Functional Capacities and Mental Skills Necessary for Expertise in Soccer

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Abstract

Purpose: Expertise in sport relies on interactions between individual, task and environment constraints. Individual performer constraints include mental and physical characteristics. The present study aimed to measure the functional capacities and mental skills in adolescent, elite (N=26) and sub-elite (N=35) soccer players to determine the important factors in the talent selection process.

Material and Methods: Participants were classified in four groups according to their age: U16, U15, U14 and U13. The OMSAT-3 was used to evaluate the mental skills. Furthermore, functional capacities were measured using four tests including aerobic resistance (shuttle run), explosive power (vertical jump), running speed (running with the ball) and strength (shooting).

Results: The results of the present study showed a significant difference between elite and sub-elite soccer players in three functional and seven mental characteristics. There were significant differences between elite and sub-elite soccer players regarding functional capacities between U15 and U16 players. Also, mental skills differentiated between elite and sub-elite players in U13, U14 and U16 age groups.

Discussion and Conclusion: It seems that soccer players lacking functional capacities and mental skills may not continue the participation and/or may not be selected for higher level participations. These results suggest that performance and psychometric characteristics of young soccer players differ at different ages. According to the results it seems that mental skill measurements at ages under 13 and 14 can help the selection process, but functional capacities should be emphasized at U15 and U16 age groups.

Key words: Soccer, Elite and sub-elite players, Talent, Functional capacities, Mental skills

Introduction

Expertise in sport is only reached when the athletes gain and maintain readiness to compete, both mentally and functionally. Several factors, such as fitness, skill and playing experience, play important roles in progressing to higher levels in soccer. Nevertheless, some mental skills are also important in helping the players reach their highest potentials. To assist young athletes in reaching elite level, it is important to gain insight into factors that influence the successful development of sport career. Many researchers 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 [18, 19, 22]. In this regard, models of talent identification suggest factors from different areas such as: anthropometry, physical qualities, mental skills, and motor skills. While most of sports determine talented athletes based on these factors, it is highly recommended that sport specific determinants be provided for each specific sport [12].

The typical measures of general performance (e.g. general fitness tests) may not be sensitive enough in differentiating elite players from their sub-elite counterparts [5, 18]. Soccer needs high levels of performance combined with technical and tactical skills as well as specific physical and physiological characteristics [17]. There is some evidence supporting this idea that measures of functional capacities consisting the sport specific variables meet the soccer`s special demands [1]. Soccer players must have high aerobic capacity to enable them be active during 90 minutes of the game or in the extra time. They must also be able to accelerate quickly in short distances. Besides these characteristics, they need to execute continuous sequence of activities (such as jumping, tackling,

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shooting or heading) which requires high anaerobic power [31]. Although, based on these traits, we can't assume definite success for a soccer player, findings of researches show that probability of success is 25% higher for these players [24].

Selection of potential elite athletes has high importance in successful recruiting and building a sport team. In team sports, such as soccer, because of the wide range of abilities needed to play the game successfully, the selection process is more complicated. Research on athletes at preadolescent stage has indicated that due to the instability before the adolescent growth period, talent identification is not possible via assessment of anthropometrical and physical attributes [6]. Although several studies have dealt with the physical measures of soccer, little attention has been paid to the influence of mental skills and functional capacities on the level of performance. According to Malina et al (2005) the selection of potential elite soccer players can be madebased on functional characteristics. Moreover, psychological attributes have specified effect on both skill acquisition and performance, and are crucialto the talent identification process[7]. However, specific information on the components of mental skills contributing to expert performance is limited[16].

Talent identification in soccer requires the comparisons between youngplayers in different performance levels at specific stages of development [22, 25]. Vaeyens et al. (2006) using performance-outcome measures on elite, sub-elite and non-elite youngsoccer players, demonstrated that the results of anthropometry and functional capacity tests significantly differ by performance level. Their results also suggest that specific tests that discriminate youngsoccer players vary at different ages during adolescence. Further, Williams and Reilly (2000) mentioned that to enhance the talent development process in soccer players, it is critical to identify talented players at early ages. The adolescence stage is referred to as the specializing stage in which the individuals focus on one or more specific sports [8].

The specialization should not take place before the age of twelve [9]. There was strong support for early specialization in the theory of deliberate practice which implied that more practice hours at early ages may lead to expertise acquisition, but this method have had limited success [28]. Recently, sports expertise has been explained using dynamical systems perspectives [21]. This theoretical model offers that expert skill acquisition appears through interactions between individual, task and environment constraints [2] and that, individual performer constraints include mental and physical characteristics [3]. Therefore, the present study assessed the mental skills and functional characteristics of young elite and sub-elite players aged between 12 to 16 years, to identify talented soccer players.

Material and Methods
Participants
The participants were 61 soccer players (26 elite and 35 sub-elite), aged between 12 and 16 years (Mean age=14/07). The mean age for elite and sub-elite groups was 14/08 ($\pm$1/15) and 14/06, ($\pm$1/04) respectively. Elite athletes were those with abackground of international games (national team members) and sub-elite players were involved in local pro league. Goalkeepers were excluded, limiting the analysis to defenders, midfielders and attackers. Mental and functional parameters were assessed in elite and sub-elite youngplayers in four age groups: U13[1], U14, U15 and U16.

Measures
The OMSAT-3[2] was used to examine the mental skills of the players. This questionnaire consists of three sub-scales, each consisting of a number of mental skills: foundation skills (Confidence, Commitment, and Goal Setting), psycho-somatic skills (stress reactions, relaxation, fear control and activation) and cognitive skills (focusing, re-focusing imagery, competition planning and mental practice). Durand-bush and salmela (2001) developed OMSAT-3 and reported high validity and reliability for this instrument. The validity of the instrument regarding the internal consistency was 0/68 to 0/88 and the reliability was 0/78 to 0/96 in all the subscales. Monfared (2006) studied the validity of OMSAT-3 in 333 athletes from Iranian national teams. The Study showed that the validity of instrument ranged from 0/37 to 0/71 and the reliability was 0/64 to 0/92.

Functional capacities examined in this study included: aerobic resistance (shuttle run), explosive power (vertical jump), running speed (running with

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1. Under 13 age, etc.
2. Ottawa Mental Skills Assessment Tool - 3

the ball) and strength (shooting).The first and second tests were proposed by many researchers as appropriate tests in soccer studies[e.g. Bangsbo, 1994; Figueiredoetal., [2009]. The third and fourth tests were selected from "FA soccer star tests" which were proposed by Britain football federation and their validity and reliability are reported 0/88 and 0/95, respectively.

Players performed shuttle run test, running between two cones, 25 yards apart, 12 times. The vertical jump test was administered with havingthe player stand next to the wall while his shoulder was perpendicular to it. The task was to jump as high as one can and to touch the wall at the highest possiblepoint. The test of running with the ball was performed having theplayer placed in a marked area with 30 yard length. The Player started the test by crossing the A-B line while keeping the ball in possession. The test finished when the ball passed the G-H line.

Shooting test was administered from 18 yard distance to goal from thetwo power lines drawn in 5 and 10 yards,behind the goal.
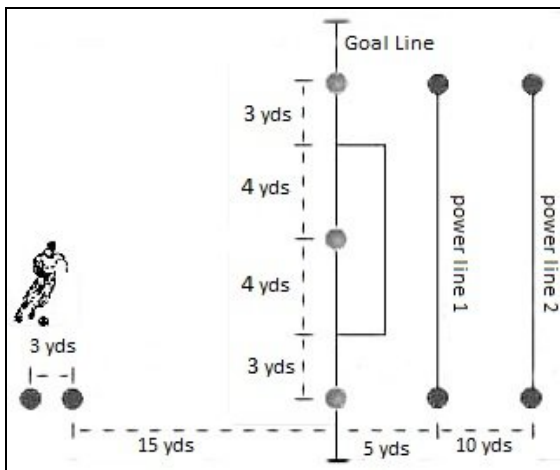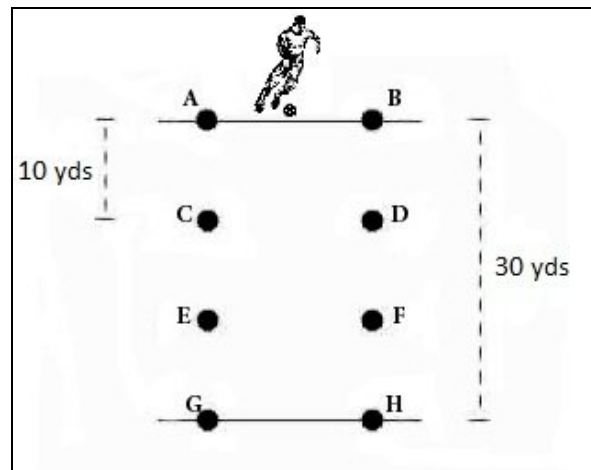

Figure 1: The test of running with the ball

Figure 2: The test of shooting

Procedure

Consent forms were completed for each participant by a parent or a guardian and the testing process was administered under identical conditions for all the subjects (same stadium and weather conditions)who hadno health problems or risk factorsaffecting theexperiments. Players were instructed to consume their normal meals on thedays leading to the test and not to have a mealbefore the test. Each player performed a favorite warm-up for10 minutes consistingof running, jogging and stretching. The tests of speed strength, and mental skills were performed inthe first session and in the morning. The power and aerobic resistance tests were takenafter 48 hours of rest andin thesame conditions.

Statistical analysis

The SPSS (Ver.16) was used to analyze data. Multivariate analysis of variances (MANOVA) and univariate ANOVA was applied to compare the two groups. Statistical significance was set at $P < .05$ for all the analyses.

Results

The age of the participants ranged from 12/25 to 16 years with a mean age of 14/07years. The mean soccer experience of elite and sub-elite players were 5/27 (±1/4) and 4/60 (±1/57)yearsrespectively. Table 1 presents a description ofthe participants' scoresin different tests administered in this study. Therewere no significant differences in height, weight, body mass index and age between the two groups.

Mean scores of the elite group on vertical jump, shooting and all mental skill sub-scales were higher than the mean scores of the sub-elite group. The elite group also showed better time records in shuttle run and running tests.

Table 2 shows the results of the analysis of the variances used to compare the mean values of functional capacities of the two groups.

Table 1: Basic statistical parameters (Mean±S.D)

Functional Capacities tests	elite	Sub-elite
Shuttle run (s)	79/69 (1/86)	82/67 (1/30)
Vertical jump (cm)	39/31 (2/46)	38/37 (2/78)
Running with the ball (s)	4/52 (0/40)	4/93 (0/54)
Shooting	16/35 (1/95)	14/97 (2/52)
Mental Skills sub-scales	elite	Sub-elite
Foundation	68/03 (5/77)	67/42 (4/75)
Psycho-somatic	83/46 (8/94)	76/60 (6/84)
Cognitive	100/15 (8/06)	92/57 (7/67)

Table 2: MANOVA for differences in functional capacities

Main Factor	Wilks` Lambda	df	df error	F	P
Functional Capacities	0/507	4	56	9/227	0/004*

Based on information illustrated in table 2, functional capacities differentiated between elite and sub-elite players. The univariate analysis showed that the two groups were significantly different in shuttle run (F=53/477, P=0/000), running (F=10/315, P=0/002) and shooting (F=5/317, P=0/025). But there was no significant difference in mean scores between the two groups regarding thevertical jump.

Table 3 illustrates the results of analysis for mental skills differences between elite and sub-elite players.

As indicated in table 3, mental skills weresignificantly differentinelite and sub-elite players. Applying univariate analysis, significant differences were foundinGoal setting (F=4/030, P=0/049), Relaxation (F=8/005, P=0/006), Fear Control (F=5/656, P=0/021), Activation (F=8/900, P=8/900), Focus (F=15/913, P=0/000), Refocus (F=8/751, P=0/004) and Competition plan (F=4/629, P=0/036) between the two groups.

The results of MANOVA comparing the mental skills and functional capacities of the four age groups are presented in table 4.

Based on table 4, there were significant differences in functional capacities between players in U15 and U16 groups and mental skills differentiated between elite and sub-elite players in U13, U14 and U16 age groups.

Table 3: MANOVA for differences in mental skills

Main Factor	Wilks` Lambda	df	df error	F	P
Mental Skills	0/555	12	48	3,207	0/002*

Table 4: MANOVA for differences in functional capacities and mental skills classified by age groups

Factor \ Stats	Age group	Wilks` Lambda	F	P
Functional Capacities	U13★	0/269	3/650	0/174
	U14	0/338	0/658	0/151
	U15	0/246	6/815	0/002*
	U16	0/342	5/375	0/033*
Mental Skills	U13	0/000	33/917	0/009*
	U14	0/006	26/819	0/036*
	U15	0/143	0/500	0/162
	U16	0/180	2/271	0/042*

★U13= Under 13, U14= Under 14, etc.

Further analysis showed that difference in running was significant between elite and sub-elite players in U13 (F=11/298, P=0/006) and U14 (F=11/203, P=0/005) age groups. The shuttle run test differentiated between elite and sub-elite players in U13 (F=15/024, P=0/003), U14 (F=5/372, P=0/037), U15 (F=31/95, P=0/000) and U16 (F=36/717, P=0/000) age groups.

Analysis of data regarding mental skills demonstrated that differences in psycho-somatic and cognitive skills between elite and sub-elite groups were significant in U13 and U14 players, but there were no significant differences in foundation skills between the groups.

Discussion and Conclusion

The main purpose of this study was to find important functional and mental measures that differentiate young elite and sub-elite soccer players. The results of this study indicated that elite players excel in most of the functional capacities and mental skills to their sub-elite counterparts. The findings of the present study demonstrated differences in functional capacities between elite and sub-elite players; with significant differences in shuttle run, running and shooting. But there was no significant difference in vertical jump. The results also indicated that among the 12 mental skills examined in this study, the differences between elite and sub-elite players were significant in goal setting, relaxation, fear control, activation, focus, re-focus and competition plan. But no difference was observed in self-confidence, commitment, stress reactions, imagery and mental practice.

It seems that soccer players lacking functional capacities and mental skills may not continue the participation and/or may not be selected for higher level participations [13]. In contrary, players who have higher scores in functional and mental measures appear to have more probability to reach elite levels. Shuttle run was the most discriminating factor among the functional tests. Thus, it seems that anaerobic power and lactic acid threshold are important in elite players' success. Ostojic (2000) reported that Serbian elite players achieved better time records in the shuttle run test, compared to sub-elite players, which is similar to the results of the present study. Likewise, findings of Vaeyens et.al (2006) are also consistent with the results of the present study. The results of discriminating

analysis in this latter study showed that shuttle run is among the most distinguishing factors between elite and sub-elite players. Shuttle run in the present study differentiated between elite and sub-elite players in all age groups, with the greatest difference between U15 and U16 players.

Speed is another functional capacity which successfully discriminated elite and sub-elite players. These results are similar to the findings of Hoare and Ware (2000). In general, the results of the present study are consistent with those of the researches who consider a basic role for speed in achieving success in soccer [e.g. Reilly, Bangsbo and Franks, [2000]. Figuerido and his colleagues (2009) in their study indicated that speed running tests differentiated between elite and club players.

The findings of this study emphasized the importance of mental skills in talent identification models. Elferink-Gemseretal., (2007) in their study on the relationship between multidimensional factors and performance level, found that psychological characteristics have high differentiating power between elite and sub-elite players, which is consistent with the results of the present study.

The greatest difference regarding the mental skills was related to focus, activation and refocus, respectively. These findings accentuate the importance of obtaining and maintaining focus in soccer. Moreover, Geczi (2009) studied the application of psychometric and motor tests in talent identification and showed that focusing skill is a highly effective factor in selection of young players, which is in line with our results.

Research shows that negative reaction to stress has negative effects on performance, while positive reaction to the stress improves the performance [27]. In the present study stress reaction skill was not significantly different between the two groups. Some athletes perceive the pre-competition stress as the necessary arousal for a better performance, while others suffer from it. Therefore, it is highly important to provide efficient instructions for young athlete on how to cope with their stress appropriately.

Mental skills in U13, U14 and U16 successfully differentiated between the elite and sub-elite players. Adolescence is a period of life with ever-changing psychological characteristics. The results of the present study suggest that providing appropriate education on the mental skills

needed to cope with these fluctuations can promote athletic performance. As mental skills were the most distinguishing factor in U13 and U14 age groups, these educational procedures should be provided earlier in the adolescence.

The findings of the present study, likewise those ofVaeyens et al (2007) and Le Gal et al (2008) showed significant age differences in both functional and mental attributes. These results suggest that performance and psychometric characteristics of young soccer players differ at different ages. Thus, age should be taken in account as an important factor in talent identification process.

Overall, these findings emphasized the importance of mental skills in talent identification models. These results also supported the application of OMSAT-3 in evaluating the mental skills of adolescent soccer players. In conclusion, mental and functional tests can successfully discriminate elite players from their sub-elite counterparts, taking into account the players'age.

The sub-scales of OMSAT-3 successfully discriminated between the two groups of elite and sub-elite players in the present study. Of course, psychometric tests cannot be the only tests administered for selecting players and they should be used in combination with functional tests to reach the best results.

From the results of the present studyit appeared that, there should be less emphasis on functional capacities and more stress on the mental skill measurements in talent identification process of players under the ages of 13 and 14.

Finally, the authors suggest increasing efforts on finding suitable talent identification processes in young soccer players, as well as the need for more researches regarding the mental aspects of expertise in soccer. These results help coaches become familiar with the appropriate methods of selection and examination, and increases their understanding of the results obtained from these measurements [14].

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