THE ANTHROPOMETRIC AND PHYSIOLOGICAL CHARACTERISTICS OF YOUNG ALGERIAN SOCCER PLAYERS

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Summary: Objective: The aim of this paper was to describe the anthropometric and physiological characteristics of young soccer players (U13) which were associated with their being successful or not as soccer players, and also to determine standard levels in the light of a test battery and indicators to select and guide the young talents as a scientific means to facilitate the selection.

Method: A total of 390 soccer players age (U13). From 14 Algerian soccer clubs were enrolled and subjected to standard anthropometric, fitness (speed 20m, CMJ, skills-related performance testing. The testing battery will be described as will the process for converting test data into standardized scores. Data will be presented to show the strengths and weaknesses of some players.

Result: After analysing the results based on the standard criteria for the proposed tests as well as the overall performance variable. And the ability of each youth to be selected according to their potential, and therefore it was stressed that the proposed criteria, which are scientific support for the field observation, should be emphasized to facilitate this process for Algerian soccer players.

The findings from this study indicate that marked improvements and parameters associated with physical maturity such as height, weight, speed, VO₂max, or chronological age are important to determine the success of a soccer player. At older ages, other factors such as agility seem to be more important. Nevertheless, players born in the 1st semester of the year are also more frequent in the older teams. These findings should be taken into account by trainers and coaches in order to avoid biasing their selection choices.

Keywords: standard levels, talents, battery test

Introduction

Soccer is recognized as the most widely practiced worldwide sport, 65 million players and 5 million referees and officials are actively involved in the game of Soccer (The FIFA

2014) and efficient organization of the team is essential for optimal development of the abilities of every player (Gil et al. 2007), the control of the opponent, and the successful resolution of a match have received reasonable attention in the literature (Silva et al. 2010; Vescovi et al. 2011; Williams & Reilly 2000). Therefore, players are placed in certain positions to fulfil specific tasks (Bate & Jeffreys 2014; Drust, Reilly & Williams 2009). Both the tactic and the position of players on the soccer field are essential for the organization of a soccer match (da Costa et al. 2009; Kannekens, Elferink-Gemser & Visscher 2011). There is a growing body of literature that recognizes the importance of the growth, maturity status, functional capacities and skills of male youth soccer players (Malina et al. 2000, 2004, 2005; Malina 1994) with the aim of identification and selection of the best soccer player. Accordingly, many football clubs and national federations invest substantial resources into the detection, identification, and development of young talented soccer players, to ensure that the most promising players receive high-quality coaching and training conditions (Baker et al. 2017; Myers et al. 2014; Sarmento et al. 2018; Williams & Reilly 2000).

The context of modern football is characterized by repeated evaluation of footballers' potential to succeed at the elite, adult level and for test selection (Baker et al. 2017; Schorer & Elferink-Gemser 2013; Schorer et al. 2017; Söderström et al. 2018). Test selection begins with an assessment of sport-specific demands (physiological and biomechanical) (Cone 2012), followed by selection of tests and their associated validity and reliability (Cone 2012; Nabli et al. 2016; Wagner et al. 2019; Hoff 2005). Fitness testing may play an essential role in determining strength and conditioning before the athlete begins program and competitive season (baseline measurements)(Ferguson 2014; Walker & Turner 2009).The physiological demands of soccer require athletes to be trained in several fitness components (Svensson & Drust 2005), including aerobic capacity, aerobic power, speed, speed endurance, strength, power, and agility (da Silva, Guglielmo & Bishop 2010; Sayers, Sayers & Binkley 2008; Walker & Turner 2009; Yilmaz 2014). Therefore, when evaluating and preparing athletes for competition, the importance of physical assessment via the implementation of appropriate, valid, and reliable fitness testing cannot be overlooked (Sayers, Sayers & Binkley 2008). Fitness tests can be very effective for a number of reasons (Hoff 2005) including assessing an athlete's current level of fitness including the identification of an athlete's individual physical (Belkadi et al. 2019) strengths and weaknesses (Granacher et al. 2018; Hoff 2005; Sayers, Sayers & Binkley 2008; Zemková & Hamar 2018). Many physical tests have been implemented in clubs and academies over the years to evaluate physical performance in soccer players

(Haugen & Seiler 2015). This long list includes linear sprinting, agility, repeated sprint ability, VO₂max, and Yo-Yo intermittent tests (Brocherie et al. 2015; Fernandez-Fernandez, Ulbricht & Ferrauti 2014; Lockie, Risso, et al. 2018; Nabli et al. 2016; Wagner et al. 2019).

There are several reports that have provided recommendations for what assessments should be included in a testing battery for soccer players (Cone 2012; Walker & Turner 2009; Sayers, Sayers & Binkley 2008). The tests selected for soccer players should specifically assess those factors that relate to soccer match play (Mohamed et al. 2019). The battery presented was adopted for a U13 years men's soccer from 14 teams. Explanations as to why these assessments were used by this team's coaching staff are provided. And this will serve to highlight the validity of the adopted assessments which is essential for appropriate athlete data collection (Miller 2012; Hoffman 2011). Furthermore, this particular testing battery has been adopted within formerly published scientific research in accordance with Lockie et al. (Lockie, Moreno, et al. 2018) also detailed the reliability and validity of each assessment. The testing battery also followed recommendations outlined in several National Strength and Conditioning Association text books and published paper (Baker et al. 2017; Sarmento et al. 2018; Wagner et al. 2019; Fernandez-Fernandez, Ulbricht & Ferrauti 2014; Miller 2012; Hoffman 2011; Bangsbo, Reilly & Williams 2014). The purpose of this article is to provide physical trainers and coaches of football clubs with evidence-based information enabling the effective implementation of an appropriate battery of football-specific fitness tests for U13. Firstly, this article will deal with the rationale for fitness tests and will be specifically intended for tests outside the laboratory. Various field tests, which assess the various components of physical condition declared specific to football will then be described and evaluated. Finally, a rationale for the choice of recommended tests will be reasoned and a timeline for implementation will be outlined.

Material & methods

Participants

The research was conducted on a sample of 390 soccer players belonging to the 14 top (U13) soccer club in Algeria which have at least 5 years of sport sand practice three training sessions per week (each about 90 min) and competed regularly in regional and national tournaments. The number of players in each team and their average age are shown in Table1. The average age of the soccer players (11.13 ± 2.65). All participants and their parents were informed about the purpose as well as experimental risks and benefits of the research. Parents or legal guardians provided written informed consent before the investigation. All Soccer

players were free from any injury that would prevent maximal effort during performance testing. The study was approved by the Ethics Committee of the University and conducted in accordance to the Declaration of Helsinki (World Medical Association 2013).

Table 1

Physical characteristics of the players in each competitive age group and results of comparisons between groups

	11-12 years (n =186)		13 years (n =204)		<i>p</i>	<i>F</i>	η^2
Variable	Mean	SD	Mean	SD			
Chronological age (CA), years	11,13	2,65	13,47	0,68	<0.01	732,58	0,82
Skeletal age (SA), years	12,29	1,56	13,98	1,28	<0.01	163,14	0,51
SA minus CA, years	0,16	0,91	0,51	0,60		2,81	0,18
Weight, kg	38,43	6,32	54,43	10,22	<0.01	149,96	0,49
Height, cm	144,93	6,82	163,83	9,42	<0.01	217,95	0,58
Sitting height, cm	73,33	3,22	82,03	5,02	<0.01	189,14	0,55
Estimated leg length, cm	72,03	4,62	82,13	5,32	<0.01	173,79	0,53
Sitting heightratio, %	50,83	1,42	50,33	1,32	<0.01	6,76	0,04
Sum of skinfolds, mm	32,73	14,62	36,63	16,22	<0.01	2,63	0,02

Study Protocol

To guarantee an appropriate execution of the exploratory tests, two acquaintance preliminaries were led in two separate days during the week preceding testing. Following two days from the last tests, players achieved two testing sessions split by 72 hours. Before every meeting, members were approached to abstain from hard physical exercises within 48 hours preceding testing (Chamari et al. 2004). They were likewise required to wear similar attire and footwear. The assessment of linear sprinting, jumping, and agility are common to soccer (G. Hoare & Warr 2000; Chamari et al. 2004) and were included in our battery of tests.

Anthropometry, Somatotype and Body Composition

In the first session, anthropometric characteristics including body height and mass were recorded. Each individual measurement and the sum of the 4 measurements were used for analysis. Fourskin folds (sub scapular, suprailiac, triceps and medial calf). All the measurements were made following the guidelines outlined by the International Society for the Advancement of Kin- anthropometry (ISAK) by a level 2 ISAK anthropometrist.

Estimation of Aerobic Capacity

Aerobic abilities, agility and muscular power were tested. The yo-yo intermittent endurance test - level 1 (Krustrup et al. 2003; Bangsbo, Iaia & Krustrup 2008; Cusano, Ascione & Mezzapesa 2019). The test consists of repeated 2 × 20 m runs back and forth between the starting, turning, and finishing line at a progressively increased speed controlled by audio bleeps

from a tape recorder (Bangsbo, Iaia & Krstrup 2008). Between each running bout, the subjects have a 10 s active rest period consisting of 2×5 m of jogging. When the subjects twice have failed to reach the finishing line in time, the distance covered is recorded and represents the test result.

Estimation of the strength of the lower limbs

Performed five maximal CMJs on a piezo-electric force platform Quattro Jump (Kistler, Switzerland) connected to a portable computer force data were recorded with a sample rate of 500 Hz. This test involves the participant jumping, starting from an upright position, with arms free to move and was conducted following a protocol as in (Bosco 1992) recording the best of two jumps.

Estimation of speed abilities

The 20 m sprint is a well-known test considered suitable to discriminate the ability of soccer players to accelerate at a short distance as previously observed within the study (Moir et al. 2004). There is a 20 m track, in the stadium, with photocells positioned exactly 20 m from the starting line at height of 1 m. The participants started from a standing position placing their forward foot 30 cm before the first photocell and were asked to sprint 20 m. This test has demonstrated high levels of reliability: correlation coefficients of 0.91 between test and retest (Moir et al. 2004).

Estimation of the agility

A Illinois change of direction test (ICODT) was used to assess changes of direction (COD) profile among different patterns of movement including sprints, directional changes, turnings and slalom runs (Roozen 2004; Hachana et al. 2014). On command, from a standing position, participants ran from point A to point B as shown in Figure 1. They performed three trials resting 3 min in-between. Participants were also instructed not to cut over the cones but to move around without touching or hitting them. In case of failure, the trial was repeated after an extra recovery (~1 min).

Figure 1

T-drill test with a ball

The main reason for choosing the T-drill classic test as a basis for a novel test was to determine agility outcomes and soccer shooting skills (Stewart, Carroll & Turner 2019; Šimonek 2019). The T-drill classic test is widely utilized to measure speed with directional changes such as forward sprinting, left- and right-side shuffling and back-pedaling. The Illinois agility test, which was also implemented in the current study, is commonly used to determine the ability to accelerate, decelerate, turn in different directions and run at different angles (Kutlu et al. 2012). Participants were instructed to sprint forward and kick the first ball with their right leg inside a soccer goal at ~10 m distance. Then, they shuffled to the left side kicking the second ball and shuffled back to the right side kicking the third and the fourth ball by alternating the shooting leg. After that, they ran backwards to the starting position. For each ball kicked inside the goal (score) 0.25 s was subtracted from the total time required to complete the course. For example, in the event of four scores, a reduction of 1s was applied to the total time. A recovery of 2 min was given between the trials.

Skills tests

The actual motor tasks of passing, controlling, dribbling and shooting the ball are fundamental aspects to the game of soccer (Ali 2011).

Dribbling tests

The ability to dribble the ball past opposing players is a hallmark of gifted players and hence is an oft-measured element of soccer skill (Kirkendall, Gruber & Johnson 1987; G. Hoare & Warr 2000; Rosch et al. 2000; Chamari et al. 2004). Most of the tests draw upon traditional coaching techniques of dribbling around cones placed 2 – 4 m away from each other in a figure-of-eight fashion (Sieghartsleitner et al. 2019) thus suggesting this type of test to be a valid and reliable indicator of soccer skill. Nevertheless, due to the nature of such tests they can be criticized for assessing the “technique” of dribbling rather than “skill” performance per/se.

Shooting tests

The clear aim of a soccer match is to score more goals than the opposing team. Therefore, one of the most highly valued and important skill elements within the game is the ability to score goals (Lyons, Al-Nakeeb & Nevill 2006). Goal-shooting tests are usually part of a battery of skill tests designed to assess overall soccer game performance (Haaland & Hoff 2003; Hachana et al. 2014). All of these tests require multiple attempts (using both feet) and aggregate points scored to determine overall performance. However, as shots are taken from a static position, it can be argued that they are assessing technique rather than skill. In addition,

there was no information on the speed of the shot, thus players could have hit the ball at speeds slower than those typical of match play. Furthermore, some of the tests required participants to shoot from relatively short distances (10 m) from the goal so they may have resembled more of a pass than a shot.

Passing tests

Accurately passing the ball to a team mate is an essential ability required by soccer players and many researchers have devised tests to examine this aspect (Rosch et al. 2000; Gil et al. 2007; Figueiredo et al. 2009; Walker & Turner 2009; Ali 2011). Studies were completed in this purpose (G. Hoare & Warr 2000) instructing players to pass the ball over distances of 5 m for 15 min; experienced coaches would then decide on performance ability.

Wall-pass tests

These tests require players to pass the ball through the air against a wall, control the rebound and make further air-borne passes against the wall typically with a set time limit and toward specific target a reason the wall (G. Hoare & Warr 2000; Williams & Reilly 2000; Silva et al. 2010; Turner et al. 2011; Hachana et al. 2014). Although a number of attributes are being assessed (including passing accuracy and control), this type of repeated wall-volley passing lacks ecological validity.

Statistical analysis

General characteristics of the participants were presented as means and standard deviations. Descriptive statistics were calculated by age group for all variables. Effect size was estimated with partial eta squared (η^2) (Lakens 2013). Level of significance was accepted at $P < 0.05$.

Results

Table 2 provides an overview of the descriptive characteristics of the measured variables for U13 players. The analysis results show that all the applied variables are normally distributed (the data is not presented). Statistical differences between the groups in anthropometric measures and skill tests between players in different age are established in the variables: Fastest sprint ($F = 63,86$; $p = .001$), Agility shuttle run ($F = 102,41$; $p = .001$), Intermittent endurance run ($F = 82,75$; $p = .001$), Squat jump ($F = 57,94$; $p = .001$), Counter-movement jump ($F = 59,06$; $p = .001$), Ball control ($F = 23,54$; $p = .001$), Dribbling speed ($F = 107,55$; $p = .001$), Wall pass ($F = 39,51$; $p = .001$), Shooting accuracy ($F = 12,1$; $p = .001$).

Table 2*Descriptive statistics for age and the skill tests for the total sample (n = 390) of adolescent soccer players*

	11-12 years (n = 186)		13 years (n = 204)				
Variable	Mean	SD	Mean	SD	F	p	n2
Fastest sprint, s	8,37	0,5	7,8	0,39	63,86	<0.01	0,29
Mean sprint, s	8,79	0,6	8,06	0,43	76,22	<0.01	0,33
Agility shuttle run, s	20,55	1,32	18,69	0,92	102,41	<0.01	0,4
Intermittent endurance run, m	1371	731	2556	912	82,75	<0.01	0,35
Squat jump, cm	23,8	4,3	28,8	4	57,94	<0.01	0,27
Counter-movement jump, cm	26,2	4,5	31,9	4,9	59,06	<0.01	0,27
Ball control, no. Hits	23,9*	22,1	68,4*	82,3	23,54	<0.01	0,13
Dribbling speed, s	15,77	1,81	13,36	0,88	107,55	<0.01	0,41
Wall pass, points	18	3,2	21,2	3,2	39,51	<0.01	0,2
Shooting accuracy, points	6,5	2,5	8,1	3,1	12,1	<0.01	0,07

Discussions

The findings of the current study show that talent selection models with the single dimensions lead in general to significant predictions with the aim of an early differentiation between 11 – 12 years and 13 years old players. Many talent identification models showed superiority over random predictions and were also calibrated appropriately for the U11, U12, and U13 age groups). Compared to the significance of predictions and the higher explained variance from the more extensive, multidimensional selection models within a similar group of participants, the less extensive models in the current study indicate substantially lower prognostic validity (Sieghartsleitner et al. 2019). This may underline the assumed advantages of multidimensionality over less extensive models (Vaeyens et al. 2008; Williams & Reilly 2000; Zuber et al. 2016). However, as long as these multidimensional models are not easily applicable to talent selection in the field (Belkadi et al. 2015), the immediate comparison between possible predictors of later performance may be of certain relevance within talent research.

The findings from this study support the discriminant validity of tests as a talent identification tool for measuring skill proficiency. High-level players displayed proficient skill behaviours for soccer-specific actions related to passing and controlling the ball along with completing more total involvements. This study's methodological approach provides coaches with a simplistic way of assessing soccer-specific skills in a practical setting. Set teams allow for players to self-discover technical and tactical strategies for problem solving with their teammates to meet the constraints of the fitness tests and adapt these as the relationship with their teammates develops (Davids et al. 2013). As players in a talent identification setting often

develop with the same teammates, it seems logical to use set teams within small-sided games. However, it is important for future research to also investigate the use of small-sided games for measuring skill proficiency when players compete in randomized teams. Randomizing teams will likely impose different technical and tactical constraints on players as they will have to adapt their behaviour according to the proficiency of their teammates. This approach may allow coaches to determine the cooperative nature of players with a diverse number of individuals.

As expected, anthropometric characteristics increased across the age groups as did the performance in functional capabilities. Previous study Deprez et al. (2014a) was evaluated in comparison with our study on the anthropometric and functional profile of 390 young soccer players between 11 and 13 years old in Algeria. An increase in anthropometric and functional measurements was observed as age increased. It has been verified that between the U11 and U12 categories, selection processes focus primarily on anthropometric characteristics of the goalkeepers and specific motor skills for midfield players. After the peak growth rate (U13), anaerobic performance becomes an important indicator (Saddek et al. 2020) to distinguish attackers from other positions.

Based on the immediate comparisons of different predictors of future performance in youth football, the current research contrasted the value of two different areas of motor performance for early talent selection. In doing so, there was a continuous superiority of sprint in descriptive values within each analysed age group through early (U11/U12) and middle adolescence (U13) despite the higher measurement reliability of the sprint test. None of the four comparisons at the different age groups led to a significant difference between sprint of U12 and U13 ($.07 \leq N2 \leq .65$).

Aerobic endurance assessed by the Yo-Yo Intermittent Recovery Test Level 1 was shown to be a predictor of defensive tactical performance in the U13 category, and explained 53% of the variance (Borges et al. 2018). The soccer defensive principles require constant movements of the player in the game space to regain ball possession. It is possible that the aerobic metabolism contributes significantly to supplying the energy demands of these movements where players with superior cardio-respiratory fitness are able to advance to the opponent's field to attack and/or return to cover and defend their zone more effectively (Santos and Soares 2001).

In the U13 category, training experience explained 19% of the variance in defensive tactical performance. Figueiredo et al. (2011), analysing predictors of functional capabilities

and specific motor skills in 390 young Algerian soccer players, concluded that training experience influenced shooting accuracy ($R^2 = 0.07$) and dribbling ability ($R^2 = 0.41$). Together these findings and the results of the present study demonstrate the importance of training experience in technical and tactical development in youth soccer.

Collectively, the Yo-Yo test, the Counter Movement Jump, abdominal strength, and body mass predicted 43 % of the variance in defensive tactical performance of 11 – 13 year-old soccer players. It is possible that the strongest players were encouraged by coaches to adopt more defensive roles and tactics, as greater body size and physical strength contribute to an advantage in the defensive system, since invasion sports are characterized by intense physical contact (Costa et al. 2010). Consistent with this finding, Deprez et al. (2014a) reported that U11 and U13 defenders were less tall and less heavy than midfielders and attackers, suggesting prevalence of taller, stronger players, more advanced in the maturational process.

As a practical application of these results, it is suggested that clubs and federations avoid selecting players guided by unilateral criteria favoring only physical and morphological advantages (Vandendriessche et al. 2012). Tactical, technical, and psychological qualities together with functional capabilities manifest themselves in symbiosis during the game and should be seen in that way during selection, detection, and sporting formation processes (Jones and Drust 2007).

A possible limitation of the study was the adoption of a cross-sectional design to the detriment of the longitudinal section which limits understanding of the variables during the maturational process. Future research should seek to employ more accurate measures of maturation. However, this study may contribute to future research involving the underlying processes in the development of young soccer players aiming to optimize this complex process identification.

Conclusion

This study was the first to examine the applicability of battery test as an assessment tool to determine the skill proficiency of youth soccer players. It was observed that players from the high-level academy displayed a significantly greater number of attempted and completed passes, touches, and overall skill involvements when compared with low-level players. In addition, skill proficiency remained relatively constant across different small-sided games (Bennett 2019).

Collectively, these findings support the use of battery test as a skill assessment tool for talent identification purposes. The information gained from such assessments can assist coaches in determining the potential of youth soccer.

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