Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH,
Vol. 10 ISSUE 2, supplement, 2010, Romania
Our JOURNAL is nationally acknowledged by C.N.C.S.I.S., being included in the B+ category publications, 2008-2010.
The journal is indexed in: 1. INDEX COPERNICUS JOURNAL MASTER LIST 2. DOAJ DIRECTORY OF OPEN ACCES JOURNALS, SOCOLAR

INVESTIGATING MOTORIC IMPROVEMENT OF ADOLESCENT FEMALE TAEKWONDO ATHLETES

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ABSTRACT

In the examination, it was purposed to examine physical and motor developments of adolescents female taekwondo athletes which were training regularly.

At this study 10-13 aged, 87 female Taekwondo athletes were participated voluntarily.

Participants' level, age, height, kilo, body mass index (BMI), competition weight, band, vertical jump, speed, grip strength of right hand, grip strength of left hand, leg force, maximal oxygen consumption (Maximum VO2), balance duration, balance point, reaction time, body fat percentage (BF%), anaerobic endurance, hip flexion, hip extension, hip internal rotation, hip external rotation, knee flexion, knee extension parameters of the volunteer sportsmen were measured in the examination.

For statistical analysis, averages of groups and their standard deviations were calculated by Independent't' and One Way Enova tests that were performed for comparison of groups.

RESULTS: As a result of comparison according to athletes' increasing age factor, hip extantion, knee flexion parameters were found significantly different ($p < 0.05$) Athletes' BMI, hip flexion and knee extantion parameters were found significantly different ($p<0,01$). Athletes' level, height, weight, competitions weight, band category, vertical jump, speed, right hand grip strength, left hand grip strength, leg strength, max. VO2, right-hand sound Reaction Time(RT), RT light right-handed, left-hand sound RT, RT left hand light, choose light RT, RT footstep, foot lights RT, BF%, anaerobic endurance, hip internal rotation, hip external rotation, parameters were found significant ($p <0.001$).

Althought differences between age groups showed a linear variability about force and RT parametres, there was not a linear variability abour motor skills and ability of athletes.

CONCLUSION: It was seen that athletes had different motor and physical skill improvement at different age and level during adolescent period. While it was seen that age factor had an important effect on maximal produced values, it hadn't and important effect on relative produced values

Key words: Adolescent, Taekwondo, Motor feature, Physical feature.

INTRODUCTION

The physical fitness levels including physical and motor characteristics of children Taekwondo athletes may significantly improve in their adolescence period. This development seems important since it will provide a basis for their future performance.

The study aims to determine the physical and motor characteristics of children that will be future Taekwondo champions and to analyze development levels of mentioned skills against aging factor.

MATERIALS AND METHOD

87 women Taekwondo athletes ranging in ages between 10 and 13 who do training on a regular basis participated in the study voluntarily.

Age; The ages of volunteers on their Republic of Turkey ID cards were recorded.

Tests performed:

Height; measured with a sliding calliper (Holtain, UK).

Body weight; measured with a weighing machine (Angel) sensitive up to 20 grams with barefoot and only wearing shorts.

Body mass index; obtained through dividing the parameters of body weight into the square of height parameters.

Belt levels; obtained through the official website of the Taekwondo Federation of Turkey with record number of athletes. The belt and gup levels were recorded as follows: 10th gup-white belt, 9th gup/white-yellow belt, 8th gup/yellow belt, 7th gup/yellow-green belt, 6th gup/green, 5th gup/ green-blue, 4th gup/blue, 3rd gup/blue - red, 2nd gup/red, 1st gup/red-black.

Vertical jump test; the device called Jumping Takei Physical Fitness Test was used for vertical jump test. The vertical jump heights of the volunteers were measured and recorded Tamer (2000)[1].

30 m Acceleration; Running time of the distance by the subjects were measured in a standard 50 m indoor running track, with a photocell timer established between 5 - 35 m and the best of three trials was recorded by applying 5 min rest intervals.

Hand Grip Strength Test; hand grip strength was measured with Takkei hand grip dynamometer Tamer (2000)[2].

Leg strength; Measurement was conducted with Takkei back and lift dynamometer Tamer (2000)[2].

Maximal Oxygen Consumption; max VO_2 , 20 m shuttle run test was used Tamer (2000)[1].

Filamingo balance test; To measure the balance of the volunteers, subjects tried to keep balance as long as possible standing on the balance beam on their preferred leg.

Reaction time; measured with reaction time measurement section of Bosco's Newtest 2000 battery. Volunteer groups visual basic (right and left hand with right foot) RT, auditory basic (right and left hand with right foot) RT and visual-choice RT (hands) were measured Tamer (2000)[2].

Calculation of body fat in percent (%); Subcutaneous fat thickness measurements were made with a Skinfold device (2). Logx = (biceps + triceps + sub-scapular + sacroiliac) % fat = (4.95 / D -4.5) * 100

Anaerobic endurance; as measuring battery**,** "Hexagonal Obstacle Test" was used Kiber [(3)].

Hip flexion, hip extension, hip internal rotation, external rotation of the hip, knee flexion, knee extensor; measurements were done with goniometer Sevim (1995)[4].

Contestant Level; measured in order to determine if volunteers have participated in competitions

Competition Ranking; used to determine ranked and unranked athletes participating in 2009 Taekwondo Championship of Turkey.

Data analysis; the mean and standard deviations of the groups were calculated. For more than two independent groups to compare the One Way Anova test were applied.

RESULTS

Table 1 Comparison of some physical and motor characteristics of the athletes between the age groups

Variables	**Age Groups**	**N**	**X ± Ss**	**F**	**p**
Contestant Level (count)	10,00	24	1,33 ± ,48[a]	10,819	**,000*** **
	11,00	18	1,00 ± ,00[b]		
	12,00	22	1,00 ± ,00[b]		
	13,00	23	1,52 ± ,51[a]		
Competition Ranking Level (count)	10,00	24	,25 ± ,44[a]	3,514	**,019***
	11,00	18	,50 ± ,51[ab]		
	12,00	22	,68 ± ,48[b]		
	13,00	23	,35 ± ,49[ab]		
Belt Level (gıp)	10,00	24	3,00 ± 1,50[a]	9,165	**,000*** **
	11,00	18	4,83 ± ,71[b]		
	12,00	22	4,41 ± 1,18[b]		
	13,00	23	2,91 ± 2,04[ac]		
Height (m)	10,00	24	1,40 ± ,09[a]	25,693	**,000*** **
	11,00	18	1,47 ± ,05[ab]		
	12,00	22	1,53 ± ,11[b]		
	13,00	23	1,61 ± ,05[c]		
Weight (kg)	10,00	24	36,23 ± 12,24[a]	12,484	**,000*** **
	11,00	18	35,84 ± 1,48[a]		
	12,00	22	43,55 ± 10,33[a]		
	13,00	23	54,24 ± 15,38[b]		
Competition Weight (kg)	10,00	24	36,92 ± 11,68[a]	10,991	**,000*** **
	11,00	18	34,94 ± 2,18[a]		
	12,00	22	44,54 ± 11,71[b]		
	13,00	23	50,04 ± 9,09[b]		
Body Mass Indeks (kg / m^2)	10,00	24	17,94 ± 4,13[ab]	4,444	**,006****
	11,00	18	16,67 ± 1,45[a]		
	12,00	22	18,44 ± 2,62[ab]		
	13,00	23	20,77 ± 5,15[b]		
Body Fat Percentage (%)	10,00	24	12,22 ± 7,15[ab]	6,803	**,000*** **
	11,00	18	8,14 ± 1,55[a]		
	12,00	22	12,26 ± 4,40[ab]		
	13,00	23	15,66 ± 5,65[b]		
Right Hand Grip Strength (kg)	10,00	24	9,83 ± 3,40[a]	27,222	**,000*** **
	11,00	18	12,96 ± 2,65[ab]		
	12,00	22	15,84 ± 4,82[b]		
	13,00	23	20,00 ± 4,51[c]		
Lleft Hand Grip Strength (kg)	10,00	24	8,38 ± 2,51[a]	28,787	**,000*** **
	11,00	18	11,20 ± 1,20[a]		
	12,00	22	15,80 ± 5,28[c]		
	13,00	23	18,45 ± 5,19[c]		
Leg Strength (kg)	10,00	24	25,42 ± 3,97[a]	27,907	**,000*** **
	11,00	18	32,94 ± 6,91[b]		
	12,00	22	42,14 ± 10,72[c]		
	13,00	23	44,83 ± 9,13[c]		
Balance Time (sn)	10,00	24	58,22 ± 8,72[a]	3,081	**,032***
	11,00	18	49,50 ± 17,53[ab]		
	12,00	22	43,93 ± 19,92[b]		

	13,00	23	52,40 ± 17,21[ab]		
Balance Score (score)	10,00	24	1,87 ± 3,33[ab]	2,736	**,049***
	11,00	18	3,78 ± 4,67[a]		
	12,00	22	1,82 ± 2,75[ab]		
	13,00	23	,87 ± 2,12[b]		

*P<0,05 **p<0,01 ***p<0,001 **abc:** the differences in abc letters, explain the differences between the groups.

As a result of comparison between groups, Competition Ranking, balance time and score parameters were significantly different (p <0.05). In BMI parameters at p <0.01 level, in Contestant Level, belt level, height, weight, competition weight, BF % , right and left hand grip strength and leg power parameters significant differences were found at p <0.001 level.

Table 2 Comparison results of motor characteristics of athletes between the age groups

Variables	**Age groups**	**N**	**X ± Ss**	**F**	**p**
Vertical Jump (cm)	10,00	24	23,42 ± 6,41[a]	44,665	**,000*** **
	11,00	18	34,33 ± 3,25[b]		
	12,00	22	33,27 ± 4,62[b]		
	13,00	23	39,13 ± 3,84[c]		
Speed 30 m (sn)	10,00	24	6,73 ± ,83[a]	11,946	**,000*** **
	11,00	18	5,67 ± ,69[b]		
	12,00	22	6,10 ± 45[b]		
	13,00	23	5,61 ± ,80[b]		
Maximal Oxygen Consumption (ml/kg/dk)	10,00	24	31,85 ± 2,28[a]	38,302	**,000*** **
	11,00	18	35,86 ± 1,64[b]		
	12,00	22	38,80 ± 2,29[c]		
	13,00	23	39,85 ± 4,13[c]		
Anaerobic Endurance (sn)	10,00	24	16,65 ± 3,20[a]	12,963	**,000*** **
	11,00	18	11,74 ± 2,34[b]		
	12,00	22	14,21 ± 2,56[c]		
	13,00	23	15,05 ± 1,92[ac]		
Agility Error Count (count)	10,00	24	4,29 ± 3,44[a]	11,627	**,000*** **
	11,00	18	,89 ± ,90[b]		
	12,00	22	1,50 ± 1,06[b]		
	13,00	23	1,13 ± 2,09[ab]		
Quick jumps (count)	10,00	24	27,87 ± 8,01[ab]	6,134	**,001*** **
	11,00	18	23,94 ± 1,89[a]		
	12,00	22	28,36 ± 6,67[ab]		
	13,00	23	32,43 ± 6,24[b]		
hip flexion (º)	10,00	24	122,04 ± 13,75[ab]	4,199	**,008** **
	11,00	18	117,22 ± 18,88[a]		
	12,00	22	125,00 ± 9,51[ab]		
	13,00	23	134,13 ± 20,09[b]		
Hip Extension (º)	10,00	24	25,92 ± 11,86[a]	,992	,401
	11,00	18	28,89 ± 10,37[a]		
	12,00	22	25,00 ± 11,95[a]		
	13,00	23	23,04 ± 9,14[a]		
Internal Hip Rotation (º)	10,00	24	29,04 ± 6,01[a]	9,558	**,000*** **
	11,00	18	33,61 ± 4,13[a]		
	12,00	22	34,77 ± 9,19[a]		
	13,00	23	21,74 ± 13,11[b]		
External Hip Rotation (º)	10,00	24	25,92 ± 3,66[a]	8,837	**,000*** **
	11,00	18	28,89 ± 5,30[a]		
	12,00	22	34,54 ± 7,22[b]		
	13,00	23	31,09 ± 6,56[b]		
Knee Flexion (º)	10,00	24	137,21 ± 40,80[a]	,782	,507
	11,00	18	135,56 ± 4,50[a]		
	12,00	22	127,73 ± 16,01[a]		
	13,00	23	136,74 ± 10,93[a]		
Knee Extension (º)	10,00	24	184,54 ± 5,03[ab]	4,357	**,007** **
	11,00	18	185,00 ± 6,18[ab]		
	12,00	22	181,87 ± 5,13[a]		
	13,00	23	187,39 ± 4,23[b]		

*P<0,05 **p<0,01 ***p<0,001 **abc:** the differences in abc letters, explain the differences between the groups.

In hip extension and knee flexion parameters of the groups, no significant differences were found (p> 0.05). In the number of quick jumps, hip flexion and knee extension parameters significant differences were found at p <0.01 level, but in vertical jump, speed, max. VO_2, anaerobic endurance, agility error count, internal and external hip rotation parameters significant differences were found at p <0.001 level.

Table 3 Comparison results of reaction time values of athletes between the age groups

Variables	Age Groups	N	X ± Ss	F	p
Right Hand Sound Reaction Time (ms)	10,00	24	299,83 ± 41,04[a]	35,141	**,000*** **
	11,00	18	247,56 ± 16,22[b]		
	12,00	22	224,77 ± 34,46[b c]		
	13,00	23	217,23 ± 20,34[c]		
Right Hand Light Reaction Time (ms)	10,00	24	397,50 ± 85,13[a]	22,332	**,000*** **
	11,00	18	305,75 ± 33,33[b]		
	12,00	22	279,94 ± 48,03[b]		
	13,00	23	291,85 ± 26,39[b]		
Left Hand Sound Reaction Time (ms)	10,00	24	315,21 ± 35,45[a]	42,518	**,000*** **
	11,00	18	276,92 ± 31,60[b]		
	12,00	22	234,45 ± 29,57[c]		
	13,00	23	232,39 ± 16,62[c]		
Left Hand Light Reaction Time (ms)	10,00	24	432,90 ± 68,38[a]	37,652	**,000*** **
	11,00	18	317,82 ± 55,84[b]		
	12,00	22	300,91 ± 49,54[b]		
	13,00	23	292,84 ± 19,97[b]		
Selective Light Reaction Time (ms)	10,00	24	428,93 ± 71,78[a]	29,562	**,000*** **
	11,00	18	321,12 ± 23,32[b]		
	12,00	22	310,22 ± 33,41[b]		
	13,00	23	345,72 ± 39,34[b]		
Foot Sound Reaction Time (ms)	10,00	24	374,62 ± 42,46[a]	44,439	**,000*** **
	11,00	18	342,05 ± 28,05[b]		
	12,00	22	285,10 ± 34,12[c]		
	13,00	23	286,43 ± 12,36[c]		
Leg Light Reaction Time (ms)	10,00	24	444,19 ± 80,40[a]	28,500	**,000*** **
	11,00	18	391,92 ± 25,42[b]		
	12,00	22	323,76 ± 43,51[c]		
	13,00	23	329,47 ± 29,37[c]		

*****p<0,001 abc:** the differences in abc letters, explain the differences between the groups.

In the right-hand sound RT, right-hand light RT, the left hand sound RT, the left-hand light RT, selective light RT, foot sound RT and leg light RT parameters significant differences were found at p <0.001 level.

DISCUSSION AND CONCLUSION

The effect of long term Taekwondo (a martial art featuring defence and combat characteristics) training over physical and physiological characteristics of athletes, can be evaluated through the tests and measurements performed. 87 women Taekwondo athletes ranging in ages between 10 and 13 participated in the study voluntarily.

VYY was found as 12.29%, between 11 years and 13 years of age less than 11 level, p>0,01 significant differences were found, among other age groups, p>0,05, no significant differences were found in level

Miguel and colleagues (1998), on elite men's taekwondo developers (n = 13, age = 22.3 ± 7.1), they have done research on body fat percentage by 9.6%, 11.6% ± 4.1 for boxers has indicated. Akgün (1986) normal body fat percentage in male athletes is between 15-20% of the population are reported. Turgut and colleagues. (1998) athletes in middle and long distance runners VYO was 12.1%, Turgut and colleages (1998) VYO group of football players was 13.5%, Cimen and colleagues (1997) Turkish youth in the national table tennis players body fat was found as 10.4. Söğüt and colleagues (2004) the study has been made in different categories of ages 11, 12 and 14 years young men tennis players the body fat percentage, p>0,05 found significant difference in levels. Puerta and colleagues, Argentine elite tennis player's body composition profiles to determine the 189 elite tennis players have done the study, 14 younger than 27 men, fat% to 10.3 ± 1.6 to identify and l p>0,05 level, a significant difference was found. Results obtained from this study shows parallelism with our literature.

When vertical jump height values examined, it is found that vertical jump values of 10 and 11 age groups pose higher averages than those of 12 and 13 age groups. When other studies of similar nature are examined, the vertical jump values of the same age group appear to be different from each other. For example, the results that Aydos and colleagues found are as follows: ± 39 6.51 cm in those doing sport, 27.93 ± 5.43 cm in those doing no physical exercise Aydos and Kürkçü(1997). Zorba and colleagues found these results in their study comparing people leading sedentary life style and actively doing sport: in football players, 30.58 ± 5.64 cm , in basketball players, 34.6 ± 7.67 cm , in sedentary, 23.4 ± 2.75 cm Zorba et al(1996). Sevim and colleagues found the vertical jump values for girl basketball players as 31.7 ± 5.20 cm and in the control group, as 30.0 ± 2.51 cm Sevim et al(1992)[13]. Muniroglu and colleagues, in the study where they compared swimmers belonging the 12-14 age groups in Ankara, they found the vertical jump values of short-distance swimmers as

34.37±3.50 cm and long-distance swimmers as 28.47 ± 0.92 cm Muniroğlu et al(2000). Senel and colleagues found these results in Junior National Badminton Team: (age 16 ± 1.89) 36.83 ± 3.86 cm Şenel et al(1998). Cimen and colleagues found these results in Junior National Table Tennis Team: (age 16.9 ± 1.67) 37.5 ± 6.27 cm Çimen et al(1997). The results achieved in this study consistently show parallelism with the values in the literature. Differences between this study and other similar researches are considered to result from independent training programs particularly applied for the type of sport. Moreover, these results are thought to result from the lack of the force produced against a rapid increase in height and body weight in adolescence. The rise in the height and weight values of the volunteers participated in the study, which depends on the age factor, seems to support the results achieved here. After all, it is quite important for adolescent athletes to protect the relative strength values they need to produce against increasing body weight, particularly for individual athletes.

Max. 36.55 VO2 ml / kg / min was found, 10 years with a 11.12, and 13 aged 10 years lower levels, p>0,01 11 years to 12 and 13 years between the age of 11, lower p>0,05 level, significant differences were found, 12 to 13 age group between level p>0,05 significantly differences weren' t found.

Cicioğlu (1995) with Stars basketball player in the Max VO2 47.11 ml / kg / min, Erol (1992), with 16-18 year-old male basketball player in the Max VO2 value of 58.9 ml / kg / min as they find value in this study, the values are high. This difference between the studies of the subject is thought to result from differences in the age group. Imamura (1999)[18], after Karate training to investigate the use of oxygen in the Fukuoka University Karate team made a research on the seven athletes. After the tests, MaxVO2, was 47.4 ml.kg.dk. Faude and colleagues in the measurements of 12 national badminton (eight women and four men) VO2max values for women 50.3 ml / kg / min., Men and 61.8 ml / kg / min. was found. In this study, it has been emphasized that well aerobic capacity is necessary for a rapid recovery.

The analysis of the speed values between groups showed that the speed values of children in rapid growth period rise as they grow older. The first of two significant findings in speed parameters is the speed values of age group 10 athletes are not at a level to compete against other age groups. The second finding is the speed values of athletes in age group 13 enter into a rapid development period. A quick research on the other studies in the literature reveals that acceleration improvement curves analyzed in connection with training sessions become more prominent. These include tests by Ugras et al where 18 amateur soccer players tested before 10-week training period in 30 m sprints and they found their average 2.75 ± 0.08 sec, post-training test results were 2.69 ± 0.08 sec showing significant decreases Uğraş et al(2002). Eler, in 1996, clocked the average speed of 15 top-level handball players in a 30 m sprint before and after the training. While pre-training results were 4.36 ± 0.12 sec, after the 12 weeks, post-training 30 m speed values were recorded as 4.30 ± 0.11 showing a significant improvement Eler(1996). Güzel et all recorded 30 m sprint values of 11 soccer and 9 volleyball athletes. While the average of volleyball players recorded as 5.87 ± 0.34 seconds, football players' values were recorded as 5:06 ± 0.20 sec. So, they found significant differences Güzel et al (2007). It is known that various sports use shock drills in order to improve acceleration and speed. Acceleration can be defined as capability of creating the maximum force that a muscle can generate by absolute dynamic energy as soon as possible Bompa(1997). The results achieved in this study consistently show parallelism with the values in the literature. When force values between groups examined, it is observed that strength values of children improve as they age during the period of rapid growth. However, these strength increases observed in adolescents seem more pronounced in the lower extremity. Linear increase occurred in maximal strength may be considered as development of maximal forces adapted to the period of rapid growth. Moreover, it may be due to relatively more intense use of lower extremity in Taekwondo comparing to the use of upper extremity. Other studies examined in the literature reach similar conclusions. For example, Taekwondo national team candidate athletes right-hand grip strength averaged at 47 ± 305.84 kg Left-hand grip 46.57 ± 5.16 kg , leg strength mean value, 151.46 ± 25.31 kg respectively Tel(1996). Seliger and colleagues found right-hand grip strength in adolescent boys as 35.8 ± 8.6 kg, left-hand strength 33.6 ± 7.9 kg Seliger et al(1991). Cimen and colleagues found these results in junior national table tennis players: (age 16.4 ± 1.07) 41.7 ± 5.38 kg right-hand grip, left-hand grip 37.4 ± 1.93 kg., leg strength 112.0 ± 2.11 kg Çimen et al(1997). Senel and colleagues (1998) identified the values of junior national badminton team players as follows: (age 17 ± 1, 85) right-hand grip strength 39.15 ± 7.75 kg., left-hand grip strength 34, 53 ± 7.16 kg Şenel et al(1998). The upper extremity strength values found in our study appear to be either lower than the results found in other studies conducted in Turkey or similar. That the strength values of Taekwondo athletes are found to be more or less same with other sports reveal Taekwondo athletes do not need more strength but similar values. When reaction times between groups examined, it is observed that every group significantly differs from each other. Significant differences between age groups include the observation of significantly lower reaction times of the 10 year old athlete group. The development occurred in reaction times results from Taekwondo training sessions focusing on speed based drills. Besides, implementation of the specific structure of the quick strength training and the training of a similar feature occur due to the development of nerve-muscle coordination in reaction time are affected positively. The reaction times in different sports-related values were examined in the literature, studies and research findings among themselves and with variable results have been achieved. For example, Senel and colleagues, in their study of male junior national badminton athletes, found the following results (age 17.1 ± 1.85), right-hand reaction time 135 ± 15.1 sec light, the right-hand visual reaction time 118.7 ± 13.5 sec. Şenel et al(1998). Senel and colleagues (1997), in their study in male cyclists (age 24 ± 2.24), found the following results visual reaction time 0.17 ± 0.03 for the right hand, right hand for auditory reaction time as 0.18 ± 0.01 Şenel et al(1998). Achieved values were found to be lower than those provided in the literature. This may be resulting from the higher ages and fitness levels of the athletes participated in the literature studies. Anaerobic endurance values were found to differ significantly between groups. The differences between anaerobic endurance values for children in the period of rapid development are also claimed by the literature. However, it is surprising that anaerobic endurance values of age group 10 are significantly higher than the values of other groups but when rapid weight gain in the rapid growth period and consequent declining relative value is taken into account, the results are not meaningless. The significant differences between the groups doing regular sport and sedentary groups in terms of anaerobic endurance values, not only in this study but also in the literature, enable us to draw promising conclusions Güzel et al(2007). The researches conducted also highlight that there is a significant difference between the groups performing Taekwondo training and the untrained group Borlu(2005). Anaerobic power and endurance average value of the national team candidate athletes is recorded as 133.81 ± 9.72. These values are significantly higher than average values of the

sedentary groups. But they provide similarity with the values obtained in certain sports requiring heaviness and intense effort Tel(1996). In the anaerobic power tests conducted by Borlu in 2005 in the different age groups, the average values of juniors recorded as 49.26 ± 7.02 Borlu(2005). In the anaerobic power tests conducted by Yardimci in 1997 on basketball, volleyball and football players, values recorded as follows: the average basketball player at 133.04 ± 10.55, volleyball players as 135.15 ± 14.15 and soccer players as 102.75 ± 10.55. It is observed that there are significant differences between different branches Yardımcı(1997). It can be concluded that this difference occurs because of the positive effects of regular training on the anaerobic power and endurance of athletes.This group is in adolescence period in which rapid physical growth and maturation occur. This period is characterized by rapid physical growth and intense hormone activities. Motor skills of boys and girls are age-specific and they keep developing from 7 years to 17 years of age Açıkada and Ergen (1990). During this period, the gender gap occurs in a more specific way. Development in girls peaks at the age of 14. But this development will continue from the age of 3 until 16-17. Motor development rate in males tend to rise at the ages of 13-14 Özer(2001). In conclusion, the regular practice of taekwondo training provides a considerable contribution to an adolescent's physical development and improvement of motor skills and motor performance. However, rapid development of these values should not be handled regardless of natural growth criteria. So we can conclude that regular training has a relatively more impact over maximal values rather than relative values.

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