THE CASE

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Abstract

Subject of this study is the strength endurance of a respondent at the age of 20 years, in context of sudden, unexpected and extreme achievement in performing deep squats repetition until failure, performed without external burden. The registered extreme achievements were being monitored for a period of one month, when the subject was not under strength programme. Significant differences were registered in the repetition until failure between the first, second and the third experimental measuring. The experiment was designed by applying relevant physiological and motor parameters, appropriate for this type of studies.

Key words: *motivation, endurance, lactates, anaerobic threshold, repetition until failure, deep squat, metabolic and mechanical strength, genes.*

INTRODUCTION

The anthropological status, which in the studies is presented according to pedagogical and bio cybernetic tendencies as a complex combination of relations among separate segments of human existence has always been a current challenge for the researchers. Movement, especially the intentional movement, is a materialized thought that contains the complex relations of structures and functions of biological sub-systems of the man. The integral functioning of man is the first criterion in defining the quality and quantity of his movements.

During investigation of individual segments of human anthropological dimensions based on the principle of probability, some unusual and extreme occurrences have been noticed, including records of movement efficiency of performers (Guinness record, world record and student record). The occurrence of unexpected, unpredicted and extreme result in kinesiology practice deserves to be registered, analysed and interpreted from a professional and scientific point of view. Such unexpected and unpredicted case was noticed during the pedagogical experiment aimed at transformation of strength capabilities of students at the Faculty of Physical Education in Skopje, which initiated the realization of this study. During the initial measuring for this experiment (April 2010), by applying the test of deep squats performed without additional burden until failure (DSQ-rpt max o.b.w), a total of 63 male students were being tested at the age of 19-20. The exercise starts from an upright position with parallel feet and hands placed on the waist. From this position, the subject performs controlled downward movement of the body by bending the knees and jumping ankles until the final position, where the shinbones and thighs of bended legs touch each other on back sides. From this position, by straightening the legs, the subject returns back to the initial position. The deep squats are performed rhythmically and without a break between the initial and final positions. The processed data from the first measuring of students' achievements showed that the average repetition until failure (DSQ-rpt max o. b. w) was 73.9 repetitions, with a standard deviation of 37.4 repetitions, where the maximum number of repetitions was 230 squats.

Subjects, divided in three experimental groups, started with the realisation of the foreseen strength programmes, the aim of which was to transform the strength endurance of the muscles on the legs,

arms and shoulders. One of the participants (B.D.) from the second experimental group (E2-matrix), during the initial testing made 100 repetitions (DSQ-rpt max o.b.w.). This subject, according to his matrix programme, in three exercise session during the first week (Mon., Tue., Wed.) performed 3 series with 33 repetitions, where in each subsequent series, he tended to perform repetition until failure. At the third training, after 4 days from the beginning of the experiment, during the last matrix session, he unexpectedly performed 1020 squats.

PROBLEM

The aforementioned data (Table 1) aroused great interest and provoked us to make analysis and to interpret such event through planned experimental procedure. Hypothetically, the strength capabilities are embedded in an area that encompasses human's the fitness capabilities. (Mekota&Blahus '83). These strength capabilities engage the energy mechanisms for regulation of movements (Kurelikj 75) and depending on the duration and intensity, the muscle tension can be concretely defined. Man manifests his strength capabilities with the intensity of muscle tension and they are part of man's integral characteristics. Man's strength capabilities have low indigenous coefficient (h2 = 0.50), which means that they can be largely improved through exercising. These capabilities depend on the quality of the nervous and muscular system and are limited by the peripheral, central and energy factors. Here, one can also include heart and lungs functions, the quantity of muscular mass, body dimensions, nutritive support and hormones, functional capacities, psychological and biological characteristics of the individual.

The effect of performed movements over a longer period is enabled by mechanisms for repetitive strength, whereas the maximum number of performed movements against certain resistance (weights, own body weight and alike) represents repetitive maximum for the individual; therefore, the best achievements during various tests of strength indicators are registered in this context. This type of strength potential is related with the local and regional endurance, whereas the intensity is inversely related with the duration of the work, where initially, the larger movement units are become involved, and as the intensity declines (increase of the duration of the effort), the endurable movement units become involved, as well, which increases the role of the cardio-vascular and respiratory system in the efficiency of the individual. The supply of energy during the work includes the anaerobic and aerobic mechanisms, in regular sequence and according to a scale, depending on the intensity and range of the performance of strength exercises. Individuals with better capability for elimination of waste products of metabolism can more easily deal with the exhaustion from this activity. Motivation in sufficiently stable and psychologically strong persons ensures higher level of repetitive strength (exhaustion tolerance, monotony). The coefficient of indigenous repetitive strength (h2 = 0.50) allows for greater turnover of positive transformation of this capability under the influence of programmed exercising. Repetitive strength has sensitive periods in young boys at the age of 11-12 and 15-16, and in young girls at the age of 11-12 and 12-13. This capability can be maintained on a quite high level for a long time during the life, and its peak can be reached around the age of 35.

METHOD

Upon obtaining written consent for participation from subject B.D., a study was being conducted with the aim of determining his maximum number of deep squats (DSQ-rpt. max o.b.w) until failure. The planned and realised test was conducted along with routine medical control prior, during and after the completion of the test.

Prior the test with subject B.D., an anaerobic threshold by Conconi was defined on a treadmill, by measuring the body mass, prior and after the completion of the test, the body height, and the size of the shinbone and the thigh, as well as the percentage of fat tissue. Concentration of lactates during the experiment was monitored 11 times, through a blood subject taken after 1, 5, 15, 30, 45, 60, 75, 90, 105, 110 and 120 minute. Blood pressure was measured prior and after the test. The type of skeletal muscles was defined for the subject. Also, the ACTN3 gene was analyzed. During the test, the heart rate was registered with Polar set RS800. A chronometer was presented on a video beam. The whole experiment was recorded on a video. In order to determine the total number of performed deep squats and their frequency, the number of the deep squats was registered for each minute from the beginning until the very end of the test.

RESULTS

Collected data are presented in tables 2, 3, 4…

The subject's mass is 71.6 kg, height 181 cm, size of thigh 58.5 cm and of the shinbone 38 cm. The percentage of fat tissue in his body is 16.7%.

The last measured result from the performance of deep squats (DSQ-rpt max o. b. w.) prior the beginning of the experiment was 1020 repetitions (Table 2), which was taken as the maximum achievement of subject B.D. He tried to improve this result during the planned experimental procedure.

Table 1. Anthropometrical measures

Body mass	71.6 kg
Height	181 cm
Size of thigh	58.5 cm
Size of shinbone	38 cm
Percentage of fat tissue	16.7%

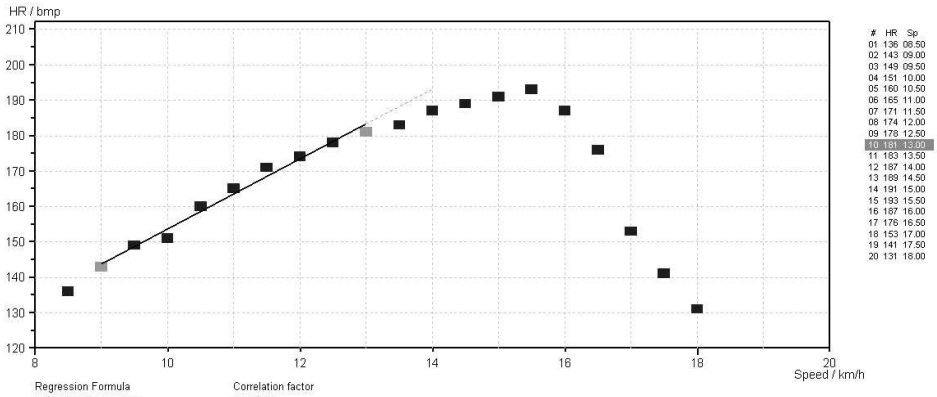
Table 2:Initial indicators prior the experiment with subject B.D.

Subject B.D. First week : DSQ-rpt. max o.b.w = 100 100:3 = 33x3 in each set in one exercise session; 1-set =33 DSQ; 2-set =33 DSQ; 3-set =DSQ-rpt. max o.b.w (to failure)				
Deep squat				
Monday	1-set	35- Rpt	35 -Rpt	100 -RPTmax
	2-set	35- Rpt	35 -Rpt	42 -RPTmax
	3-set	35- Rpt	35 -Rpt	60 -RPTmax
Wednesday	1-set	35- Rpt	35 -Rpt	103 -RPTmax
	2-set	35- Rpt	35 -Rpt	30 -RPTmax
	3-set	35- Rpt	35 -Rpt	15 -RPTmax
Thursday	1-set	35- Rpt	35 -Rpt	1020 -RPTmax
	2-set	35- Rpt	35 -Rpt	
	3-set	35- Rpt	35 -Rpt	

From the analysis of data obtained by monitoring the heart rate from the beginning until the end (after 100 minutes of exercise), it was determined that the average heart rate during the deep squats was 178 heartbeats per minute. The lactate curve (Table 4) shows that the biggest concentration was registered between the 30 (9.3 mmol/l) and 75 minute (1.4 mmol/l) and the peak was in the 60 minute (11.7 mmol/l). At the beginning of the experiment, the lactate curve was parabolic with a monotonous tendency of reaching the plane in the 40 minute. Then, it monotonously declined and ended at the lactate level higher by 2.2 mmol/l of the level measured after the first minute of the beginning of the deep squats.

Anaerobic threshold (ANTH) was determined with the protocol according to Conconi to 181 beats per minute (Table 3). The blood pressure prior the deep squats was 120/80 Hpa, whereas after one hour and 53 minutes 110/50 Hpa. Results of the analysis of the type of skeletal muscles (ACTN3) point to the fact that the subject is a homozygote (577/XX form).

In 1 hour and 40 minutes, the subject made 2591 deep squats or 25 deep squats per minute on average, which means that for one repetition he



Person	BORIS DANEVSKI	Date	5/4/2010	Heart rate average	158 bpm	
Exercise	Free	Time	1:33:51 PM	Heart rate max	195 bpm	
Sport	Running	Duration	0:23:46.8	Ascent		
Note				Selection	0:00:00 - 0:23:45 (0:23:45)	

Table 3. Anaerobic threshold - deflection point

spent 2.31 seconds, on average.

During the performance of the deep squats, the heart rate by the 5 minute was approximately 130 heartbeats/min, 175-186 heartbeats/min between 15 and 75 minute or near the anaerobic threshold, then a decline was registered near the end of the exercise or at the 90 minute and was approximately 180 heartbeats/min. The subject managed to perform 2591 deep squats until failure and gave up after one hour and 40 minutes, with an average time of 2.33 seconds for one squat.

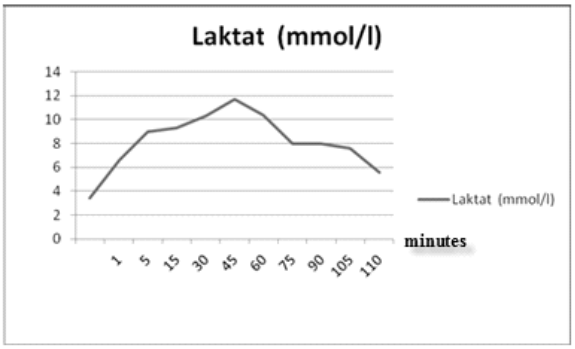


Table 4. Concentration of Lactate s

DISCUSSION

The unusual result of 2591 repetitions (DSQ-rpt. Max o.b.w.) until failure for a period 100 minutes is exceptional. In less than a month, the subject exceeded his repetitive maximum (1020 RPT) by more than 2.5 times (2591 RPT). During each individual performance, he was raising the gravity of his body by 70 cm against the earth gravity, and while going down to perform the deep squat in an eccentric muscle contraction, he was decelerating the gravity force and the body mass against the leaning surface. During the performance of this challenge, the subject B.D. performed a total mechanical work (antigravity) of 515 W for one movement into upright position. Thus, he managed to overcome a height of 1831 m in direction opposite of the gravity force with average speed of movement of 2.44 m/sec and burnt 738 kilocalories for 100 minutes only for anti-gravity muscle contraction. The answer to the question concerning the reasons for this result is not a simple one. If we start by analyzing the energy supply for performing cyclical muscle work (contraction) that lasts 1 hour and 40 minutes, we can notice that greater part of the muscle contraction was performed near the anaerobic threshold (AnT 181 ud/min) or with a prevalence of using anaerobic energy sources (Knutgen, 2007), which means that the metabolic work exceeds the mechanical work in proportion of 4:1. Indicators of concentration of lactates in the taken blood subjects (Table 4.) support the aforementioned statement. The subject, between 45 and 75 minute performed the work in III and IV training zone (V. Borilkevich, 1982), which strongly provokes aerobic mechanisms, as well as strong glycolysis. It is logical to ask whether this achievement of subject B.D. is a result of training. Nevertheless, the answer cannot be supported with the achieved sudden, unexpected and extreme strength endurance, which according to indicators

of the initial test was average (DSQ-rpt. Max o.b.w. – to failure), during the second measuring (after 3 days) it was exceeded by 920 repetitions and during the final measuring after 20 days, it was 2591 repetitions or 290 times better result. Taking into consideration the information about the genetic profile (ACTN3) of the subject (homozygote 577/x form) one can speak about genetic predisposition that ensures high efficiency in manifesting the endurance. This could be one of the reasons why the subject has selected the marathon as his discipline.

The genetic profile is consistent with the mosaic of monitored parameters such as the strong will capacity, metabolic efficiency, heart function and muscle thriftiness and long-term efficiency in performing this movement task (DSQ-rpt. Max o.b.w.) until failure. However, these parameters do not give us the right to give precedence to any of these segments in this concrete movement task, which does not mean that this case cannot be pronounced as unusual, unexpected and extreme to the maximum. In lack of parameters that assess the motivation and will structure, as well as indicators for rational transfer of points of brain activity (FMR - functional magnetic resonance), we can still support the thesis that this case manifests the dependence between biological sub-systems in man and their united structures and functions, which denies the claim that only one or few subsystems (metabolic, muscular and skeletal or circulatory) can explain the functioning of the system of the man as a whole. In this case, the applied parameters for the heart rate, concentration of lactates, speed of performing the deep squats and their duration, the overall metabolic and mechanical work, supported by evident genetic indicator give us grounds for conducting new experimental studies with the aim of collecting exact facts, especially about the functional efficiency of the managing system with the mosaic complex of movement efficiency of the man.

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СЛУЧАЈОТ

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(Оригинален научен труд)

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Апстракт

Истражувана е силовата издржливост кај еден испитаник на возраст од 20 години, во контекст на ненадејно, неочекувано и екстремно постигнување во реализација на повторувачки максимум при изведба на длабокочучнување изведено без надворешно оптоварување. Регистрираните екстремни постигнувања се следени во период оде ден месец во период кога испитаникот не бил под силов третман. Утврдени се големи разлики во повторувачкиот максимум помеѓу првото, второто и третото-експериментално мерење. Експериментот е дизајниран со соодветни физиолошки и моторички параметри прикладни за ваков тип на истражувања.

Клучни зборови: *мотивација, издржливост, лактати, анаеробен праг, повторувачки максимум, длабок чучањ, метаболитичка и механичка снага, гени.*