. D-r Duev Ratko (Faculty of Philosophy, Skopje)

Prof. D-r Dzambazovska – Stardelova Mitricka (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Fritzhand Ana (Faculty of Philosophy, Skopje)

Prof. D-r Garevski Mihail (Institute of Earthquake Engineering and Engineering Seismology, Skopje)

Prof. D-r Georgiev Antonio (PHO Cardiology-Prima, MIT University, Skopje)

Prof. D-r Georgieva Daniela (University Clinic for Orthopaedic Surgery, Medical Faculty, Skopje)

Prof. D-r Georgievski Srecko (Faculty of Agricultural Sciences and Food, Skopje)

Prof. D-r Georgiev Georgi (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Gjorgovski Icko (Faculty of Natural Sciences and Mathematics, Institute of Biology, Skopje)

Prof. D-r Gruovski Gjorgji (Faculty of Design and Technologies of Furniture and Interior, Skopje)

Prof. D-r Guguvcevska Ljuben (Faculty of Dentistry, Skopje)

Prof. D-r Gusev Marjan (Faculty of Computer Science and Engineering, Skopje)

Prof. D-r Hajrulai Musliu Zehra (Faculty of Veterinary Medicine, Skopje)

Prof. D-r Handziski Zoran (Faculty of Medicine, Skopje)

Prof. D-r Hristovski Robert (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Iliev Borislav (Remedika – General Hospital, Skopje)

Prof. D-r Jacova Zora (Faculty of Philosophy, Skopje)

Prof. D-r Jankulovski Nikola (Faculty of Medicine, Skopje)

Prof. m.a. Josifova – Nedelkova Gordana (Faculty of Music, Skopje)

Prof. D-r Josimovski Saso (Faculty of Economics, Skopje)

Prof. D-r Kaftandjiev Igor (Faculty of Medicine, Skopje)

Prof. D-r Kedev Sasko (University Clinic of Cardiology "Ss. Cyril and Methodius", Skopje)

Prof. D-r Koteva – Mojsavska Tatijana (Faculty of Pedagogy, Skopje)

Prof. D-r Kulevanova Svetlana (Faculty of Pharmacy, Skopje)

Prof. D-r Magdeski Jon (Faculty of Technology and Metallurgy, Skopje)

Prof. D-r Mancevska Sanja (Faculty of Medicine, Skopje)

Prof. m.a. Manevski Blagoja (Faculty of Fine Arts, Skopje)

Prof. D-r Markovski Nebojsa (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Meskovska Natasa (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Miladinova Daniela (Faculty of Medicine, Skopje)

Prof. D-r Milenkovski Josko (Faculty of Physical Education, Sport and Health, Skopje)

Prof. D-r Mitevski Orce (Faculty of Physical Education, Sport and Health, Skopje)

Academician D-r Mitrev Zan (Special Hospital "Filip Vtori" – Skopje)
 Prof. D-r Mladenov Mitko (Faculty of Natural Sciences and Mathematics, Institute of Biology, Skopje)
 Prof. D-r Nikolic Slobodan (Faculty of Medicine, Skopje)
 Prof. D-r Panov Nikola (Faculty of Natural Sciences and Mathematics, Institute of Geography, Skopje)
 Prof. D-r Pendovski Lazo (Faculty of Veterinary Medicine, Skopje)
 Prof. D-r Petkov Vladimir (Faculty of Veterinary Medicine, Skopje)
 Prof. D-r Pluncevic – Gligorovska Jasmina (Faculty of Medicine, Skopje)
 Prof. D-r Popeska Biljana (University "Goce Delcev", Stip)
 Prof. D-r Popova – Ramova Elizabeta (University "St. Clement Ohridski", Bitola)
 Prof. D-r Popovski Saso (Macedonian Olympic Committee)
 Prof. D-r Popovski Zoran (Faculty of Agricultural Sciences and Food, Skopje)
 Prof. D-r Postolov Kire (Faculty of Economics, Skopje)
 Prof. D-r Pulevska Lidija (Faculty of Economics, Skopje)
 Prof. D-r Radic Zoran (Faculty of Physical Education, Sport and Health, Skopje)
 Prof. D-r Ristevska –Jovanovska Snezana (Faculty of Economics, Skopje)
 Prof. D-r Ristovska Milica (Faculty of Natural Sciences and Mathematics, Institute of Biology, Skopje)
 Prof. m.a. Sekulovski Lazar (Faculty of Dramatic Arts, Skopje)
 Prof. D-r Stankovski Mile (Faculty of Electrical Engineering and Information Technologies, Skopje)
 Prof. D-r Stojceva – Taneva Olivera (Faculty of Medicine, Skopje)
 Prof. D-r Stojkovski Velimir (Rector of UKIM, Skopje)
 Prof. D-r Suklev Bobek (Faculty of Economics, Skopje)
 Prof. D-r Sukova – Stojmanovska Daniela (Faculty of Physical Education, Sport and Health, Skopje)
 Prof. D-r Temelkovska Nade (Sports Medicine, Skopje)
 Prof. D-r Timovski Vlado (Faculty of Pedagogy, Skopje)
 Prof. D-r Todorovska Lidija (Faculty of Medicine, Skopje)
 Prof. D-r Trpeski Predrag (Faculty of Economics, Skopje)
 Prof. D-r Trposki Zoran (Faculty of Design and Technologies of Furniture and Interior, Skopje)
 Prof. D-r Tufekcievski Aleksandar (Faculty of Physical Education, Sport and Health, Skopje)
 Prof. D-r Tupurkovski Vasil (Macedonian Olympic Committee)
 Prof. D-r Veleva Slavica (Faculty of Philology, Skopje)
 Prof. D-r Ziba Ajri (Tetova State University, Tetovo)

Foreign Members of the Scientific Board (alphabetically)

Prof. D-r Araujo Duarte (Portugal)
 Prof. D-r Balague Natalia (Spain)
 Prof. D-r Bjelica Dusko (Republic of Montenegro)
 Prof. D-r Bratic Milovan (Republic of Serbia)
 Prof. D-r Coh Milan (Republic of Slovenia)
 Prof. D-r Cular Drazen (Republic of Croatia)
 Prof. D-r Galea Ioan (Romania)
 Prof. D-r Geshev Pencho (Republic of Bulgaria)
 Prof. D-r Grgantov Zoran (Republic of Croatia)
 Prof. D-r Gyori Ferenc (Hungary)
 Prof. D-r Idrizovic Kemal (Republic of Montenegro)
 Prof. D-r Ivanovski Aleksandar (Republic of Serbia)
 Prof. D-r Jancheva Tatjana (Republic of Bulgaria)
 Prof. D-r Jukic Igor (Republic of Croatia)
 Prof. D-r Knjaz Damir (Republic of Croatia)
 Prof. D-r Kocic Miodrag (Republic of Serbia)
 Prof. D-r Koprivica Vladimir (Republic of Serbia)
 Prof. D-r Kosev Angelov Svetoslav (Republic of Bulgaria)
 Prof. D-r Kuloglu Murat (Republic of Turkey)
 Prof. D-r Lazarevic Ljubisa (Republic of Serbia)
 Prof. D-r Lesnik Blaz (Republic of Slovenia)
 Prof. D-r Madic Dejan (Republic of Serbia)
 Prof. D-r Mahmutovic Ifet (Republic of BiH)
 Prof. D-r Males Josip (Republic of Croatia)
 Prof. D-r Memmert Daniel (Germany)
 Prof. D-r Milanovic Luka (Republic of Croatia)
 Prof. D-r Milenkovic Sasa (Republic of Serbia)
 Prof. D-r Miletic Djurdjica (Republic of Croatia)
 Prof. D-r Obradovic Borislav (Republic of Serbia)
 Prof. D-r Obradovic Jelena (Republic of Serbia)
 Prof. D-r Pantelic Sasa (Republic of Serbia)

Prof. D-r Pausic Jelena (Republic of Croatia)
Prof. D-r Petrov Ljudmil (Republic of Bulgaria)
Prof. D-r Pisot Rado (Republic of Slovenia)
Prof. D-r Popovic Stevo (Republic of Montenegro)
Prof. D-r Radisavljevic Srecko (Republic of Serbia)
Prof. D-r Radjo Izet (Republic of BIH)
Prof. D-r Selimovic Nihad (Republic of BIH)
Prof. D-r Smajlovic Nusret (Republic of BIH)
Prof. D-r Sporis Goran (Republic of Croatia)
Prof. D-r Stankovic Veroljub (Republic of Serbia)
Prof. D-r Talovic Munir (Republic of BIH)
Prof. D-r Tusak Matej (Republic of Slovenia)
Prof. D-r Uslu Serdar (Republic of Turkey)
Prof. D-r Zivkovic Dobrica (Republic of Serbia)
Prof. D-r Zvan Milan (Republic of Slovenia)

Organizational Board

President

Prof. d-r Vujica Živković (Faculty of Physical Education, Sport and Health, Skopje)

Members

Ass. Prof. D-r Aceski Aleksandar (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Daskalovski Borce (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Gontarev Seryozha – Executive Secretary (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Kalac Ruzdija (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Misovski Andrijana (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Nedelkovski Vlatko (Faculty of Physical Education, Sport and Health, Skopje)
Prof. D-r Nikovski Goran (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Simeonov Aleksandar (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Spasovska Katerina (Faculty of Physical Education, Sport and Health, Skopje)
Ass. Prof. D-r Vuksanovic Vladimir (Faculty of Physical Education, Sport and Health, Skopje)

Acknowledgments

All articles published in the Proceedings of the Thematic Conference are reviewed by “double blind review” methods.

Ss. Cyril and Methodius University in Skopje
Faculty of Physical Education, Sport and Health



2ND INTERNATIONAL SCIENTIFIC CONFERENCE

RESEARCH IN PHYSICAL EDUCATION, SPORT AND HEALTH

CONFERENCE PROCEEDINGS



Skopje, 03-05, June 2016

CONTENTS

PREFACE	11
SELECTIVE ASSESSMENT OF MUSCLE MECHANICAL PROPERTIES THROUGH LOADED FUNCTIONAL MOVEMENTS Slobodan Jaric	17
BIODYNAMICAL FACTORS OF RUNNING SPEED DEVELOPMENT Milan Čoh, Milan Žvan, Lenče A. Veličkovska, Vujica Živković, Seryozha Gontarev	23
RESTRICTED BLOOD FLOW RESISTANCE TRAINING: THE OPTIMAL TRAINING PROTOCOL TO INCREASE MUSCLE MASS AND STRENGTH Armin Paravlić, Mitja Geržević, Rado Pišot	29
PERIODICAL PRE-PARTICIPATION PHYSICAL EXAMINATION OF ATHLETES IN R. OF MACEDONIA COMPARED WITH OTHER EUROPEAN COUNTRIES Lidija Todorovska, Beti Dejanova, Vesela M. Ivanovska, Slobodan Nikolic, Jasmina P. Gligorovska, Ivanka Karadjozova, Elizabeta S. Smilevska	37
THE CORRELATION BETWEEN LEISURE TIME AND THE FREQUENCY OF DOING PHYSICAL ACTIVITY AND MEMBERSHIP IN SPORTS CLUBS Nevenka Maras, Mirjana Marinčević, Petra Mandić Jelaska	43
ANALYSIS OF FINANCIAL CRITERION OF FOOTBALL CLUBS IN B&H ON DIFFERENT LEVELS OF COMPETITION Talović M., Mahmutović I., Ormanović Š., Jelešković E., Alić H., Mašala A., Ćirić A	49
MOLECULAR-GENETIC PREDICTIONS IN SELECTION OF SPORT TALENTS AND ETHICAL ASPECT OF THEIR APPLICATION Zoran T. Popovski, Macdonald Wick, Aleksandar Tufekchievski, Srečko Gjorgjievski, Tome Nestorovski, Aleksandar Aceski	55
APPLICATION OF THE CONCEPT OF MODERN ENTREPRENEURSHIP IN THE DEVELOPMENT OF SPORTS TOURISM IN MACEDONIA Marija Magdinceva-Sopova, Tanja Angelkova Petkova, Lidija Pulevska- Ivanovska, Simona Savic	63
ACTN3 GENOTYPE AND ISOKINETIC CHARACTERISTICS OF THE KNESS OF SOCCER PLAYERS U17 Zoran Handjiski, Eli Handzjska, Mimoza Milenkova	69
REGRESSION ANALYSIS OF VARIABLES FOR ASSESMENT OF SITUATIONAL-MOTORIC KNOWLEDGE WITH MOTORIC ABILITIES AMONG FEMALE VOLLEYBALL PLAYERS IN REPUBLIC OF MACEDONIA Andrijana Misovski, JoshkoMilenkoski, Vlatko Nedelkovski, Vladimir Vuksanovic, Katarina Nejić	75
POSSIBLE MECHANISMS IN EXERCISE INDUCED PROTEINURIA Dejanov Petar, Dejanova Beti	79
DIFFERENCES OF SOME SPECIFIC MOTOR SKILLS FOR BOXERS IN DIFFERENT LEVEL OF COMPETITIVE SUCCESS Kalach Ruzdija, Seryozha Gontarev, Branko Krstevski	83
THE RATIO BETWEEN INDIRECT AND DIRECT INJURIES IN SOCCER Adem Nura, Abdullah Elezi, Avdullah Mehana.....	89
HOW CAN HELP A SPORT PSYCHOLOGY AT BASKETBALL PLAYER Dafinë Ibrahim-Kaçuri	93

INFLUENCE ON OPINIONS OF MACEDONIAN CITIZENS ON SPORT LAWS, BASED ON SEX AND AGE IN REPUBLIC OF MACEDONIA Igor Nikolov, Ivan Anastasovski, Lazar Nanev, Slobodan Stamatovski	97
ATTITUDES OF MALE AND FEMALE STUDENTS ON UNIVERSITY "SS.CYRIL AND METHODIUS"- SKOPJE IN MARTIAL SPORTS Kalach Ruzdija, Seryozha Gontarev	103
ANALYSIS AND IMPACT OF TWO MOTOR SKILLS WITH SPECIFIC SAMPLE EXAMINEES Zoran Radich, Aleksandar Simeonov, Astrit Iseni, Ratko Pavlovic	109
PSYCHOPHYSIOLOGY AND THE SPORT SCIENCE Sanja Mancevska, Jasmina Pluncevik Gligoroska, Lidija Todorovska, Beti Dejanova, Sunchica Petrovska	115
INTERCORRELATION ANALYSIS OF THE VARIABLES FOR ASSESSMENT OF SPECIFIC MOTOR SPACE ON THE FREQUENCY OF MOVEMENTS OF MACEDONIAN KARATE TEAM MEMBERS Asani Kenan, Besnik Telai, Laureta Abazi, Nagib Lenjani	121
EFFECTS OF BEACH VOLLEYBALL TRAINING ON PHYSICAL PERFORMANCE IN YOUNG INDOOR VOLLEYBALL PLAYERS Dragan Nejić, Nebojša Trajković, Katarina Nejić, Josko Milenkoski, Andrijana Misovski	125
ONE APPROACH FOR DETERMINING THE BIOMECHANICAL SIMILARITY BETWEEN THE BASIC MOTOR STEREOTYPES OF BOXING TECHNIQUE Marko Stevanovski , Aleksandar Tufekchievski , Aleksandar Aceski	133
THE EFFECT OF ADDITIONAL AEROBIC TRAINING IN THE DEVELOPMENT OF SOME MOTOR SKILLS IN HANDBA Abdulla Elezi, Nnazim Myrtaj, Naser Rashiti	137
RELATION BETWEEN THE STANDING VERTICAL JUMP (ABALAK TEST), STANDING LONG JUMP, AND SQUAT JUMP 2 LEGS 5 JUMPS (OPTOJUMP) TESTS FOR ASSESSMENT OF THE EXPLOSIVE STRENGTH OF LEGS Vladimir Vuksanovikj, Jovan Jovanovski, Ilija Klincarov, Gregor Starc, Mihailo Sejkeroski	141
DIFFERENCES OF THESE ABILITIES IN THE PARAMETERS OF FOOTBALL PLAYERS OF AGE GROUP 14-16 YEARS OF AGE (KADET) IN THE FIRST LEAGUE OF R.MACEDONIAIN FOOTBALL FOR AGE GROUP Ardonid Abdullahu	147
DETERMINATION AND COMPARIION OF THE QUALITATIVE BIOMECHANICAL STATUS OF THE MOTOR STEREOTYPES IN HANDBALL WITH TWO METHODOLOGICAL APPROACHES Toni Trajkovski, Aleksandar Aceski, Aleksandar Tufekchievski, Vladimir Vuksanovic	155
DIFFERENCES IN ANTHROPOMETRIC, MOTORIC AND FUNCIONAL CHARACHTERISTICS BETWEEN TWO AGE GROUPS (YOUNG FOOTBALL PLAYERS OF 14-15 YEARS OLD) AND (YOUNG FOOTBALL PLAYERS OF 16 YEARS OLD) Ardonid Abdullahu	163
THE INFLUENCE OF SMOKING IN THE AEROBIC STABILITY IN FOOTBALL Avdullah Mehana, Abdullah Elezi, Adem Nura	173
RELIABILITY AND VALIDITY OF A NEW AGILITY TEST Marko Erceg, Zoran Grgantov, Saša Krstulović, Goran Kuvačić, Ante Rađa	177
CHANGES OF THE MAXIMUM STRENGTH POTENTIAL OF ELBOW FLEXORS IN 3 GROUPS OF SUBJECTS AFTER 3 WEEKS OF EXERCISES WITH MODIFIED MUSCLE CONTRACTIONS Vladimir Vuksanovikj, Jovan Jovanovski, Andriana Misovski, Aleksandar Aceski	183

RELATION BETWEEN THE STANDING VERTICAL JUMP (ABALAK TEST), STANDING LONG JUMP, AND SQUAT JUMP 2 LEGS 5 JUMPS (OPTOJUMP) TESTS FOR ASSESSMENT OF THE EXPLOSIVE STRENGTH OF LEGS

UDC: 796.431.2.012.424

Vladimir Vuksanovikj¹, Jovan Jovanovski¹, Ilija Klincarov¹, Gregor Starc²,
Mihailo Sejkeroski³

¹ Faculty of Physical Education in Skopje, University "Ss. Cyril and Methodius" Skopje, Macedonia

² Faculty of sport, University of Ljubljana, Ljubljana, Slovenia

³ FC locomotive Plovdiv, Plovdiv, Bulgaria

Abstract

The purpose of this study was to assess whether and if there is correlation between the applied tests for explosive strength of legs, so as to provide a recommendation when selecting tests for assessment of the explosive strength of legs. The subject of this research is the explosive strength of legs, tested at 36 examinees, male, age of 18-19 years. Three tests were executed: 1. standing vertical jump (SKOKVIS) – Abalak test, 2. standing long jump (SKOKDAL), 3. squat jump 2 legs 5 jumps – with optojump equipment. The examinees were divided into 3 groups. Each of the groups was randomly distributed in one of the 3 test places. Breaks of 5 minutes per examinee were given between tests. During testing, for the Abalak and standing long jump tests, the examinees have performed 2 attempts, and one attempt for squat jump 2 legs 5 jumps. The jump 2 legs 5 jumps test on optojump equipment was executed with hands on hips. Pearson's analysis was performed on the results of Abalak, standing jump and heights of optojump tests, as well as a multiple regression during which, as predictor variables, the output data were taken of the tests with optojump, for 1-contact time with surface (T.Cont), 2-flight time (T.Flight) and 3-Power as a output from the jumps, and the criteria results of Abalak, standing jump and heights of optojump. The Pearson's analysis has shown significant correlation between the results of the Abalaks, standing jump and heights of optojump tests. Highest correlation ($r=0.638$, $p=0.000$) exists between the tests Abalak and standing long jump. Lowest, yet significant, correlation exists between Abalak and the height resulting from the optojump test $r=0.466$ ($p=0.002$). In the first multiple regression analysis where height is dependant variable, the entire system of predictor variables contributes to the analysis in a statistically significant manner ($R=0.99$, $p=0.000$). In case of a SKOKVIS dependant variable, the system of predictor variables, again, has statistically significant impact in the analysis ($R=0,519$, $p=0.017$). In this case, single contribution to significance is attributed to the variable T.Flight ($p=0.017$). In the third multiple regression for the dependent variable SKOKDAL, the analysis is statistically significant ($p=0.007$), and, once again, the main (single) variable for significance is T.Flight ($p=0.03$). Existence of correlation between the three included tests in this research has shown that, in method-related terms, tests are efficient when assessing the explosive strength of legs. Presumably, it can be recommended that those who shall apply the tests for explosive strength in legs shall have to choose the test they shall systematically apply, so as to show whether there are any changes of this ability following a treatment with exercises. One can conclude that, perhaps the time spent in the flight phase can in some way be used as a predictor on the reached height, during the testing of the standing vertical jump and the standing long jump.

Key words: power, height, optojump, abalak, standing long jump, contact time

Introduction

Explosive strength represents an ability during which there is combined exertion of strength and speed per unit of time (Jovanovski, 2013). Although it acts as a hybrid of basic abilities, nevertheless, the explosive strength is singled out, in factor terms, as a strength sub-factor (Kurelic, N. i sar. 1975). Unlike the speed strength, where speed is the dominant factor, the external resistance range is dominant as regards the explosive strength (Peric D., 1999). In general terms, while performing an explosive movement, successiveness exists in terms of engagement of motor mechanisms (abilities) in the following order: initial strength, accelerating strength, and absolute strength (Verhosanskij, 1992). The basic



moment in the explosive strength manifestation is in the nervous-muscular apparatus, defined through the stretch reflex instinctively used by every human being in the performance of an explosive movement.

The explosive component of strength, through the genetic research, is related to the presence of muscular fibres responsible for the fast contractions, tested through the ACTN3 genotype and its mutation (Druzhevskaya et al., 2008; Eynon et al., 2009) (Niemi & Majamaa, 2005; Papadimitriou et al., 2008; Roth et al., 2008;). This relatively high heritability of explosive strength ($h^2=0.80$), enables slight impact upon it by training, particularly in the sensitive period for this ability, at about 10-12 years of age (Jovanovski, 2013). In practice, the explosive strength exercises (in particular for the legs) are recognized as plyometric training (Radcliffe 2003), by using the jump method. During the performance of jumps, the strength transformation is due to the [1] eccentric movement phase, during which there is plyometric regime of muscle strength generation (Zatsiorsky 1975), followed by [2] stretch reflex and reaction speed, in the domain of speed as an ability, as well as inter-muscular coordination for the purposes of more efficient transformation of the muscle work from plyometric to [3] miometric work regime, during which the strength is to be generated through concentric contraction so as to propel the body or object in the space. Therefore, there are different forms of jumps for development of the explosive strength of legs (Gaic M., 1985) preceded by, leap at a higher level, landing from higher to lower level or combinations thereof (Matic, 2015).

As a motor manifestation, explosive strength is embedded in part of the athletic disciplines (throwing, jumps, where it is most manifested), as well as in all other sports, with different contributions. Having in mind the genetic dominance fact (low transformation opportunity), this ability is also subject to testing for selection purposes. Therefore, during the selection of athletes, as well as prior to commencement of the training processes (preparatory period and similar), explosive strength assessment tests are used, so as to provide directions whether the level of this ability of the athlete is as required (Jamie f. Burr et al). Alternatively, the tests for explosive strength of legs are also used for the cyclic activities (running) for the purposes of assessing the impact of this ability on the performances in races (Paavolainen, L, et al 1999, Slattery KM. 2004, Spinks CD et al. 2007 Spurr, RW, Murphy, AJ, and Watsford, ML. 2005, Chtara., et al, 2005.), as well as on the football performances (Wisløff, U, et al 1998, Wisløff, U et al 2004).

The test selection issue was of interest to us. Which test (of those subject to analysis) shall represent the assessment of the explosive strength of legs in the best manner? Whether each of the analysed tests can provide an answer to the assessment of this motor dimension in humans?

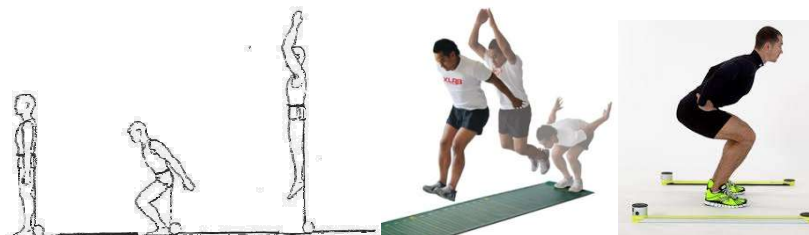
This research applies 3 tests for testing of the explosive strength in legs (herein explained). It is a common practice to recommend usage of apparatus in the form of a jumping mat or sensor devices for the purposes of more efficient testing, unlike the standard methods which use a tape measure or performing of calculations so as to obtain the value being measured (ISAACS, L.D. 1998). Therefore, it was our objective to assess whether and if there is a correlation between the applied tests, so as to provide a recommendation for selection of tests for assessment of the explosive strength of legs.

Materials and methods

The subject of this research is the explosive strength of legs, tested at 36 male examinees, at the age of 18-19 years.

3 tests were performed: 1. standing vertical jump (SKOKVIS) – Abalak test, 2. standing long jump (SKOKDAL), 3. squat jump 2 legs 5 jumps – with optojump equipment. The objective of the research was to assess whether there is correlation between the tests, for the purposes of their applicative use in practice. In addition, if there is such correlation between some of them, whether some of the indicators produced from the optojump test can be used (time of contact with mat - T.Cont, time in flight phase - T.Flight, as well as the performed work of the leg muscles in the type of power – Power) during the analysis and interpretation of obtained data from both standard test methods for explosive strength of legs (standing vertical jump (SKOKVIS) and standing long jump), through multiple regression.

The examinees were divided into 3 groups. Each of the groups was randomly distributed to one of the 3 test places. 5 minutes breaks were given between tests, per each examinee. During testing, the examinees made 2 attempts for the Abalak and standing long jump tests, and 1 attempt for squat jump 2 legs 5 jumps. The jump 2 legs 5 jumps test, on the optojump apparatus, was performed with hands on hips.



Results and discussion

Pearson’s analysis has shown significant correlation between the results of Abalaks, standing jump and heights of otopjump tests. The highest correlation ($r=0.638$, $p=0.000$) is between the Abalak and standing long jump tests. Standing long jump, with the predictive data on the achieved height of optojump, is with value $p=0.536$ ($p=0.000$). Lowest, yet significant, correlation exists between Abalak and the height obtained from the optojump testing $r=0.466$ ($p=0.002$).

Table No. 1 Correlation table

Correlations coeff.			
N=36	Height	SKOKDAL	SKOKVIS
Height	1.000	0.536	0.466
		$p = 0.000$	$p = 0.002$
SKOKDAL	0.536	1.000	0.638
	$p = 0.000$		$p = 0.000$
SKOKVIS	0.466	0.638	1.000
	$p = 0.002$	$p = 0.000$	

The predictive value for the electronically calculated height is presented as a reliable data in the tests on explosiveness (Balsalobre-Fernández, C., et al., 2014, Glatthorn, J. F., et al., 2011). Furthermore, in this research, the significance of the correlation between standard methods for assessment of explosiveness (Abalak and standing long jump) and the electronic, with assistance of photocells, has shown that optojump is maximally competitive. These arguments are also complemented with the fact that electronic testing provides additional data which can be used while defining the explosive capacities of the examinees.

The multiple regression analysis, as predictor variables, takes the output data of testing with optojump, for contact time with surface (T.Cont), flight time (T.Flight), and Power as output from the jumps. These variables were chosen due to the fact that the results being generated are approximately dependent on the ultimate effect for presenting the explosiveness of legs. 3 multiple regression analyses were performed with dependent variables Height, SKOKVIS, SKOKDAL.

For the first multiple regression analysis, where ‘height’ is the dependent variable, the entire system of predictor variables significantly contributes to the analysis, in statistical terms, ($R=0.99$, $p=0.000$). The variables T.Cont and T.Flight are, in fact, the carriers of significance of the predictor system. The ‘power’ variable has no statistically significant participation in the system prediction. In cases when ‘SKOKVIS’ is the dependent variable, the system of predictor variables again impacts the analysis with statistical significance ($R=0,519$, $p=0.017$). In this case, the variable T.Flight has the single contribution in terms of significance ($p=0.017$). In the third multiple regression for the dependent variable ‘SKOKDAL’, the analysis is statistically significant ($p=0.007$) and once again, the leading (single) significance variable is T.Flight ($p=0.03$). The obtained data from the multiple regression analysis have indicated that the selected predictor variables ‘T.Contact’ and ‘Power’ cannot be used as predictors for the dependent variables ‘SKOKVIS’ and ‘SKOKDAL’. The analysis, when ‘Height’ is the dependent variable, was performed for (one type of) control of the software of the optojump apparatus. However, the research has shown in this analysis that the data on muscle power of the examinees cannot be used (during testing of explosiveness of legs) as parallel indicators for performance assessment in vertical jump and standing long jump.

Table No. 2,3,4. Multiple regression analysis

Dependent Variable: Height					
Model	R	R ²	Adjusted R ²	S.E.e	Sig.
	0.999	0.998	0.998	0.199	0.000
Independet	B	Std. Error	Beta	t	Sig.
(Constant)	-30.818	0.491		-62.809	0.000
T.Cont	2.531	1.095	0.032	2.311	0.027
T.Flight	121.493	1.777	0.991	68.384	0.000
Power	0.006	0.012	0.009	0.489	0.628
Dependent Variable: SKOKVIS					
Model	R	R ²	Adjusted R ²	S.E.e	Sig.
	0.519	0.270	0.201	6.712	0.017
Independet	B	Std. Error	Beta	t	Sig.
(Constant)	2.181	16.531		0.132	0.896
T.Cont	-56.511	36.904	-0.408	-1.531	0.136
T.Flight	164.573	59.857	0.775	2.749	0.010
Power	-0.519	0.412	-0.433	-1.257	0.218
Dependent Variable: SKOKDAL					
Model	R	R ²	Adjusted R ²	S.E.e	Sig.
	0.559	0.312	0.248	15.210	0.007
Independet	B	Std. Error	Beta	t	Sig.
(Constant)	97.122	37.464		2.592	0.014
T.Cont	-51.908	83.635	-0.161	-0.621	0.539
T.Flight	301.528	135.653	0.608	2.223	0.033
Power	-0.212	0.935	-0.076	-0.226	0.822

Conclusion

Existence of correlation between the three included tests in this research has shown that, in method-related terms, tests are efficient when assessing the explosive strength of legs due to the fact that they approximately identically describe the ability being assessed. These data are similar to the research of Markovic G. 2004 However, in similar studies, the correlation between vertical jumps tests is not presented at a satisfactory level. Similar analysis (Bui, H. T et all, 2015, in which 3 tests were compared (optical system, contact mat, and Sargent jump), has shown that there is no correlation between the electronic devices and the Sargent jump test. Aragón, L. F. (2000) compares 4 tests and shows that even though there is validity between tests, the height values in all tests still differ in statistical terms. In addition, Leard, J. S., et all (2007), recognizing the difference in the obtained data of such type of research, include a 3D camera to compare the applied tests. Presumably, it can be recommended that those who shall apply the tests for explosive strength in legs shall have to choose the test they shall systematically apply, so as to show whether there are any changes of this ability following a treatment with exercises. Or, in case of transversal research, test-methods should be applied which shall be most efficient in terms of their application. It should be taken into consideration that new technologies provide an opportunity for collecting of a greater number of information in a single test, and their respective use in the analysis of the subject's capacities. Nevertheless, the authors are to decide on the application of a test which shall be most pragmatic for them; obviously, with verified metric properties.

Since we failed to find similar research on predictive analysis of values of the types contact time, flight time, and power, on the standing vertical jump and the standing long jump (as criteria), we can only conclude that, perhaps the time spent in the flight phase can in some way be used as a predictor on the reached height, during the testing of the standing vertical jump and the standing long jump. However, it applies in case of available optic technology, for testing of the explosive ability

References

- Aragón, L. F. (2000). Evaluation of four vertical jump tests: Methodology, reliability, validity, and accuracy. *Measurement in physical education and exercise science*, 4(4), 215-228
- Јовановски Ј., 2013, Антропомоторика, Скопје;
- Balsalobre-Fernández, C., Tejero-González, C. M., del Campo-Vecino, J., & Bavaresco, N. (2014). The concurrent validity and reliability of a low-cost, high-speed camera-based method for measuring the flight time of vertical jumps. *The Journal of Strength & Conditioning Research*, 28(2), 528-533.
- Glatthorn, J. F., Gouge, S., Nussbaumer, S., Stauffacher, S., Impellizzeri, F. M., & Maffiuletti, N. A. (2011). Validity and reliability of Optojump photoelectric cells for estimating vertical jump height. *The Journal of Strength & Conditioning Research*, 25(2), 556-560.
- Bui, H. T., Farinas, M. I., Fortin, A. M., Comtois, A. S., & Leone, M. (2015). Comparison and analysis of three different methods to evaluate vertical jump height. *Clinical physiology and functional imaging*, 35(3), 203-209
- Kurelic, N i sar. 1975. *Struktura i razvoj morfoloskih i motorickih dimenzija omladine*. Institut za naucna istrazivanja. Beograd.
- Leard, J. S., Cirillo, M. A., Katsnelson, E., Kimiatek, D. A., Miller, T. W., Trebincevic, K., & Garbalosa, J. C. (2007). Validity of two alternative systems for measuring vertical jump height. *The Journal of Strength & Conditioning Research*, 21(4), 1296-1299.
- Peric D., 1999. *Uvod u sportsku Antropomotoriku*. Sportska Akademija u Beogradu. Beograd.
- Radcliffe J.C., Farentinos R.C., 2003. Pliometrija. Gopal. Zagreb.
- Verhosanski J.V., Sestakov M.P., Novikov P.S., Nicin Dj.A. 1992, *Specificna snaga u sportu*, Fakultet fizicke kulture-Novu Sad.
- Druzhevskaya, A.M., Ahmetov, I.I., Astratenkova, I.V. & Rogozkin, V.A. (2008). Association of the ACTN3 R577X polymorphism with power athlete status in Russians. *European Journal of Applied Physiology* 103, 631–634
- Eynon, N., Duarte, J.A., Oliveira, J., et al. (2009). ACTN3 R577X polymorphism and Israeli top-level athletes. *International Journal of Sports Medicine* 30, 695–698.
- Papadimitriou, I.D., Papadopoulos, C., Kouvatsi, A. & Triantaphyllidis, C. (2008). The ACTN3 gene in elite Greek track and field athletes. *International Journal of Sports Medicine* 29, 352–355.
- Niemi A.K. and Majamaa K., 2005, *Mitochondrial DNA and ACTN3 genotypes in Finnish elite endurance and sprint athletes*, European Journal of Human Genetics (2005) 13, 965–969. doi:10.1038/sj.ejhg.5201438;
- Roth, S.M., Walsh, S., Liu, D., Metter, E.J., Ferrucci, L. & Hurley, B.F. (2008). The ACTN3 R577X nonsense allele is under-represented in elite-level strength athletes. *European Journal of Human Genetics* 16, 391–394.
- Paavolainen, L, Ha`kkinen, K, Ha`ma`la`inen, I, Nummela, A, and Rusko, H. Explosive-strength training improves 5-km running time by improving running economy and muscle power. *J Appl Physiol* 86: 1527–1533, 1999
- Slattery, KM. Practical Tests for Monitoring Fatigue and Recovery in Triathletes. School of Leisure, Sport and Tourism. Sydney, Australia: University of Technology; 2004.
- Spinks, CD, Murphy, AJ, Spinks, WL, and Lockie, RG. The effects of resisted sprint training on acceleration performance and kinematics in soccer, rugby union, and Australian football players. *J Strength Cond Res* 21: 77–85, 2007.
- Spurrs, RW, Murphy, AJ, and Watsford, ML. The effect of plyometric training on distance running performance. *Eur J Appl Physiol* 89: 1–7, 2003. 38. Stølen, T, Chamari, K, Castagna, C, and Wisløff, U. Physiology of soccer: an update. *Sports Med* 35: 501–536, 2005
- Chtara, M, Chamari, K, Chaouachi, M, Chaouachi, A, Koubaa, D, Feki, Y, Millet, GP, and Amri, M. Effects of intra-session concurrent endurance and strength training sequence on aerobic performance and capacity. *Br J Sports Med* 39: 555–560, 2005.
- Wisløff, U, Helgerud, J, and Hoff, J. Strength and endurance of elite soccer players. *Med Sci Sports Exerc* 30: 462–467, 1998
- Wisløff, U, Castagna, C, Helgerud, J, Jones, R, and Hoff, J. Maximal squat strength is strongly correlated to sprint-performance and vertical jump height in elite soccer players. *Br J Sports Med* 38: 285–288, 2004.
- Zaciorski V.M., 1975. Fizicka svojstva sportiste. *Savez za fizicku kulturu Jugoslavije*. Beograd;
- Matic, Milan S.; Pazin, Nemanja R.; Mrdakovic, Vladimir D.; Jankovic, Nenad N.; Ilic, Dusko B.; Stefanovic, Djordje L.J. 2015, *Optimum Drop Height for Maximizing Power Output in Drop Jump: The Effect of Maximal Muscle Strength*, Journal of Strength and Conditioning Research, Vol. 29 - Issue 12: p 3300–3310;
- ISAACS, L.D. 1998. Comparison of the vertec and just jump systems for measuring height of the vertical jump by young children. *Percept. Mot. Skills* 86:659–663;
- Jamie f. Burr, Veronica K. Jamnik, Shilpa Dogra, and Norman Gledhill, 2007, Evaluation of jump protocols to assess leg power and predict hockey playing potential, *Journal of Strength and Conditioning Research*, 21(4), 1139–1145
- Markovic G., Dizdar D., Jukic I., Cardinale M., *Reliability and Factorial Validity of Squat and Countermovement Jump Tests*, *Journal of Strength and Conditioning Research*, 2004, 18(3), 551–555;