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Research Article

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A Study of The Interrelationship between Weight and Hand Length of Infants in Jos Metropolis, Plateau State, Nigeria

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Abstract

Background and Objective: Anthropometric parameters such as weight and hand length are important for assessing infant growth and development. While weight is a primary indicator of nutritional and health status, hand length-though easy to measure-has been less studied, especially in Nigerian infants. This study aimed to investigate the interrelationship between weight and hand length among infants in Jos Metropolis, Plateau State, Nigeria.

Materials and Methods: A descriptive cross-sectional study was conducted on infants aged 1-120 days attending routine immunization at the Epidemiological Unit of the Plateau State Ministry of Health. Systematic random sampling was used to select participants. Infant weight was measured using a bassinet weighing scale, while hand length was measured using sliding calipers. Data were analyzed using the Number Cruncher Statistical System, and regression equations were derived to explore the relationship between weight and hand length.

Results: Polynomial regression analysis showed strong relationships between hand length and weight for both sexes, with $R^2 = 1$. Female infants exhibited higher hand length values compared to males, though the difference was not statistically significant ($p > 0.05$). Regression equations were established separately for male and female infants, demonstrating consistent patterns between weight and hand length.

Conclusion: This study highlights the predictive value of hand length for assessing infant growth alongside weight. Although sex-related differences were not statistically significant, the findings provide useful baseline data with potential applications in pediatric growth assessment and forensic science in Nigeria. Future studies with larger and more diverse populations are recommended.

Keywords: Infants; anthropometry; weight; hand length; variation; anthropometry; polynomial regression

Significance of the Study

The significance of this study lies in its contribution to understanding infant growth and development patterns within Jos Metropolis, Plateau State. By examining the interrelationship between weight and hand length, the study provides valuable anthropometric data that can serve as a simple, cost-effective indicator of nutritional and health status in infants. Such information is crucial for early detection of growth abnormalities, guiding pediatric healthcare, and supporting public health interventions. Additionally, the findings may aid in establishing local growth references, complementing global standards, and informing future research in child development, nutrition, and epidemiology within the Nigerian context.

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Introduction

Growth and development are fundamental aspects of human biology, representing a continuous and dynamic process from conception through adulthood [1]. Among the numerous anthropometric parameters used to assess growth in early life, body weight and hand length have been recognized as important indicators of nutritional status, health, and physical development in infants [2]. Anthropometry, the measurement of the human body and its proportions, provides valuable insights into the health and developmental status of individuals and populations. In infancy, when growth is rapid and health conditions can change quickly, the careful monitoring of anthropometric measurements is essential for identifying potential developmental abnormalities and guiding timely interventions [3]. In clinical and public health contexts, body weight has traditionally been one of the most widely used measurements for assessing the growth of infants. Weight reflects not only the adequacy of nutritional intake but also the presence or absence of disease, and is a sensitive indicator of both acute and chronic undernutrition [4]. On the other hand, hand length, though less frequently assessed in routine pediatric evaluations, is gaining attention as a potential proxy for overall skeletal growth and as an indicator that may correlate with body weight in early childhood. Measuring hand length offers certain advantages, including simplicity, minimal discomfort to the infant, and the possibility of reliable measurement even in situations where weighing may be challenging [5].

The relationship between weight and hand length is of interest because it may provide a basis for alternative or supplementary growth assessment tools [6]. In many low-resource settings, including parts of Nigeria, equipment for accurate weight measurement may not always be available or properly calibrated, leading to gaps in infant health monitoring [7]. If a strong correlation between weight and hand length exists, healthcare workers could use hand length as a quick and cost-effective screening measure to identify infants at risk of malnutrition or growth retardation, especially in field surveys or emergency situations [8].

Globally, several studies have explored correlations between different anthropometric parameters in infants and children, often highlighting interrelationships that can aid in developing simplified growth assessment protocols [8]. For instance, research in South Asia, East Africa, and Latin America has shown that limb measurements such as mid-upper arm circumference, foot length, and hand length, can be predictive of low birth weight and overall nutritional status. In Nigeria, anthropometric studies have traditionally focused on weight, height, and head circumference, with relatively fewer investigations specifically targeting the relationship between weight and hand length in infants [9]. This creates a research gap that merits attention, particularly given the need for adaptable, culturally relevant, and context-specific growth assessment tools in the Nigerian healthcare setting. In Nigeria, the city of Jos, the capital of Plateau State in north-central, provides a relevant setting for this investigation. Jos metropolis is characterized by diverse ethnic groups, varying socio-economic conditions, and a mix of urban and peri-urban communities. The population's diversity, coupled with the presence of healthcare facilities ranging from primary health centers to teaching hospitals, makes it a suitable location for studying anthropometric patterns in infants [10]. Additionally, the metropolis has its share of public health challenges, including malnutrition, limited access to pediatric healthcare in certain areas, and the need for effective growth monitoring strategies.

Infancy is a critical period for growth monitoring because nutritional deficiencies, infections, or congenital abnormalities can have lasting effects on physical and cognitive development [11]. Weight measurement alone, although important, may not fully capture the growth trajectory of an infant, especially in the presence of certain developmental disorders or measurement challenges. Hand length, as a relatively stable skeletal measurement during short-term illness or acute weight fluctuations, could provide additional insight into long-term growth trends [12]. By investigating the interrelationship between these two parameters, this study aimed at establishing whether hand length can serve as a reliable predictor of weight and, by extension, overall growth status in infants within Jos metropolis, Plateau State, Nigeria.

Methodology

Materials Used for the Study

For the purpose of achieving the aim of this study, the following materials were used: KTC Vernier calliper, Bassinet weighing scale (Seca 417-Vickott Black), Pens, notebook for recording measurements, and immunization record cards of the subjects.

Study Area

This study was conducted in Jos, a city in the north central region of Nigeria and the capital of Plateau State. It is located near the center of the Jos Plateau on the Dilimi River and it is about 1250 meters (about 4100 ft) above sea level. Plateau State derives its name from the geographical landscape that predominates in this part of the country. It has a population of 3,178,712 (2006 estimate). The state lies between latitude 7 and 11 degrees north of the Equator and longitude 7 degrees east. Most recent findings of National Nutrition and health survey indicate that prevalence of malnutrition among infants in Plateau state is below the W.H.O acceptable threshold [13]. The research began on 11th June, 2018 and got completed on 26th May, 2019.

Study Design

The study was a descriptive cross-sectional study carried out in Jos, the capital of Plateau state of Nigeria. The study was conducted on a population of infants aged 1-120 days' old brought for routine immunization at the Epidemiological Unit of Plateau State Ministry of Health after obtaining permission. The research was approved by the Ethics Committee of Jos University Teaching Hospital and before inclusion of subjects, informed consent was obtained from their parents/care givers. In seeking the informed consent, the following information was provided to each subject's care giver:

a) A description of the procedure to be followed;

b) A description of any reasonably foreseeable risks or discomfort;

c) A description of benefits to the subjects or to others which may reasonably be expected from the research;

d) A disclosure of appropriate procedure that might be advantageous to the subject;

e) A statement describing the extent to which confidentiality of records identifying the subject will be maintained;

f) An explanation of whom to contact for answers to pertinent questions about the research and research subjects' rights, and whom to contact in the event of a research related injury to the subject; and

g) A statement that participation is voluntary, refusal to participate will involve no penalty or loss of benefits to which the subject is otherwise entitled, and that the subject may discontinue participation at any time without penalty or loss of benefits to which the subject is otherwise entitle

Sampling Technique/Sample Size

Measurable parameters were obtained from a large sample size chosen on a systematic random (quasi-random) basis from infants aged 1-120 days' old brought for routine immunization at the Epidemiological Unit of Plateau State Ministry of Health in order to get results that are closer to the population values. The sample size was computed using the precision-based approach [14] because in anthropometry there is greater emphasis on precision-driven estimation procedures [15]. For each of the parameter measured, the length of the confidence interval (expected range of outcome or a range of statistical values within which a result is expected to fall with a specific probability) is a function of the sample size. This means that the larger the sample, the narrower the confidence interval. Since we wish to express the sample size in terms of precision, the required sample size was calculated using the formula:

$$n = \frac{Z^2_{1-\frac{a}{2}}\sigma^2}{\varepsilon^2 m^2} \quad (1)$$

From the small study (pilot study) of infants that was made, mean crown-heel length and standard deviation were 45.7cm and (m = 45.7) and 3.1 (SD = 3.1).

Since our desired relative precision was 5% (ε = 5%), the required sample size for estimating a 95% confidence interval for the mean crown-heel length for example should be at least

$$n = \frac{1.96^2 3.1^2}{0.05^2 45.7^2} \quad (2)$$

= 7 subjects per class or group.

With a maximum of 20 classes, total number of subjects is 140.

Inclusion Criteria

Apparently healthy infants aged 1-120 days old who were delivered at term and whose parents or caregivers gave consent were included in the study.

Exclusion Criteria

Infants that were sick, pre-term/pre-mature at birth, as well as those with congenital anomalies which distort anthropometric parameters (such as hydrocephalus, club foot, scoliosis, kyphosis, Down syndrome, upper limb deformities, and craniosynostosis), were excluded from the study. Infants whose parents or caregivers did not give their consent were also excluded from the study.

Data Collection

Weight Measurement

A bassinet weighing scale was used to take the weight of infants lying in the bassinet after all clothing and diapers were removed. Weight was measured in kilograms.

Hand Length Measurement

Using sliding callipers, the projected distance between the midpoint of a line joining the styloid process of radius and ulna bones of the forearm and the tip of the third finger was measured. Measurements were taken to the nearest 0.1cm. All observations were taken twice by the investigator in order to eliminate observer related errors, the average obtained and initially recorded manually and subsequently transferred to a Microsoft excel sheet for analysis.

Data Analysis

All data were analysed using Number cruncher statistical system (NCSS/ PASS 2019 version 19.0.2) and mean values, standard deviation and standard error of mean of weight and hand length of Nigerian infants in Jos from birth to the age of four months were determined as well as 5th, 50th, 95th centile values of weight and hand length Nigerian infants in Jos from birth to the age of four months. Correlation and regression analyses were carried out to determine the relationship and strength of relationship between infant weight and hand length. All the steps and processes involved in the collection, organization and analysis of data for this research have been described in a detailed and organized fashion. The methods and procedures meet standard research practice so as to eliminate bias and ensure reproducibility. All analyses were determined at the 95%confidence interval (significant level P>0.05)

Results

Descriptive Statistics of Anthropometric Parameters (Hand Length and Weight) of Infants Studied in Jos

The descriptive statistics of anthropometric parameters (hand length and weight) of infants is presented in the tables and figure under this section. Table 1 reveals grouped frequency distribution of weight of infants studied in Jos from 2.0 - 8.9 kilogram. Table 2 shows the descriptive statistics of hand length in centimeters of the total number of subjects, irrespective of sex. Similar analysis was carried out on male infants (Table 3) and female infants (Table 4).

Table 1: Grouped frequency distribution of weight of infants studied in Jos from 2.0 - 8.9 kilogram.

Weight (kg)	Frequency	Percentage (%)
2.0 - 2.9	33	5.8
3.0 - 3.9	104	18.2
4.0 - 4.9	85	14.9
5.0 - 5.9	166	29.2
6.0 - 6.9	134	23.5
7.0 - 7.9	41	7.2
8.0 - 8.9	7	1.2
Total	570	100%

Table 2: Frequency distribution of hand length measurements of infants with mean, standard deviation, standard error of mean and centiles from 2.0 - 8.9 kilogram.

					Percentile		
Weight (kg)	**Number (n)**	**Mean HL (cm)**	**SD**	**SEM**	**5th**	**50th**	**95th**
2.0 - 2.9	33	5.52	0.43	0.08	4.83	5.4	6.1
3.0 - 3.9	104	5.76	0.48	0.05	5.1	5.8	6.56
4.0 - 4.9	85	6.25	0.5	0.05	5.23	6.3	7.1
5.0 - 5.9	166	6.45	0.78	0.04	5.66	6.4	7.3
6.0 - 6.9	134	6.61	0.55	0.05	5.8	6.7	7.43
7.0 - 7.9	41	6.94	0.63	0.1	5.8	7	7.9
8.0 - 8.9	7	7.6	0.37	0.14	7	7.65	7.9
TOTAL	570						

*SD= Standard Deviation; SEM= Standard Error of Mean; HL= Hand Length

Table 3: Frequency distribution of hand length measurements of male infants with mean, standard deviation, standard error of mean and centiles from 2.0 - 8.9 kilogram.

					Percentile		
Weight (kg)	**Number (n)**	**Mean HL (cm)**	**SD**	**SEM**	**5th**	**50th**	**95th**
2.0 - 2.9	17	5.6	0.42	0.1	4.9	5.75	6.1
3.0 - 3.9	48	5.73	0.4	0.06	5.04	5.8	6.3
4.0 - 4.9	50	6.23	0.54	0.08	5.15	6.2	7.1
5.0 - 5.9	99	6.37	0.48	0.05	5.6	6.3	7.21
6.0 - 6.9	66	6.57	0.63	0.08	5.18	6.8	7.5
7.0 - 7.9	21	7.04	0.67	0.15	5.8	7.2	7.9
8.0 - 8.9	6	7.67	0.35	0.14	7	7.7	7.9
TOTAL	307						

*SD= Standard Deviation; SEM= Standard Error of Mean; HL= Hand Length

Table 4: Frequency distribution of hand length measurements of female infants with mean, standard deviation, standard error of mean and centiles from 2.0 - 7.9 kilogram.

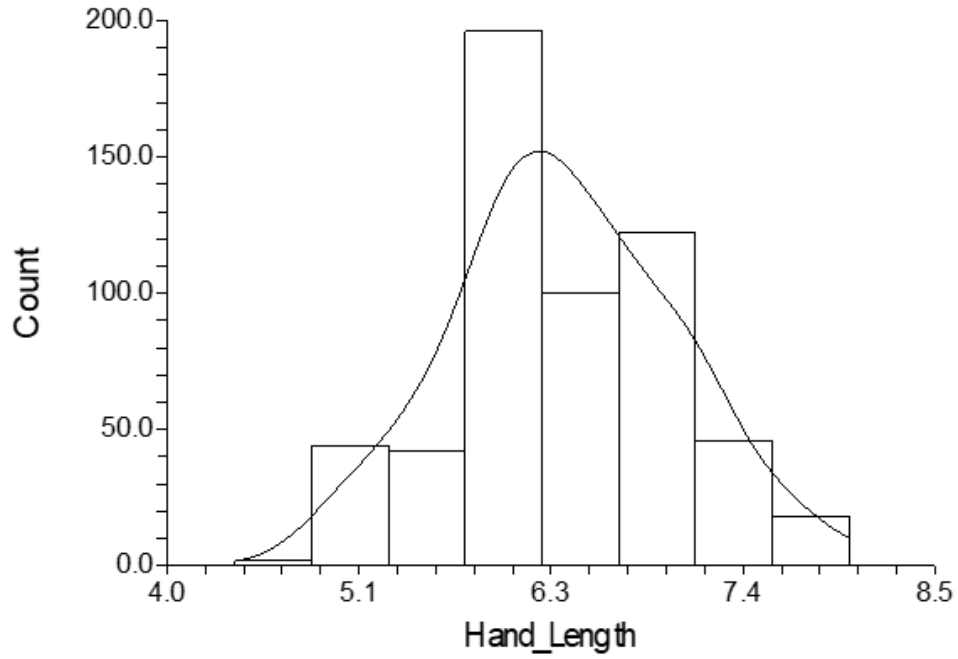
					Percentile		
Weight (kg)	**Number (n)**	**Mean HL (cm)**	**SD**	**SEM**	**5th**	**50th**	**95th**
2.0 - 2.9	16	5.44	0.45	0.11	4.7	5.3	6.24
3.0 - 3.9	56	5.8	0.54	0.07	5.08	5.8	6.8
4.0 - 4.9	35	6.39	0.44	0.07	5.2	6.3	7.05

5.0 - 5.9	67	6.57	0.45	0.06	5.8	6.55	7.37
6.0 - 6.9	68	6.65	0.47	0.06	5.94	6.6	7.4
7.0 - 7.9	21	6.84	0.6	0.13	6	6.8	8
TOTAL	263						

*SD= Standard Deviation; SEM= Standard Error of Mean; HL= Hand Length

From the findings of this study, it was observed that infants with weight between 5.0-5.9 kg were the most in number, having a frequency of 166 and a percentage of 29.3% whereas infants with weight between 8.0-8.9 kg were the least in number, having a frequency of 7 and a percentage of 1.2% as shown in Table 1 below.

Figure 1 below shows infant hand length data visual test for normality histogram superimposed on a normal distribution curve. It can be deduced from the figure that infants with hand length 5.8 cm to 6.1 cm has the highest frequency of about 195 whereas infants with hand length between 4.4 cm and 4.8 cm has the least frequency of 48.



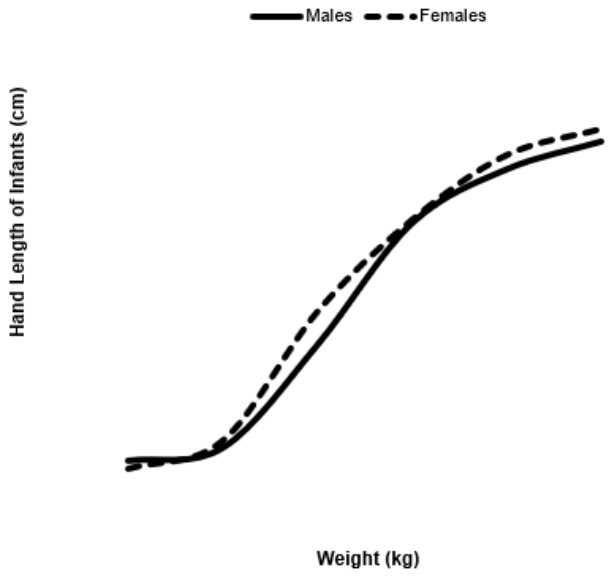
Key: X-Axis = Hand length is in centimeters (cm)
Y-Axis = Count is the frequency of infants in numbers
Unit: Y-Axis = 1cm to 25 units
X-Axis = 1cm to 5 units
Figure 1: Infant hand length data visual test for normality histogram superimposed on a normal distribution curve.

Variation in the Hand length of Male and Female Infants (Sexual Dimorphism)

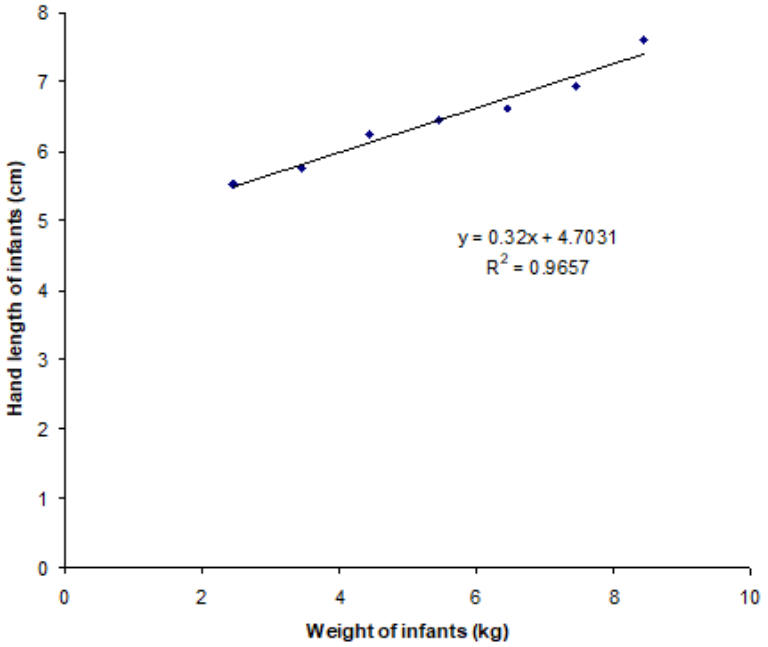
In this study, when hand length of male and female infants was compared (Figure 2), it was obvious that female subjects had higher hand length values than their male counterparts but the independent T- test for significance showed that this observed difference was not statistically significant ($p > 0.05$).

Regression Equations Predicting Hand Length and Weight in Infants

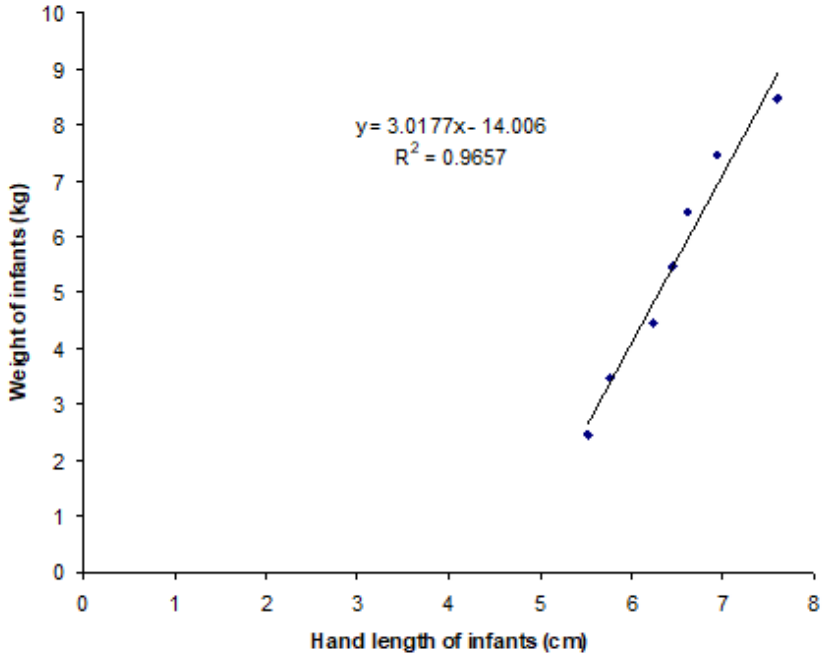
When the mean values of infants' hand length in centimeters were plotted against weight of infants in kilograms (Figure 3), a linear regression equation $y = 0.3x + 4.7031$ with a correlation of determination of $R^2 = 0.9657$ was derived where y is the hand length of infants in centimeters and x is the weight of infants in kilograms. This means that weight could predict the hand length of infants in Jos by 96.57 percent ($R^2 = 0.9657$) in 570 infants in this study. Regression modeling of weight of infants plotted against hand length demonstrated that the best-fitted regression model (Figure 4) to describe the relationship between weight and hand length was the linear regression equation $y = 3.0177x - 14.006$ with a correlation of determination of $R^2 = 0.9657$ where y is the weight in kilograms and x is hand length in centimeters. This means that hand length could predict the weight of infants in Jos by 96.57 percent ($R^2 = 0.96.57$) in 570 infants in this study.



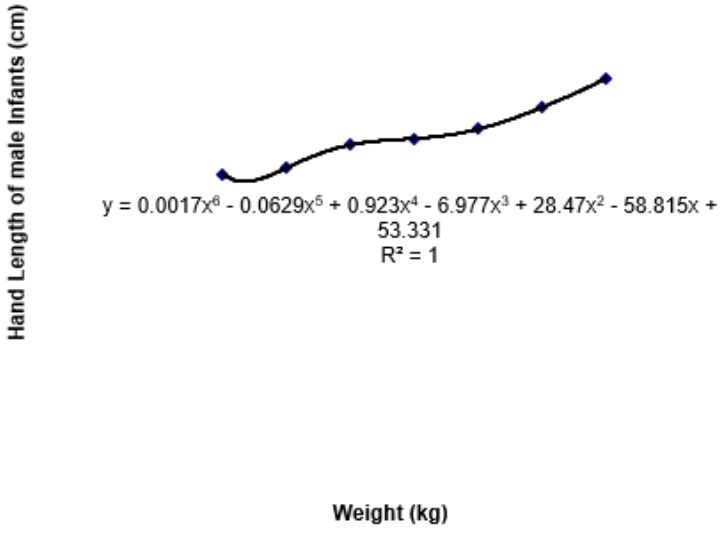
Key:
Unit: Y-Axis = 1cm to 5 units
X-Axis = 1cm to 5 units
Figure 2: Comparison between male and female mean hand length values in 570 infants in Jos plotted against weight.



Key:
Unit: Y-Axis = 1cm to 1 unit
X-Axis = 1cm to 1 unit
Figure 3: Regression equation of mean hand length values in 570 infants in Jos plotted against weight.



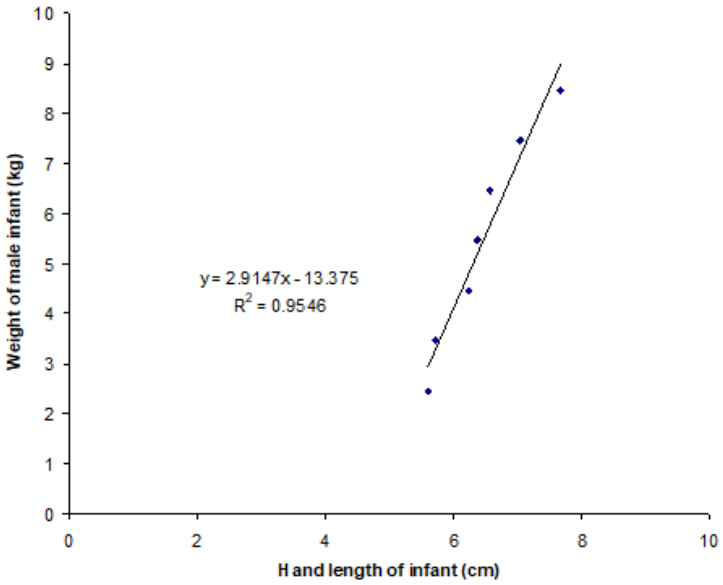
Key:
Unit: Y-Axis = 1cm to 1 unit
X-Axis = 1cm to 1 unit
Figure 4: Regression equation of mean weight values in 570 infants in Jos plotted against hand length.



Key:
Unit: Y-Axis = 1cm to 1 unit
X-Axis = 1cm to 1 unit
Figure 5: Regression equation of male mean hand length values in 307 infants in Jos plotted against weight.

When the mean hand length values of male infants were plotted against weight (Figure 5), the result was a 6th order polynomial regression equation $y = 0.001x^6 - 0.0625x^5 + 0.923x^4 - 6.977x^3 + 28.47x^2 - 58.81x + 53.33$ with a correlation of determination of $R^2=1$ where y is the hand length in centimeters and x is weight in kilograms. This means that weight could predict the hand length of male infants in Jos by 100 percent (R2 = 1) in 307 male infants in this study. Furthermore, when weight was plotted against hand length of male infants (Figure 6), the relationship was best described by the linear equation $y = 2.9147x - 13.375$ with a correlation of determination of $R^2 = 0.9546$ where y is the weight in kilograms and x is hand length in centimeters. This means that hand length could predict the weight of male infants in Jos by 95.46 percent ($R^2 = 0.9546$) in 307 male infants in this study.

Similarly, when the hand length of female infants was plotted against weight (Figure 7), it yielded a 5th order polynomial regression equation $y = 0.008x^5 + 0.234x^4 - 2.421x^3 + 11.95x^2 - 27.58x + 29.22$ with a correlation of determination of $R^2=1$ where y is the hand length in centimeters and x is weight in kilograms. This means that weight could predict the hand length of female infants in Jos by 100 percent ($R^2=1$) in 263 female infants in this study. On the other hand, when weight was plotted against hand length of female infants (Figure 8), a linear equation $y = 3.2812x - 15.661$ with a correlation of determination of $R^2 = 0.9122$ was the result, where y is the weight in kilograms and x is hand length in centimeters. This means that hand length could predict the weight of female infants in Jos by 91.22 percent ($R^2 = 0.9122$) in 263 female infants in this study.



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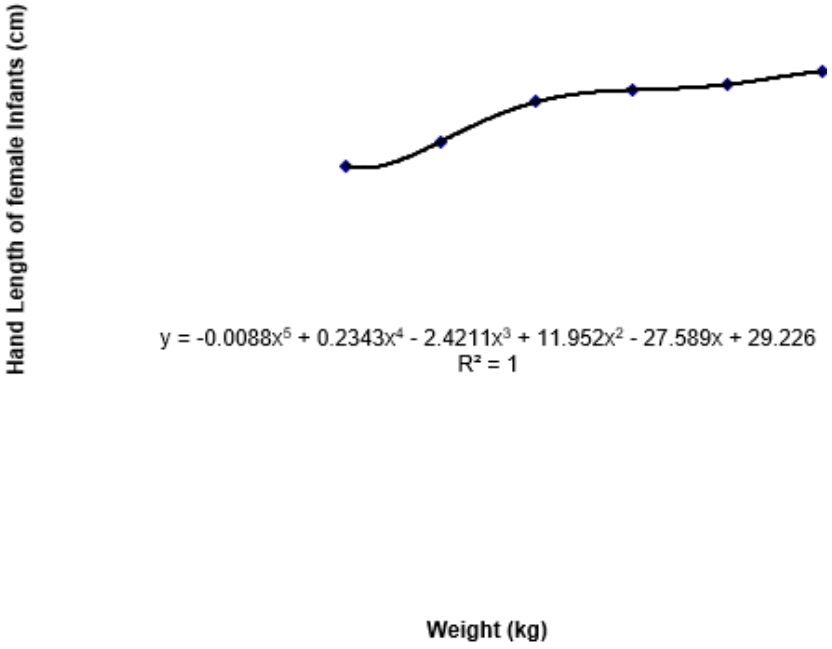
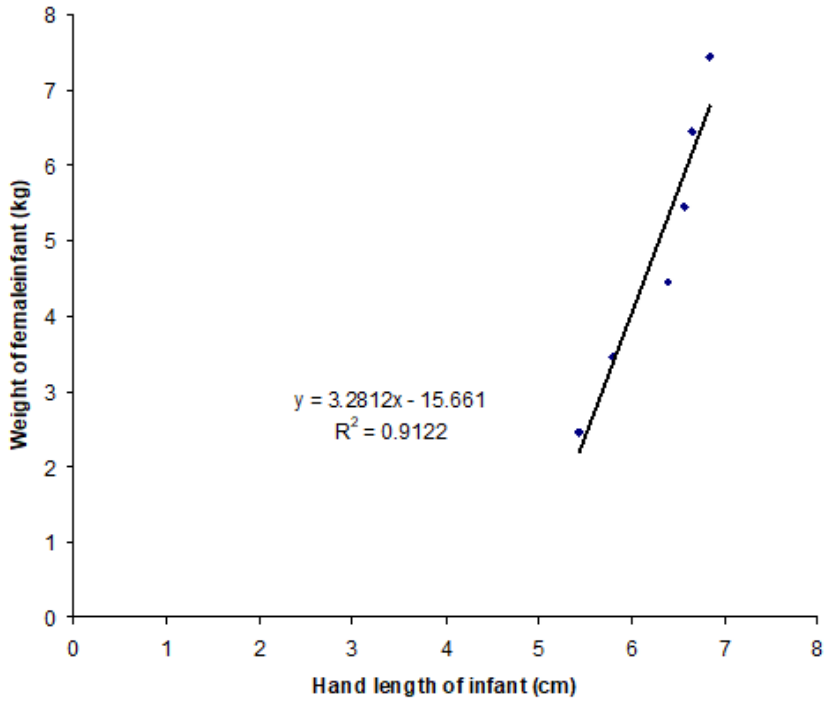
Unit: Y-Axis = 1cm to 1 unit
X-Axis = 1cm to 1 unit
Figure 6: Regression equation of male mean weight values in 307 infants in Jos plotted against hand length.



Key:
Unit: Y-Axis = 1cm to 1 unit
X-Axis = 1cm to 1 unit
Figure 7: Regression equation of female mean hand length values in 263 infants in Jos plotted against weight.



Key:
Unit: Y-Axis = 1cm to 1 unit
X-Axis = 1cm to 1 unit

Figure 8: Regression equation of female mean weight values in 263 infants in Jos plotted against hand length.

Discussion

Growth and development are fundamental aspects of human biology, representing a continuous and dynamic process from conception through adulthood. Among the numerous anthropometric parameters used to assess growth in early life, body weight and hand length have been recognized as important indicators of nutritional status, health, and physical development in infants [16]. Anthropometry, the measurement of the human body and its proportions, provides valuable insights into the health and developmental status of individuals and populations [17]. This study is of anthropometric parameters (weight and hand length) of infants in Jos, addressing the question of their means, percentiles, measure of association and how they compare with international standards. Sexual dysmorphism was assessed for and regression analyses in this study yielded formulae that are suitable for the determination of anthropometric parameters of infants in Jos, Nigeria.

In this study, all observations for each measured parameter (weight and hand length) followed normal distribution pattern, data was grouped and the arithmetic mean was calculated for each class. This was done for each parameter studied, for male infants, female infants as well as the total sample population irrespective of sex in order to give more detailed analysis and a more accurate picture of the infant population in Jos. Most studies done on the weight of infants in Jos have studied birth weight, in relation to other anthropometric parameters, maternal age, parity, social class, gestational age at delivery and foetal/infant sex [16,18]. However, there is paucity of anthropometric data available for infants as it pertains to forensic science and investigation. This has left a great gap in science which the findings of this study have filled. In this study, infant weight in kilogram was used as the independent variable used to determine other anthropometric parameters of infants in Jos. The mean weight of infants in the class of new borns was found to be at variance with those of the findings of Onyekwelu [14] who recorded higher values in a retrospective study of babies born in a private hospital in south-east Nigeria [14]. The variation from findings in this study may be due to the fact that this study was prospective and the data collected at once by the investigator as opposed to that of Onyekwelu which was retrospective and largely dependent on delivery records measured and imputed by other persons other than the investigator, prone to observer errors and may not be as reliable. Also, data used in this study was grouped unlike that of Onyekwelu, which left room for high discrepant scores thereby altering the true picture of the population. Diet and genetic variation with respect to location and tribe may also be responsible for recording higher birth weight. Poor maternal nutritional feeding practices has been found to be a predisposition to malnutrition to children in their first two years of life [15] and as such, the richer diet of mothers in south eastern Nigeria especially among those affluent enough to afford the private care as in this case, may greatly influence infant weight when compared with

north central Nigeria where this study was conducted. This could be responsible for the variance in mean weight of these infants. To further support this observation is the fact that the more recent National Nutrition and Health Survey lists Plateau state as one of the states with high infant malnutrition [16].

The length of a human hand has been studied for various purposes including growth and development monitoring, the fields of art and sports as well as in relationship studies where it is used as a measure to estimate other body parameters in forensic science for instance. Studies exist on the hand length of older children [17,18] and adults [12,13] but once again, not much published studies have been carried out on the hand parameters of the Nigerian infant in general and especially as it concerns forensics. However, in a study aimed at determining normal values for hand, palm and middle finger length in Malaysian newborns from 34 to 42 weeks of gestation [14], measurements of parameters and analysis were done based on the gestational age and not weight of the infant. In this study, term infants with mean age of 2.8 days and 8.2 days had much smaller mean hand lengths than those recorded among the Malaysian term newborns. This disparity could be owed to difference in the type of data used. It could be due to genetic or maternal nutritional variations between Nigerians and Malaysians. Another factor which could cause differences in findings is the sampling technique used to measure hand length. Although fine details of the methods and instruments used for measurement in the Malaysian study were not stated, it is an older study which more likely used out dated methods contrary to the present study where up-to-date, standard instruments with better accuracy of measurement were used.

Sex-related variations in birth outcomes, including birth weight and mortality, were initially documented by Clarke in 1786 in the Philosophical Transactions of the Royal Society of London [19]. He also observed a higher birth weight in male infants than in female infants. Other researchers have similar findings for infants, older children and adults. In this study, when the weight-for-age of male infants was compared with those of their female counterparts, the findings vary from those of other similar studies [16,17]. The male infants at birth to ten days old weigh more than the females but thereafter, the females catch up with the male and remain slightly bigger. However, this gender difference in weight-for-age is not statistically significant. Broere-Brown et al. [3] and Sinha et al. [18], in their longitudinal studies both had similar findings to this study with regards to birth weight of these infants. However, unlike findings of this study, the mean weights of male infants in both longitudinal studies remained significantly higher than those of the females up till two years of age. The disparity in findings may be due to the study designs used. While this study was cross sectional and observational with measurements of infants taken once, Broere-Brown et al. [3] and Sinha et al. [18] conducted longitudinal studies with serial measurements of the same infants taken over time. Perhaps if this study had included a longitudinal study design, the findings may have yielded more information.

There is notable paucity of data on sexual dimorphism of hand length among Nigerian infants aged between 0 to 4 months. No studies have been published on hand and foot anthropometry for Nigerian infants for forensic purposes. This discovery further underscores the need for more research into the many aspects of forensic science and forensic anthropometry in Nigeria. Relationships between anthropometric parameters in the human have been established and reported in Nigerian populations as well as other parts of the world and among adults and older children [4,5,7]. However, most of these researchers did not progress beyond correlations to deriving equations through regression analysis that can predict one anthropometric parameter from another in the event that such desired parameter cannot be obtained. For instance, in a criminal investigation where the height, length or age of an individual is required for identification but the body of the victim has been dismembered. This is also applicable when the standing height of a bed-ridden or unconscious patient is required for drug compounding and administration of that patient. Some researchers have carried out correlation and regression studies among adults [10] and foetuses [11] in Jos, Nigeria and have gone ahead to derive equations that can predict one parameter from the other. However, there are no published works on the infants in Jos, Nigeria that have produced these predictive equations. Therefore, this study has advanced over other anthropometric studies of infants in Jos by not only determining relationships between anthropometric parameters of infants in Jos, Nigeria but also producing equations that can predict these parameters.

The results of this study were reported and presented with the appropriate use of frequency distribution tables, correlation matrix and graphs (regression models). The result was reported systematically according to set objectives. The findings of this research were also discussed robustly under appropriate topics thereby revealing the ways in which this research has contributed in bridging the gap (s) identified in the practice of clinical and forensic science.

The following recommendations have been put forward upon carrying out this study:

a) Health facilities in Jos Metropolis should consider including hand length measurements alongside weight in routine infant check-ups. This could help identify early deviations from expected growth patterns, enabling timely interventions for nutritional or developmental concerns;

b) Researchers and health authorities should undertake follow-up studies tracking infants over time to establish locally relevant growth charts that incorporate both weight and hand length. Such data would improve the accuracy of growth monitoring compared to relying solely on international standards;

c) Pediatric and primary healthcare workers should be trained to assess multiple anthropometric parameters, including hand length, as indicators of infant growth and health. This would enhance early detection of growth abnormalities and support more comprehensive child health programs in the region.

Conclusion

It can be said from this study that all observations for each

measured parameter (weight and hand length) followed normal distribution pattern, data was grouped and the arithmetic mean was calculated for each class. In this study, when hand length of male and female infants was compared, it was obvious that female subjects had higher hand length values than their male counterparts but the independent T- test for significance showed that this observed difference was not statistically significant ($p > 0.05$). This study has advanced over other anthropometric studies of infants in Jos by not only determining relationships between anthropometric parameters of infants in Jos, Nigeria but also producing equations that can predict these parameters. Overall, this study has provided useful information that will aid the practice of forensic science in Nigeria, seeing that the challenges confronting investigations and investigators in the Nigerian criminal justice system are myriad.

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