PERCENTILE NORMS AND AGE AND GENDER DIFFERENCES IN THE MOTOR PERFORMANCE TESTS OF 9-10 YEAR-OLD JUNIOR TENNIS PLAYERS[2]

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ABSTRACT

The purpose of this study was to establish percentile normative data and to find age and gender differences in motor performance tests of 9-10 year-old junior tennis players in Turkey. Five different motor performance tests – 5 m and 10 m sprint tests (s), tennis ball throwing test (m), standing long jump test (m) and modified tennis planned agility test (s)- were applied to 2461 (925 boys and 647 girls aged 9; 495 boys and 394 girls aged 10) competitive tennis players. The mean and standard deviation for each test data were calculated according to the players' age and gender groups, and then percentile tables were established for them. Independent samples T test and Mann-Whitney U test were used to determine significant mean and percentage change in means differences in the related measures of the groups. Older girls and boys performed significantly better than younger boys and girls, and boys are superior to girls in the tests. Differences were found significantly in age and gender on all of the motor tests; however, age seems to be related more to performance than gender is. Differences of a lesser magnitude were found on only 5 m sprint test for gender and on only 10 m sprint test for age. The result that significant age and gender differences were found on all the motor test items may stem from biological and environmental factors. The test results and creating normative data may help players and coaches to improve specific areas of weakness to further enhance their on-court agility and speed.

Key words: Age and gender differences, tennis, motor performance, percentile norms.

9-10 YAŞ GRUBU TENIS OYUNCULARINDA MOTOR PERFORMANS TESTLERDE YAŞ VE CINSIYET FARKLILIKLARININ VE YÜZDELİK VERİLERİN BELİRLENMESİ

ÖZ

Bu çalışmanın amacı, Türkiye'deki yarışmacı 9-10 yaş tenis oyuncularının bazı motor performans test sonuçlarının yaşa ve cinsiyete göre farklarını ortaya çıkarmak ve test sonuçlarından normatif veriler elde etmektir. Toplam 2461 yarışmacı tenis oyuncusuna (9 yaş grubunda 925 erkek, 647 kız; 10 yaş grubunda 495 erkek, 394 kız) 5 farklı motor performans testi -5 – 10 m sprint testi, tenis topu fırlatma testi, durarak uzun atlama testi ve modifiye tenis çeviklik testi- uygulandı. Test sonuçları ortalama ve standart sapma olarak ifade edildi ve yaş ve cinsiyete göre normatif tablolar oluşturuldu. Ayrıca grupların ortalamalar arası farkları Bağımsız gruplarda T testi ve ortalamaların yüzde değişimleri arasındaki farklar Mann-Whitney U testi kullanılarak analiz edildi.

10 yaşındaki tenisçiler 9 yaşındakilerden ve her yaş için erkek tenisçiler kız tenisçilerden anlamlı olarak daha iyi performans gösterdiler. Test sonuçlarında yaş ve cinsiyet farkları bulunmasına karşılık, bu fark yaş faktöründe daha büyüktü. En küçük fark, cinsiyetler arasında 5 m sprint testinde ve yaşlar arasında 10 m sprint testinde bulundu. Motor performans testleri arasında yaş ve cinsiyette gözlenen belirgin farkların, biyolojik ve çevresel faktörlerden kaynaklandığı düşünülmektedir. Elde edilen test sonuçları ve oluşturulan normatif veriler, oyuncuların ve antrenörlerin saha içi çevikliği ve sürati daha da artırmalarına ve saptanan zayıf yönleri geliştirmelerine yardımcı olabilir.

Anahtar kelimeler: Yaş ve cinsiyet farklılıkları, tenis, motor performans, yüzdelik veri

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INTRODUCTION

In order to achieve high sporting success in every sport, it is necessary for talented athletes to be selected in a timely and accurate manner and then to take a long term and systematic work. The aim of the talent selection is to identify the athletes who are most likely to be involved in that sport. Anthropometric and conditioning properties are usually assessed with some tests for sports -specific talent selection. The normative data generated by the test results allow the individual to identify the visual state within the group, as well as assist in the determination and selection of skills by making the results of the motor tests comparable[19].

Tennis has evolved from a sport which required skill primarily for successful performance into one that needs complex interaction of several physical components as well (ie, strength and agility) and metabolic pathways (ie, aerobic and anaerobic)[7]. A tennis match is composed of intermittent whole body efforts, repeated short (2–10 s) bouts of high-intensity exercise with multiple explosive change of directions and short (10–20 s) recovery bouts interrupted by several resting periods of longer duration (60–90 s) and the average match time is 1.5 h, while in some cases it can be over 5 h [6,7,10,11].

It was found that physical components have a strong relation with match results and ranking[2,10]; agility for 8–12 year-old[3,17] and speed, vertical jump abilities and maximal strength in the dominant side for 13.6 year-old[8] are the only physical performance variables used to predict competitive rankings in younger male tennis players. Enhanced speed and agility skills are known to provide tennis players with economical and efficient on-court movement, and the best time to improve these qualities is between the ages of 5-12[13].

Physical characteristics develop in stages, with each stage having its own dynamics. 7-11 age is characterized by slowdown of the pace of growth in favor of changes in the structure of the body and its general strengthening. The dynamics of the development of motor performance abilities such as speed, agility, explosive strength and throwing power in boys and girls are very similar until age of 11-12 and the curves of abilities development vary depending on the age of the child until puberty, with boys being better than girls at each age level[5,9]. It is thought that gender differences are caused by biological characteristics such as greater joint and bone diameter, lower body fat, more developed muscle, and environmental factors, such as more active life according to the expectations for boys[20].

According to Ulbricht et al., the players and families can benefit from significant social, professional, and financial implications through the identification, selection, and development of talented tennis players at early ages[24]. Although it is important to assess motor performance in children for both physical fitness development and talent identification in sport, there are only few studies in the literature evaluating specific motor performances in junior tennis players and lack of normative motor performance data especially for Turkish junior tennis players. The purpose of this study was to establish percentile normative data and to find age and gender differences in motor performance tests of 9-10 year-old junior tennis players in Turkey.

METHOD

A sample of 2461 consisting of 9 and 10 year-old, best male and female youth tennis players in Turkey (from the national and regional selection groups) was assessed using a battery of standard motor performance test conducted by the Turkish Tennis Federation (TTF) at the national level. The data obtained from these tests were applied to tennis players of 9 or 10 years who participated in the Turkish championship for a period of 3 years. Every player participated in the tests once. The tennis players are participating in tennis trainings at least 6 hour per week. Their training contents generally include basic and specific strength, speed, agility drills and technical developmental exercises. In the present study, the players were divided into groups in accordance with chronological age: 925 boys and 647 girls aged 9; 495 boys and 394 girls aged 10. The subjects and their parents were informed of the procedures to be employed in the study.
The test battery was formed according to the characteristics of the sport branch and age groups. Five different speed and agility -dependent motor performance tests were applied: 5 m and 10 m sprint tests (s), tennis ball throwing test (m), standing long jump test (m) and modified tennis planned agility test (s). The tests were performed twice with 5 min rests. The highest score of two trials for each test was recorded. During the tests, the subjects were verbally encouraged to produce maximal efforts.

5 m and 10 m sprint tests: The aim is that the athlete will move from the starting point to the arrival point as soon as possible in the test ground. For measurement, electronic photocells (Newtest 2000, Powertimer Measuring System, 1995, Finland) are placed at the starting and ending points (0m - 5m - 10m). An exit line was put 1m behind the starting point[23].

Tennis ball throwing test: The aim is to throw the tennis balls in the hands of the athlete at the farthest distance they can reach. The back line of the tennis court is considered to be the starting point and each 5 m area from the singles line is marked in terms of easy measurement. The longest distance the player has thrown the ball at the end of 3 measurements is recorded in meters[12].

Standing long jump test: The aim is to move the body forward by jumping to the farthest point with two feet of the athlete. The meter is attached to the floor in order to measure the distance easily. The length measured from the ball of the rear foot of the athlete is recorded as a result[12,23].

Modified tennis planned agility test: The test was modified from Planned Agility test[16]. The aim is that the athlete starts from the center point which is placed on T point of the baseline, then touches the service line corners and in the middle of the center point, each time it comes back to the center point with a fast run as soon as possible. For measurement, electronic photocells (Newtest 2000, Powertimer Measuring System, 1995, Finland) are placed at the starting and ending points.

Statistical Analyses: The mean and standard deviation for each test data were calculated according to the players' age and gender groups. Independent Samples T test was used to determine significant mean and Mann-Whitney U test was used to determine significant percentage change in means (Δ %) differences according to age and gender of the groups separately. Then percentile tables were established for them. Roetert et al defined percentile "as a value in the distribution below which a given percentage of the scores is found"[18].

RESULTS

The results of motor ability test and gender and age differences of groups were shown in Table 1. According to the table, the results of 10-year-old players compared to those of 9-year-old and the results of boys compared to those of girls were found to be statistically better for each test performed ($p<0.05$).

Table 1: Motor ability tests results (mean ± SD) of 9 – 10 years old tennis players

Test Components	9 years old		10 years old	
	Boys (n = 925)	Girls (n = 647)	Boys (n = 495)	Girls (n =394)
5 m sprint test (s)	1.25 ± 0.11**	1.26 ± 0.12	1.18 ± 1.00*¥	1.21 ± 0.11¥
10 m sprint test (s)	2.24 ± 0.16*	2.29 ± 0.18	2.13 ± 0.14*¥	2.18 ± 0.14¥
Standing long jump test (m)	1.36 ± 0.18*	1.29 ± 0.18	1.49 ± 0.17*¥	1.43 ± 0.17¥
Tennis ball throwing test(m)	18.2 ± 4.41*	13.3 ± 3.07	22.6 ± 4.30*¥	16.5 ± 3.79¥
Modified tennis agility test(s)	13.9 ± 1.19*	14.3 ± 1.11	13.0 ± 0.79*¥	13.4 ± 0.90¥

* p ≤ 0.001, ** p ≤ 0.05 gender differences for 9 and 10 years old players, ¥ p ≤ 0.001 age differences for boys and girls.

When percentage changes in means (Δ %) for gender and age groups were separately compared, it seems that age was generally related more to performance than gender. Differences of a lesser magnitude were found on only 5 m sprint test for gender and on only 10 m sprint test for age (Table 2).

Table 2: Percentage change in means (Δ %) for gender and age groups

Percentage change in means			Tests				
			5m sprint (s)	10m sprint (s)	Standing long jump (m)	Tennis ball throwing(m)	Modified tennis agility (s)
Δ % for age groups	Boys	9 years old 10 years old	-3.3	-3.2	7.5	21.4	-5.0
	Girls	9 years old 10 years old	-1.4	-2.8	9.5	25.0	-5.4
Gender differences P values			0.940	0.251	0.069	0.059	0.248
Δ % for gender groups	9 years old	Boys Girls	-0.8	-1.9	8.4	48.3	-2.0
	10 years old	Boys Girls	-2.3	-2.5	7.3	47.0	-3.0
Age differences P values			0.551	0.952	0.425	0.179	0.440

Percentile norms of 9 and 10 year-old boys and girls are given for “5 m sprint test (s)” in Table 3, for “10 m sprint test (s)” in Table 4, for “tennis ball throwing test (m)” in Table 5, for “standing long jump test (m)” in Table 6, and for “tennis specific agility test (s)” in Table 7.

Table 3: Percentile norms for “5 m sprint test (s)”

	9 years old		10 years old	
Percentile	Boys (n = 925)	Girls (n = 647)	Boys (n = 495)	Girls (n = 394)
10th	1.39	1.41	1.30	1.36
20th	1.33	1.35	1.25	1.28
30th	1.29	1.31	1.22	1.24
40th	1.26	1.28	1.19	1.22
50th	1.23	1.25	1.17	1.19
60th	1.21	1.22	1.15	1.17
70th	1.19	1.20	1.13	1.15
80th	1.16	1.17	1.11	1.12
90th	1.12	1.12	1.07	1.09

Table 4: Percentile norms for “10 m sprint test (s)”

	9 years old		10 years old	
Percentile	Boys (n = 925)	Girls (n = 647)	Boys (n = 495)	Girls (n = 394)
10th	2.45	2.52	2.31	2.35
20th	2.37	2.42	2.23	2.28
30th	2.31	2.36	2.18	2.23
40th	2.27	2.31	2.15	2.19
50th	2.23	2.27	2.12	2.16
60th	2.19	2.23	2.09	2.13
70th	2.15	2.19	2.05	2.11
80th	2.10	2.13	2.01	2.06
90th	2.05	2.08	1.97	2.01

Table 5: Percentile norms for “tennis ball throwing test (m)”

	9 years old		10 years old	
Percentile	Boys (n = 925)	Girls (n = 647)	Boys (n = 495)	Girls (n = 394)
10th	13.0	9.60	17.0	12.2
20th	14.4	10.9	18.9	13.2
30th	15.3	11.5	20.3	14.3
40th	16.7	12.3	21.5	15.0
50th	17.8	13.0	22.7	16.0
60th	18.8	14.0	23.8	17.0
70th	20.1	14.8	24.7	18.1
80th	21.8	15.5	26.3	19.4
90th	24.2	17.3	29.0	21.6

Table 6: Percentile norms for “standing long jump test (m)”

	9 years old		10 years old	
Percentile	Boys (n = 925)	Girls (n = 647)	Boys (n = 495)	Girls (n = 394)
10th	1.13	1.07	1.26	1.22
20th	1.23	1.14	1.35	1.30
30th	1.28	1.20	1.40	1.35
40th	1.33	1.25	1.45	1.39
50th	1.37	1.29	1.48	1.43
60th	1.41	1.32	1.53	1.48
70th	1.45	1.38	1.58	1.52
80th	1.50	1.45	1.62	1.58
90th	1.59	1.53	1.71	1.65

Table 7: Percentile norms for “tennis specific agility test (s)”

	9 years old		10 years old	
Percentile	Boys (n = 925)	Girls (n = 647)	Boys (n = 495)	Girls (n = 394)
10th	15.6	15.7	14.0	14.7
20th	14.8	15.2	13.6	14.1
30th	14.3	14.9	13.4	13.8
40th	14.1	14.6	13.1	13.6
50th	13.8	14.2	13.0	13.3
60th	13.5	13.9	12.8	13.1
70th	13.2	13.7	12.5	12.9
80th	12.9	13.3	12.3	12.7
90th	12.6	13.0	12.0	12.4

DISCUSSION

Our study provides information about some motor abilities according to gender and age in 9 and 10 year-old competitive tennis players. Significant age and gender differences were found on all of the motor tests; however age appears to be related more to performance than gender is. It was also found that 5 m sprint test results between gender and 10 m sprint test results between ages have found a lesser magnitude differences.

Childhood is a period that is characterized by a slow but steady increase in physical growth. During these years, motor abilities of children improve regularly; and boys' performance is a little higher until they reach puberty. At puberty, on the other hand, female performance levels off, and male performance goes on to improve and may even accelerate. Research indicates that the motor performance of children tends to improve with age for both boys and girls, but the average performance of boys generally goes beyond that of girls at each age level[9].

Our findings are consistent with the results of other studies which examined the relationship of age and gender differences in motor performance of 3-6 years-old children[12,22]. Previous many studies indicated that there were significant age and gender differences on all the motor test items: in power-dependent skills[21]; standing long jump[26]; overhand throwing kinematics, motor performances, and muscle strength[15] – usually to the girls' disadvantage. The only study on Turkish children indicated that increases in the mean performance (standing broad jump, sit-ups, shuttle run) for boys and girls were observable with each advancing age level and there is some evidence showing the effects of sex differences after age 9[9].

One of the meta-analysis about gender differences in 20 motor skills has found a significant effect for 12 of the 20 tasks, when age was regressed on effect sizes. Effect sizes are moderate but they are in favor of boys through childhood. Differences begin to get larger at ages 10-11, and continue to increase up to ages 17-18, particularly in some motor tasks that require strength and power. Also, in two other tasks, throwing accuracy and the wall volley, gender differences were large but not related to age. In four of the tasks namely agility, anticipation timing, arm hang, and reaction time, gender differences were small favoring boys. In two tasks; however, the differences in gender were small favoring girls: fine eye-motor coordination and flexibility. The only task that showed important gender differences was overhand throwing beginning at ages 3-4 and favoring boys. It appears that such biologically related characteristics, as greater joint diameters, a smaller sum of skinfolds and more

estimated arm muscle than girls, may play a role in throwing performance differences even in young children. Thus, prior to puberty, physical characteristics of boys and girls are very similar; and biology appears to provide little explanation for the differences in motor performance. This information can be interpreted that the differences may be environmentally due to different treatment and expectations of girls and boys[20].

The study which examined age and gender differences in fundamental motor skills among three age groups: children (m = 9.37 yr), adolescents (m = 14.8 yr) and young-adults (m = 19.9 yr) found that children and adolescents performed better than young-adults ($p<0.01$) for overhand throwing, and males outperformed females for all the skills: run ($p<0.05$), jump ($p<0.05$), throw ($p<0.01$), kick ($p<0.01$), bounce ($p<0.01$) and strike ($p<0.01$)[4]. The study's results may connect with the truth that adults are less active during the day than children and adolescents.

A total of 12 male players, with an International Tennis Federation (ITF) number ranging from 3 to 6, aged 13.6 years, performed a 5-m and a 10-m sprint tests. The results of the tests were found as 1.19 ± 0.07 s (range 1.05–1.34) and 2.02 ± 0.14 s (range 1.82–2.32), respectively[8]. These results were found higher than 8-12 year-old tennis players[17] and 9-10 year-old competitive tennis players in our study, except a 5-m sprint test for 10-year-old boys.

In the 5-year-study carried out with 500 preadolescent athletes found several track (e.g., running, jumping) parameters to be weak predictors of overall tennis performance[3]. It was stated that success in young tennis players could be primarily attributed to their ability to generate consistent, accurate, and powerful shots[17]. Besides, no statistically significant differences were found in the physical and motor performance talent identification determinants of the different (early, average and late period) biological maturation groups in U-14 girl tennis players[25].

According to the normative data developed for track and field in Turkey in the ages of 10-12 yr for talent selection[14], the standing long jump performances of 10 –year-old male tennis players in our study are evaluated as "very high". It is observed that the standing long jump performance of 9-year-old girl tennis players in our study is lower than the same age group tennis players (1.39 ± 0.13m)[1]. These results may be related to the training level of the players in our study.

CONCLUSION

It is concluded in our study that significant age and gender differences were found on all of the motor tests, and age was generally related more to performance than gender. This result was found parallel with the studies on preadolescent children due to biological and environmental factors.

A set of normative data may be used by players and coaches to compare individual player's performance scores with others and to determine the skills that need improvement for players on an individual basis and talent identification in sport. The specific training programs can be designed according to a player's motor testing results and they may to assist physicians for injury prevention greatly.

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