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Original Article

Asssessment of Physical Performance of Young Soccers Players

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ABSTRACT

The purpose of this study was to determine, at the beginning of soccer training, the anthropometric and physical fitness characteristics of Tunisian male adolescents. In this study, we evaluated 133 male soccer players, ranging in age from 13 to 15 years. The athletes participated in a formal soccer training program 3 times per week, with each training session lasting 2 hours. Anthropometric and physical fitness parameters were obtained. The results, expressed as the mean standard deviation and a p value <0.05, were considered to be significant. The height and body weight and leg length increased significantly with age ($p \leq 0.05$). There was no significant difference in BMI. The 14 to 15 year-old boys were significantly faster and had greater lower limb power compared to 13-14 year-old boys ($p \leq 0.001$)., The results ($p \leq 0.001$) of the agility test indicated a significant increase in agility with age. Finally, VO2max ($p < 0.05$) increased significantly with age. It was concluded that physical fitness characteristics of young male elite soccer players improved with, and were proportional to age. Adolescents benefitted greatly from regular physical activity. The present results show that prior to the initiation of formal training at soccer clubs, young male soccer players present adequate anthropometric conditions and physical fitness so that the resistance training of strength may be introduced at this age.

Keywords: Soccer, growth, child development, fitness

INTRODUCTION

In elite soccer, coaches are constantly seeking the most effective formula for identifying and developing talented young players (Stratton 2005). In this respect, the role of the youth academy is vital in the long-term development of soccer players. Yet, different factors may predispose individuals towards a successful career in professional soccer and determining the traits that discriminate between performers may be difficult.

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When investigating youth soccer, researchers have typically undertaken comparisons between elite and sub-elite players or between already highly selected players exposed to systematic training. Researchers focusing on such groups have attempted to establish the distinguishing features of expertise and to identify the factors that determine a player's potential to progress to higher levels of play. Training history and match experience, psychological, technical, motor, and perceptual cognitive, skills have been investigated as predictors of expertise and successful performance in youth soccer. Additionally, anthropometric and physiological characteristics, maturity statusand the influence of the period during the selection year

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in which players are born, have been shown to be predictors of success in young soccer players.

The participants in youth sports are grouped by age, which is a selection criterion used to safeguard equal opportunities (Helsen et al., 2005), however, considerable complexities can arise due to the existence of significant inter-individual variations relating to growth and maturity both in infancy and, above all, in adolescence (Malina et al., 2004). However, in some teams in lower leagues and from smaller towns, or from a major town or city but located close to a big club, as is the case with the teams in the Amateur group, have much less opportunity to select players. It seems that to relative age is more evident in the Elite groups' lies in the detection of players, which is more thorough in the Elite groups. However, the effect does not increase as the age group increases, which lead us to believe that the most decisive point of the process of training elite players is the moment at which they are recruited, more decisive than the selection process.

The number of adolescents encouraged to participate in intense physical training and elite competitive activities increased over the last years. We observed this fact particularly amongst Tunisian adolescents, who searched for soccer schools, having in mind a future as elite athletes. Generally, physical activity is considered to be necessary for adequate growth and development. It s few that coaches separate soccer's in function of their age. In more case categories are under 16 and under 18. For that the process of training is similar in one category without taking care of the specificity of anthropometric and physical fitness of adolescents aged between 13-14 and 14-15ans.

The objective of the present study was to analyze the anthropometric and physical fitness characteristics of male adolescents at the beginning of soccer training. This information tend to identify the scale of age at youth level in elite clubs and sports academies belonging to amateur clubs and identify the possible spread and evolution of relative age in elite clubs.

METHODOLOGY

Participants

The sample consisted of young male athletes ranging in age from 13 to 15 years, who were part of a player development program of regional level soccer players. Players were also members of sector-based training centers and selected and integrated into a training formation that would last three to four years. All boys participating in this program were selected based on height and ability to play soccer. During the selection process hundreds of boys from different parts of Tunisia were evaluated and selected by the coaches of each soccer club. The boys selected during this phase presented the adequate characteristics to play in all soccer positions: goalkeeper, defender, midfielder, or forward. After the selection process the boys were enrolled in a training program developed by the soccer centre.

Anthropometry

The anthropometric measurements were made according to the protocols recommended by different investigators. Height was measured with an appropriate stadiometer to the nearest 0.1 cm. As shown by anthropometric and physical fitness characteristic, bodyweight was obtained with a scale to the nearest 0.1 kg with the boys wearing only shorts. We estimated, using a Lange skinfold caliper, body adiposity by the measurement of skinfold thickness to the nearest 1 mm. Using anthropometric and physical characteristic, we obtained skinfold measurements of: biceps, triceps, sub scapular, and iliac crest. Each skinfold was measured three times and the median value was used for calculation. A meter tape was used to measure the lengths of the legs and distance between the greater trochanter of the femur and the lateral malleolus.

Physical Fitness

Physical fitness was determined using the following tests:

1) A sprint Test from 10 to 30 m
2) The T test agility
3) Lower limb power measured by vertical jump using, CMJ, and Le drop jump (Adams,1997)
4) cardio respiratory fitness was determined by calculating VO2max after the YOYO Test (IRT)

Assessment of 10 and 30 m Sprint Times

We evaluated linear sprint speed over 30 m. Infrared timing gates were positioned at the start line (0 m) and at 10 m and 30 m at a height of approximately 0.5 m off the ground. Following a countdown from the lead investigator, participants commenced the test from a standing start at a distance of 0.3 m behind the first timing gate. Players were instructed to run at maximum speed throughout the full duration of the sprint test. In order to prevent a reduction in sprint speed on approach to the 30 m gate, a member of the coaching staff stood

on a marker 2 m beyond the final timing gate, providing verbal encouragement throughout each attempt. Players were instructed to maintain maximum speed until passing the marker on which the coach stood. Time started and finished when the lasers of the first (0 m) and the last (30 m) gates were broken, respectively. Athletes performed three repetitions with the fastest times used for statistical analysis. A minimum of 4 minutes recovery time was provided between repetitions.

Assessment of Agility

Agility is the ability to move quickly and change directions while maintaining control and balance. Good agility requires a combination of speed, balance, power and co-ordination. We determined agility by measuring the time necessary for the subject to alternately pick up two small wooden objects (5 x 5 x 10 cm), covering a distance of 9.15 m.

Procedure: Set out four cones as illustrated in the diagram above (5 yards = 4.57 m, 10 yards = 9.14 m). The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touch its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. They then shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A.

Assessment of *Counter Movement Jump (CMJ)*

The protocol for the CMJ followed that described by Slinde (2008). Participants performed a CMJ with the hands on hips method and without the use of an arm-swing in order to eliminate the potential influence of extraneous contribution variables. The participants performed the CMJ standing on a contact mat (Just Jump, Probotics, Huntsville, AL) with their legs in a hip wide position. A fast downward movement to about 90º knee flexion was immediately followed by a fast upward vertical movement jump for maximal height and all in one sequence. With regard to landing, both feet had to be within the frames of the contact mat. It was important that the participants landed in the same extended body position as take off to avoid knee bending to avoid an increas flight time. Investigators ensured these criteria and participants who did not fulfill the criteria were asked to rest, then re-perform the trial. A video camera recorded CMJ trials in order to provide documentation for any flight time outliers. The participants performed three maximal jumps with approximately a 2 minute rest between jumps. All jumps were recorded and the highest result was used for analysis.

Assessment of Jump height

We calculated the jump height by using a timing mat which measured the time the feet were off the mat. The athlete stood upright, in socks or bare feet, as still as possible on the mat with his weight distributed evenly over both feet. He maintained his hands on his hips throughout the test. When ready, the athlete squats down until his knees were bent at 90 degrees followed by an immediate jump vertically as high as possible, landing both feet back on the mat at the same time. A rest was allowed between trials. The take-off was from both feet, with no initial steps or shuffling. No pause was allowed at the bottom of the squat. The best result of at least three attempts was recorded. Athletes were allowed to continue to jump as long as improvements were being made.

Assessment of *Drop Jumping*

Each athlete performed a drop, not a jump, from a raised platform or box immediately followed by a jump upon reaching the ground. The subjects performed a drop-jump by firstly jumping off the box, landing, and performing immediately a maximum vertical jump. No particular instructions were provided regarding how to land or jump. The drop provided a pre-stretch (eccentric phase) to the leg muscles followed by the secondary concentric contraction phase. The loading in this exercise was governed by the height of the drop which was in the region of 70 to 110 cm (Bompa et al., 2005).

Assessment of 5-Jump Test (5JT)

The following protocol for 5JT was adapted from research by Chamari and al (2008).The participant stood with feet joined with toes directed at a fixed starting point. The participant jumped forward with one leg of his choice and continued jumping with alternate legs until each leg had performed 2 steps. At the end of 4 consecutive steps, the participant had to have landed with both feet on the ground. Prior to performance, participants viewed an image of what was expected in the jump. Participants also viewed a demonstration by the investigator. At the end of the last jump the distance from the front edge to the rear edge of their feet was spotted and recorded. Both distances (heel of foot and front edge of foot) on the

last jump were accounted for. total distance from the fixed starting location to the back edge of the feet at the final position were measure by a tape measure. The participant performed 3 trials of 5JT for greatest distance (Paavolainen et al., 1999; Slattery et al.,2006) and had 3 minutes recovery time between the trials. In the case of the athlete falling backwards at landing, the participant was required to rest and perform the test perform again.

Assessment *Yo-yo Test*

The YYIRT testing protocol was similar to that suggested by Krustrup and al. (2005). The test consisted of 40 m (2 x 20-m shuttles) controlled by audio beeps projected from a portable stereo which played the Yo-yo test CD (2). The total time of the test lasted between 5 to 9 minutes. Participants ran in individual running lanes marked by cones having a width of 2 m and a length of 20 m. A cone placed 5 m behind the finish line marked the distance in which participants completed an active recovery. Active recovery involved a walk or a slow jog around the 5m mark and return to the start line within 10 seconds. Participants stopped briefly and waited for the start signal of the next shuttle. The speed of each 2 x 20-m shuttle increased progressively until exhaustion. The YYIRTL1 consisted of one to four running bouts between 5-13 km/h (0-160 m) and another 8 bouts at 13.5-14 km/h (160-440 m). Thereafter, it continued to increase 0.5-km/h increments at every 8 running bouts (i.e., after 760, 1080, 1400, 1720 m, etc.) (Krustrup et al., 2003).

When a participant failed to reach the finish line by the time of the beep for that level, the principal investigator warned the participant verbally of the infraction. The test was terminated when the athlete failed to reach the finish line before the beep on two separate occasions, or the participant stopped voluntarily. The total number of successfully completed bouts was recorded. The total distance was calculated by multiplying the total number of completed bouts by 40 m. The total distance was used as the measure of performance. The active recovery distance covered was not counted in the total distance (Krustrup et al., 2006).

Statistical Analysis

All results were expressed as the mean standard deviation. The boys were divided into two groups: age 13 to 14 years and 14 to 15 years. Pearson's chi-square test was used to analyze height, weight, BMI and %fat percentiles. We compared the parametric data by one-way ANOVA or the Kruskal-Wallis test. When $p < 0.05$, the results were considered to be significantly different.

RESULTS

A total of 133 young male soccer players were evaluated. The height and body weight and leg length increased significantly with age ($p \leq 0.05$). There was no significant difference in BMI (Figure 1).

Almost all boys showed adequate growth and development for their age. As expected for boys participating in this sport modality, there was a low incidence of obesity and excess body fat. There were however, 20% of participants classified as thin.

Figure 2 summarizes the results of the physical fitness tests. The 14 to 15 year-old boys were significantly faster and had greater lower limb power (Table I) compared to 13-14 year-old boys ($p \leq 0.001$). The results ($p \leq 0.001$) of the agility test indicated a significant increase in agility with age (Figure 3).

Finally, VO2max ($p < 0.05$) increased significantly with age (table 2).

DISCUSSION

Little is known however, about the physical and functional characteristics of Tunisian adolescents selected to participate in professional training during this phase of growth and development.

The purpose of the present study was to analyze the anthropometric and physical fitness characteristics of male adolescents at the beginning of soccer training. This information tend to identify the scale of age

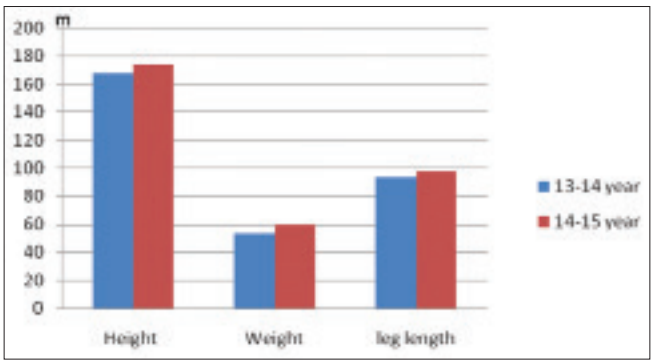

Figure 1: Anthropometric characteristics of Groups

Table 1: Average ±SD of assessment lower limb power measured by vertical jump, squat jump, countermovement jump, drop jump and five jump with age (13-14 and 14 -15years)

	Jump height (cm)	Squat jump (cm)	CMJ without arm (cm)	CMJ with arm (cm)	Drop (cm)	Five jump (m)
13-14 year	26,681	26,945	29,810	33,420	25,210	11,044
	± 6,210	± 3,705	± 3,631	± 3,837	± 4,073	± 0,822
14 -15 year	30,830*	29,700*	35,600*	36,838*	27,625	14,571*
	± 5,899	± 2,772	± 1,476	± 3,254	± 2,342	± 0,517

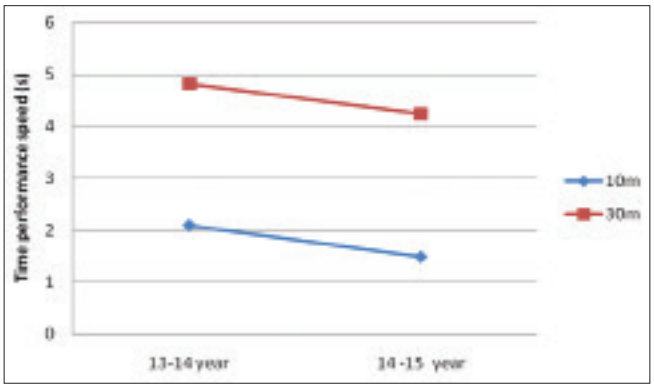

Figure 2: Performances of speed running ((10 and 30m) of two groups

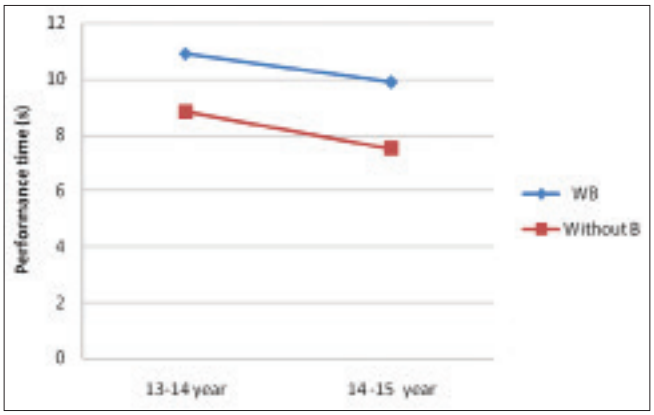

Figure 3: Performances of T-test agility of two groups

at youth level in elite clubs and sports academies belonging to amateur clubs and identify the possible spread and evolution of relative age in elite clubs.

Anthropometric Profile

In the present large sample of adolescent soccer players the indicators of growth and development before soccer training were height, weight, and BMI.

These results demonstrated that boys selected for soccer training present adequate growth and developmental characteristics (Malina et al., 2000;Mortatti et al., 2007; Stabelini et al., 2007) and agreed with similar studies of anthropometric and physical characteristics (Damsgaard et al., 2000) on different sport disciplines such as handball, basketball and volleyball.

These results are probably associated with the level of training intensity (Damsgaard et al., 2001; McIntyre, 2005,) the selection before soccer training or physical activities performed by these adolescents (Damsgaard et al., 2001). It seems to be clear that the higher energy expenditure of male athletes prior to the selection for formal soccer training contributed to body composition results during this phase of life. Furthermore, these aspects associated with genetic characteristics determined the boys' different biotypes. This data reinforced the importance of engagement in physical activity for an adequate anthropometric profile and body composition.

The significant increases in girths and body mass with age supported the notion that youth soccer players varied significantly in their anthropometry and performance according to age, adequate growth, and development for their age.

Physical Fitness

In general, studies ruled out a negative effect of physical training on growth and development as shown by anthropometric and physical characteristics (Damsgaard et al., 2000; Naughton et al., 2000; Rogol et al., 2000; Mortatti and Arruda 2007). Evidence indicates however, in some sport disciplines early excessive physical training might be detrimental (Naughton al et., 2000; Caine et al., 2005). These results however were difficult to distinguish from those of normal growth and development as shown by anthropometric and physical fitness characteristics (Naughton al et., 2000). Significant increases have been shown in maximum oxygen consumption (VO2max) (Stolen et al., 2005), running economy (Stabelini et al., 2007), strength of various muscle groups, lower limb muscle power, running velocity bone mineral content,

Table 2: Average ±SD of assessment of VO2max, VMA and running distnace by Yoyo test for two groups (13-14 and 14 -15years)

	Yoyo test		
	VO2max	VMA Km/h	Running distance (m)
13-14 years	48,806	15,332	1356,000
	±0,407	±1,017	±413,030
14 -15 years	55,966*	17,245*	1657,143*
	±1,018	±1,168	±394,273

back and hamstring flexibility, in addition to a reduction in body adiposity (Mortatti and Arruda 2007).

These benefits were identified and attributed to training in various sport disciplines such as Gaelic football and hurling as shown by anthropometric and physical characteristic long-distance running, gymnastics, swimming (Bencke et al., 2002), tennis (Kanehisa et al., 2006) and soccer as shown by anthropometric and physical characteristics (McIntyre, 2005)

Studies conducted on Brazilian child and adolescent soccer players demonstrated normal growth and development as shown by anthropometric and physical characteristics. This investigation's findings are in agreement with those reported in similar previous studies. Boys aged 13-15 years selected for formal soccer training presented anthropometric and physical fitness characteristics which were adequate for their age. In addition, VO2max increased with age; a finding which could be attributed to pubertal maturation. The VO2max values obtained in this study were on average equal to or lower than 60 ml/kg/min. These values were considered to be appropriate for boys of this age, and were higher than those obtained for non-athlete boys (Rodrigues et al., 2006) and slightly higher than the values reported by other investigators for Brazilian boys in the same phase of maturation (Stabelini et al., 2006).

CONCLUSION

Age-specific reference values from this sample of youth soccer players may be useful for trainers and coaches in both the talent evaluation and development processes The structure of the competitive system is very difficult to change, however, thus hampering the implementation of the solutions referred to above. That said, it would be more feasible for the technical directors of clubs and sporting academies to implement solutions designed to change the way they operate internally, such as grouping teams together by years of birth.

Any attempts by clubs or soccer academies to tackle the problem must involve raising the awareness of and training coaches, trainers. They should be kept informed that the real potential of a soccer player will not become apparent until they reach the end of their maturation process. As a result, therefore, they must make a special long-term commitment to themselves.

Given the existence of the relative age effect in youth soccer, it is our belief that future research should set out to explore the problem in greater detail and identify its roots cause.

We are therefore of the opinion that the possible influence of relative age in soccer schools should be assessed and the drawbacks of the talent identification processes used by elite clubs identified.

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