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Growth and maturity status of young elite and sub-elite tennis players

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ABSTRACT

The purposes of this study were to determine the growth and maturity status of young competitive tennis players and to examine their associations with national rankings. The participants were 36 male and 34 female players who competed in the U14 national team selection tournament in 2022. They were divided into three groups according to their results and entries as national players (n = 8), main draw players (n = 31), and qualifying players (n = 31). Ages at peak height velocity and growth status were calculated. Regardless of gender, the mean height and body mass percentiles of players were above the 60th centile. In girls, the results indicated that both national and main draw players were significantly more advanced in maturation ($p < 0.05$) and had higher body mass indexes ($p < 0.05$) than qualifying players. In boys, no significant differences were observed among the three groups for all variables. Correlation results showed that maturity status was the most correlated ($p < 0.01$) variable in girls. No significant relationships between rankings and other variables were obtained for boys. These results suggest that physical size and advanced maturity should be taken into consideration in the selection and identification of youth elite female tennis players.

Key words: Biological maturation, youth athletes, racket sports, talent identification.

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INTRODUCTION

The growth and maturity status of young athletes have a significant influence on their body sizes (Eisenmann et al., 2020; Malina, 2007), and individual differences in the growth and maturity status of young athletes might affect the selection since greater physical attributes may mean advantages in most sports with a few exceptions (Cumming et al., 2005; Malina, 2007; Valente-dos-Santos et al., 2012). Their impacts on the performance of youth team sports athletes are well-documented (Baxter-Jones et. al., 2020; Philippaerts et al., 2006; Torres-Unda et al., 2013; Matthys, Vaeyens, Coelho-e-Silva, Lenoir, & Philippaerts, 2012). For example, Torres-Unda et al. (2013) compared the anthropometric and physiological characteristics of elite and non-elite young basketball players and found higher results in maturity status, height, body mass, percentage of muscle mass, aerobic fitness, and countermovement jump test in favor of the elite players. However, the data on growth and maturity status in youth racket sports players are limited.

In a recent study, Coelho-e-Silva et al. (2022) examined the physical growth and biological maturation of young competitive table tennis players. Their results showed a substantial variation (between the 10th to 100th percentile) in the height and body mass of players when compared to reference values. In a similar study, Myburgh et al. (2016a) reported ranges between 50th and 90th centiles for the

mean height and body mass for young (8-17 years) elite male and female tennis players. In another study, Myburgh et al. (2016b) studied the maturity-related differences in physical fitness among young tennis players and found better results in grip strength and overhead power for the benefit of boys and girls who advanced in maturation. Conversely, no significant variations were observed in physical and performance variables between contrasting maturity groups of young female tennis players (Van Den Berg, Coetzee, & Pienaar, 2006).

The official ranking of a player is one of the major determinants of success in tennis (De Bosscher, De Knop, & Heyndels, 2003). Several earlier studies have investigated the predictors of national ranking in young tennis players. Kramer et al. (2017), for example, reported significant associations between ranking and upper body power in boys and maturity status and lower body power in girls. On the other side, findings of other recent studies indicated the technical characteristics (Kolman, Huijgen, Visscher, & Elferink-Gemser, 2021), early participation in tennis-specific practice, and weekly training volume (Söğüt, Luz, Kaya, & Altunsoy, 2019) as the most important predictors of national rankings.

In summary, current literature demonstrates fluctuating results on the correlates of ranking in junior tennis players. Besides, to the best of the authors' knowledge, no previous study has compared the physical growth and maturity status of tennis players from different competitive levels. Therefore, the purposes of this study were to determine the growth and maturity status of young elite and sub-elite tennis players and to determine their associations with national rankings.

METHODS

Participants

The sample included 36 male and 34 female young tennis players who competed in Turkish U14 National Team Selection Tournament in 2022. They were divided into three groups according to their results and entries as national players (male= 4, female= 4), main draw players (male= 16, female= 15), and qualifying players (male= 16, female= 15). The ethical approval was obtained from the Human Subjects Ethics Committee of Middle East Technical University (0294-ODTUİAEK-2022). Children and their parents or legal guardians were briefed on the measurements and purpose of the study and written informed consents were obtained.

Measurements

A portable stadiometer (Seca 213, Hamburg, Germany) was used to measure standing and sitting height to the nearest 0.1 cm. A digital weighing scale, calibrated to the nearest 0.1 kg, was utilized to measure body mass. Body mass index (BMI) was calculated by dividing body mass (kg) by the squared height (m). The physical growth status of each player was compared to a comprehensive reference database (Frisancho, 2008). Percentile and z-score values for height, body mass, and BMI were calculated. Somatic maturity was estimated through age at peak height velocity (APHV). The APHV was determined using the predictive equation proposed by Mirwald, Baxter–Jones, Bailey, and Beunen (2002). The maturity offset was calculated by subtracting the difference between the APHV and chronological age.

Statistical analysis

All data were analyzed using SPSS (v. 28.0) for Windows. Descriptive statistics (mean ± SD) were calculated for the variables. The Kruskal-Wallis Test was used to analyze the differences among groups. Mann-Whitney U tests were used to follow up pairwise comparisons and to examine the gender differences. Spearman's rank correlation coefficients were conducted to determine the associations between rankings and growth and maturity variables.

Table 1

The change in subject's physical characteristics and ranking.

	Boys	Girls	*U*	*p*
Chronological age (years)	13.5 (0.5)	13.4 (0.6)	578.5	0.693
Height (cm)	166.3 (9.2)	162.2 (6.2)	421.0	0.025
Sitting height (cm)	85.7 (5.3)	84.7 (3.5)	520.5	0.282
Body mass (kg)	53.5 (8.8)	53.6 (6.7)	609.5	0.977
BMI (kg/m2)	19.2 (1.7)	20.3 (2.0)	428.0	0.031
Height (z-scores)	0.8 (0.9)	0.6 (0.8)	532.5	0.350
Height (percentiles)	71.1 (26.9)	67.7 (24.1)	533.0	0.353
Body mass (z-scores)	0.3 (0.6)	0.5 (0.5)	484.5	0.134
Body mass (percentiles)	60.8 (20.2)	68.1 (14.7)	483.5	0.131
BMI (z-scores)	-0.01 (0.5)	0.2 (0.5)	467.0	0.088
BMI (percentiles)	49.5 (17.1)	57.3 (16.1)	470.0	0.095
APHV (years)	13.6 (0.6)	12.0 (0.4)	7.500	< 0.001
Maturity offset (years)	-0.1 (0.9)	1.4 (0.6)	70.5	< 0.001

RESULTS

The descriptive statistics and gender differences are presented in Table 1. The results indicated significant differences in body height, BMI, APHV, and maturity offset. Boys were found to be significantly taller and have lower BMI values than girls. On the other hand, girls were significantly more advanced in maturation than boys.

The descriptive statistics of male players and the results for the Kruskal-Wallis Test are given in Table 2. The results revealed no significant differences among the three groups for all parameters.

The descriptive statistics of female players and the results for the Kruskal-Wallis Test are represented in Table 3. The results indicated that both national and main draw players were significantly older (national vs qualifying: U = 4.000, p = 0.009; main draw vs qualifying: U = 41.500, p = 0.003) and more advanced in maturation (national vs qualifying: U = 8.000, p = 0.028; main draw vs qualifying: U = 48.500, p = 0.008) and had higher BMI (national vs qualifying: U = 7.000, p = 0.021; main draw vs qualifying: U = 65.500, p = 0.049) values than qualifying players. Besides main draw players had significantly greater body mass than qualifying players (U = 56.000, p = 0.019). No significant differences were observed among the three groups for other variables.

Table 2

Descriptive statistics of boys and the results for Kruskal-Wallis Test.

	National players	Main draw players	Qualifying players	*H*	*p*
Chronological age (years)	13.6 (0.5)	13.6 (0.4)	13.3 (0.6)	4.063	0.131
Height (cm)	165.9 (7.9)	167.3 (8.7)	165.3 (10.4)	0.328	0.849
Sitting height (cm)	84.8 (5.1)	86.9 (4.8)	84.6 (5.9)	1.664	0.435
Body mass (kg)	54.3 (8.4)	54.5 (9.2)	52.2 (8.9)	0.491	0.782
BMI (kg/m2)	19.6 (1.4)	19.4 (1.9)	18.9 (1.5)	0.163	0.922
Height (z-scores)	0.6 (1.1)	0.8 (0.9)	0.8 (1.0)	0.142	0.931
Height (percentiles)	67.1 (33.9)	71.8 (28.1)	71.3 (25.9)	0.153	0.926
Body mass (z-scores)	0.3 (0.6)	0.3 (0.6)	0.3 (0.6)	0.038	0.981
Body mass (percentiles)	61.9 (21.7)	61.7 (20.7)	59.6 (20.7)	0.041	0.980
BMI (z-scores)	0.1 (0.4)	0.001 (0.5)	-0.04 (0.5)	0.307	0.858
BMI (percentiles)	53.2 (14.5)	49.3 (17.7)	48.8 (17.9)	0.307	0.858
APHV (years)	13.7 (0.7)	13.5 (0.6)	13.6 (0.6)	0.598	0.742
Maturity offset (years)	-0.1 (0.8)	0.1 (0.8)	-0.3 (0.9)	1.607	0.448

Table 3

Descriptive statistics of girls and the results for Kruskal-Wallis Test.

	National players	Main draw players	Qualifying players	*H*	*p*
Chronological age (years)	14.0 (0.1)	13.6 (0.5)	13.0 (0.5)	12.814	0.002
Height (cm)	160.5 (3.5)	163.5 (5.4)	161.3 (7.4)	1.027	0.599
Sitting height (cm)	84.5 (2.3)	85.4 (3.3)	84.1 (3.9)	1.157	0.561
Body mass (kg)	55.8 (3.3)	55.5 (5.5)	51.1 (7.8)	6.813	0.033
BMI (kg/m2)	21.7 (1.8)	20.8 (1.9)	19.5 (1.9)	6.814	0.033
Height (z-scores)	0.1 (0.5)	0.7 (0.8)	0.7 (0.9)	1.383	0.501
Height (percentiles)	55.4 (18.5)	70.3 (22.7)	68.5 (27.0)	1.383	0.501
Body mass (z-scores)	0.6 (0.2)	0.6 (0.4)	0.4 (0.5)	1.466	0.480
Body mass (percentiles)	71.2 (8.4)	71.3 (13.9)	64.1 (16.3)	1.466	0.480
BMI (z-scores)	0.5 (0.4)	0.3 (0.5)	0.1 (0.4)	3.111	0.211
BMI (percentiles)	66.7 (13.4)	59.9 (17.7)	52.3 (14.1)	3.066	0.216
APHV (years)	12.3 (0.2)	12.0 (0.4)	11.9 (0.4)	3.175	0.204
Maturity offset (years)	1.7 (0.3)	1.6 (0.4)	1.1 (0.6)	8.950	0.011

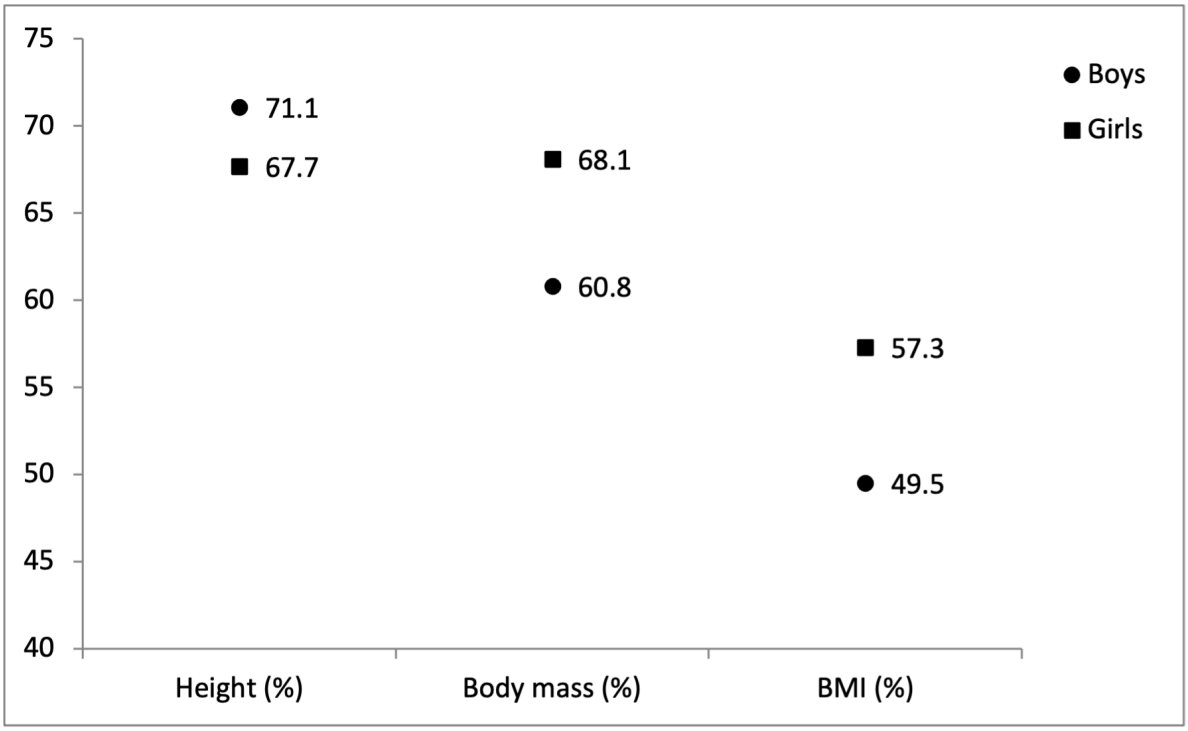

Figure 1. *The mean height, body mass, and BMI percentiles of boys and girls.*

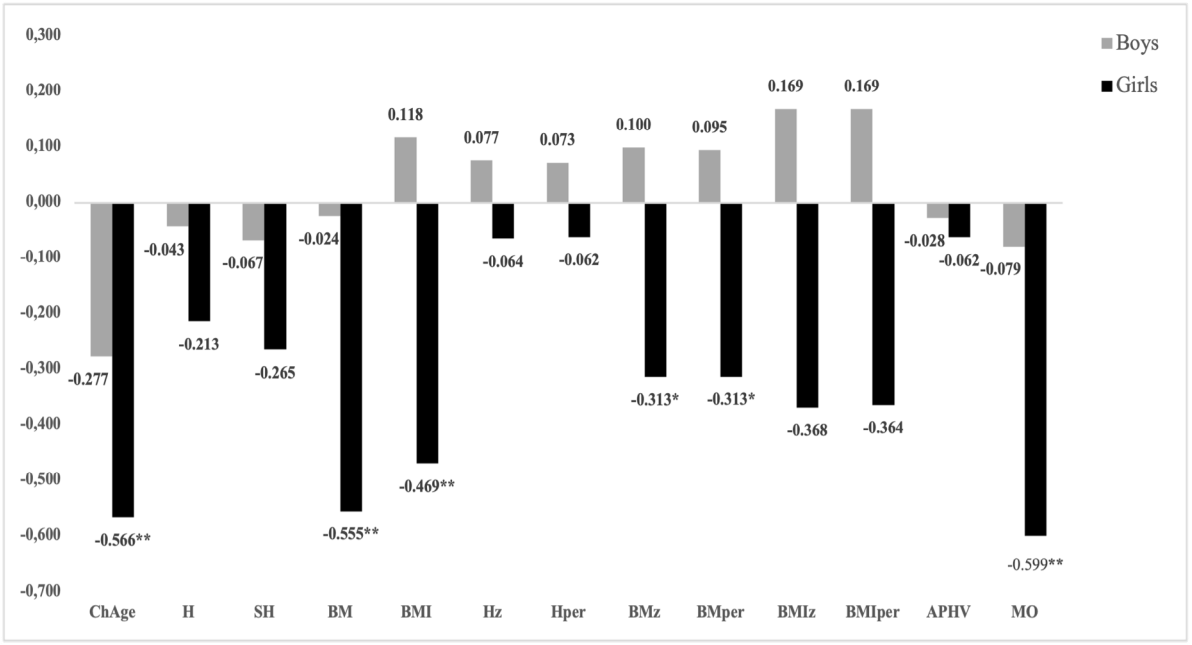

Figure 2. *Correlation results between ranking and other variables by gender.*

ChAge= chronological age, H= height, SH= sitting height, BM= body mass, BMI= body mass index, Hz= height z score, Hper= height percentile, BMz= body mass z score, BMper= body mass percentile, BMIz= body mass index z score, BMIper= body mass index percentile, APHV= age at peak height velocity, MO= maturity offset.

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

The mean body height, body mass, and BMI percentiles of male and female players are given in Figure 1. Regardless of gender, height, and body mass percentiles of players were above the 60th centile. The heights, body masses, and BMIs of male players ranged between 17th - 99th, 14th - 94th, and 14th - 93rd centiles, respectively. In girls, they fluctuated between 13th - 99th, 34th - 95th, and 31st - 87th centiles.

The correlations between national rankings and other parameters for boys and girls are presented in Figure 2. In girls, the results showed significant associations between ranking and chronological age ($r_s(32) = -0.566$, $p = 0.001$), body mass ($r_s(32) = -0.555$, $p = 0.001$), BMI ($r_s(32) = -0.469$, $p = 0.005$), BMI z score ($r_s(32) = -0.368$, $p = 0.032$), BMI percentile ($r_s(32) = -0.364$, $p = 0.034$), maturity offset ($r_s(32) = -0.599$, $p = 0.001$). In boys, no significant relationships between ranking and other variables were attained.

DISCUSSION

This cross-sectional study aimed to determine the growth and maturity status of young competitive tennis players and to examine their associations with national rankings. The results revealed gender differences in various parameters. Boys were found to be significantly taller and had lower BMI values than girls. On the other hand, girls were found to be more advanced in maturation than boys. The disparities in maturity status were also observed from the findings of previous studies (Kramer et. al., 2017; Söğüt et al., 2019). This result may be explained by the timing of the growth spurt, as girls achieve their peak height approximately two years earlier than boys do (Beunen & Malina, 1996; Malina et al., 2004; Sherar et al., 2007).

Another notable finding was that the mean height, body mass, and BMI percentiles of both boys and girls were above the 50th percentile when compared to age- and gender-matched normative references, except for the BMI percentile in boys (49.5). These results are in line with the findings of Baxter-Jones et al. (1995), Erlandson et al., (2008), Myburgh et al. (2016), and Söğüt et al. (2019). It seems that there is a tendency for greater body size among young competitive tennis players.

The results showed no significant differences among the three groups for all parameters for boys. On the other hand, for girls, both national and main draw players were significantly more advanced in maturation and had higher BMI values than qualifying players. Besides, the results for girls showed significant associations between ranking and maturity offset and BMI parameters, whereas no significant associations were observed for boys. These findings are in agreement with previous studies (Kramer et. al., 2017; Söğüt et al., 2019). Their results indicated significant relationships between national rankings and the percentage of the predicted adult stature and APHV in U12 and U13 female players, respectively. It might be concluded that maturity status has a crucial role in tennis performance for girls competing in this age category.

This study is subject to two main limitations. First, the sample was limited to U14 tennis players in a national team selection tournament. Second, tactical, technical, and psychological performance indicators were not included in this study. Unierzyski (2002) indicates that experience-related parameters might be decisive factors in actual tennis performance in junior tennis; however, they might not affect tennis performance on the professional level. Therefore, future studies are suggested to expand their scope by including consecutive age groups and other possible performance indicators.

In conclusion, this study aimed to add new insight to the scarce literature on the growth and maturity status of young competitive tennis players and their influences on actual tennis performance. The results demonstrated maturity-associated differences in favor of the elite girls. The findings suggest that physical size and advanced maturity should be taken into consideration in the selection and identification of youth elite female tennis players.

CONFLICT OF INTEREST AND FUNDING

The authors declare that they do not have any conflict of interest and that they did not receive any funding to conduct the research.

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