Anthropometry and Somatotype Characteristics of Male Provincial Youth League Soccer Players in Zimbabwe According to Playing Positions

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Abstract: ***The purpose of the study was to determine the anthropometric and somatotype characteristics of male provincial youth league soccer players according to their playing positions. Sixteen youth players (15.3±0.68 years) were purposively selected through volunteer participation from a club in Mashonaland Central Province of Zimbabwe. The following anthropometric variables were measured following the International Society for the Advancement of Kinanthropometry (ISAK): height, body mass, skinfolds: (triceps, subscapular, biceps, iliac crest, supraspinale, abdominal and medial calf), girths: (arm relaxed, arm flexed and tensed, waist, gluteal, medial calf), and bone breadths: (bi-epicondylar humerus and bi-epicondylar femur). The following derived body composition variables were also calculated from the measurements; fat mass (FM), fat free mass (FFM), fat mass index (FMI), fat free mass index (FFMI), percentage body fat (%BF) and body density (Db). Somatotype was calculated using the Heath-Carter (1990) method. Results (mean±SD) were as follows; body mass 63.0±5.49kg, height 170.2±4.61cm, sum of skinfolds 41.1±6.00mm, %BF 10.0±1.19%), fat mass 6.3±1.05kg, fat free mass 56.7±4.79kg), fat mass index 2.2±0.27, fat free mass index 19.6±1.37 and Db 1.08±0.00 g/cc. Mean somatotype of the players was 1.56-3.45-2.74, (endomorph, mesomorph and ectomorph). No statistically significant differences were observe among playing positions in both anthropometric and somatotype variables (p>0.05) except in height (p<0.01). It was concluded that mean anthropometric and somatotype for Zimbabwean youth players was slightly lower than that of players of similar age group around the World. Lack of significant differences among playing positions reflect a systematic criteria of Talent Identification and Selection being followed resulting in selected players being of similar characteristics.***

Keywords: Anthropometry; Somatotype, Endomorph, Mesomorph; Ectomorph.

1. Introduction

Players in one soccer team tend to have varying body composition and body shapes. Soccer players carry their weight over a distance; by so doing they should have a lean body composition in order to achieve a better movement economy. Studies in soccer revealed that most soccer players are ectomorphic-mesomorphs [2], [6], [10]. Anthropometry comprises of measurement of physical characteristics such as weight and height, as well as body composition measurements that include percentage body fat (%BF), lean body weight (LBW), body mass index (BMI), limb lengths and girths, as well as limb and body circumferences. Somatotype is a technique used to describe the relative fatness (endomorphy), relative musculo-skeletal robustness (mesomorphy), and the relative linearity or slenderness (ectomorphy) [3].

Body composition and somatotype profiles in sport help to prescribe optimal body weight for a particular sport in order to maximize playing performance as well as assessment and evaluation of a training programme [16]. Generally, a minimum relative percentage body and a relatively low ratio of fat mass to fat-free mass is desirable for successful sporting performance [1], [15]. Excess body fat is a burden to athletes due to its non-contribution to energy production, especially in activities which require transference of body weight against gravity as in high jump, long jump or pole vaulting and in activities which require horizontal propulsion of the body, as in soccer, rugby or track athletics.

Researchers on youth soccer players agree that body composition and somatotype variables differ according to playing positions [4], [6], [7], [14], [17]. For instance, percentage body fat (%BF) was high in goalkeepers followed by defenders but was low in midfielders and forwards [6], [14], [11]. A plethora of studies on anthropometry, body composition and somatotype of young soccer players have been done in Europe, America, Australian and Asia while literature on African young soccer players is scant. There is only one study that explored body composition and somatotype of junior soccer players in Zimbabwe [8]. Further investigations into the body composition and somatotype of youth soccer players seem to be observably relevant hence the thrust of this study was to investigate body composition and somatotype characteristic of male youth soccer players participating in provincial soccer league and to identify their difference according to playing positions.

2. Materials and Methods

Sixteen (16) youth soccer players (15.3±0.68 years) were purposefully selected through volunteer participation. Players were classified according to their playing positions (goalkeepers, defenders, midfielders, and forwards). The team consisted of 3 goalkeepers, 4 defenders, 4 midfielders and 5 forwards. Written consent was sort from the club directors and coaches. Players signed Assent forms and their parents and guardians signed Consent form on behalf of the players since they were below the legal age of majority (18 years).

3. Procedure

Anthropometric variables were measured following the International Society of the Advancement of Kinanthropometry (ISAK) protocol. Anthropometric measurements that were taken include: Body mass - using a digital scale (Gima®), height - using a stadiometer (Gima®), skinfolds thickness - using slimguide skinfold caliper (Rosscraft®), girths - using anthropometric tape (Cescorf®) and bone breadths - using bone caliper (Cescorf®). Seven (7) skinfolds (triceps, biceps, abdominal, supraspinale, subscapular, front thigh, medial calf), five (5) girths (arm relaxed, arm flexed and tensed, waist, gluteal, medial calf) and two (2) bone breadth (bi-epicondylar humerus and bi-epicondylar femur were taken).

To ensure consistence and reliability of measurements, all anthropometric measurements were taken by one measurer on the right side of the body and in one day during the same time of the day (morning 8am-11am). Players were instructed to refrain from vigorous activities for at least 48 hours before the testing day and to avoid consumption of large volumes of water 2 hours prior to testing as well as to maintain their normal diet.

Data was computed using a Statistical Package in Social Sciences (SPSS) version 20. Student T-test was used to compare means and One-Way Analysis of Variance (ANOVA) was used to compute the difference between playing positions and a 'p-value' of 0.05 was considered statistically significant.

Somatotype and somatoplots were computed using the Heath-Carter's (1990) method, while Somatotype Analysis of Variance (SANOVA) was calculated using the somatotype software (SomatotypeV.1_2_5).

4. Results

4.1 Anthropometric variables

Results were presented as means and standard deviation in tables and chats. Mean anthropometric values are shown in Table 1. Mean body mass for the team was 63.0±5.49kg and mean height was 170.2±4.61cm. There were no statistically significant difference between playing positions in body mass, sum of 7 skinfolds, FM, FFM, FMI, FFMI, sum of skinfolds and Body density ($p>0.05$). A statistically significant difference was noted in the height of players ($p<0.01$).

Goalkeepers were the tallest and heaviest at 176±2.71cm and 66.6±3.14kg respectively. They also exhibited highest values of sum of skinfolds, %BF, and fat mass. Midfielders were the shortest (165.9±4.98cm), they were the leanest (9.2±0.26%BF) and had the smallest sum of skinfolds (35.8±3.30mm) while defenders were the lightest (59.3±2.71kg) and had the lowest fat free mass (53.5±2.0mm). Sum of skinfolds for midfielders and defenders were below group mean (41.1±6.00mm).

4.2 Body Composition Measurements

Table 1: Anthropometric characteristics of players according to playing positions

Variable	*Goalkeepers n=3*	*Defenders n=4*	*Midfielders n=4*	*Forwards n=5*	*Total n=16*	*p-value*
Age (year)	14.7± 0.58	15.0± 0.82	15.5± 0.58	15.6± 0.55	15.3± 0.68	0.21
Body mass (kg)	66.6± 3.14	59.3± 2.71	62.6± 8.12	64.1± 5.27	63.0± 5.49	0.37
Height (cm)	176.3± 2.71	168.7± 2.27	165.9± 4.98	171.2± 2.05	170.2± 4.61	0.00
Σ7skf (mm)	45.5± 6.66	39.7± 5.69.	35.8± 3.30	42.6± 5.03	41.1± 6.00	0.11
%BF (%)	11.2± 0.91	9.7± 0.87	9.2± 0.26	10.0± 1.49	10.0± 1.19	0.11
FM (kg)	7.5± 0.79	5.8± 0.76	5.8± 0.75	6.43± 1.10	6.3± 1.05	0.08
FFM (kg)	59.1± 2.69	53.5± 2.0	56.8± 7.39	57.7± 4.78	56.7± 4.79	0.48
FMI	2.4± 0.88	2.0± 0.26	2.1± 0.87	2.19± 0.33	2.2± 0.27	0.26
FFMI	19.0± 0.52	18.8± 0.62	20.6± 1.78	19.7± 1.55	19.6± 1.37	0.29
Db (g/cc)	1.07± 0.00	1.08± 0.00	1.08± 0.00	1.08± 0.00	1.08± 0.00	0.11

Db-body density, Σ7skf-sum of skinfolds, FM-fat mass, FFM-fat free mass, FMI-fat mass index FFMI- fat free mass index

4.3 Somatotype variables

Somatotype components are shown in Table 2. The mean somatotype of the team was 1.56±3.45 - 3.45±0.97 - 2.74±0.74, hence the team was categorised as mesomorph-ectomorph category. There were no significant differences in somatotype between players in different positions ($p>0.05$), although midfielders presented the highest mesomorphy followed by goalkeepers, forwards and defenders. Forwards had the highest endomorphic component value (1.66±0.37), a finding that varies with many researchers who found goalkeepers having the highest endomorphic value. [5], [6], [8], [14].

Table 2: Somatotype of players according to playing positions

Playing position	*Endomorphy*	*Mesomorphy*	*Ectomorphy*	*p-value*
Goalkeepers	1.60 ±0.10	4.13±0.50	3.23±0.21	
Defenders	1.45±0.13	2.75±1.12	3.10±0.48	
Midfielders	1.52±0.10	4.32±0.67	2.05±0.83	
Forwards	1.66±0.37	2.90±0.38	2.72±0.73	
All	1.56±3.45	3.45±0.97	2.74±0.74	0.06

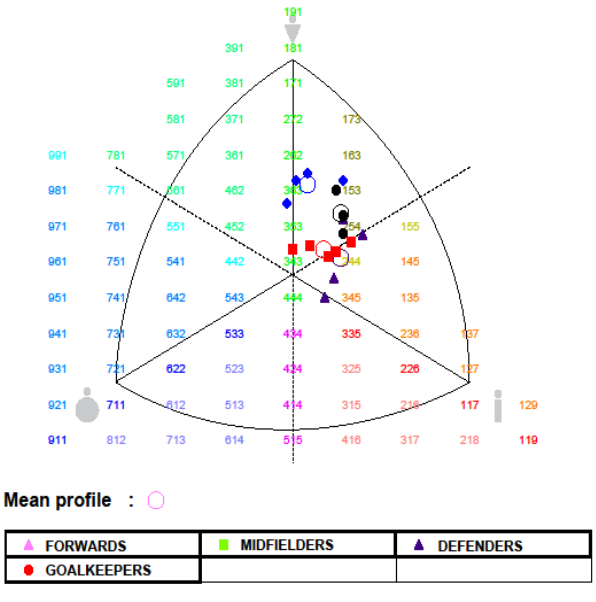

Figure 1: somatoplots of players

5. Discussion

Players of this study were categorized into four playing positions common in soccer, goalkeepers, defenders, midfielders, and forwards, a categorization system was also used by other researchers [9], [12], [13], [19], [21].

5.1 Anthropometry

The mean body mass and height for goalkeepers was 66.6±3.14kg and 176.3±2.71cm respectively and they were the tallest and heaviest among the group. Similar findings were reported by other authors [6], [8]. Defenders were the lightest while midfielders were the shortest among the group (Table 1). This shows that there is a deliberate tendency by talent selectors to prefer tall and heavy players for goal keeping positions. The mean height and weight for the total group (all positions combined) was 170.2±4.61cm and 63.0±5.49kg respectively. These findings are in the similar range with those of players of the same age from other studies, [8] but were slightly lower than those reported in other previous studies [6], [7], [14], [18]. Height has an influence on the performance of soccer players especially on reaching high balls, thus lower height can be a disadvantage to players in the current study when playing high balls.In this study, and goalkeepers were found to possess high percentage body fat. This finding corresponds with that reported by Salgado *et al*, [14], Makaza *et al*, [8] and Gil *et al*, [6]. Although there is no significant difference in the team's body composition signaling that all players receive similar training, high %BF for goalkeepers could be attributed to their positional role which does not require a lot of running during match playing. (When other players run during the match, goalkeepers will be less active thus contributing to the slightly higher %BF). Midfielders had the least %BF, findings similar to those of Gil *et al*, [6]. This could be attributed to their role as link between defenders and forwards which subject them to an extra work thereby shading more fat than other players. The average %BF for the team was 10.0±1.19%, the results are higher compared to the 7.6±1.4% reported by Makaza *et al*, [8]. They were similar to those reported by Valtuena *et al*, [20] but lower to the 16.1±4.3, reported by Salgado *et al*, [14], 11.6±0.2% reported by Gil *et al*, [6] and 11.7% reported by Casais *et al*, [4]. Lower %BF was reported to be of great advantage in sport and relates to positive soccer performance Singh *et al*, [15] , this therefore means that Zimbabwean players have a better trainability potential compared to other young players of similar age around the Globe.

5.2 Somatotype

In this current study, there were no significant differences in somatotype variables among players in different poistion ($p>0.05$). The results correspond with those reported by Erceg *et al*, [5], and Makaza *et al*, [8] . Makaza *et al*, [8] , also observed no differences among playing position in Zimbabwean junior soccer players except that he reported players being ectomorphic-mesomorphs. The findings also revealed that goalkeepers and midfielders had high mesomorphic component whereas forwards and defenders had the lowest. Forwards were among the the groups which possessed the highest endomorph, this is contrary to most studies which found forwards and midfielders to have the least endomorph while goalkeepers and defenders had higher endomorph [6], [8], [14].

6. Conclusions

Based on the results of this study, the following conclusions can be drawn about Zimbabwean provincial youth league soccer players:

- Generally, there is a dominance of the mesomorph component in all playing positions.
- Anthropometry and somatotype of Zimbabwean players are comparably lower than those of players elsewhere in the world.
- Lack of significant inter-positional differences in body composition and somatotype of players show that there is a systematic talent identification and selection criterion implemented by coaches and team selectors.
- Lack of inter-positional differences among the players' body composition and somatotype components could also imply that there is no position specific training in the team. All the players are given similar training prescription during practice.

7. Future Scope

The purpose of the study was to determine anthropometry and body composition of provincial youth league soccer players in Zimbabwe. This study is among the first studies to explore this field of anthropometry on Zimbabwean soccer players. Therefore it could facilitate coaches to adopt a scientific approach to coaching and systematic Talent Identification and selection rather than relying on traditional non-scientific prognostic approaches. The study gives a baseline contribution to literature on Zimbabwean youth soccer players from which other researchers can explore further players at other levels of play such as the Division one or Premier league. Such literature is currently scant in Zimbabwe.

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