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Determination of Taekwondo National Team Selection Criterions by Measuring Physical and Physiological Parameters

Behrouz GHORBANZADEH* Sürhat MÜNİROĞLU* Cengiz AKALAN* Mohammad Rasoul Khodadadi Sadettin KİRAZCI*** Metin ŞAHİN******

**Ankara University School of Physical Education and Sports, Ankara, Turkey*
*** PNU University School of Physical Education and Sports, Tehran, İran*
****Middle East Technical University Faculty of Education and Sports, Ankara, Turkey*
***** Selcuk University School of Physical Education and Sports, Konya, Turkey*

ABSTRACT

The aims of this study were to establish the physical and physiological attributes of elite and sub-elite Turkish male and female taekwondo players and to determine whether these attributes discriminate elite players from sub-elite players. Measurements and tests of basic anthropometry, explosive power, anaerobic recovery capacity arm strength, were conducted on two occasions, separated by at least one day. The research has been carried out with 24 men and 16 women successful Turkish National Team taekwondo athletes who have had degrees in European and World Championships several times, and 24 male and 16 female ordinary athletes who have not been in National Teams. 81 subjects have taken part in this research. In the research, totally 31 physical and anthropometric variables have been analysed by testing. In comparing the data obtaining from the athletes who were and were not in National Teams in free groups,'t' test; and as for determining the statistical relations between the anthropometric and physical characteristics, Pearson Correlation analyze statistics has been used. In analyzing the results, the signifance level has been accepted as ($p<0.05$).

Keywords: Taekwondo, Anthropometry, physical properties.

INTRODUCTION

Taekwondo is practiced in over 140 countries around the world and 120 nations are official members of its major organization, the World Taekwondo Federation (WTF). Taekwondo reached the Olympic stage as a demonstration sport in the 1988 Seoul Olympics and the 1992 Barcelona Olympics (29). It became an official Olympic sport in the 2000 Sydney Olympic Games. Taekwondo, renowned for its high and fast kicks, was developed as a technique used by Korean peasants to dismount their attackers who rode on horseback. In a competition, kicks and punches score points when contact is made with the torso (by punches and kicks) or the head (only by kicks), which is sufficient to displace that particular part of the body. A match can be

won by a knockout or by points. While punches to the head are not permitted, kicks to the head and face are allowed. Research studies related to Taekwondo have tended to concentrate on injury rates (3, 8, and 20).

The researchers found that the percentage of body fat in elite athletes was relatively low compared to average athletes concluded that because of the importance of aerobic ability in Taekwondo, reducing the percentage of body fat and increasing lean body mass are needed to gain the highest possible VO2max (9). Melhim found no significant differences in either resting heart rate or aerobic power after training; however, significant differences were observed in anaerobic power and anaerobic capacity (17). Examined the differences between successful and less successful Croatian national Taekwondo champions and found that successful athletes achieved significantly higher maximum running speed, a significantly higher ventilatory anaerobic threshold at a significantly lower heart rate, significantly higher explosive power, anaerobic alactic power and lateral agility, a somewhat lower percentage of body fat (2.3%), and were slightly taller (by 5.8 cm) than less successful athletes (16). On the other hand, other researchers agree that the possession of specific anthropometric qualities alone cannot guarantee a gold medal (10, 9, and 12). Success in competition is indeed the result of a combination of physical attributes, talent, skill, technique, determination, strategy and psychological preparation. Many of these qualities have not been investigated among elite WTF Taekwondo athletes (7).

The purposes of this study were to determine the somatotype and anthropometric profiles, flexibility, strength, vertical jump and reaction time values of elite and subelite Turkish Taekwondo athlete's and display the possible differences of these parameters between elite and sub-elite group and according to results make interpretations about deciding factors of being elite and subelite.

MATERIALS AND METHODS

Subjects

Totally 81 taekwondo athletes participated in this research voluntarily, 40 athletes (16 female and 24 male) who were in the squad of Turkish national team camp and 41 athletes (16 female and 24 male) who does taekwondo in various clubs and are not in national team.

After securing institutional ethical approval, all subjects were informed of the test procedures, including the possible risks involved, and they were required to provide written consent. In addition, immediately before testing, all subjects were examined by a physician to determine their health status. Besides, participants were asked to refrain from any food intake for three hours before the measurements and avoid caffeine, alcohol and strenuous exercise for 48 hours (anything which would affect the metabolism) before tests. The subjects, who is in Turkish national team, included 3 female world championship medallists, 4 male world championship medallists, 4 male and 3 female junior world championship medallists and 11 other internationally ranked athletes (European championship 1st to 3rd places).

The Anthropometric Measurements

Measurements were carried out in accordance to the standard anthropometric techniques recommended. All measurements were carried out by the same person, using the same equipment (24).

Height and sitting height were measured to the nearest 0.1 cm, with a stadiometer (Holtain, UK). Body mass was measured to the nearest 0.01 kg, with electronic scale (Avis 333, Korea). Body

mass index (BMI) of subjects, defined as weight/height^2 was calculated according to these measurements. Skinfold thickness was taken with a Holtain (UK) caliper at the following sites: biceps, triceps, subscapula, suprailiac, calf, abdomen, thigh and chest.

In addition, biepicondylar widths of the humerus and femur, biacromial and bi-iliocristal widths were measured as well as the girths of the flexed and tensed biceps, calf, thigh, chest, hip, abdomen and shoulder. The median was used for statistical analysis if the measurements had to be taken three times, while the mean was utilized if the first two measurements were within the acceptable range. The Heath Carter method was used to estimate somatotype (24).

The body fat percentages of athletes were estimated according to the method of Yuhasz (33).

Arm strength was measured with Cosmed trifit system (ITA). Vertical jump results measured and recorded by Sport expert performance tester (TUR)

Measurement of Flexibility

Trunk flexibility of subjects was measured through sit and reach test. During the test subject sat to the floor and leaned his foot's sole to the test table in a straigth way. Besides, the subject streched out as possible as he can, bent his body forward and his hands are in front of his body without twisting his knees. In this position, at the farthest point he waited 1-2 seconds without streching forward or backward. The test was repeated two more times and the highest result was recorded.

Arm Strength

While the test subjects are standing their back straight, legs tight and holding the dinamometer bar with shoulder width as their palms directed to up and the angle of elbow is 90 degrees, they applied maximum strength for five seconds without twisting their knees and changing the straigthness of their backs. Two more trials were done with a one minute rest and the best result is recorded.

Vertical Jumping Test

The subjects jumped as high as they can while their hands are on their waists bending with a quick movement. By using the results of the test of vertical jumping, the anaerobic power wascalculated by using Lewis nomogram (given below):

$P= (\sqrt{4,9}\ x Weight)\ x\ \sqrt{d}$,

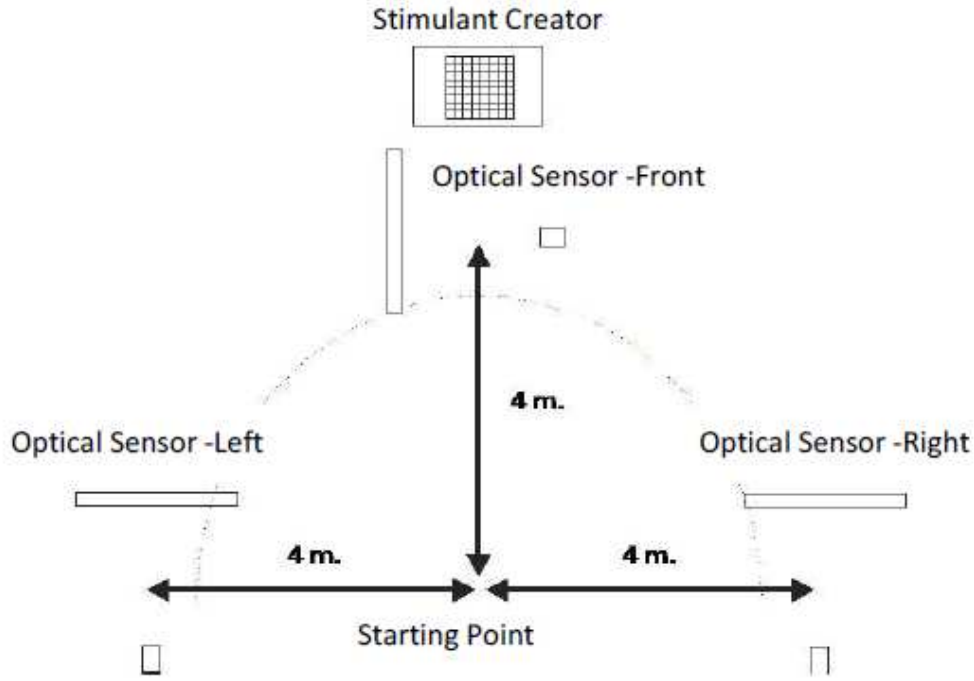
D = the result of vertical jumping by means of m.

Reaction Test

The multiple choice test of reaction time which measures the time of determination and reaching to target was applied through sport expert performance tester (TUR). During the test stimulant creator of the device showed three different stimulant (an arrow which shows 3 directions) which appears randomly successive and the sound also was given at the same time with the direction stimulus. The system is composed of a visual stimulant producer, three optical sensors, sound unit and controlling unit.

The general placement of the system is as showed below.

Figure 1. Test mechanism of visual and auditory reaction time measurement



At the beginning of the test a sound is heard from the sound unit and the first stimulant (as a shape of an arrow) appears. The subject runs for the sensor which stimulant creator shows, steps the area between and run back to center (starting point) as fast as possible. After a randomized time, a stimulant appears again; this time the subject runs for sensor which new stimulant showed and steps the area between and runs back to center. This process continues until the time which was programmed for the test or the repetition number is over. The test applied on a sports hall which has been using for Taekwondo competitions and trainings and has Taekwondo tatami on its surface. During the research, the stimulant was given for two minutes. As a result of reaction time test, the information below was obtained:

1. The total time of the test or the total repetition done during the test
2. The longest time of the determination and reaching to sensor and at which repetition it occurred
3. The shortest time of the repetition and the reaching the sensor and at which repetition it occurred
4. Average time of determination and reaching to sensor.

Statistical Analysis

Descriptive statistics were calculated for the age, weight, height, and body mass index of the athletes by gender and eliteness level. To compare the data obtaining from the athletes who were and were not in national teams, independent samples't' test; as for determining the statistical relationships between the variables, Pearson moment correlation coefficient statistics has been used through SPPS 16 software. The statistical significance level has been accepted as ($p<0.05$).

RESULTS

Table I. Comparison of Male and Female National and Non-National Taekwondo Players in selected body composition parameters

			Elite		Sub-elite		t	P
	N	Sex	Mean	Sd	Mean	Sd		
Age (Years)	24	M	22.58	2.84	18.87	2.40	4.882	0.001**
	16	F	22.37	4.73	18.76	1.52	2.989	0.005**
Sports Age (years)	24	M	9.79	2.20	5.04	2.92	6.350	0.001**
	16	F	10.25	4.46	4.17	2.50	4.857	0.001**
B. Weight (kg)	24	M	71.12	10.69	64.21	7.29	2.618	0.012*
	16	F	60.31	8.32	54.45	4.79	2.494	0.018*
Stature (cm)	24	M	181.0	7.07	176.5	5.01	2.597	0.013*
	16	F	172.0	6.45	164.0	6.54	3.515	0.001**
BMI	24	M	21.60	2.22	20.57	1.80	1.763	0.085
	16	F	20.30	2.09	20.23	1.27	0.129	0.898
Total Body Water	24	M	45.00	6.25	40.91	4.69	2.564	0.014*
	16	F	35.40	4.513	30.94	2.70	3.472	0.002**
Protein	24	M	13.32	1.85	12.12	1.43	2.508	0.016*
	16	F	10.26	1.40	8.88	0.82	3.488	0.001**
Mineral	24	M	4.18	0.60	3.78	0.43	2.619	0.012*
	16	F	3.48	0.42	3.14	0.28	2.742	0.010**
Lean Body Weight	24	M	29.21	3.71	25.92	2.81	3.454	0.001**
	16	F	20.21	4.84	18.99	3.40	0.839	0.408

** p<0.05* *** p<0.01*

A significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of age, sports age, lean body weight ($p<0.01$), body weight, stature, total body water, proteins and minerals ($p<0.05$). No significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of BMI, and lean body weight ($p>0.05$).

Table II. Comparison of Male and Female National and Non-National Taekwondo Players in selected body composition parameters and somototype characteristics

			Elite		Sub-elite		t	p
	N	Sex	Mean	Sd	Mean	Sd		
Left Leg Fat Weight	24	M	1.53	0.65	1.29	0.51	1.398	0.169
	16	F	1.98	0.98	2.07	0.44	- 0.345	0.733
Right Leg Fat Weight	24	M	1.53	0.65	1.31	0.51	1.304	0.199
	16	F	1.99	0.98	2.07	4.43	- 0.316	0.754
Left Leg Fat-Free	24	M	10.73	1.61	9.71	1.43	2.321	0.025*
	16	F	7.87	1.15	7.09	0.74	2.331	0.026*
Right Leg Fat-Free	24	M	10.73	1.57	9.58	1.04	2.989	0.004**
	16	F	8.32	1.10	7.29	0.67	3.247	0.003**
Body Fat Percentage	24	M	11.84	1.89	10.51	1.32	2.816	0.007**
	16	F	11.19	1.58	12.33	1.30	- 2.261	0.031*
Body Fat	24	M	4.41	1.86	3.78	1.44	1.312	0.196
	16	F	5.74	2.80	6.03	1.22	0.384	0.704
Endomorphy	24	M	2.58	0.70	1.96	0.55	3.347	0.002**
	16	F	2.40	0.86	3.15	0.72	- 2.069	0.011*
Mezomorphy	24	M	2.63	1.48	3.59	1.11	- 2.525	0.015*
	16	F	5.08	1.25	3.43	1.10	4.006	0.001**
Ectomorphy	24	M	3.51	0.98	3.75	0.95	- 0.861	0.394
	16	F	3.63	1.14	3.12	0.87	1.440	0.164

** p<0.05* *** p<0.01*

A significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of right leg lean body weight, endomorphy, body fat percentage ($p<0.01$), left leg lean body weight and mezomorphy ($p<0.05$). No significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of left leg fat weight, right leg fat weight and ectomorphy ($p>0.05$).

Table III. Comparison of Male and Female National and Non-National Taekwondo Players in selecter antropoemtric parameters

			Elite		Sub-elite		t	P
	N	Sex	Mean	Sd	Mean	Sd		
Anaerobic Strength	24	M	97.47	13.00	80.95	11.31	4.695	0.001**
	16	F	69.66	10.50	60.01	8.04	2.974	0.006**
Basal Metabolic Rate	24	M	1688	152.8	1610	117.1	1.974	0.054
	16	F	1338	72.23	1281	44.30	2.735	0.010**
Arm Strength	24	M	55.20	13.32	42.54	12.45	3.401	0.001**
	16	F	27.25	9.96	26.47	5.06	0.286	0.777
Elasticity (cm)	24	M	27.31	8.10	26.62	4.67	0.360	0.72
	16	F	30.63	5.17	26.59	4.99	2.281	0.030*
Sitting Height (cm)	24	M	95.75	2.95	89.61	4.12	5.935	0.001**
	16	F	91.75	4.22	85.50	2.92	4.969	0.001**
Fathom Length (cm)	24	M	179.7	8.47	175.2	6.09	2.108	0.040*
	16	F	169.3	7.972	157.2	7.55	4.494	0.001**
Arm Length (cm)	24	M	62.15	2.89	62.27	3.35	- 0.135	0.894
	16	F	60.24	2.73	55.98	3.22	4.089	0.001**
Leg Length (cm)	24	M	96.84	7.47	95.67	5.14	0.632	0.530
	16	F	92.52	5.33	84.68	8.50	3.149	0.004**
Waist-Hip Ratio	24	M	0.83	0.02	0.77	0.67	3.863	0.001**
	16	F	0.73	0.03	0.72	0.02	1.246	0.222
Vertical Leap (cm)	24	M	39.00	5.54	32.66	4.84	4.217	0.001**
	16	F	27.50	3.65	25.05	4.95	1.603	0.119
Circumference of Calf (cm)	24	M	36.74	2.53	35.40	2.27	1.92	0. 061
	16	F	36.00	2.41	33.52	1.61	3.48	0.001**
Circumference of Chest (cm)	24	M	92.29	5.45	87.31	3.89	3.63	0.001**
	16	F	86.20	4.13	82.64	4.94	2.23	0.033*

** p<0.05 ** p<0.01*

A significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of anaerobic strength, vertical leap, arm strength, sitting height, ($p<0.01$) and fathom length **waist-hip ratio, basal metabolic rate**. No significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of elasticity, full arm length and full leg length ($p>0.05$) **basal metabolic rate , waist-hip ratio, circumference of chest ($p<0.01$).**

Table IV. Comparison of Male and Female National and Non-National Taekwondo Players in Terms of Reaction Time

			Elite		Sub-elite		t	P
	N	Sex	Mean	Sd	Mean	Sd		
Reaction Aver. Time of Deciding	24	M	1.69	0.12	1.71	0.20	- 0.35	0.725
	16	F	1.85	0.20	1.80	0.22	0.61	0.542
Reaction Minimum Time of Deciding	24	M	1.22	0.77	0.78	0.64	2.14	0.038*
	16	F	1.40	0.41	0.73	0.71	3.26	0.003**
Reaction Maximum Time of Deciding	24	M	3.26	1.55	3.56	2.80	- 0.45	0.651
	16	F	2.86	1.14	3.27	0.82	- 1.17	0.250

** p<0.05 ** p<0.01*

A significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of minimum time of reaction deciding and reaching the sensor ($p<0.05$). No significant statistical difference between male/female national taekwondo players and male/female non-national taekwondo players has been found in terms of reaction maximum time of deciding and reaching the sensor and reaction average time of deciding and reaching the sensor ($p>0.05$).

DİSCUSSİON

Taek-Wondo's impact on athlete's physical and anthropometric characteristics, as a game which carries the features of combat and defensive sports, can be evaluated through tests and assessments by carrying out a long running study. Within this study, 24 male and 16 female athletes from National Taekwondo Team and 24 male and 16 female athletes from various Taek-Wondo Clubs were used as the subject group. To achieve the goal of the study, a total of 31 physical and anthropometric parameters were measured and evaluated.

The research carried shows that Taiwan Male Natioanal Taek-Wondo team's age for sports (How long have they been practicing the related sport?) is approximately 8.6 ± 2.9 years, those who remain out of the team have an average age rate of 7.6 ± 3.5 years (6). In this research, findings show that among sports such as athletics, volleyball, handball, wrestling, the shortest training period belongs to Taek-Wondo with 10.76 ± 3.16 years. In the research carried age rate for sports for athletes who manages to get into Turkish Natioan Taekwondo Team is averagely 13.14 ± 2.41 years, and for those who cannot get into the team the average rate is 9.88 ± 2.84 years (30).

The findings that take place in the research demonstrate that athletes who manage to get into Turkish National Taek-Wondo Team have averagely 9.79 ± 2.20 years of age rate for sports and athletes who cannot get into the team have averagely 5.04 ± 2.92 years of age rate for sports. Athletes who manage to get into Female National Taekwondo Team have an average of 10.25 ± 4.46 years age rate for sports and female athletes who cannot get into the team have relatively 4.17 ± 2.50 years higher age rate when it is compared with the average years of age (Table I).

The result of the research indicates that age for sports is an important factor in getting into a national team. Because athletes who manage to get into The National Team have higher levels of age for sports when they are compared to the rest of the group and those who cannot get into The National Team.

All the athletes who were invited to The National Team (40 people) took place in Championship in Turkey, 20 male subjects took place in international competitions, 13 subjects took place in European Championship and 6 subjects participated in World Championship. Among female subjects 12 athletes managed to win medals in international competitions, 7 athletes in European Championship and 5 athletes in world championship.

Turnagöl and his friends found the average age of Teak-Wondo National Team athletes as 20.7 ± 3.2 years (31). In the research carried the average age of athletes who managed to get into Taiwan Male Teak-Wondo National Team was found as 20.4 ± 1.6 years (6). In the research carried the average age of male Taek-Wondo athletes was found 23.6 ± 3.8 years and average age rate of female Taek-Wondo athletes was found 24.1 ± 3.8 years (5). In the researches carried average age of athletes who managed to get into Malaysian National Taek-Wondo Team was found 18.63 ± 1.92 years and average age of Malaysian female athletes who managed to get into

the national team was found 18.10 ± 1.37 years (18). In the research carried out by Çatıkkaş average age of athletes who managed to get into Turkish National Taek-Wondo Team was found 23.6 ± 2.2 years (4).

When we examine individual and weight-division based branches of sports; it can be seen that average age of boxers is 20.5 ± 2.8 years, average of wrestlers is 21.6 ± 3.8 years, average age of Judo athletes is 22.6 ± 2.3 years, average age of Karate athletes is 21.9 ± 2.7 years (31).

Turkish Male Teak-Wondo Team candidate athletes who participate in the research have an average age of 22.58 ± 2.84 years and athletes who could not get into the team have an average age of 18.87 ± 2.40 years. Average age of female National Team athletes was found 22.37 ± 4.73 years and average age of female athletes who could not get into the national team was found as 18.76 ± 1.52 years.

The results of the research indicates that athletes who practice individual and weight-division based sports and who are about to be promoted to the national team have close average age rates.

According to the findings of the researh carried average height of male Taek-Wondo athletes was found as 178.0 ± 3.7 cm and their average body weight as 71.6 ± 9.0 kg also average height of female Taek-Wondo athletes was found as 161.3 ± 4.9 cm and their average body weight as 58.6 ± 8.3 kg (5). In the research carried average height of the athletes who managed to get into Taiwan National Taek-Wondo team was found as 176.2 ± 6.7 cm and their average body weight as 75.5 ± 11.5 kg (6). In the researches carried average height of Teak-Wondo athletes who managed to get into Malaysian National Team was found as 168.65 ± 7.36 cm and their average body weight as 68.29 ± 20.69 kg also average height of the female athletes who managed to get into the national team was found as 158.22 ± 4.11 cm and their average body weight as 59.72 ± 10.03 kg (18). In the research carried out by Çatıkkaş average height of the athletes who managed to get into Turkish National Taek-Wondo Team was shown as 179.8 ± 5.9 cm and their average body weight as 69.3 ± 9.8 kg (4).

Average height of Turkish National Team contestants who took place in the research was found as 181.0 ± 7.07 cm and their average body weight as 71.12 ± 10.69 kg. Also average weight of female athletes who managed to get into the national team was found as 172.0 ± 6.45 cm and their average body weight as 60.31 ± 8.32 kg.

When we look at the body fat percentage as the most important factor in determining the body composition, we can see a considerable difference between the groups who practice a sport and who do not practice any sport. In the research carried the average percentage of body fat for athletes who managed to get into Taiwan National Taek-Wondo Team was shown as %15.29 ± 5.18 mm (6). In the research carried out this percentage was shown as %21.40 ± 6.30 mm for males who managed to get into Malaysian National Taek-Wondo Team and for females the percentage is %32.46 ± 3.93 (18). In the research carried out by Çatıkkaş the average percentage of body fat for athletes who managed to get into Turkish National Taek-Wondo Team was shown as %12.5 ± 1.8 (4).

Average body fat percentage for Turkish Male National Team Taek-Wondo athletes who participated in the research was found as %11.84 ± 1.89 and for those who could not get into the national team the percentage was found as %10.51 ± 1.32. The average body fat percentage for female Taek-Wondo athletes was found as %11.19 ± 1.58 and for those who could not get into the team the percentage was found as %12.33 ± 1.30.

In the research on Olympic Tae-Wondo athletes shows that average body mass index rate for male athletes is 22.4 ± 2.3 and for female athletes average body mass index was found as 20.4 ± 2.5. In the research carried out by Çatıkkaş average body mass index for athletes who managed to get into Turkish Natioanl Team was found as 21.4 ± 2.0 (4, 13, 14).

Teak-Wondo is one of the sports which requires anaerobic power. Anaerobic leg power (explosive power) is a highly important factor for flying kicks, defense and attacks and counter-attacks (7).

It is emphasized that there is a considerable difference between anaerobic power rates among groups who practice sport and who do not practice any sport. Polat and his friends spotted that junior male Taek-Wondo team's anaerobic power rate values were found as 95.26 ± 17.08 kg/m/sec and Adult Male Taek Wondo Team's anaerobic power rate values were found as 109.22 ± 19.98 kg/m/sec (23). In the research carried anaerobic power of athletes who practice boxing was found as 113.35 ± 22.29 kg/m/sec, anaerobic power rates for Tae-Wondo athletes were found as 121.40 ± 17.56 kg/m/sec and anaerobic power of athletes practicing Karate was found as 116.00 ± 25.39 kg/m/sec (25). Anaerobic power rates in some other branches of sports were measured as 131.18 ± 7.33 kg/m/sec for soccer players, for basketball players anaerobic power rate was measured as 140.51 kg-m/sec (11), for handball players the rate was 130.1 kg-m/sec and the research carried out by Tel shows that the average anaerobic power rate was found as 133.81 ± 9.72 kg/m/sec (30).

Average anaerobic power of Turkish National Taek-Wondo Team contestants who participated in the research was found as 97.47 ± 10.50 kg/m/sec, average anaerobic power of athletes who could not get into the national team was found as 80.95 ± 11.31 kg/m/sec. Average anaerobic power rate for female athletes who managed to get into the national team was measured as 69.66 ± 10.50 kg-m/sec, average anaerobic power rate for female athletes who could not get into the national team was measured as 60.01 ± 8.04 kg-m/sec. In both sexes there is a considerable difference between anaerobic rates of athletes who managed to get into the national team and who could not get into the national team.

With the help of these findings we can suggest that in order to be successful in the branch of Taek-Wondo athletes need to have a strong anaerobic capacity and anaerobic capacity should be improved through practice.

An athlete with a wide range of movements also has a high capability for movement operation and his/her performance, endurance and efficiency develops parallel with these factors. Athletes with high flexibility have a lower risk of injury (1).

In the research carried flexibility rates of athletes who managed to get into Malaysian Male National Taek-Wondo Team was found 31.99 ± 6.17 cm and for female athletes the rates were 35.75 ± 4.15 cm (18). In the research carried the flexibility rate for national Taek-Wondo team was found as 32.00 ± 5.06 cm (30). In the research carried on elite Taek-Wondo athletes flexibility was measured as 34.44 ± 5.31 cm (12). Miguel and his friends (1998) measured the flexibility of elite Teak-Wondo athletes as 36.0 ± 9.1 cm and Tel with his research upon Turkish National Taek-Wondo Team measures the flexibility rate as 34.44 ± 5.31 cm (30).

Average flexibility rate of Turkish Male National Taek-Wondo contestants who participated in the research was found as 27.31 ± 8.10 cm and for male athletes who could not get into the national team the rate was 26.62 ± 4.67 cm. Flexibility rate of female national team was

measured as 30.63 ± 5.17 cm and female athletes who could not get into the national team the rate was measured as 26.59 ± 4.99 cm. The flexibility rates of Teak-Wondo athletes in Turkey whether they participate in the national team or not are low when they are compared with the international research rates. Therefore, we can say that there must be more time and space for flexibility practices.

In all sport branches, especially in sports which necessitate binary struggle, strength is an important factor. The researches show that there are statistical differences between grip, leg and back strength among groups who practice a specific sport and groups who do not practice any sport (32).

In the research carried on male Taek-Wono athletes grip strength for right hand was found as 47.30 ± 5.84 kg and for left hand it was found as 46.17 ± 5.66 kg (15). Yaman study on soccer players revealed that right hand strength was 39.11 ± 6.81 kg and left hand was 42.94 ± 8.85 kg (32). In the research carried grip strength of right hand for athletes who managed to get into Turkish National Taek-Wondo Team was found as 47.30 ± 5.84 kg and for left hand 46.57 ± 5.16 kg, average leg strength value was found as 151.46 ± 25.31 kg and average back strength value was found as 151.46 ± 23.71 kg (30).

Average arm strength rates of Turkish National Taek-Wondo Team members was found as 52.20 ± 13.32 kg and average arm strength rate for athletes who could not get into the national team was found as 42.54 ± 12.45 kg. Average arm strength rate for female national team members was found as 27.25 ± 9.96 kg and average arm strength rate for female athletes who could not get into the national team was found as 26.47 ± 5.06 kg.

Polat and his friends found the average vertical jumping rate for Taek-Wondo national team athletes as 50.46 ± 5.02 cm (23).

Turkish National Team Taek-Wondo athletes who took place in the research had a vertical jumping rate of 39.00 ± 5.54 cm and athletes who could not get into the team had a vertical jumping rate of 32.66 ± 4.84 cm. Vertical jumping rate of female national team athletes was found as 27.50 ± 3.65 cm and vertical jumping rate of female athletes who could not get into the national team was found as 25.05 ± 4.95 cm. When we consider the importance of anaerobic power for Taek-Wondo performance, it is an expected result that more successful Taek-Wondo athletes have higher jumping rates.

Somatotype; is defining the morphological constitution of the body. The relationship between muscle rate, fat rate and slimness is defined through scientific methods (27).

In the research carried somatotype values of male Taek-Wondo athletes were found as: endomorphy 4.2 ± 1.1, mesomorphy 4.7 ± 1.0, ectomorphy 2.9 ± 1.0 and somatotype values of female athletes were found as: endomorphy 6.3 ± 1.5, mesomorphy 4.2 ± 1.0, ectomorphy 2.0 ± 1.0 (5). In the research carried on club level Taek-Wondo athletes, somatotype values for endomorphy mesomorphy, ectomorphy were respectively 2.5 – 4.9 – 2.7 and samototype values for Teak-Wondo athletes on regional level were 2.2 – 4.5 – 2.2 and for elite TaeWondo athletes values were 1.4 – 4.1 – 2.0 (19). In the research carried out by Taaffe and Pieter somatotype values of elite male Taek-Wondo athletes for endomorphy, mesomorphy and ectomorphy were found as 1.65 – 4.53 – 3.59 and somatotype values of female elite Teak-Wondo athletes were spotted as 2.08 – 3.23 – 3.98 (28).Song and his friends, found the somatotype values of female elite Teak-Wondo athletes as 5.0 – 4.1 – 2.5 (26). Osborne's study on basketball players found

the values as: endomorphy 3.6, mesomorphy 4.2, ectomorphy 3.2 (20). In the research on gymnasts found endomorphy as 4.81, ectomorphy as 3.07 and mesomorphy as 4.81 (21). In the research carried Somatotype values of Turkish male volleyball team' were found as 1.97 ± 0.52 – 2.06 ± 0.84 – 3.96 ± 0.96 (2). The findings we gathered out of the tests indicate that there are no considerable difference between mesomorphic values among elite and sublevel Taek-Wondo athletes when we look at the international norms and statistics (2).

Somatotype values (endomorphy-mesomorphy-ectomorphy) of Turkish Male Taek-Wondo National Team athletes who took place in the research were found as 2.58 ± 0.70 – 2.63 ± 1.48 – 3.51 ± 0.98 and somatotype values of male athletes who could not get into the national team was found as 1.96 ± 0.55 – 3.59 ± 1.11 – 3.75 ± 0.95. Somatotype values of female national team members were found as 2.40 ± 0.86 – 5.08 ± 1.25 – 3.63 ± 1.14 and somatotype values of female athletes who could not get into the national team was found as 3.15 ± 0.72 – 3.43 ± 1.10 – 3.12 ± 0.87.

It can be seen that female athletes in the national team have more muscular (mesomorphic) and low-fat (endomorphic) body constitution. For male athletes the opposite situation can be observed. According to the findings we can say that in Teak-Wondo it is more important for female athletes to have a mesomorphic body constitution in order to be successful when compared with male athletes.

Reaction Time can be defined as the period between the beginning of stimuli and the beginning of the reaction (27). Reaction Time is very important especially in sports such as boxing which requires quick movements.

Heller and his friends found the audio reaction rate of 11 elite Taek-Wondo athletes (age=20.9 ± 2.2 years) as 1960 ± 16.4 millisecond (12).

In sports like Karate which involves physical contact and a high risk of physical injury, athletes must react quickly. Experienced athletes can use the visual information they have attained to guess the next attempt of their opponent and act according to the possibilities of the situation by using the information they have gathered. Therefore they can decide easily and quickly (12).

Turkish Male National Taek-Wondo Team athletes who participated in the research had an average decision making time of 1.69 ± 0.12 – and shortest decision making time was spotted as 1.22 ± 0.77 – also longest decision making time was found as 3.26 ± 1.55. The reaction rate of athletes who could not get into the national team was found as 1.71 ± 0.20 – the shortest decision making time was 0.77 ± 0.64 and longest decision making time was 3.56 ± 2.80. Average reaction values of Female athletes who compete in the national team were spotted as; average decision making time was 1.85 ± 0.20 – shortest decision making time was 1.40 ± 0.41 – and longest decision making time was 2.86 ± 1.14. Average reaction time of female athletes who could not get into the national team; average decision making time was 1.80 ± 0.22 –, shortest decision making time was 0.73 ± 0.71 and longest decision making time was spotted as 3.27 ± 0.82.

CONCLUSION

To examine physical and anthropometric features of Turkish National Taek-Wondo team athletes and the relationship between these features and Taek-Wondo performance, along with age, training age, height, sitting height, weight, body fat percentage also anaerobic power, height measurements, diameter measurements, vertical jumping test, arm strength, flexibility and

reaction test were carried out. Heath-Carter method was used to determine somatotype features of the research group; also body fat percentage was measured through Yuhasz formula (33).

Turkish National Taek-Wondo team athletes who managed to get into the team had 9.79 ± 2.20 years of average age rate for sports; athletes who could not get into the national team had 5.04 ± 2.92 years of average age for sports. Female athletes who managed to get into the national team had 10.25 ± 4.46 years average age for sports, athletes who could not get into the national team have relatively 4.17 ± 2.50 years higher age rate when it is compared with the average years of age.

The result of the research indicates that age for sports is an important factor in getting into a national team. Because athletes who manage to get into The National Team have higher levels of age for sports when they are compared to the rest of the group and those who cannot get into The National Team

It can be seen that having a mesomorphic body constitution is more important for female Taek-Wondo athletes and it carries less importance for male athletes. The same case can be observed in endomorphy and body fat percentage. Therefore, different approaches can be taken towards choosing and directing male and female Taek-Wondo athletes especially according to body composition. However, in order to get more accurate results, it would be beneficial to have the same number of athletes and same body weight-division for Teak-Wondo athletes who go through measurements and comparison.

When we consider that national team athletes are superior to those who are not in the national team in terms of anaerobic power, arm strength, height. Choosing athletes for Taek-Wondo as branch of sport requires an emphasis on these factors and within the process of athlete's development these parameters must be truly integrated to training system so that their importance can stand out.

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