

ANTHROPOMETRIC AND PERFORMANCE CHARACTERISTICS OF ELITE NIGERIAN SOCCER PLAYERS

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Abstract: This study assessed the anthropometric and performance characteristics of male elite soccer players in the South Western Nigeria with a view to determining status and to examine if there were positional related differences among players. The descriptive survey design was used in this study. Ninety male players were drawn from six soccer clubs competing at the Professional League level in South-West Nigeria using the purposive sampling technique. The procedure of the International Society for the Advancement of Kinanthropometry (ISAK) was used for all anthropometric measurements. Performance characteristics were measured using standard tests in line with the recommendations of the American College of Sports Medicine (ACSM, 2009). Data were analyzed using Analysis of Variance (ANOVA) and t - Test statistics. The results showed that there were significant differences in three anthropometric variables (height, $F = 13.010$; $p < 0.05$, weight, $F = 2.625$; $p < 0.05$ and BMI, $F = 3.389$; $p < 0.05$) when players at different positions were compared. Players however did not show significant positional related difference in other three ($\Sigma 7$ Skinfolds, $F = .369$; $p > 0.05$, % body fat, $F = .185$; $p > 0.05$ and body density, $F = .408$; $p > 0.05$). The result also showed that though there were no significant positional-related differences in five out of six performance parameters, players showed significant difference in speed ($F = 4.788$; $p < 0.05$).

The study concluded that there were no distinctive differences between the performance profiles of elite Nigerian soccer players playing at different positions.

KEY WORDS: Anthropometry, Performance, Elite-Athlete, Soccer

Introduction

Sports performance is complex and intricate, involving the physical (general and specific), psychological (personality and motivation) and body composition (body morphology and anthropometry) factors. Ball games require comprehensive ability including physical, technical, mental and tactical abilities. Physical abilities such as flexibility, dynamic and explosive strength, jump height, coordination and agility of players, exert marked effects on the skill of individual players and the tactics of the team. Ball games demand repeated maximum exertion, such as dashing and jumping, the physique of athletes thus enhances their performance (Bloomfield, Polman & Donoghue, 2007). Explosive-type ball games such as soccer require that players should possess physical abilities to make rapid and powerful movements in addition to

aerobic and anaerobic capacities that make them competent in prolonged vigorous offensive and defensive maneuvers.

Soccer is one of the most widely played games in the world. It is so great in popularity that the men's world cup attracts a bigger audience than the Olympic Games (Tumilty, 2000). Typically, soccer is characterized by intermittent bouts of high intensity activity occurring throughout the duration of a match (Bloomfield, Polman and O'Donoghue, 2007). It is a contact/collision sport that requires significant muscle mass to produce the power necessary to accelerate horizontally, vertically, and to contest possession (Tumilty, 2000). The activity pattern of soccer is characterized by approximately 1,350 discrete movement changes during a game, with the mean duration of any activity being 4 to 6 seconds. Acceleration and speed are very crucial requirements in soccer, and these may differ among players at different levels of the game (Tumilty, 2000). Running seems to constitute between 1 to 11% of the total distance typically covered in a match as a player may complete 19 high intensity runs within an interval of 4 to 5 minutes throughout a game. A soccer match lasts 90 minutes and there may also be a 30 minutes extra time of play in order to produce a conclusive outcome (Tumilty, 2000). On the average, a player will spend approximately 20% of the match standing, 40% of the match walking, 17% jogging, 17% running and the remaining time completing other movements such as skipping, jumping, or diving (Mohr, Krustup and Bangsbo, 2003). During a game, professional soccer players perform about 50 turns, comprising sustained forceful contractions, to maintain balance and control of the ball against defensive pressure. Hence, strength, power and muscular endurance are of great importance in top level soccer play (Clark, 2007). Because of the varying intensities displayed throughout the game, players must rely on energy supply

from both the aerobic and anaerobic pathways. Styles of play which varies from country to country may also affect the pace or intensity of the game.

The identification of physical parameters characteristic of a sport enables coaches and athletes to design and apply suitable conditioning programmes which contribute to player's peak performance. In addition to being used for differentiating athletes in different sports, descriptions, such as anthropometry, muscle fiber types and physiological parameters have been explored in attempts to describe and differentiate athletes in various sports as well as those playing different roles within the same sports (Adeniran, Toriola and Amusa, 2010). Despite a number of reports on the morphological and performance characteristics typical of successful soccer athletes and those suggesting positional-related differences in anthropometric and performance characteristics of soccer players at different levels (Bloomfield, Polman & Donoghue, 2007; Tumilty, 2000; Reilly, Bangsbo and Franks, 2000; Helgerude, Hoydal, Wang and Hoff, 2007; Zapartidis, Vareltzis, Gouvali and Kororos, 2009), studies delineating these parameters among elite soccer players in Nigeria are scanty. This present study therefore examined anthropometric and performance characteristics of male elite soccer players in the South-Western Nigeria.

Methods

Participants

The sample for this study comprised 90 male soccer players aged 18 to 30 years, purposively drawn from six soccer clubs competing at the Professional League level in South Western Nigeria. The study was cleared by the Ethics Committee of Obafemi Awolowo University, Ile-Ife (ERC/2015/30/12). Subjects were duly briefed of the testing procedures and written consent was obtained from them. Tests were administered on participants when they had been in camp for six weeks prior to the Professional League tournament. Participants' height and weight were measured using an electronic stadiometer/ BMI scale (SECA 220). Circumferences were measured with a flexible non- extensible fiber tape to the nearest 1mm. Skinfolds were measured with a Lange skinfold caliper (PAT. NO. 3.008.239; Cambridge Scientific Industries, Cambridge Maryland).

Anthropometric Variables

Participants' anthropometric variables; body weight, height and skinfold thickness (Biceps, Triceps, Subscapular, Abdominal, Supraspinale, Front Thigh and Medial calf) were measured. The protocol of the International Society for the Advancement of Kinanthropometry (ISAK) was used for all measurements related to anthropometry and all measurements were taken at the right side of participants to ensure uniformity. Measurements were taken three times and where there was disparity in readings, the average of three measurements was used.

Performance Tests

Players' flexibility was assessed using the sit and reach test. This test which provides a good approximation of flexibility around the hip joint was selected for its ease of administration and applicability. The sit-up test also known as curl-up test was used to measure abdominal muscle endurance. The number of repetitions made in 30 seconds was recorded the participant. Handgrip strength test was administered on participants to measure the maximum isometric strength of the hand and forearm muscles which correlate to core strength. Participant griped the handle of the dynamometer with his or her hand keeping arm at right angle to the side of the body. He/she squeezed the dynamometer with maximum isometric effort which was sustained for 5 to 10 seconds. The best score from 3 trials was recorded for each participant.

Players speed was assessed through the 20-meter sprint test with timing gates placed at 0-5 meters, 10-meters and 20-meters. The best test result out of three attempts with a 10-minute interval was recorded for each participant. The Vertical Jump test was administered to determine the maximal jumping ability of participants and to assess their lower body power. Participants crouched from a standing position and then immediately jumped maximally at a wall. Arm swing was allowed to aid in jump performance and legs were kept straight while in the air. Two trials were performed with a minimum of 2 minutes rest between trials; data from the best effort was recorded.

Statistical Analysis

Statistical analysis was carried out using the 'Statistical Packages for Social Sciences' (SPSS) software, version 16.0. Descriptive statistics are presented in means and standard deviations. Inferential statistics of Analysis of Variance (ANOVA) was used to determine significant differences among players at different positions.

Results

Anthropometric and performance characteristics of the soccer players engaged in this study are presented in tables 1, 2, 3 and 4. Tables 5 and 6 present summaries of ANOVA statistics on the differences among players in anthropometric and performance variables.

Results in Table 1 showed that the mean age of players was 27.2 ± 2.65 yrs., while their mean height and weight were $177.9\text{cm} \pm 5.25$ and $72.7\text{cm} \pm 5.40$ respectively. Soccer players in this study had mean BMI (23.03 ± 1.71), $\Sigma 7$ Skinfolds (47.5 ± 5.57), % Body fat ($6.33 \pm .99$) and Body density ($1.09 \pm .005$) respectively. Results in Table 2 described the Anthropometric characteristics of players at different playing positions. The mean height of Goalkeepers was $183.8\text{cm} \pm 3.50$, while defenders ($179.6\text{cm} \pm 3.83$), midfielders ($176.3\text{cm} \pm 4.58$) and strikers ($175.0\text{cm} \pm 5.11$) had mean heights of $179.6\text{cm} \pm 3.83$, $176.3\text{cm} \pm 4.58$ and $175.0\text{cm} \pm 5.11$ respectively. In terms of weight, goalkeepers weighed $72.8\text{kg} \pm 7.60$ while defenders, midfielders and strikers weighed $75.4\text{kg} \pm 4.78$, $72.2\text{kg} \pm 4.56$ and $70.5\text{kg} \pm 4.62$ respectively. The Body mass index of players by positions were 21.6 ± 2.5 ; 23.4 ± 1.39 ; 23.3 ± 1.60 and 23.0 ± 1.39 for goalkeepers, defenders, midfielders and strikers respectively. Goalkeepers in this study have mean $\Sigma 7$ Skinfolds of $46.0\text{ mm} \pm 5.68$, while defenders, midfielders and strikers have mean $\Sigma 7$ Skinfolds of $47.6\text{ mm} \pm 7.11$, $48.2\text{ mm} \pm 4.80$ and $47.4\text{ mm} \pm 4.59$ respectively. In body density, the groups have means of $1.09 \pm .00$, $1.08 \pm .01$, $1.08 \pm .01$ and $1.09 \pm .01$ for goalkeepers, defenders, midfielders and strikers respectively. Goalkeepers have the least % body fat in the group with a mean 6.1 ± 1.15 ; they were followed in rank by strikers ($6.2 \pm .79$), midfielders ($6.4 \pm .85$) and defenders (6.5 ± 1.20).

Data in Table 4 on the performance characteristics of the players at different positions showed that the means of goalkeepers, defenders, midfielders and strikers' flexibility are

10.69cm \pm 2.37, 9.14cm \pm 2.11, and 9.20cm \pm 2.16 and 8.89cm \pm 2.08 respectively. Goalkeepers performed best in vertical jump recording mean score of 26.01cm \pm 3.55, followed by midfielders (24.74cm \pm 2.45), defenders (24.71cm \pm 3.01) and strikers (23.89cm \pm 2.45). Goalkeepers were also the strongest in hand-grip (48.71kg \pm 6.11), followed by defenders (47.99kg \pm 5.21), midfielders (46.71kg \pm 5.76) and strikers (46.00kg \pm 4.54). In speed however, strikers were the fastest of the group of players sampled, recording speed of 1.87sec \pm .31 ahead of defenders (2.09sec \pm .23), midfielders (2.14sec \pm .15) and goalkeepers (2.33sec \pm .11).

The results of the study (Table 5) showed that soccer players at different positions in the study differed significantly in height ($F = 13.196$; $p < 0.05$), weight ($F = 4.250$; $p < 0.05$) and BMI ($F = 3.972$; $p < 0.05$) but were not significantly different in sum of seven skinfolds ($F = .436$; $p > 0.05$), % body fat ($F = .655$; $p > 0.05$) and body density ($F = .878$; $p > 0.05$). The results in Table 6 also showed that soccer players across positions were not significantly different in flexibility ($F = 2.067$; $p > 0.05$), vertical jump ($F = 1.659$; $p > 0.05$), hand grip ($F = 1.021$; $p > 0.05$) and acceleration ($F = 2.517$; $p > 0.05$). Players at different positions however differed significantly in speed ($F = 11.219$; $p < 0.05$) and sprint performance ($F = 10.120$; $p < 0.05$).

Discussions

Elite soccer players are characterized by a relative heterogeneity in body size (Reilly, Bangsbo & Franks (2000). The result of this study with regards to height and weight of elite soccer players agreed with the findings of Reilly, Secher, Snell & Williams (1990), who reported means of 177.9 \pm 0.05cm and 74.0 \pm 1.6kg for height and weight of nine professional soccer players. Sales et al. (2014) also reported mean values of 70.8 \pm 8.9, 175.1 \pm 6.4 and 23.1 \pm 2.0 respectively for body weight, height and BMI of professional soccer players. This findings were

however different from that of Ostojic (2000), who in his study of elite Serbian soccer players reported mean height of 181.9 ± 5.7 cm and mean weight of 77.4 ± 5.9 kg. The difference in the findings of Ostojic and that of this current study could be attributed to differences in nutritional patterns and socioeconomic concerns. When players of different playing positions were compared in anthropometric characteristics, goalkeepers and defenders in this study were the tallest and heaviest while strikers had the least height and weight. This finding agreed with the submission of Reilly et al. (2000) and that of Brahim, Bougatfa and Mohamed (2013) which suggested that goalkeepers and central defenders do possess greater height and weight over their counterparts in other playing positions. When players of different playing positions were compared on performance variables, the results did not reveal clear significant differences in notable performance characteristics such as flexibility, vertical jump and hand grip strength. This finding differ considerably from the profiles of top class elite soccer players reported in the literature whose performance characteristics were more role specific and suited for their respective playing positions.

Since success in soccer is largely dependent on the harmonious performance of each member of the team whose roles and responsibilities are quite specific and specialized, it would be expected that players at different playing positions in this study should exhibit significant differences in anthropometric and performance characteristics. This lack of positional difference could be due to failure of coaches and trainers to individualize training programmes to suit playing positions within the team. Variability in anthropometric and performance characteristics may influence the tactical role allocated to individual players in the team (Reilly, et al. 2000).

Table 1: Anthropometric characteristics of soccer players

Age of Participants in Years ($\bar{x} \pm SD$)	Height of Participants (cm) ($\bar{x} \pm SD$)	Weight of Participants (kg) ($\bar{x} \pm SD$)	BMI ($\bar{X} \pm SD$)	$\Sigma 7$ Skinfolde ($\bar{X} \pm SD$)	% Body Fat ($\bar{X} \pm SD$)	Body Density ($\bar{X} \pm SD$)
27.2 ± 2.65	177.9 ± 5.25	72.7 ± 5.40	23.03 ± 1.71	47.5 ± 5.57	6.33 ± .99	1.09 ± .005

Table 2: Anthropometric characteristics of soccer players by playing positions

	Age in Years ($\bar{x} \pm SD$)	Height (cm) ($\bar{x} \pm SD$)	Weight (kg) ($\bar{x} \pm SD$)	BMI ($\bar{x} \pm SD$)	Sum of seven Skinfolde ($\Sigma 7$) ($\bar{x} \pm SD$)	Body Density ($\bar{x} \pm SD$)	% Body Fat ($\bar{x} \pm SD$)
GK	27.58 ± 3.10	183.8 ± 3.50	72.8 ± 7.60	21.6 ± 2.5	46.0 ± 5.68	1.09 ± .00	6.1 ± 1.15
DEF	28.38 ± 2.63	179.6 ± 3.83	75.4 ± 4.78	23.4 ± 1.39	47.6 ± 7.11	1.08 ± .01	6.5 ± 1.20
MF	27.04 ± 2.68	176.3 ± 4.58	72.2 ± 4.56	23.3 ± 1.60	48.2 ± 4.80	1.08 ± .01	6.4 ± .85
ST	26.00 ± 1.98	175.0 ± 5.11	70.5 ± 4.62	23.0 ± 1.39	47.4 ± 4.59	1.09 ± .01	6.2 ± .79

Note: GK = Goalkeeper; DEF = Defender; MF = Midfielder; ST = Striker

Table 3: Performance characteristics of soccer players

Performance characteristics	Participants (N=90) ($\bar{x} \pm SD$)
Flexibility (cm)	9.29 ± 2.18
Vertical Jump (cm)	24.66 ± 2.77
Hand Grip Strength (kg)	47.14 ± 5.32
Acceleration (sec)	1.40 ± 0.11
Speed (sec)	2.07 ± 0.28
Sprint Time (sec)	3.52 ± 0.22

Table 4: Performance characteristics of soccer players by playing positions

	Flexibility ($\bar{x} \pm SD$)	V. Jump ($\bar{x} \pm SD$)	Hand Grip ($\bar{x} \pm SD$)	Acceleration ($\bar{x} \pm SD$)	Speed ($\bar{x} \pm SD$)	Sprint ($\bar{x} \pm SD$)
GK	10.69 ± 2.37	26.01 ± 3.55	48.71 ± 6.11	1.34 ± .112	2.33 ± .27	3.68 ± .31
DEF	9.14 ± 2.11	24.71 ± 3.01	47.99 ± 5.21	1.44 ± .10	2.09 ± .23	3.59 ± .20
MF	9.20 ± 2.16	24.74 ± 2.45	46.71 ± 5.76	1.41 ± .11	2.14 ± .15	3.54 ± .12
ST	8.89 ± 2.08	23.89 ± 2.45	46.00 ± 4.54	1.41 ± .10	1.87 ± .31	3.36 ± .18

Note: GK = Goalkeeper; DEF = Defender; MF = Midfielder; ST = Striker

Table 5: ANOVA summary table on Anthropometric characteristics of soccer players by playing position

		Sum of Squares	df	Mean Squares	F	Sig
Height	Between groups	772.147	3	257.382	13.196	.000*
	Within groups	1677.338	86	19.504		
Weight	Between groups	335.193	3	111.731	4.250	.008*
	Within groups	2260.856	86	26.289		
BMI	Between groups	31.753	3	10.584	3.972	.011*
	Within groups	229.147	86	2.665		
Σ7 Skinfolds	Between groups	41.331	3	13.777	.436	.728
	Within groups	2719.914	86	31.627		
% Body Fat	Between groups	1.940	3	.647	.655	.582
	Within groups	84.896	86	.987		
Body Density	Between groups	.000	3	.000	.878	.456
	Within groups	.002	86	.000		

Note: * Significant at p < 0.05

Table 6: ANOVA summary table on the Performance characteristics of soccer players by playing positions

		Sum of Squares	df	Mean Squares	F	Sig
Flexibility	Between groups	28.484	3	9.495	2.067	.111
	Within groups	395.001	86	4.593		
Vertical Jump	Between groups	37.367	3	12.456	1.659	.182
	Within groups	645.736	86	7.509		
Hand- Grip	Between groups	86.626	3	28.875	1.021	.387
	Within groups	2518.196	86	28.274		
Acceleration	Between groups	.079	3	.026	2.517	.064
	Within groups	.906	86	.011		
Speed	Between groups	2.023	3	.674	11.219	.000*
	Within groups	5.169	86	.060		
Sprint Time	Between groups	1.100	3	.367	10.120	.000*
	Within groups	3.116	86	.036		

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