

J O R H A S S

(VOLUME 12 NUMBER 1 2015)

ISSN 1118-616X

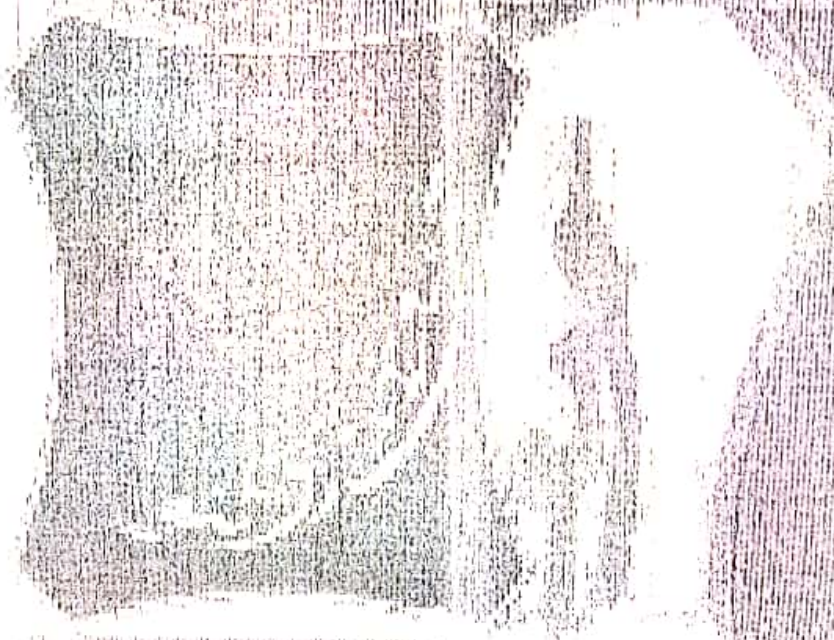
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Journal Of Research In Health And Sports Science



*Official Journal Of The Department
Of Physical And Health Education Of
Bayero University, Kano, Nigeria*

JOURNAL OF RESEARCH IN HEALTH AND SPORTS SCIENCES



OFFICIAL JOURNAL OF THE DEPARTMENT OF
PHYSICAL & HEALTH EDUCATION, BAYERO
UNIVERSITY, KANO-NIGERIA.

JOURNAL OF RESEARCH IN HEALTH AND SPORTS SCIENCES

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JORHASS: the official journal of the Department of Physical & Health Education of Bayero University, Kano, Nigeria Vol.14 No.1 July 2015.

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ISSN 1118-616X

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ANTHROPOMETRY AND MOTOR PERFORMANCE VARIABLES AMONG FEMALE UNIVERSITY CHAMPION-HANDBALLERS IN WEST AFRICA

BY

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ABSTRACT

Handball builds a strong, flexible athlete with quick responses, eye and hand co-ordination, balance and incredible stamina. This study focused on Anthropometry and motor performance variables among university female champion-handballers in West Africa. The aim of the study was to analyse the anthropometric and motor performances variables of female university champion-handballers in West Africa. The ex-post facto research design was used for the study. All the female handball players from the three universities that participated in the West Africa university games constituted the population. A purposive sampling technique was used to select all the thirty-six players that were available during the competition for the study. Standardized instruments were used for the study. One main hypothesis and three sub-hypotheses were formulated and tested using both the descriptive and inferential statistics of t-test and ANOVA. Scheffe post hoc multiple comparison test was used to indicate significance difference that existed between the groups of means ($\times$). Item analysis was used to identify the possible influence of the variables on performance. The alpha level for the rejection or acceptance of the hypothesis was set at 0.05 alpha level of significance. The study found out that the female players across the universities had significant differences, in weight ($F_{2,34}=6.993$, $p=0.003$), forearm length ($F_{2,34}=3.498$, $p=0.042$), ; and there was no significant difference in their finger span ($F_{2,34}=0.061$, $p=0.358$), speed ($F_{2,34}=0.057$, $p=0.944$), leg power ($F_{2,34}=2.357$, $p=0.110$) and shooting ability ($F_{2,34}=1.179$, $p=0.320$). It was concluded from this study that the selected performance variables used in this study are important to handballing ability. It was therefore recommended that coaches could use the variables in their selection and coaching of handballers.

Keywords: Anthropometry, Motor performance, Female University Champion-handballers

INTRODUCTION

The game of Handball is both an Olympic and professional sport played all over the world between teams with seven players on each side (six court players and one goalkeeper).

Handball is one of the explosive team sports which require short burst of high intensity and power production like other team sport such as basketball, tennis(Deng, Lin, Xia& Cheng,1990;Paule, Madole, Garhammer, Lacourse & Rozenek, 2000; Bence, Damsgaard, Saekmose, Jorgensen& Klausen,2002; Ratel, Bedu, Hennegrave, Dore & Duche,2002; Hassan,Rahaman, Cable & Reilly,2007).

Although many researchers,,such as Olaitan,(2012), Dominic,(2011), Ajayi-vincent (2005) ,Amusa & Omotowa,(1993),Talabi,(1992) and Owolabi,(1985), Igbunugo & Ajayi-vincent (1995) had also identified these performance characteristic in various sports in Nigeria. Others had specifically investigated and compared performance variables including somatotype among other sports athletes in relation to performance and incidence of injuries (Sibila,Bon,Mohoric & Pori, 2011, Tuma, & Vozobulova,, 2011, Urban,Kandrac & Taborsky, 2011, Visnapuu, Jurimae,Jurimae & Allikivi, 2011).A lot of studies exist as to the variables essential for excellence in handball (Michalsik, Madsen & Aagaard,2011);describing the profile and physiological demands in female elite team, but not much have been known or done in particular on the University Handball athletes, especially in the west Africa University Games. Since many factors can contribute to dominance in some aspects of life over others, this study therefore intends to look into the aspect of physique and motor performance variables of West Africa University champion handballers as it contributes to handball playing ability within the west Africa.

The significance of the study will provide data on the anthropometry and motor performances variables of female university champion handballers in the West Africa.

Research Questions

1. What are the Anthropometric variables of University Female handball players in West Africa?
2. Are there any differences in the motor performances variables among Female handball players in West Africa sub-region?
3. What is the influence of Anthropometric and motor variables on performance among Female handball players in West Africa?

Hypothesis:-

Main: - There is no significant difference in the anthropometric and motor variables of champion handballers among Universities of West Africa.

Sub-hypothesis:-

1. There are no significant differences in the Anthropometric variables (Weight, Finger span, Forearm length of Female University champion-handballers among West Africa.
2. There is no significant difference in the motor performance variables (speed, shooting ability and leg power) of female university champion-handballers among West Africa
3. There are no significant influences in the Anthropometry and motor variables on performance of female university champion-handballers among West Africa.

METHODS AND MATERIALS

The Ex-post facto research design was used for this study. According to Marguerite, Dean & Katherine (2006) said, the design sought to measure and to compare the existing status of the subjects in relation to the variables measured.

The population for this study consisted of all the handballers representing their Universities at the 13th West Africa University Games (WAUG) who volunteered for this study. A total of 36 players who took part in the games were sampled through purposively sampling techniques. The Three Female teams used for this study were University of Ilorin, University of Benin and Nnamidi Azikwe University. The tools used for the study

are standardized instruments and facilities which include: measuring tape, stop watch, weighing scale, plain sheet, and a standard handball courts. Reliability of the instrument was done through a pilot study using the university of Ilorin second team players. Researcher and 2 trained research assistants were used during the research work.

A. Measurements of Anthropometric and Motor variables.

All the variables of weight, Forearm length, Finger span, speed, leg power and shooting ability were measured following the guidelines set out by Zhang(2010), ISAAK protocol(2014) and Visnapuu(2009).

Table: 1: Summary of Descriptive Statistic of Anthropometric and Motor Performance Variables among University Female Champion-Handballers in West Africa

Variable s	A (University of Benin)				B (Nnamdi Azikwe University)				C (University of Ilorin)				Total (ABC)			
	N	X	SD	Range	N	X	SD	Range	N	X	SD	Range	N	X	SD	Range
Weight (kg)	1	67.6	1.1	48.5	1	70.2	6.8	58-75	1	57.9	5.2	49.5-	3	65.2	9.8	48.5
	2	3	8	-	2	1	1		2	5	3	66	6	6	1	-
				81.2												81.2
Forearm length (cm)	1	28.7	.87	27.4	1	30.1	2.3	26-	1	27.9	2.5	24.8-	3	28.9	2.1	24.8
	2	1		-31	2	1	1	33.7	2	2	5	33.5	6	1	9	-
																33.7
Finger span (cm)	1	58.0	4.1	51.2	1	57.4	5.0	47.1-	1	55.0	6.7	45.5-	3	56.8	5.4	45.5
	2	5	8	-	2	7	3	63.8	2	2	3	63.5	6	5	3	-
				64.2												64.2
Speed (sec)	1	3.65	.63	3-	1	3.58	.51	3-4	1	3.58	.51	3-4	3	3.61	.54	3-
	2			4.5	2				2				6			4.5
Leg power (cm)	1	2.37	.13	2.19	1	2.47	.14	2.24-	1	2.48	.13	2.25-	3	2.44	.14	2.19
	2			-	2			2.70	2			2.70	6			-
				2.56												2.70
Shooting (reps)	1	34.8	9.8	11-	1	30.9	5.1	21-38	1	31.0	5.0	22-38	3	32.2	7.1	11-
	2	3	7	45	2	2	7		2	8	4		6	7	0	45

Table 1 above presents the means and standard deviations results of anthropometric variables for the female champion handballers. There were wide variations in the anthropometric and motor values among the female University champion-handballers such as forearm length (24.8-33.7cm), weight (48.5-81.2kg), finger span (45.5-64.2). Speed (3-4.5), leg power (2.19-2.70) and shooting ability (11-45 reps). This could suggest that the game could be played by individuals with wide range of anthropometric and motor variables because of the significant variability displayed as University Champions.

Table 2: Summary of ANOVA Statistic on Anthropometric Variables for University Female Champion-Handballers in West Africa

Variable(units)	Source of variation	Sum of square	df	Mean square	F-ratio	Decision
Weight(kg)	Between Groups	1000.722	2	500.361	6.993	S
	Within Groups	2361.201	33	71.552		
	Total	3361.923	35			
Forearm length (cm)	Between Groups	29.561	2	14.780	3.498	S
	Within Groups	139.435	33	4.225		
	Total	168.996	35			
Finger span(cm)	Between Groups	62.301	2	31.150	1.061	NS
	Within Groups	969.169	33	29.369		
	Total	1031.470	35			

F (0.05) = 3.32 S- Significant NS- Not significant

In table 2 above, the ANOVA result revealed that there were no significant difference among the West African Universities female handballers in their Forearm length ($F_{cal}=1.123 < 0.05=3.32$) and finger span ($F_{cal}=1.061 < 0.05=3.32$). However, significant differences were found among the female players in their weight ($F_{cal}=6.993 > 0.05=3.32$, Forearm length ($F_{cal}=3.498 > 0.05=3.32$). Therefore the hypothesis was accepted that there is no significant difference among the players in forearm length and finger span. Thus significant difference were indicated in weight, forearm length, This implied that as there were similarities in the female players' anthropometric characteristics, so also some differences also as shown by the above result.

Table 3: Summary of Motor Performance Variables of University Female Champion-handballers in West Africa

Variables(units)	Source	Sum of square	df	Mean Square	F.cal.ratio	Decision
Speed(sec)	Between Groups	0.36	2	0.18	0.57	NS
	Within Groups	10.203	33	0.309		
	Total	10.239	35			
Leg power(m)	Between Groups	.086	2	0.043	2.357	NS
	Within Group	.604	33	0.018		
	Total	.690	35			
Shooting(reps)	Between Group	117.722	2	58.861	1.179	NS
	Within Group	1647.500	33	49.924		
	Total	1765.222	35			

$F(0.05)=3.32$ S=Significant NS=Not significant

In table 3, there was no significant difference found among the University Female handball players in speed ($F_{cal}=0.57 < 0.05=3.32$), leg power ($F_{cal}=2.357 < 3.32$), and shooting ability ($F_{cal}=1.179 < 3.32$). this made the hypothesis that there is no significant differences in the motor variables of the West Africa Universities Female handballers.

Table 4: Scheffe post hoc tests results on the Anthropometric and Motor**Performance Variables of University Female Champion-Handballers in West Africa**

Variables(units)	Indep	Dep(2)	Mean Differences	Standard Error	Sig.
Weight(kg)	Nnamdi Azikiwe Ilorin	Uni-	12.25*	3.45	.005
			2.58	3.45	.758
	Uni-Benin				
Forearm length (cm)	Nnamdi Azikiwe Ilorin	Uni-	2.19*	.83	.045
			1.40	.83	.263
	Uni-Benin				

Table 4 is the Scheffe post hoc results of the anthropometric and motor variables among female university champion-handballer in West Africa. From the table, Nnamdi Azikiwe and Uni-Ilorin were very similar in weight, forearm length. The table also revealed that Uni-Benin was significantly different from the other two universities in weight, forearm length.

Table 5: Influence of Anthropometric and Motor Variables on performance at WAUG.

Anthropometric and motor performance variables	1 st Position University of Benin X	2 nd Position Nnamidi Azikwe University X	3 rd Position University of Ilorin X
Weight (kg)	67.63	70.21	57.95
Forearm length (cm)	28.71	30.11	27.91
Finger span (cm)	58.05	57.47	55.01
Leg power (M)	2.37	2.47	2.48
Shooting ability (reps)	34.83	30.91	31.08
Speed (sec)	3.65	3.58	3.58

Discussions of Findings

Hypothesis 1: There is no significant difference in the Anthropometric variables of University Female champion Handballers of West Africa. The anthropometric variables employed in this study were discussed below:

Weight(kg): The mean and standard deviation weight for the female handballers is 65.26 ± 9.80 kg with a range of 48.5-81.2kg. The F-ratio of 6.993(table 10) was statistically significant at 0.05($F_{0.05}=3.32$). The null hypothesis that weight of the female handball players is not significantly different was rejected. That is the handballers in this study were significantly different in weight.

The Scheffé post hoc result test analysis (table 9) also confirmed there was a significant difference and that there were greater similarities among Nnamdi-Azikiwe (70.21kg) and Uni-Ilorin (57.95kg) team players than Uni-Benin (67.63kg) handball players.

According to Rusko et al., (1977) and Ajayi-Vincent (2005), body weight may exert positive influence on performance provided that the proportion of work against gravity in that particular sport is relatively small, while high body weight will greatly inhibit the ability to propel one's body upward (Owolabi, 1985). In the game of handball that involves fast speed and agility, heavy weight could be a disadvantage. However, when it comes to defending the ball, too light weight could be a disadvantage.

Forearm length (cm): The mean Forearm for the female handballers was 28.91 ± 2.19 cm with a range of 24.8-33.7cm. The F-ratio of 3.498 (table 10) was statistically significant at 0.05($F_{0.05}=3.32$). The null hypothesis that forearm length of the female handball players is not significantly different was rejected.

The Scheffé post hoc test analysis (table 9) also confirmed that there were significant differences and that there are greater dis-similarities among Nnamdi Azikiwe and Uni-Ilorin team players than with Uni-Benin handball players. This study demonstrated variability in the forearm length of the female players (24.8-33.7cm) the finding indicated that there was no clear-cut dimension for fore-arm length that could be used as cut-off point for University female handballers. Training however could be a factor of developing stronger forearm (Luttgens & Hamilton, 2006).

The forearm length of 28.91cm for this group was similar to the forearm length for elite and sub-elite fencers with 27.62 and 26.63 (Tsolakis and Vagenas, 2010); and 29.7 ± 1.8 cm for elite water polo players Ferragu, Abrales, Vila, Rodriguez, Argudo & Fernandez (2011).

Finger span (cm): The mean finger span for the female handballers was 56.84 ± 5.43 cm with a range of 45.5-64.2cm. The F-ratio of 1.061 (table 10) was not statistically significant at 0.05 ($F_{0.05}=3.33$). The null hypothesis that finger span of the female handball players is not significantly different was upheld. That is the handballers in this study had very similar finger span.

The variability as shown by the range 45.5-64.2cm revealed that handball players were generally vary widely in their finger span. According to Delamarche & Bideau (2011) in handball, the hand and arm characteristics are correlated to throwing velocities. It has been reported that players who throw the ball at a higher velocity also have a wider finger span related to their body height (Skoufas et al. 2003) and <http://www.topend sports.com>.2012). Finally, Grip strength as measured in several sports disciplines (Margonato et al., 1994, Pugh et al. 2003) is important for success in handball (Leyk et al., 2006).

Hypothesis 2: There is no significant difference in motor variables (speed, shooting ability and leg power) among female University handballers in West Africa.

SPEED (sec): The mean speed for the female handballers was 3.61sec, 541sec with a range of 3-4.5sec. The F-ratio of 0.57 (table 8) was not significant at 0.05 ($F_{0.05}=3.32$). The null hypothesis that speed of the female handball players is not significantly different was upheld. That is all the players from the West Africa sub-region were having relatively the same speed (3.61sec) with the range of 3.4-5secs.

The mean speed of 3.61sec for this study was different from the speed of elite youth soccer players speed of 6.03 ± 0.31 (Carling, Gall, Reilly & Williams; 2009), and 4.86sec for different levels of young team handball players (Zapartidis, Vareltsis, Gouvali & Kororos; 2009).

According to Nesser et al., (1996), quick start and rapid acceleration, strength of knee flexors and hip extensors to propel the body forward and the capacity of these muscles to rapidly contract and produce force are important in sports like handball. Again sprints for

short distances (20-30m) are fundamental in team handball during a fast break or while returning to defence after a ball loss (Lidor et al., 2005).

Leg power/Strength (m): The mean strength for the female handballers was 2.44 ± 0.14 with a range of 2.19-2.70m. The F-ratio of 2.357 (table 7) was not significant at 0.05 ($F_{0.05}=3.32$). The null hypothesis that leg explosive power of the female handball players is not significantly different was upheld. That is the handballers in this study had similar leg power. All the players from West African Universities had relatively the same strength of 24.4cm through the range from 21.9-27.0cm.

The mean leg power of 24.4cm for this study was different from the leg power value of 46.09cm by Kartic, Grgantov & Jurko(2006), where players were ranked according to their playing efficiency; It was also different for Vertical jumps and spike jump in a volleyball talent search program with values of 46.0 ± 11.2 and 50.7 ± 13.6 cm (Gabbett, Georgieff & Domrow 2007); Ajayi-Vincent (2005), www.elitesportsperformance.com (2013) all confirmed that the need for muscle strength varies for each sport hence performance in some sports is expected to posse's higher leg power value than others. In a game of Handball like any other ball games, it requires a combination of strength and speed (i.e. strength in action) for successful performance and that the product of strength and speed is muscle power, sometimes called anaerobic or explosive power. So athletes in power events like Handball have been found to have significantly higher leg force (strength) than not only non-athletes but also than endurance trained athletes (www.physicalactivityline.com 2013; www.coachr.org 2013; www.elitesportsperformance.com 2013; Ajayi-Vincent 2005). In conclusion, there is no doubt that lack of sufficient strength would be a serious handicap to many good athletes and would also limit the excellent levels of many elite athletes, especially in handball.

Shooting Ability (reps): The mean shooting ability for the female handballers was 32.27 ± 7.10 reps with a range of 11-45reps. The F-ratio of 1.179 (table 8) was not significant at 0.05 ($F_{0.05}=3.32$). The null hypothesis that shooting of the female handball players is not significantly different and was retained. That is the handballers in this study had a very similar shooting ability.

All the female players from the universities had relatively the same shooting ability of 32.27reps, even though the range was from 11-45reps. This could be ideal for an elite

handball player. The shooting ability of 32.27reps for this group was different from the shooting ability of male and female young handball player's ball velocity with higher value of (70.72 ± 7.00) . According to Hoff & Almasbakk (1995), Van de Tillar (2004), Gabbett (2005) that throwing velocity in handball and rugby, which is dependent on the ability to produce power, is important for success, and Muijtjens et al., (1991) also noted that the combination of ball velocity and accuracy in throwing is one of the most important factors and has a decisive role in scoring. Again Trewartha et al., (2008) confirmed that players demonstrated greater accuracy at shorter throwing distances than during throws over longer distances.

Hypothesis 3: There is no significant influence of anthropometric/motor variables on performance in Handball among University female Champion- handballer in West Africa.

Table 5 was concerned with the item-by-item analysis of the Anthropometric and Motor performance Variables used in this study and performance of each handball team that participated during the WAUG games.

At the end of a round robin championship during the games, the female team performance rating was as follows:-

1st – UNI-BEN

2nd – NNAMDI AZIKWE

3rd – UNI-ILORIN

From the analysis on table 5, Nnamdi Azikwe university female players had the highest values in weight, forearm length. While Benin had the highest in Finger span. Then Uni-Benin had the highest values in shooting and speed while University of Ilorin had the highest values in leg power. Uni-Ilorin infant came last in all five variables and first in one.

The scheffe post hoc analysis table also confirmed that Nnamdi Azikiwe and Uni-Ilorin were very similar in weight, forearm length. The table also revealed that Uni-Benin was significantly different from other two universities in weight, forearm length. Finger span, shooting ability, speed and the second highest score in weight, forearm length came position, while the team with the highest in weight, forearm length, fingerspan and leg power came

second overall. It is also note working that the team with the lowest scores in height, forearmlength, fingerspan and speed came last overall.

This may be in line with the research of Agbonjimi (1995) and Dominic (2006) who explained that sports performance is based on a complex and intricate diversity of variables.

Conclusions

1. There is a significant difference in the weight of University female champion-handballers.
2. There is a significant difference in the forearm length of University female champion-handballers.
3. There is no significant difference in the finger span of the University female champion-handballer.
4. There is no significant difference in the speed of University female champion-handballers.
5. There are no significant differences in leg power of the University female champion-handballers.
6. There are no significant differences in shooting ability of University female champion-handballers.

Recommendations

Based on a careful review of the procedures and findings of this study, the following recommendations were made:

All these anthropometric variables would have impacts on athletes' physical performance. Therefore, a greater attention should be paid to the anthropometric variables of elite athletes and the relationship between the anthropometric variables and performances indicators. These may be helpful in identifying potential players with promising future, and making the training more effective.

Experienced coaches can use this information in the process of designing training programme to maximize fitness development of handball players.

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