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Correlation of Selected Anthropometric Characteristics of Infants: A Forensic Perspective in North Central Nigeria

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Abstract

Accurate anthropometric data on infants are critical for forensic investigations involving newborns and young children, particularly in cases related to child identification, welfare, and criminal inquiries. Despite the relevance of such data, there remains a significant gap in forensic anthropometric records for infants in Nigeria. This study aims to address this gap by examining the interrelationships among key anthropometric parameters of infants and exploring their potential forensic applications. A cross-sectional design was employed to collect anthropometric measurements from 570 infants in Jos, Plateau State, Nigeria. Data collection adhered to established ethical protocols, and statistical analysis was performed using the Number Cruncher Statistical System (NCSS/PASS 2019, version 19.0.2, Dawson Edition, USA). Results revealed strong, positive correlations among infant weight, age, mid-upper arm circumference, crown-heel length, foot length, hand length, and head circumference. These findings underscore the consistency and reliability of these parameters in reflecting infant growth patterns and physical development. The study contributes valuable baseline data for forensic science in Nigeria and demonstrates how infant anthropometry can support investigative processes involving missing children, age estimation, and

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identification in legal or humanitarian contexts. The implications of this research are significant for improving forensic capacity in pediatric and child protection cases, particularly within resource-limited settings.

Keywords: Infant Anthropometry; Forensic Science; Correlation Analysis; Child Identification; Nigeria

INTRODUCTION

Anthropologists are convinced that man has changed over time in response to changing conditions and they believe that it is the genetic material that environmental forces work upon to create evolutionary changes referred to as variation (Tseng & O'Connor, 2015; Cordeiro & Tanaka, 2020). Anthropometry, a subfield of anthropology that examines the science of measuring fundamental to the physical and biological components of humans, has become important in a variety of industries, including the provision of healthcare and forensic science (Ogunranti, 2012). In recent years, forensic anthropology has advanced dramatically, making significant contributions to the resolution of criminal cases, the identification of human remains, and the determination of individual identities.

Despite the fact that developing countries like Nigeria, has had their own share of both natural and manmade disasters including child trafficking, infanticide, baby factories and insurgency. However, these crimes have received little research attention and are seldom investigated (Alichie, 2015; Abrahams et al., 2016). One of the main factors responsible for this is a dearth of knowledge and practice of forensic science. Also notable is that while anthropometric data for adults and older people has received substantial study and use in forensic situations, there is a glaring gap in the literature on infant anthropometry. By analyzing the association between several newborn anthropometric parameters and highlighting their potential forensic consequences, this paper aims to close this gap.

MATERIALS AND METHODS

This was a descriptive cross-sectional study carried out on 570 randomly selected infants aged 0 to 120 days old receiving routine immunization at the Plateau state

epidemiological unit in Jos, North central Nigeria. Apparently healthy infants delivered at term and being exclusively breast fed were included in the study while infants that were sick, pre-term / pre-mature at birth as well as those with congenital anomalies which cause distortion of anthropometric parameters (such as hydrocephalus, club foot, scoliosis, kyphosis, Down syndrome and craniosynostosis), were excluded from the study. Infants whose parents or care givers did not give their consent were also excluded from the study.

Ethical clearance was obtained from relevant authorities and both written and verbal informed consent was obtained from the care givers of the subjects. The weight, crown-heel-length, head circumference, mid arm circumference, hand length and foot length of each subject were measured using standard instruments and procedures (Sasanow, Georgieff & Pereira, 1986; Fletcher, 1988). The age in days was obtained from the biodata section of the immunisation cards. Every subject was measured and included only once so that a pure cross-sectional set of data was constructed and for each subject. Statistical analysis was performed using Number Cruncher Statistical System (NCSS/ PASS 2019 version 19.0.2 Dawson Edition, USA). Means, standard deviations and standard errors of mean were determined and correlation analyses were carried out.

RESULTS

Data was collected from a total of 570 infants at the Epidemiological Unit of Plateau State Ministry of Health, Jos metropolis, north central, Nigeria. The mean age of the studied sample was 53.4 ± 35.8 days ranging from 1 – 117. Out of 570 infants, three hundred and seven (53.9%) were males and two hundred and sixty-three (46.1%) were females.

The relationship between the weight, age, mid-arm circumference, length, foot length, hand length and head circumference of infants aged 0-4 months was analyzed and represented in a correlation matrix (table 1). The analysis revealed that all correlations between weight and age, mid-arm circumference, length, foot length, hand length and head circumference were positive. This means that with increase in the weight of an infant between ages 0 to 4 months in Jos metropolis, there is also increase in age, mid-arm circumference, length, foot length, hand length and head circumference (table 1) .

Table 1. Correlation Matrix of Weight, Age, Mid-arm circumference, Length, Foot Length, Hand Length and Head Circumference of Infants Aged 0-4 Months in Jos Metropolis

Variable		Variable						
		Weight (Kg)	Length (cm)	HC (cm)	MAC (cm)	FL (cm)	HL (cm)	Age (days)
Weight (Kg)	*R*	1						
	p-value							
Length (cm)	*R*	0.808	1					
	p-value	<0.001						
HC (cm)	*R*	0.782	0.713	1				
	p-value	<0.001	<0.001					
MAC (cm)	*R*	0.862	0.763	0.729	1			
	p-value	<0.001	<0.001	<0.001				
FL (cm)	*R*	0.760	0.727	0.676	0.734	1		
	p-value	<0.001	<0.001	<0.001	<0.001			
HL (cm)	*R*	0.605	0.615	0.548	0.537	0.651	1	
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001		
Age (days)	*R*	0.832	0.811	0.724	0.793	0.693	0.527	1
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	

scale:

0.80-1.00=very strong

0.60-0.79= fairly strong

0.40-0.59= moderate

r= correlation coefficient

HC= Head Circumference

MAC= Mid-arm Circumference

FL= Foot Length

HL= Hand Length

All parameters correlated perfectly ($r = 1$) with themselves. That is to say that weight correlates perfectly with weight and so do the other parameters. Table 1 also reveals very strong and fairly strong correlations in all the parameters studied with correlation coefficient r ranging between 0.80-1.00 and 0.60-0.79 for very strong and fairly strong correlation respectively.

DISCUSSION

Investigators around the world have reported relationship between various anthropometric measurements relating to the human body (Shobha, PravinKumar, Pragnya & Vijayakumar, 2019; Ukoha, Okeke,Ukoha, Ekezie & Onyenankeya, 2019; Gul et al., 2020). The findings of the present study have also further confirmed that there exist relationships between anthropometric parameters of infants. This study findings agrees with those done in similar studies among an Indonesian (Nur, Azis, Tjipta & Aldy, 2001) and Sudanese (Elshibly & Schmalisch, 2008) population. On the other hand, although there were positive relationships between anthropometric parameters studied in a more recent report among Indian neonates (Soni & Kanchan, 2017), the strongest correlations observed were between chest and abdominal circumferences; parameters that were not analysed in this study. The results of this study demonstrate how crucial newborn anthropometric information is in forensic investigations. The discovered correlations give forensic specialists in Nigeria useful tools for determining the age, height, mid arm circumference, weight, head circumference, hand and foot lengths of newborns and young children. These ideas can be used in a variety of forensic situations, such as:

- Age estimation in circumstances involving infants who are either missing or unidentified.
- Identification of kids who have been kidnapped or trafficked.
- Identifying one's ancestry in situations where biological or familial identity is required.

CONCLUSION

This study examines the dearth of forensic information on infant anthropometry in Nigeria and reveals that there exists strong, positive correlations between the weight, length, head circumference, mid-arm circumference, foot length and hand length of infants aged zero to four months in Jos metropolis. These findings highlight the potential forensic uses for infant anthropometric information, such as age estimation, tall prediction, and ancestry mapping. Infant anthropometry can help forensic specialists better understand and solve cases involving infants and young children, which would ultimately improve child welfare and justice in Nigeria. To broaden the body of knowledge and enhance forensic procedures

relating to newborns in the Nigerian setting, additional research and data gathering in this field are encouraged.

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