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Original Research Article

Fitness Profile of Uros Gutic, Runner Middle and Long Distance: Case Study

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Abstract

Defining the profile of runners for medium and long distances, in addition to adequate analysis of anthropometric characteristics, body composition, involves the detection and evaluation of motor (physical) abilities, which are often defined by the term fitness profile. Based on good detection, analysis and evaluation of these parameters, it is possible to propose and define the so-called future fitness model runners. The results will be all the more relevant if the fitness profile of top-level runners is evaluated with notable results. The current study analyzes the fitness profile of U.G., a middle and long distance runner who has exceptional results at the national level in the 3000m (8:37.06min) and 5000m (15:04.05min).

Keywords: Physical abilities, detection, evaluation.

1. INTRODUCTION

Anthropometric characteristics and body composition are associated with running performance in middle and long-distance athletes (Arrese & Ostariz, 2006; Knechtle, Knechtle, Schulze, & Kohler, 2008), with skin folds determining body fat distribution by defining relevant morphological parameters of top runners. The amount of subcutaneous adipose tissue of the lower extremities in men is directly related to the result of running 1500m and 10000m, enabling a much more efficient effect of the activity. According to Maldonado, Mujika, & Padilla (2002) significant running performance is correlated with body height and weight (cranial and caudal limb circumference and skin folds) (Knechtle, Knechtle, Schulze, & Kohler, 2008). Some research (Billat, Demarle, Slawinski, Paiva, & Koralsztein, 2001; Muñoz, Muros, Belmonte, & Zabala, 2020) analyzed the anthropometric characteristics, somatotype and body composition of elite male athletes in an effort to define an adequate profile for certain athletic disciplines. It has been determined that body morphology together with body composition have a significant impact on physical performance (Gabbett & Georgieff, 2007) where a high degree of endomorphic component limits physical abilities, while a high degree of mesomorphic component is more adapted to physical abilities (Pavlović, Mihajlović, Radulović, Gutić, 2021). According to Wan Nudri, Ismail, & Zawiak (1996) physical ability and physique are important for success in athletic performance where a different type of body composition (endomorph, mesomorph, ectomorph) is usually required for maximum performance in certain athletic disciplines. Variables associated with racing disciplines include physical abilities, maximum oxygen consumption (Bassett, & Howley, 2000; Maldonado-Martin, Mujika, & Padilla, 2004), body composition, (Deason, Powers, Lawyer, Ayers, & Stuart, 1991; Brandon, & Boileau, 1992), lactate threshold, energy expenditure during running (Maldonado, Mujika, & Padilla, 2002), running economy and stride length (Heinert, Serfass, & Stull, 1988).

Running on medium and long distances is a demanding athletic discipline which, in addition to good functional abilities, appropriate anthropometric characteristics, adequate body composition, also implies an exceptional fitness profile of runners. Body size and strength contribute to motor performance, so an increase in strength is associated with an increase in total muscle mass (Lucia, Esteve-Lanao, Olivan, Gomez-Gallego, San Juan, Santiago, et al., 2006). A significant positive correlation between strength and performance suggests that stronger and more powerful individuals were athletes who also had more successful results (Ball, Massey, Misner, McKeown, & Lohman, 1992). However, the pattern of improving strength and physical ability is not uniform in all tasks, because strength may be important for the successful performance of some motor performances (throwing disciplines), but not so important for some others (long-distance racing disciplines). High-performance athletes require specific biological profiles with exceptional abilities and strong psychological characteristics. Today, all runners are as capable and technically tactically advanced as their opponents.

According to Ortega, Ruiz, Castillo, Sjöstörm (2008), the performance of athletes is influenced by a number of factors such as level of physical fitness, physiological and psychological abilities, technique, motor skills, body morphology, and application of biomechanical principles. The relationship of sports performance with physical readiness, psychological and physiological abilities has been a problem for researchers for decades in order to develop an adequate physical and physiological profile of athletes, to be reliably used by different athletes to predict sports results.

Athletic disciplines include and provide an ideal situation for challenge, competition and testing of motor skills. It is motor fitness and its components that play an important role in various fields of sports activity, especially in athletics. Fitness has a broader meaning that includes not only physical fitness, but also anatomical psychological and physical fitness, so fitness is not just a matter of muscle, but also physical capacity (Sheokand, 2018). Motor fitness is often called fitness and is considered the part of physical fitness that is responsible for any motor activity. There are various components of motor fitness such as strength, speed, endurance and agility and are considered conditional components of motor fitness (Arafat, Rickta, & Mukta, 2020).

Physical (motor) fitness is important in athletics, but to our knowledge there is a lack of certain studies in B&H that analyze and define the fitness profile of runners. Precisely due to the lack of these studies, which are related to the fitness abilities of athletes, the current case study aims to detect and evaluate a kind of fitness profile of middle and long distance runners as a relevant parameter in the result success.

2. MATERIAL AND METHODS

2.1 Participants

The study was conducted with Uroš Gutić (23 year, Body height 181cm; Body weight 67kg; BMI 20.02kg/m^2; Body fat 6.3%; Body water 67.9%; Body muscle 59.6kg; Pulse 41bmp; Oxygen saturation 98%; VO_2max average 69.56ml/kg; $\%HR_{max}$ average 81,51bpm), a member of AK Sarajevo and the BIH national team on middle and long distances. His personal record at 3000m (8:37.06min), and the 5000m (15:04.05min).

2.2 The sample of variables

The total of 25 variables were variables of evaluation Fitness profile (Bosco, *et al*., 1983; Mackenzie, 2005):

1. Press-ups test (max.)
2. Sit-ups test (max.)
3. Chin up test (max.)
4. Standing broad jump test (cm)
5. Triple jump standing (m)
6. Five jumps standing (m)
7. Run 15m (sec)
8. Run 30m (sec)
9. Run 100m (sec)
10. Run 200m (sec)
11. Run 400m (sec)
12. Hand grip strength test - $HGS_{Right\ hand}$ (kg)
13. Hand grip strength test -$HGS_{Left\ hand}$ (kg)
14. Throwing the ball 3kg standing (m)
15. Throwing the ball 3kg sitting (m)
16. Ball Throwing Speed with 7meters (m/s)
17. Leg strength test (jumps on one leg)
18. Sprint Bound index
19. Ilinois agility run test (sec)
20. Squat jump-SJ (cm)
21. Countermovement jump -CMJ (cm)
22. Abalak jump test (cm)
23. Stiffness jump test (cm)
24. Energy of elasticity*
25. Coordination index**

2.3 Experimental design

Anthropometric measurements were performed according to the methodology of the International Society for the Assessment of Kinanthropometry (ISAK). The standard metric instruments were applied: Stadiometer used for measuring body height (SECA 206, Germany); Body weight and Body Composition were assessed with the Bioelectrical Impedance Analysis (BIA) method using a body composition analysis (Tanita InnerScan BC-545N, Tokyo, Japan), in accordance with the measurement protocol. The HGS of the was measured by the method of isometric dynamometry (digital dynamometer CAMRY-EH101,USA). The results are expressed in kilograms (kg) with a measurement accuracy of 0.01 kg. To estimate arm speed the subject threw the handball ball from a distance of 7m with the dominant right hand. The speed of movement of the ball was measured by the Velocity Speed Radar Gun-Bushnell (model 101911, USA). Ergo Tester Jump Globus (Italy) was used to estimate the explosive power of the extremities (SJ, CMJ, Abalakov jump test, Stiffness test). All measurements were conducted during training at May, 2021, were in accordance with the procedures of the Declaration of Helsinki.

3. RESULTS AND DISCUSSION

The aim of the study was to detect and evaluate the fitness profile of athletes, middle and long distance runners. To assess the quantitative fitness profile (fitness abilities) of our runner, 25 tests were defined which detected the degree of physical fitness (Table 1, Graph 1).

Table 1

Measured parameters		Value
1	Press-ups test (max.)	40
2	Sit-ups test (max.)	150
3	Chin up test (max.) above average	10
4	Standing broad jump test (cm)	240
5	Triple jump standing (m)	6,30
6	Five jumps standing (m)	11,30
7	Run 15m (sec.)	3,01
8	Run 30m (sec.) average	4,70
9	Run 100m (sec.)	12,58
10	Run 200m (sec.)	26,76
11	Run 400m (sec.)	52,29
12	Hand grip strength test- HGS Right hand (kg)	48
13	Hand grip strength test -HGS Left hand (kg)	45,1
14	Throwing the ball 3kg standing (m)	9,4
15	Throwing the ball 3kg sitting (m)	5,5
16	Ball Throwing Speed with 7meters (m/s)	16,11m/s
17	Leg strength test-(jumps on one leg (sec)	4,5
18	Sprint Bound index	61,99
19	Ilinois agility run test (sec)	17,6 Average speed 3,69m/s
20	SJ (cm)	37,4 average
21	CMJ (cm)	44,6
22	Abalakov jump (cm)	45,6
23	Stiffness test (cm)	36,4 40,57w/kg
24	Energy of elasticity *	16,14
25	Coordination index **	2,19

Note : *the formula is used ((CMJ-SJ)/CMJ)x100; **the formula is used ((ABK-CMJ)/ABK)x100

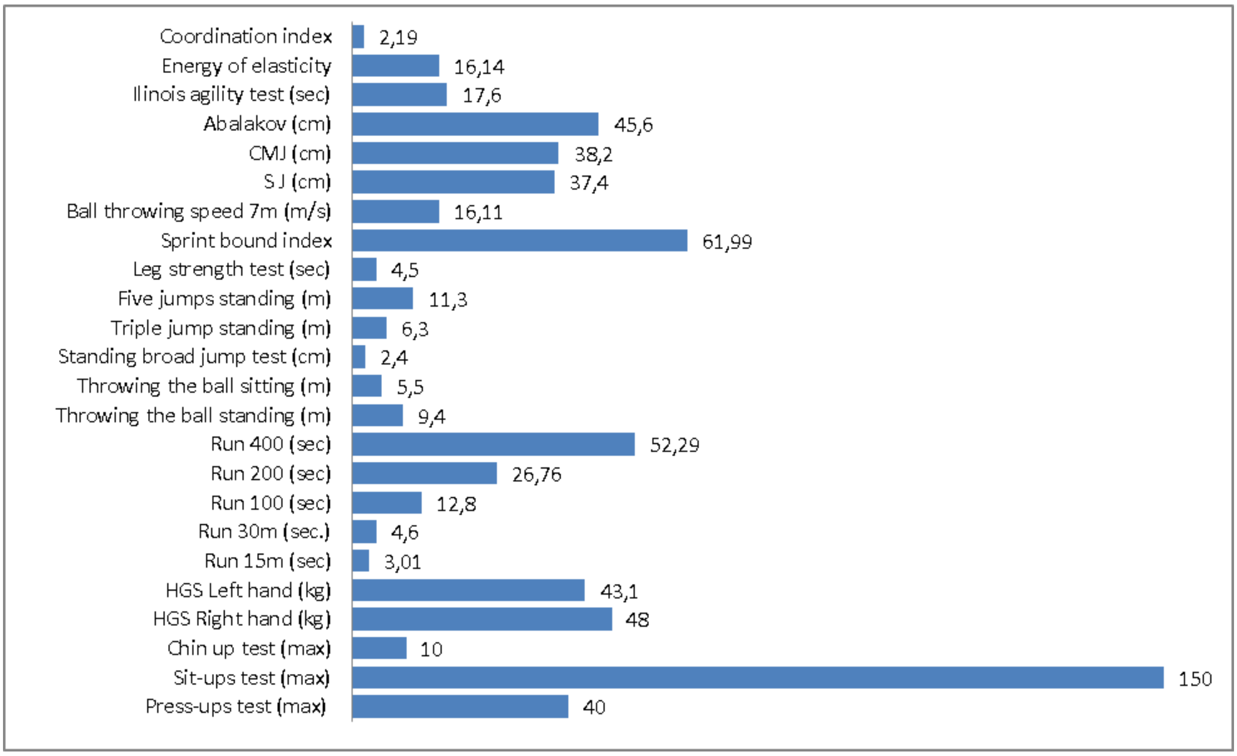

Figure 1: Fitness profile runner

Structurally, the racing cycle contains the rebound phase, the flight phase and the landing phase, where the explosiveness of the movement of the caudal extremities of the runner and the repetition of the same or different amplitudes of the racing step are present. This includes the appropriate frequency of movement. Also, the cranial extremities are in a phase that requires considerable strength of repeated movement with the engagement of the muscles of the cranial extremities. This activity binds to the muscular kinetic chains, enabling good posture and posture of the torso, with the engagement of the abdominal muscles, pelvic muscles as well as the muscles of the caudal extremities. In middle and long distance runners, there is muscular endurance, which means performing activities for a longer period of time.

The fitness profile of athletes plays an important role in determining the potential for success within the racing disciplines. Specific physical characteristics along with body composition are required for the highest levels of performance in a particular athletic discipline. Energy power and economy are the main parameters of racing performance. The first parameter is in direct correlation with the physiological profile of the athlete, while the economy of work defines the efficiency in moving the body in space and is directly related to the motor and biomechanical profile of the athlete (Anderson, 1996). Assessing the economy of motor movement is a generally accepted means of improving the performance of racing endurance and is considered a physiological criterion for its efficiency. Running on medium and long tracks is a cyclic activity of medium and high intensity, which in addition to good functional abilities, adequate morphological and physical status implies a good state of development of motor skills of runners. Some research (Bakaev, Bolotin, Vasil'eva, 2015; Kuznetsova et al., 2015) has proven that the competitive activity of runners in the long run places high demands and levels of their physical abilities. The training process of long-distance runners is based on the development of physical qualities, among which the most important are different types of endurance, aerobic and anaerobic-aerobic. Also, the development of these abilities is possible only in the case of targeted impact on their physiological systems, and especially the mechanisms of energy supply for muscular motor activity (Ammann and Wiss, 2015). Motor fitness is defined as the relationship between the central nervous system and muscles, so it is often called neuromuscular coordination. So, it is a neuromuscular component of fitness, which enables a person to work successfully in a certain motor skill, game or activity. Specific components of fitness include agility, balance, coordination, strength, reaction time and speed. All these components must be integrated in the best possible way, which is confirmed by the results of this study. Insight into the personal parameters of runners can be concluded that it is a top morphological status (Height, Weight, BMI), body composition (Body fat, Body water, Body muscle) and functional parameters (Pulse, Oxygen saturation, VO2max average, %HRmax average) that suit top athletes.

In our study, the strength of the muscular chains of the runners' arms and shoulder girdle was assessed by the maximum number of Press-ups (40), Sit-ups lifts (150), and the number of Chins up test (10) are indicators of good motor status of runners. Runner hand grip strength estimated by dynamometry is in average values relative to tabular values (Mackenzie, 2005). The state of explosiveness and speed of individual movement of cranial extremities was estimated by throwing the ball (3kg) from a standing position (9.4m) and sitting position (5.5m) are quite good, given the body weight of our runner (67kg). Also, the parameters of the explosiveness of the caudal extremities were estimated by standing broad jump test (240 cm), triple jump from the place (6.30 m), five-jump from the place (11.30 m), speed of the ball shot from 7 meters (16.11 m/s). The obtained results also confirm the good state of explosiveness, which is manifested in the length of the racing step in the sagittal plane.

Due to the fact that the running speed of medium and long tracks in some parts of the sprint character (at the start of the race, during the run of the opponent on the track, during the finish, etc.) is extremely important sprint speed, which is confirmed by running results at 15m, 30m, 100m, 200m, 400m which mobilizes phosphocreatine and glycolytic mechanisms (Table 1, Figure 1). Sometimes the average speed in the last lap of the 5000m or 10000m race is closer to the 400m running speed. This is an indication that sprinting abilities are very much present in long-distance runners when fast-twitch muscle fibers are activated. The achieved result of the Sprint bound index test (SBI=61.99) is a good indicator of strength and explosiveness in the caudal extremities of runners. Together with the values of the leg strength test (Leg strength test=4.5sec), it projects good strength that corresponds to the above-average result according to the tabular values (Mackenzie, 2005). Also numerical indicators of different variants of vertical jumps, such as SJ=37.4cm, CMJ=44.6cm; Abalak's test=45.6 cm defined and confirmed the good condition of the muscle kinetic chains of the caudal extremities. This is an indication that vertical explosiveness is necessary, despite the fact that it is a middle and long distance runner. In the vertical jump Stiffness test 2/6, our runner recorded an average height of 36.4cm with an average leg strength of 40.57w/kg. Only the coordination index proved to be a lower value (CI=2.19). However, this parameter is partly expected, because it is a runner and a discipline of long cyclic duration in the sagittal plane, so coordination of this type is not a necessary motor criterion. Illinois agility test with time (Illinois=17.3sec) and average speed

(3.69m/s) is an indicator that our runner has a well-developed so-called motor intelligence (agility), which largely depends on the degree of development of the central nervous system. The state of the central nervous system is characterized by a variable that we defined as the energy of elasticity whose value (EE=16.14) corresponds to a good neuromuscular adaptation of runners.

Elasticity plays a significant role in increasing strength in a variety of cyclical movements, including running. If a tendon or active muscle is stretched, elastic energy is stored within these structures. This deformation energy is stored and used to improve motor output in the concentric relaxation-contraction phase. A middle and long distance runner who reactively runs a distance at a given time shows completely different types of performance (energy consumption and coordination) than someone who runs the same distance at the same time using a technique that is weakly reactive with high energy dissipation. It therefore makes sense to learn reversible (contraction-relaxation) muscle action (Noakes, 2003; Bosch & Klomp, 2005).

Based on scientific sources and empirical training, analyzes have shown that the development of muscle elasticity plays an important role in improving the neuromuscular adaptation of runners in the long run. This type of adjustment is in line with the requirements of long distances at a high level of running (fast pace and the ability to maintain and change as needed). Since the brain is the most important organ associated with motor power, its role of nerve regulation should be viewed as a determinant of efficient neuromuscular adaptation (Nurmekivi, Lemberg & Pääsuk, 2016).

4. CONCLUSION

The results of this study will provide a better understanding of the importance of fitness profiles of runners on medium and long distances, which will be a kind of guideline for trainers to adjust the training process with the help of data on the physical condition of their runners. The study provides in part normative data that can provide significant assistance to coaches in identifying future talents of middle- and long-distance runners. This case study is an indicator of the importance of the participation of motor (physical) abilities in the result success of running on medium and long distances, confirming the thesis on the importance of the integration of anthropometric, functional and motor abilities.

Conflict of Interest Statement: The authors declare no conflicts of interests

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