ORIGINAL ARTICLE

DETERMINATION OF SEX FROM OCCIPITOFRONTAL CIRCUMFERENCE, BIRTH WEIGHT AND PLACENTA WEIGHT OF NEONATES IN SELECTED PRIVATE HOSPITALS IN ILORIN METROPOLIS IN NIGERIA

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ABSTRACT

The aim of the study is to determine the sex of neonates from the occipitofrontal circumference, weight of neonate, and weight of placenta in selected private hospitals in the Ilorin metropolis. The sample study comprised 244 subjects (122 males and 122 females) having no birth deformities. The occipitofrontal circumference was taken using an infant head circumference tape. The weight of birth and the weight of the placenta was measured using an analogue baby weighing scale. Pearson's Chi-square and Chi-square Automatic Interaction Detector (CHAID) decision tree analysis were used to analyze the data. $P < 0.05$ was considered significant. The result showed that birth weight, placental weight and occipitofrontal circumference did not determine the sex of neonates. There were no significant relationships between each of the neonatal parameters and the sex of neonates. An increase in the birth weight led a significant increase in the placental weight. Also, the placental weight was significantly different in terms of the mode of delivery; it being higher in neonates born via C/S.

Keywords: *Neonates, Placental weight, Birth weight, Occipitofrontal circumference*

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Citing this article
Alabi A.S., Abioye O.D., Salako A.O. Adumo G.O. Babatunde E.O., Amasiatu V.C. Aigbogun Jr. E,O, Usman I.M. DETERMINATION OF SEX FROM OCCIPITOFRONTAL CIRCUMFERENCE, BIRTH WEIGHT AND PLACENTA WEIGHT OF NEONATES IN SELECTED PRIVATE HOSPITALS IN ILORIN METROPOLIS IN NIGERIA. KIU J. Health Sci, 2023: 3(1);

Conflict of Interest: None is declared

INTRODUCTION

By inventing new sex determination procedures or fine-tuning existing methods on specific parts of the skeleton, forensic anthropologists are always attempting to improve skeletal identification methods. Birth weight is the most important indicator of the neonate's maturity and the mother's health status. A newborn infant's birth weight is impacted by a number of factors, including maternal, environmental, and genetic factors. Prenatal mortality is increased by low birth weight (less than 2.5kg) for a variety of reasons ranging from prematurity to placental insufficiency. Macrosomia, or a large birth weight (greater than 4.0kg), causes obstetric complications such as difficult delivery and following birth trauma, such as birth asyphylxia (lack of oxygen causing death or loss of consciousness). The gestation period lasts nine months, and the average weight of a term baby is around 3.2kg [1].

Birth weight discrepancies between men and women have received less attention. One possibility is that mothers carrying a boy consume more energy. Tamimi found a link between fetal testicular testosterone release (which is strongly anabolic in nature) and maternal food intake in a study of 304 pregnant women in Boston, Massachusetts. Similar findings were discovered in UK newborns with androgen deficiency, who were 300 grams lighter than control boys. A few of Jordanian research suggested that a mother's prenatal awareness of fetal sex may have altered her diet and mental health in favor of a male fetus [2]. Many variables influence embryonic and fetal growth, including placental development and function [3]. The placenta is a highly specialized prenatal organ that aids in the foetus regular growth and development. The placenta's growth and function are meticulously controlled and coordinated to ensure that the flow of nutrients and waste products between the maternal and foetal circulatory systems is as efficient as possible [4]. The fully grown placenta occupies 15-30% of the decidua and weighs around a sixth of the foetus' weight [5]. The placenta's primary function during early pregnancy is to mediate embryo implantation into the uterus and, secondarily, to produce hormones that cause maternal recognition of pregnancy. The placenta's primary job after implantation is to mediate and regulate nutrient intake from the mother to the foetus [6]. The association between placental weight and newborn size at birth has been investigated for over a century. Placental weight has been linked to pregnancy outcomes in previous research. A large placenta was linked to a poor neonatal outcome, a low Apgar score, respiratory distress syndrome, and perinatal death, while a small placenta was linked to medical issues in the mother [7]. The normal fetal head circumference at term ranges between 32-38cm and there are abnormal sizes which could be smaller or bigger than the normal. The entire situation could be the result of one or more problems, or it could be hereditary. Babies born with a

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small head circumference may have a problem due to their mother's habits or environmental factors, whereas babies born with a larger head circumference may have some head diseases [1]. The aim of the study is to determine sex of neonates from occipitofrontal circumference, weight of neonate and weight of placenta in selected private hospitals in Ilorin metropolis.

MATERIALS AND METHODS

Materials

Infant head circumference tape, Analogue baby weighing scale, Laboratory Coat, Hand gloves, Nose mask, Consent form, Recording booklet

Method of Data Collection

Samples were obtained from various hospitals visited and permission was obtained from their Chief Medical Directors to carry out the research. Measurements were taken in the hospital since it involved the use of a baby weighing scale. The neonates were laid face-up on a flat surface comfortably to take all measurements. The occipitofrontal circumference was taken in cenimeters using an infant head circumference tape. On the scale, there were meter rules which were in pounds. The meter rules were used to measure the weight of the placenta. A pointer on the meter was used to ascertain the correct weight and then the measurements were taken and recorded.

Study Sample

The study was carried out using infant head circumference tape and analogue baby weighing scale. The records were obtained in various private hospitals in Ilorin metropolis. The sample measurements used were of neonates with no congenital abnormalities.

Study Size

The sample size was determined based on the number of childbirths. In total, 244 childbirths records were obtained which included 122 males and 122 females.

Inclusion Criteria

All subjects had to be newborns within 24 hours of births. All subjects were confirmed to be healthy and free from any form of head deformity or injuries and placental abnormalities.

Ethical Approval

Ethical clearance was sort and obtained from the Department of Anatomy Ethical Review Committee of the University if Ilorin, Ilorin. The ethical approval number was 16/48KC009/08/2021

Sampling Techniques

Informed consent was obtained from the parents of study cohorts who met the inclusion criteria. The following procedures were taken followed to obtain their measurements;

- The neonates were laid face-up on a flat surface comfortably to take all measurements.
- The occipitofrontal circumference (OFC) was taken in cenimeters using an infant head circumference tape.

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- The tape is wrapped around the widest possible circumference of the head, usually one or two finger widths above the eyebrow on the forehead and then across the most prominent part of the back of the head.
- The weighing scale was used to measure the weight of the placenta (WOP) and weight of birth (WOB).

Statistical Analysis

Pearson's Chi-square and Chi-square Automatic Interaction Detector (CHAID) decision tree analysis were used to analyze the data. Numerical variables were expressed as mean ± standard deviation; $P < 0.05$ was considered significant.

RESULTS

The descriptive characteristics of the neonatal parameters for males and females were presented in table 1. Table 2 shows the association between sex and mode of delivery. For males, 75 (61.7%) were born through SVD and 47 (38.5%) were born through C/S. For females, 81 (66.4%) were born through SVD and 41 (33.6%) were born through C/S. In total, 156 representing 63.9% of the total number of childbirths through SVD and 88 representing 36.1% of the total number of childbirths through C/S.

WOB, WOP, and OFC were higher among females when compared to their male (Table 3) and C/S when compared to that from SVD (Table 4). Although the difference was not significant ($p<0.05$). WOB and OFC were higher among males, while WOP was higher among female from SVD (Table 5). WOB and OFC were significantly ($p<0.05$) higher among females when compared to the males (Table 5).

Table 6 shows the correlation between the neonatal parameters and mode of delivery in male neonates. In SVD, it was found that there was a positive correlation between the weight of birth and occipitofrontal circumference (<0.001), a positive correlation between the weight of birth and weight of placenta (0.009) and a positive correlation between the weight of placenta and occipitofrontal circumference (0.001). While in C/S, a positive correlation was found only between the weight of birth and occipitofrontal circumference (0.001). However, there's no significant correlation between the weight of birth and weight of placenta and the weight of placenta and occipitofrontal circumference. The correlation between the neonatal parameters and mode of delivery in female neonates was presented in table 7. In SVD, a positive correlation was found only between the weight of birth and occipitofrontal circumference (<0.001). However, there was no significant correlation between the weight of birth and weight of placenta and the weight of placenta and occipitofrontal circumference. In C/S, a positive correlation was found between the weight of birth and occipitofrontal circumference (<0.001), the weight of birth and weight of placenta (0.021), and the weight of placenta and

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occipitofrontal circumference (<0.001).

DISCUSSION

Determination of sex is important in establishing the identity of an individual. The sex of embryo affects the size of both the fetus and the placenta, and the ability of the placenta to respond to adverse stimuli. Differences in how male and female placentas cope with stressful conditions helps us to understand how it contributes to sexual dimorphism later in life [8].

WOB, WOP, and OFC were higher among females when compared to their male and C/S when compared to that from SVD. Although the difference was not significant. WOB and OFC were higher among males, while WOP was higher among female from SVD. WOB and OFC were significantly higher among females when compared to the males. Past study found that the mean birth weight of male neonates is comparatively greater than that of female neonates [9], which is in contrast to this present study which shows that there's no significant difference between the mean birth weight of male neonates and female neonates. In previous studies conducted, they concluded that because placental weight has a relationship with birth weight, there should be a positive correlation between infant sex and placental weight [10,11,12]. However, another study found no positive correlation between infant sex and placental weight [13], which is similar to this present study. This may be perhaps due to differences in ethnic and/or genetic factors [13]. Birth weight is dependent of head circumference; birth weight and head circumference are dependent on sex [1]. The study found that male neonates had a higher birth weight and occipitofrontal circumference compared to that of female neonates [1]. However, in this present study, it was discovered that there was no significant difference between the occipitofrontal circumference of male neonates and female neonates.

In this study, it was found that there's a positive correlation between the placental weight and the birth weight in neonates delivered through SVD, that is, an increase in the placental weight will lead to a significant increase in the birth weight of neonates, whereas no positive correlation was found between the placental weight and birth weight in neonates delivered through C/S. This is similar to a study carried out which found a positive but weak correlation between the placental weight and birth weight [7]. In another study carried out it was discovered that the placental weight increases are associated with rise in birth weight in normal pregnancy [14]. Mean placental weight was higher in neonates delivered through C/S than those delivered vaginally [7], which is similar to this present study that also shows that the mean placental weight is higher in neonates delivered through C/S than those delivered vaginally. Mean birth weight of neonates delivered through C/S was lower than those delivered vaginally [7], this

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present study found that the mean birth weight of neonates delivered through C/S was higher than those delivered vaginally. Differences in cord clamping time have been suggested to explain these differences since the umbilical cords are frequently clamped relatively late in vaginal delivery (so as to optimize blood transfer to the fetus) while in caesarean section early clamping of the cord is usually the rule. Furthermore, due to the absence of uterine contractions during caesarean section, the intervillous space in the placenta is more expansive and likely to contain more maternal blood than in vaginal deliveries where maternal blood is squeezed out of the placenta by contraction of the uterus [7].

CONCLUSION

From this present study, it was concluded that WOB and OFC were significantly higher among females when compared to the males. There was a positive correlation between the sex of the neonates and occipitofrontal circumference which was negligible notwithstanding. However, some correlations were found between the neonatal parameters.

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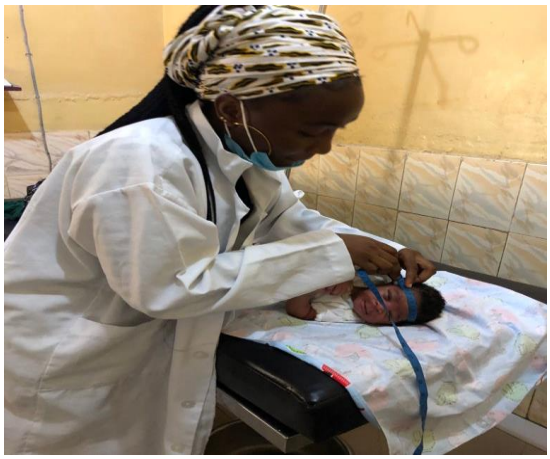

Figure 1: Measuring the head circumference

Figure 2: Measuring the weight of placenta

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Table 1: Descriptive characteristics of study variables

Variables	Description	
Sex	Male (122; 50%)	Female (122; 50%)
MOD	SVD (156; 63.9%)	C/S (88; 36.1%)
Mean WOB	3.24±0.51 (range; 1.7 - 5.1) kg	
Mean WOP	0.59±0.14 (range; 0.2 - 1.3) kg	
Mean OFC	34.79±1.44 (range; 30.0 - 39.0) cm	

MOD: Model of delivery, WOB: Birth weight, WOP: Weight of placenta, OFC: occipitofrontal circumference.

Table 2: Association between sex and model of delivery (MOD)

SEX	MOD		Chi-square		
	SVD	C/S	X^2	df	P-value
Male	75	47	0.64	1	0.424
	61.5%	38.5%			
Female	81	41			
	66.4%	33.6%			
TOTAL	**156**	**88**			
	63.9%	**36.1%**			

MOD: Model of delivery, SVD: Vaginal delivery, C/S: Caesarian section.

Table 3: Test of mean difference of the neonatal parameters of males and females

Group Statistics	Descriptive			Test of mean difference		
	Sex	N	Mean	t-value	p-value	Inference
WOB (kg)	**Male**	122	3.19±0.48	-1.452	0.148	NS
	Female	122	3.28±0.53			

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WOP (kg)	**Male**	122	0.59±0.17	-0.214	0.831	NS
	Female	122	0.60±0.12			
OFC (cm)	**Male**	122	34.72±1.36	-0.728	0.467	NS
	Female	122	34.86±1.52			

MOD: Model of delivery, WOB: Birth weight, WOP: Weight of placenta, OFC: occipitofrontal circumference.

Table 4: Test of mean difference of the neonatal parameters of males and females and mode of delivery

Group Statistics	**Descriptive**			**Test of mean difference**		
	MOD	**N**	**Mean**	**t-value**	**p-value**	**Inference**
WOB (kg)	**SVD**	156	3.23±0.48	-0.280	0.780	NS
	C/S	88	3.25±0.56			
WOP (kg)	**SVD**	156	0.58±0.14	-1.455	0.147	NS
	C/S	88	0.61±0.16			
OFC (cm)	**SVD**	156	34.67±1.44	-1.706	0.089	NS
	C/S	88	35.00±1.43			

MOD: Model of delivery, WOB: Birth weight, WOP: Weight of placenta, OFC: occipitofrontal circumference.

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Table 5: Test of mean difference of the neonatal parameters of males and females stratified by delivery type

Group Statistics		Descriptive		Test of mean difference		
	Sex	N	Mean	t-value	p-value	Inference
SVD						
WOB (kg)	Male	75	3.26±0.44	0.718	0.474	NS
	Female	81	3.20±0.51			
WOP (kg)	Male	75	0.58±0.15	-0.251	0.802	NS
	Female	81	0.59±0.14			
OFC (cm)	Male	75	34.73±1.26	0.496	0.621	NS
	Female	81	34.62±1.60			
C/S						
WOB (kg)	Male	47	3.08±0.53	-3.176	0.002	**S**
	Female	41	3.44±0.45			
WOP (kg)	Male	47	0.61±0.21	-0.157	0.876	NS
	Female	41	0.61±0.07			
OFC (cm)	Male	47	34.71±1.51	-2.085	0.038	**S**
	Female	41	35.33±1.26			

MOD: Model of delivery, WOB: Birth weight, WOP: Weight of placenta, OFC: occipitofrontal circumference, SVD: Vaginal delivery, C/S: Caesarian section.

Table 6: Correlation of male neonatal parameters stratified by mode of delivery

Variables		WOB (kg)	OFC (cm)
Male SVD (N=75)			
WOB (kg)	Pearson Correlation		**0.543**
	Sig. (2-tailed)		**<0.001**
WOP (kg)	Pearson Correlation	**0.301**	**0.392**
	Sig. (2-tailed)	**0.009**	**0.001**
Male C/S (N=47)			
WOB (kg)	Pearson Correlation		0.464
	Sig. (2-tailed)		**0.001**
WOP (kg)	Pearson Correlation	0.262	0.249
	Sig. (2-tailed)	0.076	0.091

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MOD: Model of delivery, WOB: Birth weight, WOP: Weight of placenta, OFC: occipitofrontal circumference, SVD: Vaginal delivery, C/S: Caesarian section.

Table 7: Correlation of female neonatal parameters stratified by mode of delivery

Variables		WOB (kg)	OFC (cm)
Female SVD (N=81)			
WOB (kg)	Pearson Correlation		**0.530**
	Sig. (2-tailed)		**<0.001**
WOP (kg)	Pearson Correlation	0.132	0.207
	Sig. (2-tailed)	0.239	0.063
Female C/S (N=41)			
WOB (kg)	Pearson Correlation		**0.618**
	Sig. (2-tailed)		**<0.001**
WOP (kg)	Pearson Correlation	**0.359**	**0.615**
	Sig. (2-tailed)	**0.021**	**<0.001**

MOD: Model of delivery, WOB: Birth weight, WOP: Weight of placenta, OFC: occipitofrontal circumference, SVD: Vaginal delivery, C/S: Caesarian section.

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