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Comparison and Description of Fitness Level ‹Physiological and Anthropometric Profiles of Selected Versus Non Selected Iranian National Team Table Tennis Players

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Abstract

Objectives: The aims of this study were to comparison and describe the anthropometric characteristics physical fitness and physiological profile of the first 5 and the lower ranked elite male Iranian national table tennis players, who participated in table tennis championship, to compare the anthropometric data, physical fitness and physiological profile of the first 5elite tennis players on the ranking with the lower ranked players, and to establish an anthropometric and physiological profile chart for elite tennis players.

Methods: On the direction of this aim 16 male National table tennis Players' participated in this study. According to ranked some physical fitness, physiological and anthropometric variables were recorded of each subject. In this research; Physical fitness was determined using the following test: 1) speed; 36m sprint, 2) shoulder, back and hamstring flexibility; sit and reach, 3) lower limb power; side jump, 4) Anaerobic power; wingate test, 5) Aerobic power; 1600 m running, 6) reaction time; visual reaction time, 7) mussel endurance; sit- ups. In addition to anthropometric analysis (height, weight, siting height, arm length), body composition and somatotype of participants have been assessed. The kolmogorof-smirnov test was applied to determine the nature of data distribution. Since a normal distribution was confirmed, a t- test for independent samples was performed to examine statistical differences between groups and p value < 0.05 was considered to be significant.

Results: There were no significant differences in height, jump, shoulder, back and hamstring flexibility, speed, visual reaction time, anaerobic power and BMI between the first 5 and the lower ranked table tennis players, while there were significant differences in weight, side jump, aerobic power, present body fat and somatotype component. A mesomorph – endomorph somatotype was registered for the lower ranked and somatotype of first 5 table tennis players could be defined as mesomorph – ectomorph.

Conclusions: As a result, Table tennis in (mesomorph-Ektomorf) were dominant body type and it is determined that it is important to aerobic power.

Keywords: physical fitness, anthropometry, profile, talent identification, table tennis

Iran Masa Tenisi Milli Takımı Seçmelerinde Seçilen ve Elenen Sporcuların Bazı Fiziksel, Fizyolojik ve Antropometrik Parametrelerinin Karşılaştırılması

Özet

Amaç: Bu çalışma; Iran masa tenisi milli takımı seçmelerinde seçilen ve elenen sporcuların bazı fiziksel, fizyolojik ve antropometrik parametrelerinin belirlenmesi ve karşılaştırılması amacıyla yapılmıştır. Bu amaç doğrultusunda sıralamada ilk 5 sırada yer alan sporcuların fiziksel uygunluk ve antropometrik profilleri ile alt sırada yer alan sporcuların verileri karşılaştırarak elit tenis oyuncuları için antropometrik ve fizyolojik profil grafiği kurmak önem arz etmektedir.

Yöntem: Bu çalışmaya 16 erkek Ulusal masa tenisi oyuncusu gönüllü olarak katılmıştır. Sporcuların bazı fiziksel uygunluk, fizyolojik ve antropometrik değişkenleri test edilmiştir. Fiziksel uygunluk, aşağıdaki testler kullanılarak belirlenmiştir: 1) sürat; 36m sprint testi, 2) omuz, sırt ve hamstring esnekliği; otur- eriş testi, 3) alt ekstremite gücü; Yana atlama testi, 4) Anaerobik güç; wingate testi, 5) Aerobik güç; 1600 m koşu testi, 6) Reaksiyon süresi; görsel reaksiyon testi, 7) dayanıklılık; 20 mt mekik (shuttle run) testi. Antropometrik analiz için; boy, kilo, otur boy ve kol uzunluğu testeri uygulanmıştır. Veri dağılım niteliğini belirlemek için Kolmagorof-Smirnov testi uygulanmıştır, Verilerin normal dağılım gösterdiği doğrulanmış olup, istatistiksel farklılıkları incelemek için bağımsız t-test yapılmıştır. Anlamlılık düzeyi ($p < 0.05$) olarak kabul edilmiştir.

Bulgular: Elde edilen bulgulara göre; Boy uzunluğu, esneklik, sürat, görsel reaksiyon, Anaerobik güç ve VKİ değerleri ilk 5 sırada yer alan sporcular ile alt sırada yer alan sporcular arasında istatistiksel olarak anlamlı bir fark bulunamamıştır. Sporcuların yana atlama testi, vücut yağ yüzdesi, aerobik güç ve Somatotip değerleri arasında anlamlı farklılıklar tespit edildi. Sıralamaya göre ilk 5 e giren sporcularda mezomorf – ektomorf baskın bulunurken, Alt sırada yer alanlarda ise mezomorf – endomorf baskın bulunmuştur.

Sonuç: Sonuç olarak; Masa tenisçilerde mezomorf-Ektomorf vücut tipinin baskın olduğu ve aerobik gücün önemli olduğu tespit edilmiştir.

Anahtar kelimeler: Fiziksel uygunluk, antropometri, profil, yetenek seçimi, masa tenisi

Introduction

Physical activity is considered a key factor for a healthy physical and mental development of person's, improvements in muscular fitness and speed/agility, rather than cardiorespiratory fitness, seem to have a positive effect on skeletal health (Denker & Andersen, 2008; Ortega et al., 2008). Motor ability is a players performance abilities which is affected by the factors like speed, agility, power, balance and coordination (Milanese, 2010). From the last few decades the interest in physical characteristics, anthropometric measurements, from different competitive sports has increased a lot. In these years of latest developments, it has also been well described that every sport has its own specific physical characteristics that indicate whether the player would be suitable or not to compete at the highest level in his preferred sport. It says that the quantification of morphological characteristics of elite athletes can be described as a key point in relating body structure to sports performance (Kerr, 1995; Carrasco, 2010). Racket sports are a kind of sports in which players always have a very little amount of time to respond, effort and rest (Morel, 2008; Zagatto et al, 2010). These sports are characterized by movements of agility, reaction speed, explosive power, strength, visual skills, velocity, and balance that are the predominant factors of match play, and they are highly correlated with match performance (Kovacs, 2007). However, in a match the specific ability can be a determinant factor between ''winning'' and ''losing'' (Girard et al, 2006; Zagatto et al 2010). The physical fitness of players of racket sports is always correlated with their performance (Hornery et al, 2007). In racket sports, the phosphagenic energy source (ATP-PC) is the main mechanism of resynthesis ATP during a rally, being aided by anaerobic glycolysis system only on efforts with higher duration (more than 15 seconds) (Zagatto et al 2010; Kovacs, 2007). A rally in Table Tennis normally takes 10 to 15 seconds while a match ends in 10 to 25 minutes (Lees, 2003). This long duration consequently represents the aerobic system as principal output energy in a full match (Girard et al 2006; Zagatto et al 2010). Several studies have been suggested to identify the physiological profile of racket sports (Girard et al 2006; Fernandez-Fernandez et al 2007; Mendez-Villanueva et al 2007) and the same studies also verify the sports-specific characteristics (Marinqu et al, 2003; Fernandes et al, 2006; Johnson et al, 2006).Table tennis, unlike some other popular games and sports, is a cyclic sport in which work and rest time are continuously alternated. As well as the intensity developed during the match makes it a mixed activity (Carrasco et al 2010). Its players need both a wide range of skills and a high standard of physical fitness. The fitness includes strength, agility, flexibility, balance, endurance and upper limb speed. Several studies have assessed the anthropometric, physiological and motor skill attributes of individual sports (Bencke et al., 2002; Thelwell et al 2006). Table Tennis is a dynamic sport characterized by highly developed motor skills such as agility, reaction speed, explosive power, strength, and eye movement and its coordination (Rodrigues, 2002; Jafarzadehpur, 2004; Kondric, 2007;).Endurance and velocity are the most important physical capacities of the players. No doubt physical training plays an important role to reach sport success, but we can never neglect the fact that, at the same training level, the best performances are shown by those players who have better compatible anatomic conditions (Kondrič etal., 2013).Thus taking into account the importance of early sports talents detection, biotype influence in sport performance and lack of definition of suitable morphology of Table Tennis players, it is necessary to do analysis that may provide specific anthropometric reference for this sport (Carrasco et al., 2010, Goran et al., 2011). It is also evident that within specific sports, sport disciplines and different playing positions dominates an almost identical body type, while this similarity is less present within some other sports, that is, the morphological constitution of an

athlete does not play a crucial role in achieving good competitive results. It is evident from the structural characteristics of table tennis that this is a highly complex sport, and is conditioned by a great number of factors. So it would be an interesting fact to find out how important is the role of a somatotype physical and motor fitness in achieving competitive results (Petroski et al., 2013; Goran, M & et al., 2011) . Numerous table tennis trainers have focused on maximal aerobic capacity, completely ignoring such items as peak muscle power and local muscle endurance, even though these fitness components are important for various situations in the table tennis game. For example, there are many events where it is essential to develop high intensity power instantaneously or within a few seconds. Intermediate term anaerobic performance capacity is defined as the total work output during a maximal exercise repetition lasting for about 30 s. This can be considered as being equivalent to the Wingate test in terms of intensity and duration **(**Kondric, 2007, MacDougall, Wenger, & Green, 1991). The Wingate anaerobic test has been accepted in laboratories around the world to assess muscle power, muscle endurance and fatigability (Kondric, 2007; Bouchard, 1999; Taylor, Simoneau, & Dulac, 1991; Inbar, Bar-Or, & Skinner, 1996; Bar-Or, 1987). The modern table tennis game demands very good motor abilities such as: speed, strength, endurance, agility, balance and good reflexes (Kondric, 2007). Though the physical and physiological profiles of table tennis players are considered very important, yet only a few papers have been published on this. However players profiling is given due importance and it has become an important process on the road to excellence in sports. Sports performance and anthropometric are the topics of research nowadays. In sports, besides the proper body composition, the importance of motor characteristics is accepted by everyone. But table tennis, a sport that always needs high physical performance, has never been accepted as a sport. So it would be an interesting fact to find out how important is the role of a physical and motor fitness in achieving competitive results. Thus our study was twofold. First, physical fitness and second, anthropometric identification of young top –level Table Tennis players. The main objectives of this research are to determine to which of the motor ability do the best young Iranian top level table tennis players to find out whether a certain motor fitness is dominant.

Methodology

Participants

On the direction of this aim sixteen male table tennis players participated in this study. We aimed to separate the players at the highest ranked in the final classification from the lower ranked players. Therefore, were grouped according to their results. In this research; male table tennis players (mean (SD) age 26 (7.4) years; height 174.2 (6.05) cm; body mass 74 (10.48) kg; competing at national levels volunteered to participate in the study. All players were from the first league table tennis. These players were highly ranked in the national ranking list, According to rank the subjects were divided two groups. The first group consisted of the five best highly ranked in the national ranking players while the second group consisted of the lower ranked in the national ranking male players**.** According to ranked some physical fitness, physiological and anthropometric variables were recorded of each subject.

Anthropometric measurements

In addition to anthropometric analysis (height, weight, siting height, arm length), body composition and somatotype of participants have been assessed. Height and weight were measured to the nearest 0.1cm and 0.1 kg, respectively, using a model 707 scale (Seca,

Hamburg, Germany) with subjects standing bare foot and dressed in shorts or light clothing. The body mass index (BMI) was calculated as weight divided by the square of the height. Body fat (%BF) was estimated using the method of Yuhazs.

Physical fitness

Physical fitness was determined using the following test: 1) speed; 36m sprint, 2) shoulder, back and hamstring flexibility; sit and reach, 3) lower limb power; side jump, 4) Anaerobic power; wingate test, 5) Aerobic power; 1600 m running, 6) reaction time; visual reaction time, 7) mussel endurance; sit- ups. After specific stretching and warm-up, the players made one or two attempts to become familiar with the equipment. Next, two maximal attempts were performed, and the best result was used for analysis. Hamstring flexibility was evaluated by the sit-and-reach test. This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at one-two seconds while the distance is recorded. Lower limb power was measured by the side jump test, The weight requires pedaling for 9 s at maximal speed against a constant force setting to yield the highest mean and peak power. We used the original recommended equation for force settings (0.075 kpkg–1 bw, a force equivalent to mechanical work of 4.41 J per pedal revolution per kilogram body weight) on the Monark 634 ergometer (Bar-Or, 1987, Kondric, 2007). Warm-ups were done on a cycle ergometer to promote more specific physiological and motor adaptations. The subjects pedal as fast as possible against a low resistance to overcome the inertial and frictional resistance of the flywheel and to shorten the acceleration phase. After a few seconds the full load is then applied to start the 9 s test. The subject needs to pedal as fast as possible from the beginning and to maintain maximal speed throughout the 9 s period. Curl-up; the aim of this test is to perform as many sit-ups as you can in 60 seconds. Lie on the mat with the knees bent at right angles, with the feet flat on the floor and held down by a partner. The fingers are to be interlocked behind the head. On the command 'Go', raise the chest so that the upper body is vertical, then return to the floor. Continue for 60 seconds. For each sit up the back must return to touch the floor.Cardiorespiratory fitness (using the Aerobic power; 1600 m running). In this test, test is finished when the subject stop or reach the end lines. The EUROFIT test battery (Council of Europe, 1988) was used to assess physical fitness. All tests were performed following EUROFIT guidelines.

Statistical analysis

The kolmogorof-smirnov test was applied to determine the nature of data distribution. Since a normal distribution was confirmed, a t-test for independent samples was performed to examine statistical differences between groups and p value < 0.05 was considered to be significant.

Results

The results of both groups (a; highest ranked and b; lower ranked) are presented in TABLE 1, TABLE 2 and TABLE 3 are the results of t-test. The physical and anthropometric characteristics of the subjects are presented in Table1. The mean (± SD) height of the highly ranked was 170 ± 4 cm, the average siting height was 90.6 ± 2.3, the average arm length was 169 ± 5.68,the average weight was 65.8 ± 4.60 kg and the average percent body fat was 15.20 ± 5.07 %, The mean (± SD) height of the lower ranked was 176 ± 5.97 cm, the average siting height was 93.9 ± 2.8, the average arm length was 177 ± 9.5,the average weight was 77.72 ± 10.36 kg and the average percent body fat was 22.20 ± 4.89 %.Analysis showed that there were no significant differences in height, arm length between the first 5 and the lower ranked table tennis players, while there were significant differences in weight, siting height and present body fat component. $p < 0.05$ (see Table 1)

Table1. Physical and anthropometric characteristics of the participants (mean ±sd)

		N	Mean	SD	df	P
Height	**a**	5	170	4	14	0.6
	b	11	176	5.97		
Siting height	**a**	5	90.6	2.3	14	0.038*
	b	11	93.9	2.8		
Arm length	**a**	5	169	5.68	14	0.120
	b	11	177	9.5		
Weight	**a**	5	65.8	4.60	14	0.029*
	b	11	77.72	10.36		
Body fat%	**a**	5	15.20	5.07	14	0.020*
	b	11	22.20	4.89		

*Significantly different: * $p < 0.05$*

The physical fitness characteristics of the subjects are presented in Table2 .The mean (± SD) side jump of the highly ranked was 140 ± 18.26 n, the average curl-up (n) was 60.20 ± 6.26, the average Sit and reach was 47.40 ± 3.91 cm, the average speed was 5.10 ± 0.25 s, the average visual reaction time was 396 ± 96.13, the average Anaerobic power was 4.43 ± 0.9 and the average Aerobic power was 46.4 ± 6.05 watts per kg–1. The mean (± SD) side jump of the lower ranked was 123 ± 11.98 n, the average curl-up (n) was 49.81 ± 10.45, the average

Sit and reach was 45.45 ± 17.04 cm, the average speed was 5.33± 0.31 s, the average visual reaction time was 457.55 ± 156.97, the average Anaerobic power was 4.77 ± 0.57 watts per kg–1 and the average Aerobic power was 40.77 ± 4.34. There were no significant differences in curl-up, hamstring flexibility, speed, visual reaction time, and anaerobic power between the first 5 and the lower ranked table tennis players, while there were significant differences in side jump and aerobic power. P < 0.05 (see Table 2).

Table2. Physical fitness characteristics of the participants (mean ±sd)

		N	Mean	SD	df	P
side jump	**a**	5	140	18.26	14	0.034*
	b	11	123	11.98		
curl-up	**a**	5	60.20	6.26	14	0.061
	b	11	49.81	10.45		
Sit and reach	**a**	5	47.40	3.91	14	0.808
	b	11	45.45	17.04		
speed	**a**	5	5.10	.25	14	0.172
	b	11	5.33	.31		
visual reaction time	**a**	5	396	96.13	14	0.436
	b	11	457.55	156.97		
Anaerobic power	**a**	5	4.43	0.9	14	0.357
	b	11	4.77	0.57		
Aerobic power	**a**	5	46.4	6.05	14	0.05*
	b	11	40.77	4.34		

*Significantly different: * p < 0.05*

The somatotype characteristics of the subjects are presented in Table3 .The mean (± SD) endomorph of the highly ranked was 2.75 ± 1.11, the average mesomorph was 3.41± 1.06, the average ectomorph was 4.46± 0.85, and the mean (± SD) endomorph of the lower ranked was 4.33 ± 1.13, the average mesomorph was 3.91± 0.72, the average ectomorph was 2.99± 0.61. There were significant differences in endomorph, mesomorph and ectomorph between the

first 5 and the lower ranked table tennis players. A mesomorph – endomorph somatotype was registered for the lower ranked and somatotype of first 5 table tennis players could be defined as mesomorph – ectomorph. Ectomorphy component was higher in highly ranked players' than in lower ranked $p < 0.05$ and endomorphy component was higher in lower ranked players' than in highly ranked $p < 0.05$ (see Table 3)

Table3. Somatotype characteristics of the participants (mean ±sd)

		N	Mean	SD	df	P
Endomorphy	**a**	**5**	**2.75**	**1.11**	**14**	**0.021***
	b	**11**	**4.33**	**1.13**		
Mesomorphy	**a**	**5**	**3.41**	**1.06**	**14**	**0.002***
	b	**11**	**3.91**	**0.72**		
Ectomorphy	**a**	**5**	**4.46**	**0.85**	**14**	**0.029***
	b	**11**	**2.99**	**0.61**		

Significantly different: * $p < 0.05$

Conclusion

During the last few years some studies have examined physical characteristics related to playing table tennis (Zagatto, 2008, Carresco, 2010). Our study attempts to describe the motor ability characteristics in a homogeneous sample (according to performance) of elite table tennis players. Therefore determine to which of the physiological and anthropometric profile is dominant of top-level table tennis players. Although the influence of motor ability characteristics on table tennis performance is not clear yet, it seems obvious that a agility and balance predominance can play a decisive role in this sport. Indeed, several investigations carried out with table tennis players demonstrated a superior muscular development in lower extremities (Zagatto, 2008, Carresco, 2010).Our study investigated the anthropometric characteristics physical fitness and physiological profile of the first 5 and the lower ranked elite male Iranian national table tennis players, who participated in table tennis championship, to compare the anthropometric data, physical fitness and physiological profile of the first 5elite tennis players on the ranking with the lower ranked players, and to establish an anthropometric and physiological profile chart for elite tennis players. The results showed significant differences in weight, side jump, aerobic power (VO2max) , present body fat and somatotype component between the first 5 and the lower ranked table tennis players. Generally, body size and weight are negatively correlated to motor fitness tests where the work is performed against gravity as a running, jumping, sit-ups (Kondrič et al., 2013, Zagatto et al., 2014). Measurement of anaerobic parameters in athletes is extremely important, especially in sports where there is greater participation from glycolytic and phosphagenic

energy sources during periods of intense effort, as in the Case of table tennis (Zagatto, 2004). Table tennis is characterized by force and power movements in the legs combined with fast arm movements. Zagatto (2004). The desirability of a minimum quantity of strength in table tennis has long been recognized. Unfortunately the advantages of maximum levels of strength in table tennis have not yet been recognized by all physical educators, athletes and coaches. This neglect of the strength, anaerobic and aerobic power factor were the result of an unscientific acceptance by almost everyone concerned that the development of large amounts of strength in the musculature inevitably resulted in a condition known as muscle-bound. Being muscle-bound was supposed to limit both the range and speed of table tennis strokes (Kondric, 2007). The importance of strength in table tennis is not always obvious. From this point of view we can observe power as the result of two factors: strength to produce the force and speed to increase the rate at which the force can be applied (Kondric, 2007). Studies have shown a significant increase in maximum oxygen consumption (VO2max) and running economy, an increase in the strength of various muscle groups an increase in lower limb muscle power and running velocity and a reduction in body adiposity, These benefits have been identified and attributed to training in sport disciplines such as and long-distance running, gymnastics, swimming, tennis and soccer (Canhadas, 2010; Bencke, 2002; Rowland, 1995; Kanehisa, 2006; McIntyre, 2005). Maximal oxygen uptake or aerobic capacity (VO2max) is the maximum capacity of an individual's body to transport and utilize oxygen during incremental exercise, which reflects the physical fitness of the individual. This expression is often used to compare the performance of athletes (Ales Suchomel. 2010). The sit-and-reach and the sit-up are two tests, which are included in the Eurofit test battery. Sit and reach is often used to evaluate flexibility (Tomkinson, GR, 2007) and competitive sports clubs (Kovacs, Pritchett, Wickwire, Green, & Bishop, 2007). According to Kovacs (2006), tennis players show a reduced flexibility in both hamstrings compared with other athletes. This poor hamstring flexibility may be explained by the need to be in a “low ready position” (hamstrings shortened). Tennis has been classified as a anaerobic predominant activity requiring high levels of aerobic conditioning to avoid fatigue and aid in recovery between points (Kovacs, 2006). Significant differences were obtained in 1600m run test and maximum oxygen intake. Therefore, a more aerobic training could have enhanced the maximum oxygen intake significantly (Gonzalez Jurado, Beaus, Guisado, Naranjo, Molina, & De Teresa, 2005). High levels of body fat could have a negative effect on sport performance, since body mass improvements are not correlated with the capacity of generating muscular strength. Regarding to motor ability and anthropometric assessment, sid- jump, VO2max, present body fat and somatotype were the most important component in players. It seems anthropometric and physical fitness are important parameters for performance. The dominance of the mesomorph-ectomorph body type reveals a potential advantage of this body type, that increases the success probability, while the anaerobic alactic system is the most energetic system used during periods of exertion in a table tennis game a strong capacity for endurance is what helps a player recover quicker for the following match and the next day of competition. This information provides a reference frame for coaches to control the training process in order to help improve athletes’ performance, and to improve talent detection and identification in table tennis.

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