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The Correlation Between Body Extremities Morphometrics and Athletic Performance Among University Sports Students

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ABSTRACT

Introduction: this study is aimed to determine the anatomical variations in physical characteristics and muscle strength among University athletic students in Nigeria. A cross-sectional study was conducted on 57 volunteer students, both male and female, ranging in age from 15 to 35 years, who were divided into four groups based on their individual sports: football, basketball, volleyball, and lawn tennis. Anthropometric measurements were taken for each group based on their sport type, including leg features and hand dimensions using weighing scales, vernier calipers, and recording sheets.

Results: the research observed no significant variations between the measurements of the variables, which included age, height, weight and body mass index at P≤ 0.05. Palm Breadth, Hand Length, and Finger Length demonstrated a strongly positive correlation with stature (height), with significant differences reported for each. When compared to the sport types, the full leg length, foot length, foot breadth, palm breadth, and hand length were found to be considerably different. Regression analyses of the combined data, however, revealed that all of the hand and foot metrics strongly correlated with the height of the athletes.

Conclusions: the study concluded that there is a relationship between the anthropometric data measured and the sport type in terms of sport students' optimum performance. Sport students' stature can be estimated using either hand or foot dimensions because neither is more reliable than the other.

Keywords: Anthropometric measurements; Anatomical variations; Athletic performance; Sport type; Physical characteristics.

Introduction

Every discipline of medicine uses measurements taken on patients to establish diagnosis, and this technique extends back to ancient times (Banister, 1995; Chamella, 1997). Several variables influence anthropometric variation in different demographics, including genetic influences, environmental conditions, and nutritional status (Mortezaee *et al*., 2013). Physical characteristics and body composition are known to be the basis for high athletic performance levels (Ciplak *et al*., 2020), since these measurements are important to predict physical and physiological performances (Moncef *et al*., 2012). As a result, anthropometric measurement is a reliable assessment method for estimating an individual's muscle strength (Foo *et al*., 2007; Ling *et al*., 2010). Anthropometric data, such as height, weight, body mass index (BMI), body fat percentage, and skeletal muscle mass, can provide useful information about an athlete's physical features, which can be used to assess fitness, performance, and health (Claessens *et al*., 1991; Ackland *et al*., 2003).

The human hand is the most complex body structure, which explains its importance in a variety of physical or sporting activities (Grice, 2015; Adheke *et al*., 2019). Additionally, hand dimensions such as hand length, hand breadth, palm length, palm breadth, and including handgrip strength, which is known to be the maximal power of forceful flexing of the fingers occurring under bio-kinetic conditions, have been successfully proven for sports personnel performance. (Koley *et al*., 2008; Ling *et al*., 2010; Koley & Kaur, 2011; Adheke *et al*., 2019).

Likewise, the features of the legs has been shown to also affects the performance of sports athlete, as some research indicates that long distance runners have been characterized as long-legged while shorter distance runners, or sprinters, are characterized with shorter proportional leg lengths (Malina, Harper, & Avent, 1971; Dixon, 2017).

In accordance with the aforementioned, Fidelix *et al*. (2014) point out that coaches typically report that technical and tactical aspects are extremely important for the performance of sports students as well as professional sports personalities; however, they suggest that a significant amount of importance has been given to the morphological characteristics of players because they can be viewed as the foundation of technical and tactical development. As is the case for the majority of college students who participate in sports, their body morphometry, particularly the size

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of their hands and legs, is vital for their technical and tactical growth as they develop their talent.

As a result, a sports population's technical and tactical abilities, physical health, and body composition depend on the sort of sport they play (Aytek, 2007). Every sports professional needs to have unique anthropometric characteristics and a body composition for self-sport discipline because every sports branch has different requirements (Massuca and Fragoso, 2011).

Although anthropometric measures are frequently utilized in sports science and performance research, university athletes in Nigeria still know little about the connection between anthropometric data and athletic performance. Knowing how these factors interact may aid in developing training plans, spotting gifted athletes, preventing injuries, improving equipment design, and promoting an active and healthy lifestyle.

The purpose of this study is to determine the anatomical differences in physical characteristics and muscular strength by examining variations in leg and hand dimensions among athletic students at the University of Port Harcourt in Nigeria.

The aim is anticipated to be accomplished by:

I. Measuring the leg characteristics of sport-related students at the University of Port Harcourt, including the knee length (KL), functional leg length, foot breadth, and foot length, and various hand measurements, including hand length (HL), palm length (PL), hand breadth (HB), palm breadth (PB), and finger length.

II. Correlating the leg and hand dimension differences between the sexes as well as among the various sport-related University of Port Harcourt students.

III. Investigating the relationship between anthropometric measurements made for a particular sport's best performance via key performance markers like speed, agility, endurance, and strength.

The purpose of this project is to provide specific research answers to the following questions:

Our objectives for this research study were based on the answers to the research questions listed below.

What differences in leg and hand sizes can you find among Nigeria's University of Port Harcourt's athletes?

Is there a significant difference in the anthropometric characteristics of sporting students based on their respective sports, such as football, basketball, volleyball, and lawn tennis?

What relationship exist between anthropometric measurements and important performance metrics, such strength, speed, and agility, among athletes at the University of Port Harcourt in Nigeria?

Methods

Study design and population

The research employed a cross-sectional approach sample to gather samples of volunteer sports students aged between 15 to 35 years that covers a population of fifty-seven (57) students, including sporting male and female involved in various sporting categories of football and handball (Figure 1). Anthropometric measurements and athletic performance tests was conducted for each group based on their respective sports, using standardized protocols and equipment. Study was conducted after it was approved by the Ethics Committee of the University of Port-Harcourt even as participants' consents were sought before carrying out the measurement on them for this study. All participants were healthy and without any form of deformities. Simple random sampling technique was used to select the subjects for the study and the sample size was determined using the Cochran method of 1997.

Measured Dimension

Nine static anthropometric dimensions such as knee length (KL), functional leg length (FLL), foot breadth and foot length, hand length (HL), palm length

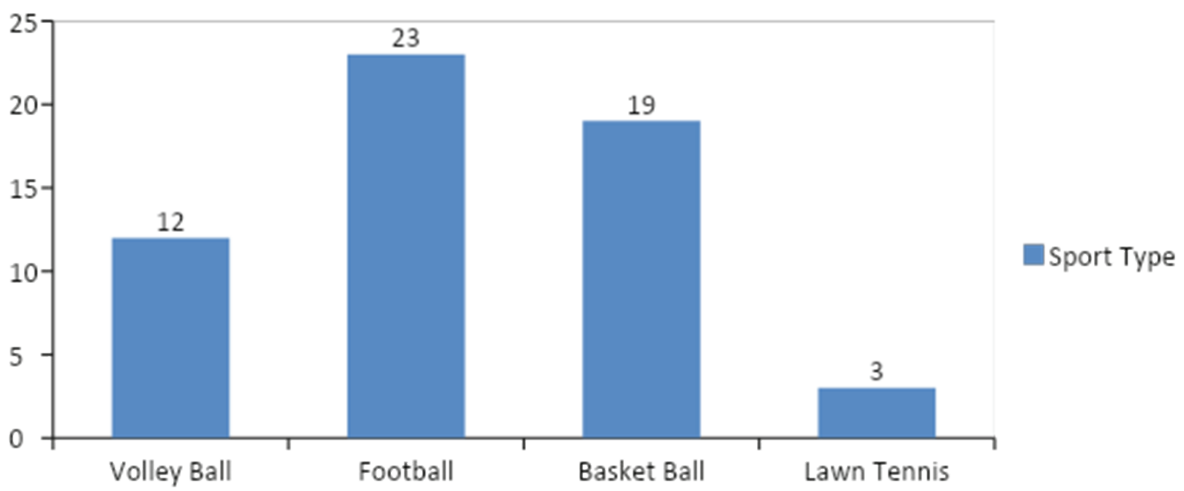

Figure 1. Bar chart showing the types of sport of the participants.

(PL), hand breadth (HB), palm breadth (PB) and finger length (FL) of the University of Port- Harcourt sport's students.

Knee length (KL): Measured as the distance between the anterior surface of the thigh (above the condyles of the femur and about 4 cm above the patella) and the floor.

Functional leg length (FLL): Taken as the true leg length from the anterior superior iliac spine to the medial mallelous.

Foot breadth (FB): Measured as the distance between the lateral and medial sides at the metatarsal region.

Foot length (FL): As the maximum distance between the most anterior and posterior projecting parts of the foot with an anthropometer

Hand length (HL): Defined as tip of middle or longest finger to the centre of inner styloid line while hand is placed on a stable cardboard.

Hand breadth (HB): Defined as the radial side of the index finger to the ulnar end of the small finger.

Palm length (PL): Defined as the distance from the mid-point of the distal transverse crease of the wrist to the proximal flexion crease of the middle finger

Palm breadth (PB): Defined as the widest area where the fingers join the palm across the hand length.

Finger length (Fl): Taken as the distance between the tip of the finger to the distal Metacarpo-phalangeal crease.

Measuring Instruments

The instruments adopted and used were based on traditional method of measurement which involves the use of simple moveable instruments such as weighing scale, vernier caliper and recording sheets (for documentation of the measured dimensions). The measurements were taken twice for each subject and the average was taken as the correct value provided the readings and measurements agreed within 0.04 ranges when this condition was not met, two further measurements were taken and the mean of the closest readings taken as the best estimate to prevent intra observer bias.

Data Analysis

Statistical tools were used to analyze the data and the data analysis was presented in tables. An independent samples t-test was used to compare differences in anthropometric variables between both sexes in each subject category. One-way ANOVA was also used to compare the mean differences between the sport groups. Finally, a Pearson's correlation and regression analysis was used to determine for any relationship between features of hand and leg parameters and performance and identify significant differences which 0.05 level of probability ($P \leq 0.05$) was considered statistically significant. All these were carried out with the aid of the Statistical Package for the Social Sciences (SPSS) version 23.0.

Results

Socio-demographic Characteristics of Sport Athletes

The study population comprises a total number of 57 students from the University of Port Harcourt in various departments involved in specific sports. Table 1 shows the distribution of the respondents according to their socio-demographic data.

Table 1. Frequency table showing the age and gender of sport athletes.

Parameters	Frequency (n = 57)	Percentage
Sex		
Male	50	87.7
Female	7	12.3
Age Group		
<20 years	6	10.5
20 to 30 years	47	82.5
31 years and above	4	7.0
Educational Level		
100 Level	6	10.5
200 Level	12	21.1
300 Level	8	14.0
400 Level	20	35.1
500 Level	11	19.3
Field of Study		
Science/Engineering/Medical	38	66.7
Non Science/Engineering/Medical	19	33.3

As shown from Table 1, from the 57 students (sport athletes) participated in the survey, a total of 50 were males, representing 87.7% while 7 (12.3%) were females implying that there are more male participants in the study than female participants. Also, the table shows the age distribution across the participants, those below the age 20years old represent 10.5% (6 out of 57), 20-30 years of age are the highest with 82.5%(47 out 57) and those above 31 years of age are least with 7.0% (4 out of 57). The respondents that are singled are 36.7% and the married 63.3% of the population of study. The educational level presented in table shows that sport athlete in their 400level were the highest participants 35.1% of the study population (20 out 57), followed by those in 200 level with 21.1%(12 out of 57), 500level students with 19.3% (11 out of 57), those in 300level with 14.0% (8 out of 57) while the least participants are those in 100level representing 10.5% of the study population (6 out of 57). Also, the table also shows that 66.7 of the participants were either in Science/Engineering/Medical departments (38 out of 57) while those in other departments are 33.3% (19 out of 57 participants).

Table 2. Descriptive statistics of the Age, Height, Weight and BMI of Sport students.

Sport Type	Age (Years)	Height (m)	Weight (kg)	BMI (kg/m^2)
Volley Ball	24.17±4.86	1.73±0.17	68.08±7.45	21.89±2.99
Football	23.30±3.08	1.72±0.14	66.65±6.65	22.54±3.18
Basket Ball	25.47±4.46	1.78±0.16	64.89±6.31	21.96±4.18
Lawn Tennis	22.33±2.08	1.68±0.09	61.67±3.51	19.60±2.82

The mean ± standard deviation of the height (m) of the subjects involved in volleyball, football, basketball and lawn tennis were 1.73±0.17, 1.72±0.14, 1.78±0.16 and 1.68±0.09 respectively. The mean weight (kg) of the subjects involved in volleyball, football, basketball and lawn tennis were 68.08±7.45, 66.65±6.65, 64.89±6.31 and 61.67±3.51 respectively. The mean of the BMI (kg/m^2) of the subjects involved in volleyball, football, basketball and lawn tennis were 21.89±2.99, 22.54±3.18, 21.96±4.18 and 19.60±2.82 respectively.

Table 3 shows the results of the one-way ANOVA between groups and within groups of the association of Sport type with age, height, weight and BMI of Sport Students. No significant difference was found in any of the variables between the measurements for anthropometric characteristics, in Age ($F(1,2) = 1.260$, $p>0.05$), height ($F(1,2) = .487$, $p>0.05$), weight ($F(1,2) = 1.070$, $p>0.05$) or in BMI ($F(1,2) = .649$, $p>0.05$).

In table 4, the results of the data analyzed presented in mean ± standard deviation shows the anthropometric parameters as measured in foot and hand dimensions of the subjects (sport students). The full leg length (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 103.75±5.14, 102.19±4.09, 110.74±5.58 and 105.67±7.09 respectively. The Foot Length (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 30.01±2.05, 28.72±1.93, 31.61±2.64 and 28.33±3.06 respectively. The Foot Breadth (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 8.60±0.95, 9.49±1.07, 10.84±1.43 and 8.50±1.50 respectively. The Knee Length (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 10.17±0.58, 11.50±0.01, 12.00±0.17 and 11.40±0.21 respectively. The Palm Length (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 12.11±0.89, 10.26±0.98, 12.42±1.50 and 10.47±0.06respectively. The Palm Breadth (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 8.18±1.24, 7.68±0.72, 9.80±0.91 and 7.80±0.29 respectively. The Hand Length (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 25.46±1.41, 22.94±3.54, 27.86±3.90 and 24.17±1.76 respectively. The Hand Breadth (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 9.24±0.96, 8.96±1.39, 14.84±1.89 and 10.00±1.73 respectively. The Finger Length (cm) of the subjects involved in volleyball, football, basketball and lawn tennis were 9.54±0.68, 9.67±0.70, 9.82±0.85 and 9.63±0.78 respectively.

Table 3. Association of Sport Type with Age, Height, Weight and BMI of Sport Students.

Parameters		SS	Df	MS	F	Sig.
Age	Between Groups (Combined)	59.639	3	19.880	1.260	0.297
	Within Groups	835.940	53	15.772		
	Total	895.579	56			
Height	Between Groups (Combined)	.033	3	.011	.487	0.693
	Within Groups	1.197	53	.023		
	Total	1.230	56			
Weight	Between Groups Combined)	140.778	3	46.926	1.070	0.370
	Within Groups	2324.590	53	43.860		
	Total	2465.368	56			
BMI	Between Groups (Combined)	23.934	3	7.978	.649	0.587
	Within Groups	651.425	53	12.291		
	Total	675.359	56			

SS= Sum of Squares; MS= Mean Square.

Table 4. Anthropometric profile (foot and hand dimensions) of Sport Students.

Anthropometric Parameters	Volleyball	Football	Basketball	Lawn Tennis
Foot Parameters				
Full Leg Length (cm)	103.75±5.14	102.19±4.09	110.74±5.58	105.67±7.09
Foot Length (cm)	30.01±2.05	28.72±1.93	31.61±2.64	28.33±3.06
Foot Breadth (cm)	8.60±0.95	9.49±1.07	10.84±1.43	8.50±1.50
Knee Length (cm)	10.17±0.58	11.50±0.01	12.00±0.17	11.40±0.21
Hand Parameters				
Palm Length (cm)	12.11±0.89	10.26±0.98	12.42±1.50	10.47±0.06
Palm Breadth (cm)	8.18±1.24	7.68±0.72	9.80±0.91	7.80±0.29
Hand Length (cm)	25.46±1.41	22.94±3.54	27.86±3.90	24.17±1.76
Hand Breadth (cm)	9.24±0.96	8.96±1.39	14.84±1.89	10.00±1.73
Finger Length (cm)	9.54±0.68	9.67±0.70	9.82±0.85	9.63±0.78

Data are presented as Mean ± Standard deviation.

Table 5, shows Pearson's Correlation between stature (height) and hand and foot parameters of sport students. The results indicated that, anthropometric parameters of the Full Leg Length, Foot Length and the Hand Breadth had a significantly positive correlation with the stature (height), and no significant difference were found while Palm Breadth (r= 0.141, p= 0.030) Hand Length (r= 0.297, p= 0.25) and Finger Length (r= 0.309, p= 0.019) had a significantly positive correlation with the stature (height), and significant difference were found respectively. The results also indicated that anthropometric parameters of the Foot Breadth, Knee Length and Palm Length had a significantly negative correlation with the stature (height), and no significant differences were found respectively.

Table 5. Correlation between stature (height) and hand and foot parameters of sport students.

	Pearson's Correlation	Significance (2-Tailed)
Foot Parameters		
Full Leg Length (cm)	0.115	0.060
Foot Length (cm)	0.179	0.461
Foot Breadth (cm)	-0.083	0.537
Knee Length (cm)	-0.009	0.947
Hand Parameters		
Palm Length (cm)	-0.022	0.870
Palm Breadth (cm)	0.141	0.030*
Hand Length (cm)	0.297	0.025*
Hand Breadth (cm)	0.095	0.481
Finger Length (cm)	0.309	0.019*

* Significant correlation at p<0.05

The descriptive data of the measured anthropometric variables in comparison of the Hand and Foot Parameters with sport type among sport students are presented in mean ± standard deviation shown in Table 6. As indicated in table 6, the results shows that the Full Leg Length (p= 0.001), Foot Length (p= 0.047), Foot Breadth (p= 0.023), Palm Breadth (p= 0.000) and Hand Length (p= 0.050) shows significant difference when compared with the sport types while the Knee Length, Palm Length, Hand Breadth, Finger Length shows no significant difference when compared with the sport types at p<0.05.

In table 7, Information on the effect of the predictor variable on the criterion variable tested through a regression-based procedure, whose values are shown through the unstandardized and standardized coefficient of regression. Thus, the Correlation coefficient and Regression analysis between height and hand and foot parameters of sport students were presented in table 7. As indicated in the study only Full Leg Length (B= .004, T=0.951, β=.151), Hand Length (B= .009, T=1.350, β=.204), Palm Breadth (B= .017, T=.669, β=.105) and Finger Length (B= .065, T=1.720, β=.322), had a significantly positive correlation with the height but show no significant difference respectively at p<0.05.

a. (Constant) = Finger Length, Knee Length, Palm Breadth, Foot Breadth, Palm Length, Hand Length, Full Leg Length, Foot Length, Hand Breadth, SEE= Standard Error of the Estimate

Table 8 shows the summary of the regression prediction analysis between the results of height and anthropometric indices (hand and foot parameter) were performed for Sport students. Thus, the table 8 shows the Correlation Coefficient and Regression analysis between Height and Hand and Foot parameters of the sport student with respect to the height of the population studied (p< 0.05). However, multiple

Table 6. Comparison of Hand and Foot Parameters with Sport Type among Sport students.

Parameters	Sport Type	Mean ± SD	p-value
Full Leg Length (cm)	Volleyball	103.75±5.14	0.001*
	Football	102.19±4.09	
	Basketball	110.74±5.58	
	Lawn Tennis	105.67±7.09	
Foot Length (cm)	Volleyball	30.01±2.05	0.047*
	Football	28.72±1.93	
	Basketball	31.61±2.64	
	Lawn Tennis	28.33±3.06	
Foot Breadth (cm)	Volley Ball	8.60±0.95	0.023*
	Football	9.49±1.07	
	Basket Ball	10.84±1.43	
	Lawn Tennis	8.50±1.50	
Knee Length (cm)	Volley Ball	10.17±0.58	0.079
	Football	11.50±0.01	
	Basket Ball	12.00±0.17	
	Lawn Tennis	11.40±0.21	
Palm Length (cm)	Volley Ball	12.11±0.89	0.480
	Football	10.26±0.98	
	Basket Ball	12.42±1.50	
	Lawn Tennis	10.47±0.06	
Palm Breadth (cm)	Volley Ball	8.18±1.24	0.000*
	Football	7.68±0.72	
	Basket Ball	9.80±0.91	
	Lawn Tennis	7.80±0.29	
Hand Length (cm)	Volley Ball	25.46±1.41	0.050*
	Football	22.94±3.54	
	Basket Ball	27.86±3.90	
	Lawn Tennis	24.17±1.76	
Hand Breadth (cm)	Volley Ball	9.24±0.96	0.199
	Football	8.96±1.39	
	Basket Ball	14.84±1.89	
	Lawn Tennis	10.00±1.73	
Finger Length (cm)	Volley Ball	9.54±0.68	0.796
	Football	9.67±0.70	
	Basket Ball	9.82±0.85	
	Lawn Tennis	9.63±0.78	

* Value is significant at $p<0.05$.

Table 7. Correlation coefficient and Regression analysis between height and hand and foot parameters of sport students.

Coefficients							
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**95.0% Confidence Interval for B**	
	B	**Std. Error**	**B**			**Lower Bound**	**Upper Bound**
(Constant)	.962	.541		1.778	.082	-.127	2.052
Full Leg Length	.004	.004	.151	.951	.346	-.004	.012
Foot Length	-.004	.011	-.069	-.387	.700	-.026	.018
Foot Breadth	-.013	.016	-.113	-.818	.418	-.045	.019
Knee Length	-.004	.024	-.023	-.161	.873	-.051	.044
Hand Length	.009	.007	.204	1.350	.184	-.005	.023
Hand Breadth	-.007	.014	-.092	-.490	.627	-.035	.021
Palm Length	-.027	.020	-.221	-1.336	.188	-.068	.014
Palm Breadth	.017	.024	.105	.699	.488	-.032	.066
Finger Length	.065	.038	.322	1.720	.092	-.011	.140

Table 8. Summary of the regression prediction for height estimation using hand and foot parameter of Sport Students.

Model	SEE	R	R2	Adjusted R2	F	P
1	.144	.454a	.206	.054	1.36	.05

a. (Constant) = Finger Length, Knee Length, Palm Breadth, Foot Breadth, Palm Length, Hand Length, Full Leg Length, Foot Length, Hand Breadth, SEE= Standard Error of the Estimate.

regressions of the combined data revealed that all the hand and foot parameters contributed significantly to the height of the population studied ($F=1.36$; $R^2 = 0.206$; $p<.05$). The $R^2 = 0.206$ indicates that the independent variable (foot and hand dimension) significantly affects 20.6% variation in dependent variable (Height).The multiple regression equations resulted in lower SEE value (0.144).

Discussions

The mean of the height (m) of the subjects involved in volleyball, football, basketball and lawn tennis were 1.73±0.17, 1.72±0.14, 1.78±0.16 and 1.68±0.09 respectively. This is the stature of the subjects, characterized as medium, with the height between 1.60m and 1.8m for both male and female involved in those sport types. The mean weight (kg) of the subjects involved in volleyball, football, basketball and lawn tennis were 68.08±7.45, 66.65±6.65, 64.89±6.31 and 61.67±3.51 respectively. The mean BMI (kg/m^2) of the subjects involved in volleyball, football, basketball and lawn tennis were 21.89±2.99, 22.54±3.18, 21.96±4.18 and 19.60±2.82 respectively. In the study, students showed healthy, normal BMI with a mean for males and females involved in volleyball, football, basketball and lawn tennis, in accordance with the BMI classification made by the World Health Organization (WHO, 1996).

However, between groups and within groups, the ANOVA results showed that there was no significant difference between measurements in anthropometric characteristics in the age, height, weight and BMI of the subjects involved in volleyball, football, basketball and lawn tennis. The average height remained stable though increased slightly for those in basketball and decreased a little for subjects in lawn tennis, the weight increased a little for those in volleyball and decreased for those in lawn tennis and so did the BMI decreases for those in in lawn tennis (table 2 and 3).

Therefore, our findings about the anthropometric profile of basketball are consistent with previous research (Delextrat and Cohen, 2008; Metaxas *et al.*, 2009), even if basketball has the largest standard deviation values for height among other sports. Volleyball players have a lower BMI than athletes in football and basketball, with the exception of lawn tennis. These results agree with earlier research' conclusions about the lean body mass of volleyball players (Sheppard *et al.*, 2008). Volleyball players' average height and standing reach demonstrated the value of these anthropometric traits in a game where the majority of players engage in attack and blocking movements (Fontani *et al.*, 2015; Marquez *et al.*, 2009). The lack of body contact in volleyball matches lends credence to the idea that the players' performances can be improved without gaining significant amounts of body mass (Sheppard *et al.*, 2008). In our study, lawn tennis players had the lowest averages for age, height, weight, and BMI. Although tall individuals are typically preferred in sports like tennis and volleyball since it would be simpler for them to attack or block the ball. Shorter players can pass the ball more effectively and typically respond to defensive situations more quickly. A typical team will therefore include of players of different heights to accommodate the many roles needed because this game requires a combination of

speed, talents, and tactics (Filipic *et al*., 2012). Although the results of this study go against Filipcic & Filipcic's (2005) position, they thought that young tennis players' competitive success is positively influenced by body height and that both male and female tennis players must meet specific selection criteria. It was therefore expected that they would be taller than their peers. The results of the study on low body mass index and lawn tennis players are consistent with those of Filipic *et al*., (2012), who proposed that lower body weight in younger age groups results in faster start-up of movements (split step and speed of acceleration), efficient positioning for shots (footwork, movement patterns), and change of directions (agility). They also discovered that young people who were heavier performed worse when they ran, walked, jumped, or did sit-ups, all of which required the body to overcome or oppose gravity.

According to the study, the average measurements for full leg length, foot length, foot breadth, and knee length were highest in the sport of basketball. These measurements were also related to anthropometric profiles for feet, which had the highest averages. The length of the foot, however, is not an important variable in other sports like football, volleyball, or lawn tennis. However, it is positive in football because players with longer and wider feet have a modest advantage when kicking, rolling, or blocking the ball since the foot surface is used against the ball. Big feet are important in football when limiting an opponent access to the ball; small feet are less useful when properly guarding the ball (Yamaner *et al*., 2011). However, the study's football participants have medium to large foot length and breadth measurements.

According to the study, among other sports, basketball was also shown to have the highest average measurement for hand dimensions, including palm, hand, and finger lengths. The study's findings were consistent with those of a study Pelin *et al*. (2007) conducted on Turkish male athletes, which indicated that the foot dimension (Full Leg Length, Foot length and Foot Breadth) and hand dimension of basketball players (Palm Length, Palm Breadth, Hand Length and Hand Breadth) was greater when compared to other sports groups. According to Gaurav, *et al*., (2010), when compared to athletes in other sports, basketball and volleyball players tend to have larger hands and feet relative to their height and body mass, which is necessary for outstanding athletic performance. They highlighted that while the palm's length and breadth might not be important, they do provide the ability to palm the ball easily, which can be very beneficial in passing, shooting, and ball handling. In both basketball and volleyball, ball control is essential (Gaurav *et al*., 2010). In grip sports like basketball, the shot or throw will be more accurate the longer the finger. The wrist and fingers are used to complete all throws and shoots. According to Visnapuu and Jürimäe (2007), athletes with longer fingers and larger hands may also have stronger grips. Additionally, the results demonstrate that only the Full Leg Length, Foot Length, Foot Breadth, Palm Breadth, and Hand Length differ significantly from the sport types, while the Knee Length, Palm Length, Hand Breadth, and Finger Length do not (p 0.05).

The combined data from the various regressions showed that the height of the population under study was significantly influenced by all of the hand and foot factors. The dependent variable (Height) is strongly affected by the independent variable (foot and hand dimension) by a factor of 20.6%. This is an indication that all hand and foot parameters can adequately predict stature in our studied population. These findings are in accordance with the study of Soo-Chan *et al*., (2017) that showed that mean value estimates were close to each other. The study has also shown that to assess the accuracy of our regression equations, the standard of estimate (SEE) is very valuable since it predicts the deviation of estimated stature from the actual stature. All the SEE in our study were closely related, thus confirming the accuracy of our equations.

Also, in this study, Full Leg Length, Foot Length and the Hand Breadth had a significantly positive correlation with the stature (height), while Palm Breadth, Hand Length and Finger Length had a significantly positive correlation with the stature (height), and shows significant difference respectively. According to another study (Ishak *et al*., 2012), stature (height) and foot length had the most significant correlations. A few anthropometric investigations have noted variations in foot length and width with age. Sports students' foot lengths correlated with height in a way that was similar to Kumar *et al*., (2010) and Krishan and Sharma (2007) but less favorable than Sanli *et al*. (2005). Egyptian hand and phalange lengths were used by Habib and Kamal (2010) to estimate height. They noted values for hand length that were similar to those in the current study. This shows that estimates of stature vary across different population groupings. Despite the aforementioned, this study found a high association between every metric and stature, meaning that any of these parameters can be used to accurately estimate stature. Additionally, as demonstrated by Krishan (2008), the correlation coefficient of the measured factors indicates a linear and close link of stature with them. Coaches generally state that technical and tactical factors are important for student athletes' success as well as professional athletes' personalities; however, they assert that players' morphological traits have received significant attention because they serve as the foundation for technical and tactical development (Fidelix *et al*., 2014). As is the case for the majority of college students who participate in sports, their body morphometry, particularly the size of their hands and legs, is vital for their technical and tactical growth as they develop their talent in order to determine the anatomical

variation in the leg features and hand dimensions of athletic students at University Of Port Harcourt, Nigeria, this study was conducted.

Conclusions

This study has demonstrated that several anthropometric measurements, such as foot and hand sizes, vary between different sport kinds. The findings of this study demonstrated that sport type and performance are significantly influenced by the morphological traits of sport students. As a result, there was a marginally significant difference in the association between the anthropometric data obtained with the sports type and its ideal performance. Additionally, this study was able to demonstrate that hand and foot parameters may effectively estimate stature. In light of this research, anthropometric characteristics may be helpful for risk assessment, injury prevention, and performance enhancement in sports.

The significance of this study is that it provides statistical information about the variation in leg and hand anthropometrics in the population that can be used to improve products and predict the best possible performance in a particular sport based on the anthropometric characteristics of the professional subjects analyzed. The study can assist coaches and players in adapting training regimens to suit their body types and maximize performance by finding the association between anthropometric data and athletic performance. An objective criterion for identifying and choosing talented athletes for various sports can be derived from anthropometric data. When designing injury prevention programs to lower the risk of injuries in athletes, the morphometric data generated can also be used to identify athletes who are at a higher risk of injury, particularly in sports that require repetitive motions or place an excessive amount of stress on specific body parts. Equally the anthropometric data can also be useful in ergonomic anatomy for the design of better sports equipment, such as shoes, gloves, and helmets that fit athletes' body types and enhance their performance while minimizing the risk of injuries.

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