Talent Identification in Iranian Youth Soccer Players Aged between 12 and 16 Years Old Using a Multivariate Approach

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Abstract

To determine the applicability of a multivariate test battery in youth soccer players, we made a comparison between 45 elite and 51 sub-elite youth soccer players concerning physiological, psychological, anthropometrical and technical factors. Some researchers (e.g., Reilly et al., 2000) have also proposed similar TI models to be applied on soccer schemes. The players completed the ACSI-28 questionnaire as a psychological test. Also, all players performed the FA soccer star tests in order for their technical characteristics to be determined. The seven measures in anthropometrical cluster analysis include: height, body mass, body fat percentage and four girths (waist, shoulder, mid-thigh, calf). Besides, five tests performed by players to determine their physiological characteristics: Vertical jump, sit-ups, 280 meter shuttle run, 10 and 40 meter sprints. The results of present study demonstrated significant differences between elite and sub-elite players in the four measured clusters. A significant difference was also found in age as a covariate. The most distinguishing factors, accentuating the importance of speed in TI models, were 40-m sprint and shuttle run (among physiological factors), peaking under pressure (among psychological factors) and speed (among technical factors).. There were significant differences between U14 and U15 groups in physiological and technical factors. Besides, the elite U16 players scored better than their sub-elite peers in psychological and technical measurements. The results indicated that a multivariate approach, considering age differences, can successfully distinguish elite soccer players from sub-elite players at young ages.

Keywords : Talent identification, Youth Sports, Performance level, Age differences

Introduction

The Talent Identification (TI) process may take several forms. The systematic form of talent identification was established by Eastern European countries, although the viability of such programs has been questioned [1]. Despite applying different modifications on those programs, this process is still highly dependent on observational assessment. The coach is essentially being asked to evaluate the potential of the child, and if the child meets the criteria considered as important by the coach, he or she is identified and selected. However, this process must involve more formal identification and selection of individuals who presumably have the skill, physical, and behavioral prerequisites for success in a given sport [2].

Talent identification is the process by which children are persuaded to take part in sports they have potential to become successful in, based on the results of specific tests [3]. Understanding the key factors of this process is important for all people associated with youth development in sports including soccer [4, 5, 6]. Hence, clubs always seek for scientific guidelines to allocate their resources and education facilities to future elite players [7, 8], trying to invest their money to identify and develop really- talented youngsters [9, 6]. Researchers who focus on TI models in youth sport can help clubs and coaches to attain this goal; however, TI in team sports such as soccer is a complicated process and requires a multidisciplinary approach [10, 9, 6, 11]. Williams (1998) noted that the potential predictors of soccer talent include anthropometric, physiological, neuro-motor, cognitive-perceptual and psychosocial attributes. Hoare and Warr (2000) indicated that potential elite female soccer players can be selected based on anthropometric, physiological, and technical variables. Nonetheless, researchers suggest that assessment of essential soccer skills should also be applied in multi-factorial battery of tests used in the soccer TI models [9]. A multidisciplinary test battery, adopted by Reilly (2000) to contribute to skill measurements, appeared to be practical in distinguishing elite players from their sub-elite counterparts.

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The focus of previous researches in the field of talent identification in youth sports often has been on comparisons between youth players at different performance levels at specific stages of development [12, 9]. Vaeyens et al (2006), using performance-outcome measures on elite, sub-elite and non-elite youth soccer players, demonstrated that the results of anthropometry and functional capacity tests significantly differ with performance level. Their results also suggest that specific tests that discriminate youth soccer players vary at different ages during adolescence. Furthermore, 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. Hence, the present study assessed the characteristics of youth elite and sub-elite players aged between 12 and 16 years old to identify talented soccer players. This age range is referred to as the specializing stage in which the individuals focus on one or more specific sports [4].

One of the questions, this study aimed to answer, was that in which characteristics the elite youth soccer players score higher than their sub-elite peers. Moreover, this question might be asked to address the age groups in which our multivariate battery of test can differentiate successfully between elite and sub-elite youth soccer players.

Materials and Methods

A sample of 96 soccer players (45 elite and 51 sub-elite) aged between 12-16 years old participated in this study (mean age= 15.07). Subsequently, Participants were assigned to four groups based on their chronological age: U13, U14, U15 and U16 (Table 1).

Elite athletes were the current or previous members of Iranian national team playing in Tehran province clubs, and sub-elite participants were playing at the highest level possible for their age group in Tehran province clubs too, but without national games. Having excluded goalkeepers, the analysis was limited to defenders, midfielders and attackers. Players, their parents/guardians and club officials were informed of testing protocol, and the informed consent was obtained from them. Clubs ethics committee approval has also been obtained. Experiments were performed during 2009-2010 soccer competitions season.

Multi-factorial parameters were assessed in elite and sub-elite youth players in all age groups. These parameters are described as follows into four clusters:

Anthropometrical measurement

Seven measures in this cluster include: height, body mass, four girths (waist, shoulder, mid-thigh, calf) and body fat percentage. The circumferences of mid-thigh and calf were measured on dominant limbs. Body fat estimation was done by measuring skinfold thickness at four sites (triceps, biceps, subscapular and suprailiac) on the dominant side of the body using a Harpenden skinfold caliper (British Indicators Ltd., Luton) and putting the quantities into appropriate equations [13]. Skinfolds were measured according to the International society for Advancement of Kin anthropometry protocol [14].

Physiological measurement

Five tests performed by players to determine their physiological characteristics included: Vertical jump (explosive power), sit-ups (abdominal muscular endurance), 280 meter shuttle run (cardio-respiratory endurance), 10 and 40 meter sprints (speed). All participants had 10 minutes favorite warm-up before performing the tests. Also, the environmental conditions (weather, testers, etc.) were stable during the measurements.

Psychological measurement

The players completed the ACSI-28 questionnaire (Smith et al 1995) that contains 7 sub-scales including: coping with adversity, peaking under pressure, goal setting and mental preparation, concentration, freedom from worry, confidence and achievement motivation, and coachability. They were asked to fill in the questionnaire honestly to ensure maximum accuracy and validity of the results. Previous Research has shown that ACSI-28 can be used as a good tool for predicting future elite athletes [15]. The internal consistency of ACSI-28 has shown to be high for both male (0.84) and female (0.88) athletes. Besides, test-retest reliability coefficients were high for all the subscales [16].

Technical measurement

All players performed the FA soccer star tests (including running with the ball, turning with ball, speed, dribbling, heading and shooting). The tests reflect the technical ability of the players in these techniques. These tests have been validated by Professor Tim Holt (1988). Likewise, they have been proven to display 95% reliability and 88% validity by Dadkan and Daneshjoo (2005) in Iranian players (unpublished observation).

Analysis

The statistical analysis was performed using SPSS version 15.0 with a $p<0/05$ level of significance. A multivariate analysis of covariance

(MANOVA) with age as covariate was used to compare the dependent variables among players within each group in all age groups and expertise levels. Univariate analysis of variance using Bonferroni method was used as follow-up test, where appropriate. Finally, stepwise discriminant analysis was used with the level of performance as dependent variable.

Results

The mean and standard deviation of players' scores in four clusters of the test battery (Physiological, psychological, Technical and Anthropometrical), are presented in table 2.

The results of the MANCOVA revealed main effects for age, F = 4.542, Wilks' Lambda = .624, *p* <0.001, and expertise level, F = 13.149, Wilks' Lambda= .278, *p* <0.001. Age as the covariate significantly affects the players' scores on physiological tests in U13, U14 and U15 groups, and on technical tests in U14 and U15 groups. It also significantly influences psychological factors in U16 players (Table 3).

Follow-up univariate analyses showed that there are significant differences between elite and sub-elite players in the following variables: Vertical jump (F=18.502, P <0.01), Shuttle run (F=27.845, P <0.01), 10-m sprint (F=15.373, P <0.01), 40-m sprint (F=38.747, P <0.01), peaking under pressure (F=16.119, P <0.01), freedom from worry (F=8.943, P <0.01), confidence and achievement motivation (F=9.352, P <0.01), turning with the ball (F=7.255, P <0.05), technical speed (F=21.653, P <0.01), dribbling (F=10.739, P <0.01), and body fat (F=19.533, P <0.01). Overall, the elite group scored significantly higher than the sub-elite group in four of the physiological variables, three of psychological variables, three of technical variables and one of anthropometrical variables.

The summary of stepwise discriminate analyses is presented in Tables 4 and 5. The most discriminating factors between the two groups (elite and sub-elite) were 40-m sprint, shuttle run, speed and peaking under pressure. As the average squared canonical correlation was 0.730, it can be inferred that by knowing the players' scores on the above-said factors, we can classify them into the appropriate groups with 73% precision.

Table 1: Number of players at different age groups and expertise levels

Expertise and age	U 13	U 14	U 15	U 16
Elite	8	9	12	16
Sub-elite	12	12	17	10
Total	20	21	29	26

Table 2 - means and standard deviations of participants' scores in four clusters of tests

Physiological	elite	Sub-elite	**Technical**	elite	Sub-elite
Sit-ups	45.37 (1.74)	44.04 (1.77)	Running with the ball (s)	5.65 (.35)	6.07 (.55)
Vertical jump (cm)	83.15 (2.10)	80.92 (2.02)	Turning with the ball (s)	24.72 (1.53)	26.13 (1.62)
Shuttle run (s)	17.72 (1.49)	18.83 (1.26)	Speed (s)	11.45 (.82)	13.01 (1.01)
10 meter sprint (s)	1.80 (.08)	1.93 (.07)	Dribbling (s)	15.68 (1.3)	17.40 (1.50)
40 meter sprint (s)	5.59 (.37)	5.97 (.31)	Heading	2.77 (.52)	2.51 (.92)
			Shooting	16.50 (1.95)	15.86 (1.69)
Psychological	elite	Sub-elite	**Anthropometrical**	elite	Sub-elite
coping with adversity	8.39 (1.45)	8.49 (1.27)	Height (cm)	1.61 (.07)	1.59 (.07)
peaking under pressure	9.36 (1.49)	8.82 (1.36)	body mass (kg)	45.82 (3.65)	45.09 (5.19)
goal setting and mental	8.95 (1.18)	8.86 (1.20)	waist girth (cm)	66.41 (1.97)	68.12 (2.06)
concentration	9.39 (1.48)	9.28 (1.39)	shoulder girth (cm)	98.50 (1.91)	97.51 (2.27)
freedom from worry	9.55 (.92)	8.61 (1.32)	mid-thigh girth (cm)	45.82 (1.25)	44.02 (1.30)
confidence and achievement	10.55 (1.17)	9.13 (1.65)	calf girth (cm)	35.57 (1.14)	34.34 (1.28)
coachability	9.06 (1.23)	8.67 (1.59)	Body fat (%)	11.8 (1.6)	13.3 (2.1)

Table 3: result of MANCOVA with age as the covariate: differences by age groups and expertise level

	age groups				expertise level			
	Wilks' lambda	**F**	**df**	**p**	**Wilks' lambda**	**F**	**df**	**p**
Physiological								
U-13	.295	24.783	5	.010	.594	1.706	5	.203
U-14	.316	16.537	5	.005	.295	14.239	5	.000
U-15	.257	25.845	5	.002	.281	15.768	5	.000
U-16	.576	4.494	5	.105	.624	2.484	5	.047
Psychological								
U-13	.835	1.536	7	.446	.704	.853	7	.359
U-14	.869	.880	7	.614	.498	12.740	7	.065
U-15	.737	1.875	7	.262	.633	2.359	7	.207
U-16	.309	17.723	7	.015	.587	2.127	7	.142
Technical								
U-13	.774	1.706	6	.203	.886	.783	6	.342
U-14	.533	4.239	6	.015	.776	1.527	6	.278
U-15	.204	13.768	6	.000	.642	2.045	6	.075
U-16	.498	5.484	6	.001	.213	20.394	6	.005
anthropometry								
U-13	.679	.776	7	.377	.639	2.778	7	.265
U-14	.903	.274	7	.896	.867	.839	7	.766
U-15	.628	1.490	7	.328	.785	.983	7	.652
U-16	.754	.835	7	.589	.873	.467	7	.745

Table 4: variables entered/removed in stepwise discriminant analyses [a]

Step	**Entered**	**Wilks' Lambda**							
						Exact F			
		Statistic	df1	df2	df3	Statistic	df1	df2	P-value
1	40 meter sprint	.497	1	1	92	64.297	1	92	.000
2	Shuttle run	.414	2	1	92	34.703	2	91	.000
3	Technical Speed	.378	3	1	92	31.882	3	90	.000
4	Body fat	.323	4	1	92	25.373	4	89	.000

[a] At each step, the variable that minimizes the overall Wilks' lambda is entered. Maximum number of steps is 50. Minimum partial F to enter is 3.84. Maximum partial F to remove is 2.71. F level, tolerance, or VIN insufficient for further computation.

Table 5: variables in the analyses in stepwise discriminant analyses

Step		**Tolerance**	**F to remove**	**Wilks' Lambda**
1	40 meter sprint	1.000	64.297	
2	40 meter sprint	.945	51.313	.793
	Shuttle run	.945	10.530	.727
3	40 meter sprint	.943	49.893	.785
	Shuttle run	.905	12.310	.671
	Technical Speed	.936	9.076	.653
4	40 meter sprint	.930	40.439	.715
	Shuttle run	.908	14.621	.624
	Technical Speed	.912	12.648	.601
	Body fat	.916	9.947	.589

Discussion

As Bompa (1985) noted, an ideal accepted model is necessary for both athletes and coaches to compare their own sport qualities with, but there is no consensus among experts regarding the factors which must be applied in TI process [7]. Therefore, the more focused researches need to be conducted in this area [2]. The present study by adopting a multidisciplinary model showed that a combination of anthropometrical, physiological, psychological and technical characteristics may distinguish properly between elite and sub-elite youth players.

The physiological measurements were the most discriminating of the four clusters with statistically significant differences between two groups on four of the seven tests. The elite players scored higher than their sub-elite peers in vertical jump, shuttle run, 10-m sprint and 40-m sprint measurements. These results are consistent with those of the studies indicating the critical role of aerobic and anaerobic capacity measures in soccer success (e.g. Reilly, Bangsbo, and Franks, 2000).

Elite players were also better in the subscale of confidence and achievement motivation from psychological measures. This finding is in line with the previous studies showing that self confidence and motivation should be more emphasized in TI models [17]. The elite players also had higher scores in peaking under pressure and freedom from worry.

The results presented that elite players performed better than their sub-elite counterparts on technical tests, with statistically significant difference on turning with the ball, technical speed and dribbling. As indicated in Table 4, technical speed is the most discriminating factor in this cluster.

While body fat was significantly different in favor of the elite group, from girth measurements, only the waist girth was slightly bigger in sub-elite group, and there was no significant difference in other anthropometrical measures. Thus the results suggest that in spite of little difference in body girths, the sub-elite players have more adipose tissue than their elite peers. The poor performance of sub-elite players in physiological tests could be attributed to their higher levels of body fat [18, 19].

The physiological and technical factors discriminated most successfully in U14 and U15 participants. Physiological characteristics also were important discriminating factors in U13 players. These results are in line with the study of Vaeyens and his colleagues [3, 15], in which elite and sub-elite youth soccer players were significantly different in functional capacities and sport-specific skills. Further, the elite youth players in U16 group scored higher than their sub-elite counterparts on psychological and technical characteristics. This primacy could be referred to the effects of neuro-motor development, as elite players at older ages have had more opportunities to gain experience and benefit from good education. This age-related and gradual development is attributed to maturational process of the central nervous system [20].

In summary, we measured physiological, psychological, technical and anthropometric characteristics of 45 elite and 51 sub-elite players to identify characteristics that could help to predict future elite soccer players. The battery of test applied in this study appeared to discriminate successfully between elite and sub-elite soccer players. Of our measurements, 40 meter sprint, shuttle run, technical speed and body fat were the most distinguishing factors. Our findings are consistent with those of Hoare and Warr (2000), suggesting that more weight should be given to speed and acceleration [21, 22]

Lastly, it is difficult and possibly immoral to separate the talented children from their ordinary peers. Talent Identification should be a continuous process, and should not be dependent on an individual's performance during a single performance test. It must be recognized, therefore, that the identification of talent is complex, with many factors that must be noticed if the process is to be optimally effective. But, in case of emergency for selecting a group of talented young soccer players preparing for competition, the battery of test used in this study can be helpful.

Conclusion

This study used a battery of test which is comprehensive in structure, although convenient in administration. As opposed to studies in which the technical measures were ignored [23, 22], the present study highlighted the importance of these factors in TI Studies. In many ways, the model used in present study is identical to the model proposed by Reilly (2000), and like the Reilly’s, it seems to be appropriate for identifying talent in youth soccer players, although it is most practical in U14 and U15 players. However, endeavors to establish more appropriate methods of identifying sports talent are highly suggested (24). As Du Rant (2008) noted, this efforts will continue as long as countries want to outstand at international competitions. We also suggest performing more refinements on this model as well as selecting samples of women soccer players in future studies.

In conclusion, the future elite soccer players can be predicted using multivariate measurements. Besides, it appears that age differences must be considered in choosing the measurements in youngsters to identify the soccer talent.

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