Original Article

Can a one-day field testing discriminate between competitive and non-competitive preteen tennis players?

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Abstract

Previous studies aiming to compare junior tennis players of different competitive levels have not implemented tennis- specific tests. The purpose of this study was to evaluate basic somatometric and physical fitness parameters of 10 to 12 year old tennis players during a one- day field testing battery and to examine the effect of their competitive level on these parameters. Twenty- one players of both genders were divided into two groups according on the basis of their participation (A group) or not (B group) in any championship (A; $n = 12$ and B; $n = 9$). The somatometric parameters evaluation included body height and mass, body mass index, as well as arm span. The physical fitness parameters analyzed were the flexibility of the hamstrings and lower back, the flexibility of the shoulder and wrist joint, the prediction of maximal aerobic power, the maximal running speed over a 20m distance and the agility through the Spider run test. In addition, a physical activity questionnaire was used. Differences between the two groups were determined using independent samples *t*-test. Values of A group were slightly greater in almost all the tested parameters, compared to B group. However, statistical significant differences were only attained for the parameters evaluated during the 20m multistage shuttle run test (maximal aerobic power and running velocity), where A group demonstrated enhanced values. Supplementary, the values of body mass index were also statistical different between the two groups. In conclusion, the field testing battery for the fitness assessment applied in this study was not able to discriminate competitive and non- competitive preteen tennis players.

Key words: Assessment, anthropometric and physical parameters, junior players, tennis.

Introduction

Success in tennis greatly depends on technical, tactical (Filipic et al., 2015) and psychological skills (Crespo & Reid, 2007). However, a high aerobic and anaerobic fitness level is also essential for optimal performance (Fernandez-Fernandez et al., 2009). To evaluate these physical skills a variety of testing procedures has been applied, while the field- based tests may be more ideal, compared to the laboratory- based tests, as they involve sport- specific tasks that mimic the movement patterns of a game (Groppel & Roetert, 1992; Urso et al., 2013) also allowing to regularly obtain athletes' performance profile (Fernandez-Fernandez et al., 2014).

With the number of children engaged in a competitive or a recreational level in tennis being continuously increasing, there are a number of studies examining the impact of various physical and training characteristics on tennis performance. For instance, Bloomfield et al. (1984) reported higher values of muscle strength of the lower limbs and greater cardiovascular endurance, but also similar values regarding specific somatotype components and upper body muscle strength in 65 tennis players aged from 7- to 12- year old, compared with non- competitive schoolchildren of similar age. More recently, in a study analyzing the anthropometric characteristics of lower ranked and the first 12 elite junior elite tennis players from various national teams (mean age: 16.04 ± 0.2 yrs) no significant differences were revealed in boys. In contrast, the top ranked girls exhibited significantly higher values compared with the lower- ranked girls (Sanchez-Munoz et al., 2007). However, in these cases no on- court tennis performance tests were included, despite the fact that tennis-specific assessment is recommended (Groppel & Roetert, 1992). Therefore, the aim of this study was to evaluate basic anthropometric and physical fitness parameters of 10 to 12 year old tennis players during a one- day field testing battery and to examine the effect of their competitive level on these parameters.

Materials and Methods

Participants

Twenty- one junior players from two different tennis clubs of both genders were volunteered for this study (mean age: 11.09 ± 2.30 yrs) and divided into two groups according on the basis of their participation (A group) or not (B group) in any championship (A; $n = 12$ and B; $n = 9$).

Procedure

The testing session was initiated with the pubertal stage determination according to pubic hair development (Tanner & Whitehouse, 1976). Following, the anthropometric parameters' evaluation included body height and mass, body mass index (BMI) as well as arm span.

The physical fitness parameters testing started with the flexibility of the hamstrings and lower back, using the sit and reach test, and the flexibility of the shoulder and wrist joint test. After a standardized 5- min warm up, maximal running speed was assessed over a 20m linear distance, while agility was evaluated with the Spider run test. In these two last testing procedures, two pairs of photocells (Tag Heuer, La Chaux-de-Fonds, Switzerland) with the respective reflectors, placed 1.0m from the ground level, and a chronometer connected to a printer (Chronoprinter 503) were used. During the speed and agility tests, each player performed two maximal trials with a 1- min passive rest in between and the fastest time was used for evaluation, while verbal encouragement was given throughout. Finally, after a 3- min passive recovery period, the aerobic fitness was assessed through the prediction of maximal aerobic power, using the 20m multistage shuttle run test.

All testing procedures were performed in an indoor court with an artificial clay surface, under the same environmental conditions (temperature 20-22°C, relative humidity 35-40%) and time of the day (9.00-11.00). It should be noted that all tests implemented in this study are proposed by the International Tennis Federation. Furthermore, the Godin- Shephard Leisure- Time Physical Activity Questionnaire was used (Godin & Shephard, 1985). Parental consent was obtained before participation. The study conformed to the standards set out in the Declaration of Helsinki (2000) and was approved by the Institutional Ethical Committee.

Statistical Analysis

In order to detect the significant differences between mean values, unpaired *t*-test with the Bonferroni adjustment was used. Statistical calculations were performed using SPSS v.21 statistical package (IBM Corp., Armonk, NY). Data are presented as mean $\pm$ *SD* and statistical level was set at $p \leq 0.05$.

Results

In Table 1 participants' maturity status, anthropometric and physical fitness parameters and *P* values are demonstrated.

Table 1. Mean $\pm$ *SD* and *P* values of all tested parameters.

Test	A group	B group	<i>P</i> value
Maturity status	2.33 $\pm$ 0.77	2.25 $\pm$ 0.70	0.346
Training age (yrs)	4.50 $\pm$ 1.15	2.77 $\pm$ 1.73	0.011*
Anthropometric parameters			
Height (cm)	149.0 $\pm$ 9.32	144.03 $\pm$ 8.18	0.241
Body Mass (kg)	38.20 $\pm$ 6.60	41.52 $\pm$ 6.90	0.268
BMI	17.11 $\pm$ 1.65	19.80 $\pm$ 1.51	0.001*
Arm span(cm)	149.62 $\pm$ 10.26	145.11 $\pm$ 9.45	0.301
Physical activity questionnaire	68.07 $\pm$ 11.84	57.14 $\pm$ 15.77	0.096
Physical fitness parameters			
Sit and Reach (cm)	0.00 $\pm$ 6.96	3.55 $\pm$ 6.69	0.246
Flexibility of shoulder joint (cm)	32.0 $\pm$ 8.85	35.11 $\pm$ 4.62	0.347
20m maximal running speed test (sec)	3.74 $\pm$ 0.17	3.96 $\pm$ 0.20	0.113
Spider run (sec)	22.60 $\pm$ 1.48	23.32 $\pm$ 2.25	0.374
Maximal aerobic power (ml·kg·min ⁻¹)	50.81 $\pm$ 2.01	46.94 $\pm$ 3.48	0.004*
Velocity during the 20m shuttle run test (km/h)	11.11 $\pm$ 0.41	10.27 $\pm$ 0.66	0.002*

Notes: * $p \leq 0.05$, A group= Competitive players, B group= Non- competitive players.

According to the data presented, the values of A group were slightly greater in almost all the studied parameters, compared to B group. However, statistical significant differences were only attained for the parameters evaluated during the 20m multistage shuttle run test, and specifically maximal aerobic power ($p=0.004$) and running speed ($p=0.002$), where A group demonstrated enhanced values (Table 2). Supplementary, the values of BMI were also statistical different between the two groups ($p=0.001$).

Discussion

The results of this study clearly indicate that competitive junior tennis players reported greater, but no significantly different values in almost all the anthropometric and physical fitness parameters tested, compared to the non- competitive players, with the exception of those attained during the 20m multistage shuttle run test (prediction of maximal aerobic power and running velocity), as well as BMI values; nevertheless, the latter were classified as normal for this age group (Krebs et al., 2007). In addition, as expected, the training age was also significantly different between the two groups. These results are in accordance to previous studies reporting that

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anthropometric (height and body mass), flexibility (Birrer et al., 1986) and physical fitness parameters (Roetert et al., 1995), are not the best predictors for tennis performance in this specific age group.

The participants tested in the present study demonstrated somewhat different values for height and body mass to those reported in 30 players of both genders and similar age (range 10 to 12 years old) (Elliot et al., 1990) (147.09 vs. 143.18cm and 39.55 vs. 35.18kg, respectively). Roetert et al (1995) evaluated 158 boys and 148 girls aged 12 years and under in order to develop a data base of fitness testing results and establish percentile scores. According to this study, the mean values from both groups of our sample are classified as the lower 10% for both the Spider run and the sit- and- reach test.

Preteen athletes are generally involved in various forms of games, sports and other physical activities in- and- out of school. The answers derived from the physical activity questionnaire confirm this assumption in the current study, partly explaining the non- significant differences between the two groups. Thus, we can suggest that sport- specific technical and tactical skills and/or muscle strength values are likely to be the key parameters that differentiate athletes of different competitive levels in this age group.

A possible limitation of this study may be addressed regarding the lack of evaluating muscle strength and power values through a simple testing procedure (e.g., sit- ups, grip strength, push- ups, vertical jumps or medicine ball throws). However, at the age range of 10 to 12 years old some of the players may have only reached at level 1 on the Tanner stage (2 players in this study). This fact may affect strength and power scores, consisting these parameters evaluation problematic. Future studies could include these kinds of tests for a more comprehensive fitness assessment battery.

Conclusions

The one day field- testing battery for the fitness assessment including biological maturity and specific anthropometric and physical parameters applied in this study was not able to discriminate competitive- and non-competitive pre- adolescent tennis players of both genders. This information is expected to facilitate tennis coaches to properly organize strength and conditioning sessions.

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