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Longitudinal Skeleton Dimensionality Characteristics of Nigerian Junior Male Handball Players

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Abstract: *The aims of this study were to determine the longitudinal skeleton dimensionality (LSD) component of anthropometric features common to junior male handball players; and to analyse the probable variations in LSD features among players in the five positional playing groups of Goalkeeper (GK), Inside back position (IBP), Centre back position (CBP), Pivot position (PV) and Wing position (WP). Standard LSD measurements for body height (cm), arm span (cm), arm, hand and leg lengths (cm) were recorded for a sample of 106 junior (under 18) male handball players that participated in the study mean values in most of the LSD measures for body height (176.16±7.93cm), hand length (21.12±2.85cm), leg length (40.32±2.96cm) and arm span (187.57±10.05cm). The GKs, however, recorded the highest mean values in arm length (32.41±2.46cm), while the CBPs had the lowest recorded mean values in all the LSD measures. When data were analysed for positional differences, the IBP were significantly taller (F=3.02; p<0.02) with longer arm span (F=2.98, p<0.02) than players in all other positional groups. There were no significant differences in arm, hand and leg lengths of the players. The obtained position related difference suggest that the possession of superior body height and arm span are prerequisites for players playing and desirous to play in the inside back position. These findings could provide realistic morphological benchmarks for the selection of potential junior male handball players competing in specific individual positions and positional playing groups.*

I. Introduction

Team handball, a complex and intermittent body contact sport, was introduced into Nigeria in 1972 in preparation to host the 1973 2nd All African Games in Lagos, Nigeria (Handball Federation of Nigeria – HFN, 2000). From that point, the game developed very fast and enjoyed nationwide popularity, perhaps next to soccer. This culminated in several successful high points in Nigeria's handball history. According to the Handball Federation of Nigeria (HFN, 2000), Nigeria won the African junior women handball championships in 1986, 1988 and 1990. She also hosted the 7th World junior ladies handball championship in 1989; became the first team sport in Nigeria, apart from soccer, to participate at the Olympic Games in 1992; and in the 1999 world male handball championships in Egypt. Overtime, the fortune of the game of handball in Nigeria began to record a consistent decline inspite of these initial successes and recognition in the eighties (Dauda, 2010).

In the last two decades, trends in the game of handball show some changes in techniques, tactics and even more so in the physical demands of the game and other parameters of performance success. Research interests and activities directed at detecting and improving several aspects of the game at the global level (Bayios, Bergelis, Apostolidis, Noutsos & Koskolov, 2006; Taborsky, 2007; Hassan, Rahaman, Cable & Reilly, 2007) have, however focussed more on the physiological and biochemical parameters of performance success among senior elite and sub – elite male and female handball players. Similarly, research studies relating anthropometric characteristics of senior male and female players to performance success in handball and other team sports are fairly well documented (Zapartidis, Tonganidis, Vareltis, Christedoulidis, Kororos & Skoufas, 2009; Hassan et al, 2007; Gabbett & Georgieff, 2007; Duncan, Woodfield & Ai – Naskeeb, 2006). A consistent conclusion that runs through most of these studies seems to suggest that anthropometric characteristics of players have contributed to the athletes level of performance (Oxyzoglou, Ore & Rizos, 2004); and thus, constitute a predisposing factor for success in elite sports (Rakovac, Smoljanovic, Bojanic, Hannafin, Hren & Thomas, 2011).

The longitudinal skeleton dimensionality (LSD) component of anthropometric characteristics of players are presumed to have a fairly important role in determining player's level of performance (Katic, Cavala & Srhoj, 2007). Srhoj, Marinovic & Rogulj (2002) have confirmed that top level handball players are characterised by athletic body build with a pronounced longitudinal dimensionality of skeleton. In junior handball players, research findings (Mohammed, Vaeyens, Mattys, Multael, Lefevre, Lenoir & Philippaerts, 2009) have specifically identified the arm length as a factor, among other physiological and skill characteristics, that can distinguish performance of players within similar age and stage of development.

Players especially those in team sports, have been shown to perform different match play tasks during a game or competition depending on playing positions (Gabbett, 2005; Meir, Newton & Curtis, 2001). Team

positions in handball have generally been classified according to the different tasks and roles individual players perform on the field of play (Acsinte & Alexandru, 2007; Sibila, Vuleta & Pori, 2004). The conventional playing positions in handball, according to Zapartidis, Vareltzis, Gouvali and Kororos (2009), are: back players, wing players, pivots, centre backs and goalkeepers. It is conjectured that a wide range of anthropometric qualities and other predictors of performance success may actually play out to complicate the definition of the ideal somatic composition required of players at different playing positions. The identification of such predisposing anthropometric qualities possessed by players operating at various playing positions becomes important performance considerations.

Generally, as competitions become fierce in modern sports, younger athletes with potentials in anthropometric qualities, a wide range of skills and abilities and other parameters of performance success are usually in demand as gladiators in the sports arena (Zapartidis, Tonganidis et al, 2009). Therefore, evaluating a young athlete's anthropometric qualities and other parameters of performance success may likely give an insight into the player's quality and ability to specialise early in different playing positions. This may also form the basis for determining the player's potential for development, trainability, and promotion to higher levels of participation. Thus far, studies identifying players' anthropometric characteristics and those reporting differences in relation to playing positions are rare in Nigeria. There is, therefore, no a priori reason to suggest that the anthropometric, and any other performance variables for that matter, have specific relationship with excellence in handball performance at different playing positions as it affects the game in Nigeria. Some light may therefore be shed on this problem by identifying the anthropometric characteristics of Nigerian junior male handball players in different playing positions. It seems necessary as a first step, to determine the longitudinal skeleton dimensionality (LSD) components of anthropometric characteristics of Nigerian junior male handball players in relation to playing positions so as to better point out talents for selection, training and development.

The main aim of the study, therefore, was to verify whether the longitudinal skeleton dimensionality component of anthropometric characteristics possessed by Nigerian junior male handball players are distinguishable according to basic playing positions. Specifically, the study was designed to:

i. identify the longitudinal skeleton dimensionality component of anthropometric characteristics common to junior male handball players; and
ii. analyse the probable variations in longitudinal skeleton dimensionality component of anthropometric characteristics of players in relation to basic playing positions.

II. Methods

Samples

The total study sample consisted of 106 junior (mean age of 18years ± 6months) male handball players selected from 7 out of the 15 state under 18 (U18) male handball teams that competed at the 2012 National U18 Handball Championships in Nigeria. The 7 state teams were selected on the basis of their ranking/performance at the championships. The selected players were assigned to the playing positions they regularly occupy in their respective teams and these include: 17 goalkeepers; 34 inside back players; 14 centre back players; 15 pivot players; and 26 wing players.

Variables

Experts (Katic, Cavala & Srhoj, 2007; Katic, 2003) have classified anthropometric attributes on the basis of the presumed existence of four morphological dimensions, namely: Longitudinal Skeleton Dimension (LSD); Transverse Skeleton Dimension (TSD); Absolute Voluminosity of Body (AVB); and Subcutaneous Fatty Tissues (SFT). Five LSD variables were selected for measurement on the basis of previous publications, research (Cavala, Rogulj, Srhoj, Srhoj & Katic, 2008) and relevance to the game of handball. The variables are: Body height (cm), arm span (cm), arm, hand and leg lengths (cm). Measures obtained from these variables were treated as the dependent variables while the playing positions were treated as the independent variables.

Data Collection

The researchers and three trained assistants carried out all measurements. The researchers had received the ISAK level 2 training in 2003 and participated in the 2003 Nigeria All African Games Research Project (NAAGReP) in Abuja, Nigeria under Professors J. Hans Ridder and Lateef O. Amusa. The participant's provided signed written consents to participate in the study, according to the research policy of the University of Benin, Nigeria. All measurements were taken on the participant's dominant side (on the right for right-handed players and on the left for the left-handed player). These will ensure that differences caused by continuous use of the dominant side of the body in competition and training does not invalidate the measurement results carried out on the handball court, at the same specified time, and completed in the same order. Participants were required to appear in minimum clothing and thereafter "landmarked".

Body height was measured on stadiometer (GPM, Serifex, Inc., East Rutherford, New Jersey) while the steel anthropometry tape (Lufkin W606PM, Rosscraft, Surrey, UK) was used to measure arm span. Arm length (acromiale – radiale) and hand length (midstylion – dactylion) were measured using Campbell 20 large sliding calliper with A – P branches (Rosscraft, Surrey, UK) and segmometer (Rosscraft, Surrey, UK) respectively. The Martin type Siber – Hegner GPM anthropometer (GPM, Serifex, East Rutherford, USA) was used to measure leg or tibial length (tibial – mediale). All measurements were taken to the nearest 0.1cm. These instruments have been previously validated in different research settings and population (Ingebrigsten & Jefferys, 2012; Cavala et al, 2008; Katic, Grgantov & Jurko, 2006). However, the instruments were frequently calibrated prior to use and the standard techniques for measurements recommended by the International Society for the Advancement of Kinanthropometry (ISAK) was adopted. Sufficiently high intra – class correlation coefficient (r) of 0.98, 0.98, 0.95, 0.96 and 0.96 with corresponding technical error of measurement (TEM) of 0.2%, 0.3%, 0.5%, 0.3% and 0.2% were obtained for the LSD measures of height, arm span, arm, hand and leg lengths respectively.

Statistical Analysis

Data were analysed using standard descriptive statistics (mean, standard deviation) to present the characteristics of the subjects for all variables. The differences in LSD attributes of players according to playing positions were established using the univariate Analysis of Variance (ANOVA). The scheffe post hoc test was used to test for sources of significant ANOVA differences. The 5% level of probability ($p < 0.05$) was chosen to represent statistical significance. All statistical operations were conducted using the IBM version 20 of the statistical package for social sciences (SPSS).

III. Results

The descriptive statistics (mean, SD) of the longitudinal skeleton dimensionality (LSD) aspect of anthropometrics for all junior male handball players are presented in Table1. The results of the univariate analysis of variance of the LSD for players in specific playing positions are also presented in Table1 and in box plots depicted in figures i – v.

Table 1: Descriptive Longitudinal skeleton dimensions of body height, arm length, hand length, leg length and arm span of junior male handball players and differences among playing positions.

LSD Variable	All male junior players (n=106) Mean	SD	Playing Positions GK(n=17) Mean(SD)	IBP(n=34) Mean(SD)	CBP(n=14) Mean(SD)	PV(n=15) Mean(SD)	WP(n=26) Mean(SD)	F	Sig
Body Height(cm)	173.37	7.3	174.94(5.5)	176.16(7.9)	170.04(7.9)	171.43(7.8)	171.60(5.7)	3.02*	0.02
Arm Length(cm)	31.79	2.2	32.41(2.5)	32.16(2.3)	31.00(1.9)	31.57(2.8)	31.44(1.7)	1.23	0.31
Hand Length(cm)	20.50	1.9	20.47(0.9)	21.12(2.9)	20.11(1.3)	20.13(1.4)	20.13(1.2)	1.44	0.23
Leg Length(cm)	39.64	2.6	39.68(2.6)	40.38(3.0)	38.64(2.5)	38.83(2.4)	38.92(2.1)	1.99	0.10
Arm Span(cm)	184.38	9.6	187.32(8.6)	187.57(10.1)	179.82(9.0)	181.56(10.9)	182.35(7.3)	2.98*	0.02

GK= Goalkeeper; IBP=Inside Back Players; CBP = Centre Back Players; PV= Pivot Players; WP=Wing Players. * =Significant Mean difference at 0.05;

The findings showed that the inside back players (IBP) had higher mean (x ± SD) values in most of the longitudinal skeleton dimensions of body height (176.16 ± 7.93)cm, hand length (21.12 ± 2.85)cm, leg length (40.32 ± 2.96)cm and arm span (187.57 ± 10.05) cm. The goalkeepers (GK), however, recorded highest mean (x ± SD) values in the arm length (32.41 ± 2.46) cm. The center back players (CBP) had the lowest recorded mean (x ± SD) values in all the measured anthropometric LSD. Generally, significant statistical differences were found for body height ($F = 3.02$; $P < 0.02$) and arm span ($F = 2.98$; $P<0.02$) as shown in Table1. The significant results are buttressed by the box plots in figures i and v in contrast to box plots in figures (ii), (iii), and (iv) that were non-significant

To confirm the possible direction of these significant differences in body height and arm span, the Scheffé multiple post hoc comparisons of mean differences were performed. The results of these comparisons summarised in Table 2, showed that the mean difference in body height between the inside back players (IBP) and the centre back players (CBP) as well as the mean difference in arm span between the IBP and CBP were statistically significant at $p < 0.022$ and $p < 0.044$ respectively. This implied that the IBP seem sufficiently endowed in body height and arm span than other players.

Fig.(i)

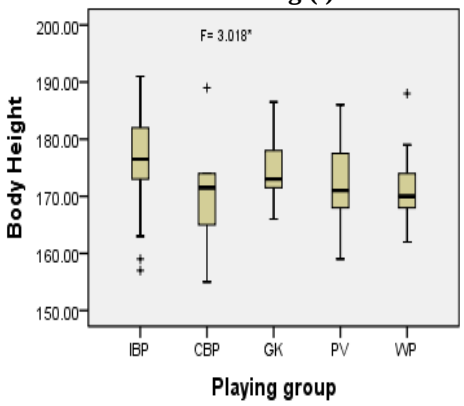


Fig.(ii)

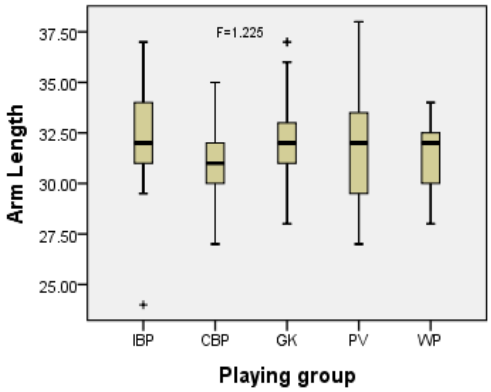


Fig.(iii)

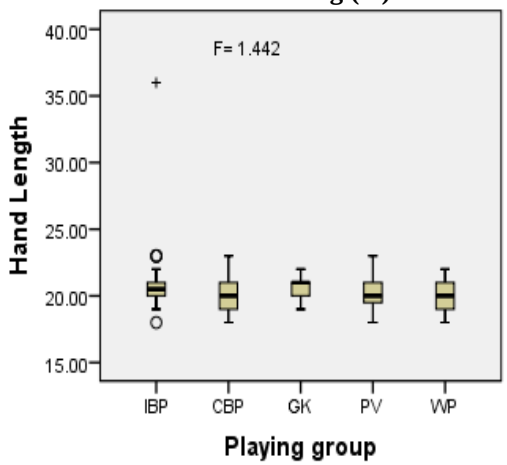


Fig. (iv)

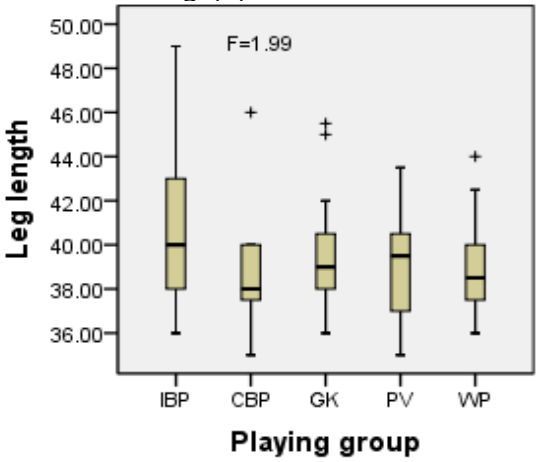
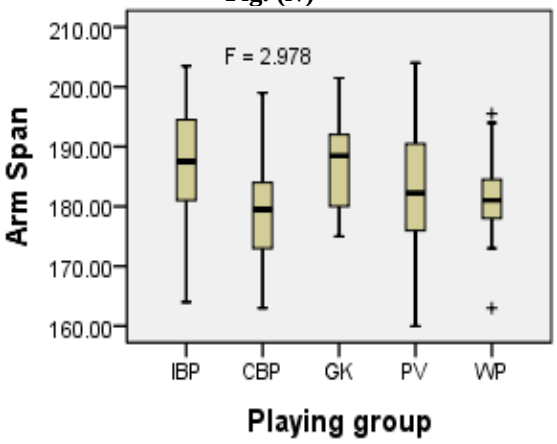


Fig. (iv)



Figures i-v: Box plot analysis of variance for longitudinal skeleton dimensionality variables
*p < 0.05

Table 2: Scheffé multiple post-hoc comparisons of mean difference for body height and arm span

LSD Variable	Playing Positions (I)		Playing Positions (J)	Mean difference (I-J)	Standard error SE	Sig. (P-value)
	IBP	-	CBP	6.126	2.240	0.022*
	IBP	-	GK	1.221	2.095	0.987
	IBP	-	PV	4.728	2.186	0.329
Body	IBP	-	WP	4.566	1.838	0.195
height	CBP	-	GK	-4.906	2.546	0.451
	CBP	-	PV	-1.398	2.621	0.991
	CBP	-	WP	-1.560	2.338	0.978
	GK	-	PV	3.508	2.499	0.741
	GK	-	WP	3.345	2.200	0.679
	PV	-	WP	-0.163	2.287	1.000
	IBP	-	CBP	7.752	2.927	0.044*
	IBP	-	GK	0.250	2.738	1.000
	IBP	-	PV	6.014	2.857	0.357
Arm	IBP	-	WP	5.247	2.401	0.322
Span	CBP	-	GK	-7.502	3.326	0.286
	CBP	-	PV	-1.739	3.425	6.992
	CBP	-	WP	-2.525	3.055	0.953
	GK	-	PV	5.764	3.265	0.541
	GK	-	WP	4.977	2.875	0.561
	PV	-	WP	-0.786	2.988	0.999

*** Mean difference is significant**

IV. Discussion

The Nigerian junior male handball players of the present study may be described as shorter in height (173.4cm) in comparison to the under 18/19 players in 2003 (188.7cm) and 2004 (188.2cm) European and 2007 (186.4cm) world handball championships respectively as reported by Taborsky (2007a). Ibnzianten, Poblador, Leiva, Gomez, Viana, Nogueras and Lando (2002) also reported an average height of 189.96cm for Spanish junior male handball players. The Nigerian junior male players, however, had greater LSD values for arm span (184.4 ± 9.6cm) than the value of 179.28 ± 7.2 cm reported by Raja (2011) for intercollegiate male handball players of Bharathiar University, Coinbatore, India.

The longitudinal skeleton dimensions of height and arm/leg lengths have been identified as advantageous anthropometric biomarkers of success in playing the game of handball (Taborsky, 2007a). It has also been observed by Taborsky (2007b) that players in handball teams from Africa and Asia were comparatively smaller than majority of players in European teams using the 2007 men's world championship as a point of reference. For now, the results of this study, in comparison to results from other cultures and environments show that Nigerian junior male players may generally be disadvantaged whenever they play opponents who are comparatively taller. To deal with such disadvantage, Tomkinson and Olds (2002) suggested that coaches should deliberately seek and select players that are naturally endowed with tall heights and possess superior features of the other longitudinal skeleton dimensions. The authors also suggested the selection of players that can adapt to identified anthropometric insufficiency by compensating with the development of other skills.

The most striking contrast in anthropometric make – up of handball players in individual playing positions as it concerns LSD were the differences found in body height and arm span. On the average, the IBPs were the tallest, while the goalkeepers were taller than the wing and pivot players. The CBPs were surprisingly the shortest. These results were consistent with the results of other studies for elite male handball players (Sibila, et al, 2004; Chaouachi Brughelli, Levin, Boudhina, Gronin & Chamari, 2009; Srhoj Marinovic, & Rogulj, 2002). The result of this study that showed the CBPs as the shortest is however, contrary to the findings in other studies that reported the WPs (Zapartidis and the proofs (Srhoj etal, 2002) as the shortest. The CBPs have the role of organising and controlling the game from the backline (Zapartidis et al, 2009). Along with the IBPs, the CBPs also form the backline or central defense of a team. They block opponents' shots at goal, shoot over the opponent's defensive wall, have better visual control of the court and cooperate with other players, especially

the pivot and wing players (Ohnjec, Vuleta, Milanovic & Guic, 2003, Srhoj etal, 2002). It was expected therefore, that the CBPs would at least possess similar anthropometric features of LSD as those of the IBPs. This was not the case in this study. This probably could be due to the coaches decision or option to place taller players in the inside back position where most shots at goal are presumed to occur. Furthermore, in a typical 5:1 defence formation, the pivot player (PV) occupies a position on the 9m line, directly in front of the CBP. This, on its own, prevents direct play on the CBP by the opposing backline players.

V. Conclusion

The results demonstrate that a number of differences in LSD component of anthropometric characteristics exist among the playing positions. Specifically, the IBP had superior mean values in all the measured dimensions. However, body height and arm span were significantly differentiated among the playing positions, with the differences between the IBP and CBP significantly responsible for the observed differences. This seems to suggest that the possession of superior body height and arm span are prerequisites for players playing in the inside back position. On the other hand, arm, hand and leg lengths did not necessarily differentiate players at this level according to playing positions.

This study seems to have provided reference LSD anthropometric values for junior male handball players in Nigeria. These reference values could be compared with age – matched handball players from other continents and cultures. The possession of these LSD components of anthropometric characteristics should constitute fundamental benchmarks for the selection of potential junior male handball players in Nigeria with a view to a better development of youth sports in general and handball in particular.

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