ORIGINAL ARTICLE

DISTRIBUTIONS OF ANTHROPOMETRIC MEASUREMENTS OF NEW BORN BABIES AMONG VARIOUS ETHNIC GROUPS IN MAIDUGURI, NIGERIA: A PROSPECTIVE STUDY.

[1]Takai IU, [2]Audu BM, [2]Bukar M, [3]Abudu OO, [2]Geidam AD

[1]Department of Obstetrics and Gynaecology, Aminu Kano Teaching Hospital,
[2]Department of Obstetrics and Gynaecology, University of Maiduguri Teaching Hospital, Maiduguri, [3]Department of Obstetrics and Gynaecology,
Lagos University Teaching Hospital, Idi Araba, Lagos state, Nigeria

Correspondence and reprint request to: **Dr Idris Usman Takai**,
Department of Obstetrics and Gynaecology, Aminu Kano Teaching Hospital, Kano.
PMB 3452, Kano State, Nigeria.
eMail:- takaiidris@yahoo.co.uk
Tel: +2348035994552

ABSTRACT

Background: Weight and other newborn anthropometric measurements at birth are considered as the most important indicators of a newborn's chances of survival, growth, long-term health and psychosocial development.

Objective: To determine the mean birth weight, birth length and head circumferences of new born babies among the various ethnic groups in Maiduguri.

Method: A descriptive cohort study involving 854 pregnant women with their live singleton babies was carried out in the Departments of Obstetrics and Gynaecology of the University of Maiduguri Teaching Hospital (UMTH) and the State Specialist Hospital (SSH), Maiduguri, over a 6-months period, between 2nd February 2009 and 29th July 2009. Mothers' socio-demographic and obstetrics performances, baby's birth weights, birth lengths and head circumferences were obtained and recorded and data analyzed using SPSS version 16. Statistical significance was computed by t-test and Chi-square. A P value <0.05 was considered significant.

Results: A total of 854 mothers together with their 854 live singleton babies were studied. There were 460 (53.9%) male and 394 (46.1%) female babies. Among these babies, 144 were low birth weight, 660 had normal birth weight while high birth weight was seen in 50 babies. The mean birth weight of all babies delivered in the study population was 3030.47±631g, with mean birth length of 47.8±3.1cm, and the mean head circumference was 34.2±2. All the parameters studied were significantly lower in those that were of LBW compared to babies that were not of LBW, and the mean difference was statistically significant (P value 0.000).

Conclusion: All the anthropometric measurements were highest in Igbo newborns while Hausa/Fulani had the lowest among the various ethnic group studied in Maiduguri. Improving the socio-economic status especially of the disadvantage ethnic group and further community based research is recommended.

Keywords: Anthropometric measurements, birth weight, birth length, head circumference.

INTRODUCTION

Many infants in developing countries are not weighed at birth.[1]In sub-Saharan Africa, for example, it is estimated that nearly 75 per cent of newborns are not weighed. In other regions, the percentages ranges from 20 per cent to 82 per

cent.[1]The highest proportions of infants who are weighed are in Latin America and the Caribbean (only 17% not weighed) and in Central and Eastern Europe and the Commonwealth of Independent States (21% not weighed). [2] Many births in developing countries take place at home without the assistance of skilled health personnel, and these births are therefore not weighed nor have their weights recorded. In Nigeria, even today, majority of the deliveries are conducted in the community.[3] Logistic difficulties in recording birth weight (BWs) at home therefore preclude accurate national estimates of the mean birth and other anthropometric measurements. However, a large volume of data on birth weight is available from individual studies, most of which are hospital based.[3]

Gestational age at delivery is the most important determinant of BW.[4] The normal GA for the spontaneous delivery of human pregnancies is well accepted as 280 days (40weeks) from the first day of the last menstrual period (266 days after ovulation). Because fewer than 3% of births[5] occur at precisely 40 weeks' gestation and because the standard deviation for term pregnancies is 1 week, the normal range of term BW is typically referenced to the mean BW for pregnancies delivered at 38-42 weeks' gestation (i.e. mean term GA ±2SD). During this 4-week interval, the typical foetus gains approximately 12.7±1.4g/day, with a difference of ±0.3g/day depending on the sex of the foetus (male fetuses gain weight more rapidly and are bigger than female fetuses when matched for GA and for all other known factors that influenced foetal weight). The average BW during this period varies substantially and depends on many factors including maternal ethnicity, size, height, pregnancy weight gain, glucose tolerance, haematocrit, ambient altitude and physical activities.[6] Parity is directly and independently associated with foetal size. The greater the maternal parity, the larger the foetus is likely to be. Maternal parity is closely linked to maternal age, but once maternal parity is specified, maternal age is not an independent predictor of fetal weight.[7, 8] Pathological factors such as maternal and/or foetal infections, hypertension, pre-eclampsia, diabetes mellitus and uterine malformation are also important determinants of BWs.[5-8]

Because BW data from population studies are often non-normally distributed, the mean BW at each GA is reported. In Canada, for live births recorded in 1986-1988, the median term BW at 38-42weeks' gestation for 557,359 male singleton births was 3290-3800g. In the US, for 38,818 term singleton births at 38-42 completed weeks' gestation, the median BW was 3020-3572g. In Sweden, for 32,087 term male births in 1956-1957, the median BW was 3300-3790g. In Great Britain, a similar study of 41,718 newborns showed that the average was 3201-3753g.[5, 9] In Iran, a study of 3734 singleton newborns, the mean birth weight was 3200±470g[7]. The mean birth weight was reported to be 2610±248g, in a study of 282 singleton babies in India.[8]

The mean BWs of Nigerian babies differ within the country and in general, are lower than those of the Caucasians counterparts. Wide regional variations within the country were apparent from the literature. Genetic, nutritional and environmental factors such as malarial infection of the placenta might be contributory to the reduced BWs in Nigerian babies.[10-12] Mean BWs in Nigeria are highest in the South (Lagos: 3380g) and Middle-Belt (Jos: males; 3203g and females; 3186g). [13] In AKTH Kano,[14] North-Western Nigeria, a study involving 200 babies revealed the mean actual birth weight of 3270±530g. A study in Zaria among the 890 singleton births, the mean BWs were 3042g and in Malumfashi,[13]among the 1199 singleton births the mean BWs were 2950g. An earlier study over 2-decades ago in the UMTH Maiduguri,[15] North-Eastern Nigeria, a study of 1530 full-term singleton babies showed a mean birth weight of 3200g±590g, with males having a higher mean BWs of 3340g±600g as compared to

3250 ±460g. In Ibadan,[16] South-Western Nigeria, a study of 492 singleton babies showed that mean BW was 3167g ±451g (males; 3205g ± 469g and significantly higher than females; 2991g±468g). In Ilorin[17], Nigeria, BW of 3053 babies were studied, the mean BWs were 2998g ±133g for males and 2932g ±154g for females. In Jos,[18] North-Central Nigeria, the BW of 208 singleton neonates were analyzed; results showed that the mean BW was 3080±131g. In Benin City, the mean birth weight of 5,324 live singleton babies, showed a higher mean birth weight of 3276±484g in males than in females 3112±562g; the mean birth weight of both sexes was 3243±582g.[19]

Most of the studies on BWs of Nigerian newborn babies have suffered one major drawback. They were retrospective in nature; and consequently, vital information on the relationship between BW and GA and other anthropometric measurements of the new born were ignored. Attempts to bridge this gap was provided by some studies[5, 14, 16, 19, 20], and this is also what the present study wants achieved. Recent studies have found some significant differences in birth weight among different social and economic groups; the more disadvantaged groups experiencing lower mean birth weights.[17, 20] According to the 2006 population census [21] Maiduguri, the capital of Borno state has a population of 521,492, with about 138,625 women of reproductive age. Previous study conducted by Patwari et al,[15] in UMTH over 2 decades ago, found a mean birth weight of 3200g±590g, with males having higher mean BWs of 3340g±600g as compared to 3250 ±460g. To our knowledge, this was the last retrospective study carried out in this environment which is related to the present study. This is against the backdrop of the hard and declining socio- economic realities of recent times, emergence of new diseases like HIV, compared to the relatively prosperous economy of the 1980s when the study was carried out.[22] In this study, which was conducted in a teaching hospital, only privileged neonates in the middle and upper socio-economic class were included. Therefore the population studied was not representative of the population of Maiduguri. The true mean birth weight and other anthropometric values for Maiduguri newborn babies will therefore be known only if a representative sample is studied. This is what the present study aims to achieve by including the State Specialist Hospital Maiduguri, which cater for the majority of the poor. The aim of this study is therefore to establish the mean birth weight, birth length and head circumferences of the new born babies among the various ethnic groups in Maiduguri.

METHOD

This was a prospective hospital based cohort descriptive study which was conducted in two health facilities, the University of Maiduguri Teaching Hospital (UMTH) and the State Specialist Hospital (SSH) in Maiduguri, Borno state, over a-6 months period; between February 2nd, and July 29th, 2009. The study population included consenting pregnant women from 14 completed weeks of gestation, who booked and delivered in UMTH and SSH, and their live singleton newborns. Those who consented after counselling were enrolled at the time of their antenatal booking clinic and were followed up till delivery. We excluded all pregnant women who declined consent, multiple gestations and gross congenital malformation at birth or diagnosed antenatally and still born babies. A minimum sample size was calculated using the Taylors' formula[23] for proportion and was found to be 683 patients. An attrition rate of 20% was allowed, which brought the patients to 854.These patients who consented and met the inclusion criteria were then recruited for the study. All aspects of the study were reviewed, authorized and approved by the research and ethical committee of the hospitals (UMTH and SSH Maiduguri). Informed verbal consent was also obtained from the patients prior to the study.

Convenient sampling technique was employed in recruitment of the patients during the weekly booking clinics until the required sample size

was obtained. Unbooked patients with known LMP were later included in the study when the expected date of delivery of all the recruited patients passed by two weeks (considered defaulters) to complete the sample size. Mother's age, educational level, occupation, ethnic group, marital status, address, parity and duration of pregnancy (in weeks) were obtained. Patients were fully examined. A predesigned proforma and the booking cards were used to record the information obtained and labelled with the patient's identification number and followed up until patient presented in labour. To complete the booking process, investigation forms were given to each recruited patient for packed cell volume, blood group and Rhesus typing, haemoglobin genotype, Venereal disease research laboratory test (VDRL), urinalysis for albumin and glucose. Ultrasound scanning was offered to the study population. Voluntary counselling and testing for HIV with opt out option was also offered to all women. Haematinics were given routinely to all women while tetanus toxoid immunization was given as indicated. Intermittent preventive treatment with suphadoxine-pyramethamine combination was given at booking (after 16weeks or after quickening) and repeated 4 weeks from the 1st dose but before 36 weeks of pregnancy. HIV positive mothers had 3 doses of the IPT. The women continued their antenatal care and were seen according to their appointments.

At the time of delivery, when patients presented in labour, a packed cell volume and urinalysis was done for all patients in labour. Gestational age (in weeks) was assessed by calculating the number of completed weeks of gestation since the last menstrual period (LMP). Early (<20weeks) ultrasonic measurements were also considered in the assessment of GA. Other methods, such as assessment of fundal height or quickening, were used to confirm LMP-derived GA in some patients. Patients were fully examined, labour allowed to progress, monitored in accordance to standard protocol and delivery conducted. The babies were fully examined, sex identified, and within the first one hour of delivery, BWs of the babies were measured without clothes by trained midwives and doctors, using a spring type weighing scale (Baby Weigh TM Scale, manufactured by MedelaR Inc. model 040.7012 which has an accuracy rate of 0.034–0.042%). A birth weight of <2500g = LBW; 2500-3999g = NBW and ≥ 4000g = HBW. Babies were then broadly grouped into either LBW or Not LBW (NBW+HBW). The baby's birth length (Crown-heel length) was measured using flexible, non-stretchable tailoring (measuring) tape, with the baby supine, knees fully extended and soles of the feet held firmly against the foot of the board and head touching fixed board. The head circumference (in cm) was measured using flexible, non-stretchable tailoring (measuring) tape, which was passed over the supra-orbital ridges in front and the occiput behind, which gave the maximum diameter. To minimize errors in measurements, scale was always checked and zeroed before weighing. Record review format was used for reviewing antenatal care cards for the earlier recorded information. All information were then entered in to the patient's proforma already prepared at booking. The volunteer clinicians for this study assisted in collecting data as per their usual shifts. Each questionnaire was completed within 24 hours of birth. As far as possible the principal investigator checked the quality and validity of data.

After collection, data were checked, verified, coded and transferred into an IBM compatible PC and analyzed using SPSS statistical package version 16 (SPSS.16 Inc, Chicago, USA). Simple descriptive univariate analysis was performed to determine and inspect the frequency of the various variables. Quantitative variables were described using measures of central tendencies (means, median) and measures of dispersion (range, standard deviation) were appropriate and t-test was used to compare and assess differences in the means of continuous

variables. The Chi squared statistics with its corresponding probability levels were computed for significance. A P-value of <0.05 was considered significant. Results were presented by simple statistical tables.

RESULTS

A total of 854 mothers (720 booked and 134 unbooked), together with their 854 live singleton babies were studied. There were 460 (53.9%) male and 394 (46.1%) female babies. Among these babies, 144 were low birth weight (LBW), 660 had normal birth weight (NBW) while high birth weight (HBW) was seen in 50 babies. The mean gestational age at delivery was 38.5±1.7weeks. The term delivery rate was 75.1% (641), while preterm delivery in the entire study population was 24.9% (213). Table 1 shows the socio-demographic and reproductive characteristics of the study population. Most of the women (69.8%) were aged 20-34years mean age was 26.6±6.0 years. Almost all (99.5%) the study population were married, 67.7% were multiparas with a mean parity of 2.2 ±2.3 (range 0 – 14); 51.9% were housewives and 33.6% had secondary education. About 72.2% were Muslims and the Kanuri/Shuwa constituted the highest (41.6%) ethnic group.

Distribution of number of LBW and not LBW babies delivered among the studied ethnic groups is presented in table 2. The Kanuri/Shuwa mothers accounted for 355 (41.6%) of the deliveries, the Igbo 137 (16.0%), Hausa/Fulani 97(11.4%), Babur-Bura 82(9.6%), Yoruba 55(6.4%) while other tribes accounted for 128(15.0%) of the deliveries. Among the 144 LBW babies, the highest incidence of LBW was found among Kanuri/Shuwa (20%), closely followed by the Hausa/Fulani (19.6%) while the lowest incidence occurred in the Igbo ethnic group (8.8%). These associations were however not statistically significant (^{2} = 10.13; df; =5; P-value 0.07).

Table 3 shows comparison of mean birth weight, birth length and head circumference of babies at birth analyzed according to whether or not they are of LBW. The mean birth weight of all babies delivered in the study population was 3030.47±631g (range 1000-5000); males 3042.34±641g and females 3016.62±621g. The LBW babies had a mean birth weight of 1983±356g, while those that were not of LBW had a mean birth weight of 3242±432g.The mean birth length for all babies was 47.8±3.1cm (range 37-58); males 47.8 ±3.1cm and females 47.78±3.11.The LBW babies had a mean birth length of 42.9±2.9cm, while those that were not of LBW had a mean birth length of 48.8±2.0cm. The mean head circumference for all babies was 34.2±2.3cm (range 25-40); males 34.3±2.3cm and females 34.1±2.4cm. Babies with LBW had a mean head circumference of 30.4±2.2cm and those who were not LBW had mean head circumference of 34.9±1.4cm. All the parameters studied were significantly lower in those that were of LBW compared to babies that were not of LBW, and the mean difference was statistically significant (P value 0.000). Males had a higher mean birth weight than females (mean difference = 26g). However, no statistically significant difference was observed when baby's parameters were compared by sex according to whether or not they were of LBW.

Distribution of mean birth weight, birth length and head circumference by sex among various ethnic groups in Maiduguri is shown in table 4. Igbo babies had the highest mean birth weight (3305±610g) while Hausa/Fulani had the lowest mean birth weight (2921±634g). Igbo male babies had the highest mean birth weight of 3364.17±562g while the Hausa/Fulani females had the lowest mean birth weight of 2783.75±618g. There was no statistically significant difference when compared between other ethnic groups among the population studied. The mean birth length of Igbo babies (48.9 ±2.9cm) was significantly higher (P-value 0.002) when compared with other ethnic groups. Igbo newborns had the highest (35.0±2.0cm) mean head circumference, and the difference was statistically significant (P-value 0.043).

Table 1: Socio-demographic and Reproductive Characteristics of the Participants

Variables		Number	Percentage
Age (years)	<20	155	18.1
	20-34	596	69.8
	≥ 35	103	12.1
	Total	**854**	**100**
Marital status	Single	2	0.25
	Married	850	99.5
	Widowed	2	0.25
	Total	**854**	**100**
Education	Non literate	206	24.1
	Primary	93	10.9
	Secondary	287	33.6
	Tertiary	268	31.4
	Total	**854**	**100**
Occupation	Housewife	443	51.9
	Civil servant	163	19.1
	Business	156	18.3
	Petty trading	62	7.3
	Professional	26	3.0
	Farmers	4	0.4
	Total	**854**	**100**
Mother's ethnic group			
Kanuri/shuwa		355	41.6
Igbo		137	16.0
Hausa/Fulani		97	11.4
Babur-Bura		82	9.6
Yoruba		55	6.4
*Others		128	15.0
Total		**854**	**100**
Parity			
0		276	32.3
1-4		441	51.6
≥5		137	16.1
Total		**854**	**100**
Religion			
Islam		617	72.2
Christianity		237	27.8
Total		**854**	**100**

Key: *(others) = Gwoza, Marghi, Higgi, Karekare, Igbira, Chibok, Chadian and Cameroonian.

Table 2: Distribution of number of LBW and not LBW babies delivered by ethnic group

Ethnic group	LBW babies	Not LBW	Total
Kanuri/Shuwa	71	284	355
Igbo	12	125	137
Hausa/Fulani	19	78	97
Babur-Bura	11	71	82
Yoruba	9	46	55
*Others	22	106	128
Total	**144**	**710**	**854**

^{2} = 10.13; df; =5; P-value 0.07

Key: * (others) = Gwoza, Marghi, Higgi, Karekare, Igbira, Chibok, Chadian and Cameroonian.

Table 3: Comparison of mean birth weight, birth length and head circumference at birth between LBW and Not LBW

Parameters	LBW		t-test	p-value	Total
	Yes	No			
Mean birth weight ±S(g)					
All infants	1983±356	3242±432	32.77	0.000	3030±631
M	1979±372	3246±452	22.64	0.000	3042±641
F	1987±341	3228±407	23.93	0.000	3016±621
Mean birth length ±S(cm)					
All infants	42.92±2.99	48.77±2.03	30.45	0.000	47.79±3.12
M	42.66±2.80	48.78±2.05	22.02	0.000	47.79±3.13
F	43.20±3.17	48.77±2.07	18.59	0.000	47.78±3.11
Mean head circumference ±S(cm)					
All infants	30.39±2.20	34.95±1.44	28.09	0.000	34.18±2.33
M	30.50±2.33	35.00±2.33	21.79	0.000	34.28±2.32
F	30.27±2.07	34.90±1.42	22.50	0.000	34.07±2.35

Key: LBW = Low Birth Weight, S = standard deviation

Table 4: Distribution of mean birth weight, birth length and head circumference by infant's sex among various ethnic groups in Maiduguri.

Ethnic group	Mean weight ±s(g)	Mean length ±s(cm)	Mean circumference ±s(cm)
Kanuri/Shuwa	2987±633	47.60±3.15	34.03±2.37
M	3035±613	47.65±3.08	34.18±2.37
F	2927±654	47.54±3.23	33.84±2.37
t-test	1.595	0.327	1.324
p-value	0.312	0.695	0.793
Igbo	3305±610	48.93±2.91	35.03±2.00
M	3364±562	49.25±2.03	35.18±1.57
F	3259±644	48.68±3.43	34.91±2.27
t-test	0.994	1.146	0.795
p-value	0.252	0.002	0.043
Babur-Bura	3037±510	47.72±2.74	34.30±2.14
M	2929±565	47.51±3.14	34.00±2.40
F	3146±428	47.93±2.29	34.61±1.82
t-test	1.958	0.682	1.291
p-value	0.128	0.099	0.34
Hausa/Fulani	2921±634	47.51±3.14	33.93±2.51
M	3018±632	47.72±3.27	34.32±2.22
F	2783±618	47.20±2.95	33.38±2.80
t-test	1.815	0.798	1.837
p-value	0.588	0.421	0.156

Yoruba	2995±502	47.36±2.62	33.89±2.02
M	3060±530	47.59±2.81	34.38±2.02
F	2904±455	47.04±2.36	33.22±1.85
t-test	1.143	0.763	2.162
p-value	0.596	0.683	0.925
*Others	2947±694	47.52±3.43	33.95±2.49
M	2868±777	47.28±3.74	33.89±2.68
F	3049±562	47.82±3.00	34.04±2.24
t-test	1.469	0.887	0.329
p-value	0.079	0.064	0.320

* = Gwoza, Marghi, Higgi, Karekare, Igbira, Chibok, Chadian and Cameroonian.

DISCUSSION

In this study, the mean birth weight, birth length and head circumference of the new-born babies among the various ethnic groups in Maiduguri has been described. In most countries, well-to-do families and communities have higher mean birth weight and other anthropometric indices and therefore lower incidence of LBW babies than do the poor segment of the population. This has been reported in many studies in developing countries.[4, 8, 13, 15, 17, 24] In our study, the delivery of LBW was highest among the Kanuri/ Shuwa and the Hausa/Fulani ethnic groups of Northern Nigeria. This perhaps may be a reflection of the predominance of the groups in the study environment and as much as 51.9% the population in this series were house wives and probably not gainfully employed. Similarly studies have shown that this region has the worst socio-economic indices when compared with other regions in the country.[15, 22, 25]

The Igbo ethnic group who are from the Southern part of the country with a relatively better socio-economic situation when compared to the Northern part of the country,[22, 25] has the lowest number of LBW babies delivered. Studies have shown that mean BW in Nigeria are highest in the Southern part of the country (Lagos: 3380g), [13, 17, 19] with a relatively better socio-economic status compared to the Northern part of the country,[22] with a relatively poor socio-economic status. The present study showed that the mean birth weight for the total deliveries was 3030.47±631g (range 1000-5000); males 3042.34±641g and females 3016.62±621g. However, the mean birth weight for the total deliveries in this study has shown a down ward trend in the same locality from 3200±590g in 1988 to 3030±631g in 2009; giving a difference of 170g. The decrease may not be because of decline in socio-economic status of average Nigerian in recent times alone, but also due to inclusion of the SSH which cater for the majority of poor and also the inclusion of complicated pregnancies and deliveries and preterm neonates in our study. It may also be due to the fact that only higher income classes

with full term singleton pregnancies were included in the previous study. Our mean birth weight was however comparable with what was reported for some African Countries,[17] and within Nigeria,[16, 17, 18] but lower than other figures reported,[13, 14, 19] in Nigeria. It is however higher than the mean birth weight reported in some studies from India,[8, 26, 27] and Malumfashi,[13] Nigeria. Males had a higher mean birth weight than females in this study, as previously reported in the same locality,[15] and other series across the country.[16, 17, 19, 28] Igbo babies had higher mean birth weight while Hausa/Fulani had the lowest mean birth weight. This is in keeping with a report from the same environment,[15] but with a decreasing trend of 145g (Igbo); and 264g (Hausa/Fulani). Igbo male babies had a higher mean birth weight of 3364.17±562g while the Hausa/Fulani female babies had the lowest mean birth weight of 2783.75±618g. Similarly, the mean birth length and head circumference of the Igbo babies were higher than the entire various ethnic group studied. Thus, Igbo babies were comparatively larger than the other ethnic groups and this could be due to several factors including socio-economic status, nutritional status, maternal size and height, and educational status.[15, 22] The mean birth weight and other anthropometric indices of Hausa/Fulani babies were the lowest, and this may be explained by the fact that the Hausa/Fulani mothers come from a comparatively lower socio-economic status.[15, 22]

It goes to show that all the distribution of the anthropometric measurements of Igbo babies in this study is higher compared to the other ethnic group in Maiduguri and the Hausa/Fulani babies have the lowest indices. In a study from Malumfashi,[13] North-Western Nigeria, 69% of multi-ethnic population in that series were Hausas of low socio-economic status and 11.7% were Yorubas and of higher socio-economic class. The mean BW for the Hausa newborn in that study was 2950g, while the Yoruba newborn baby weighed on average, 3100g, which favourably compares with our finding of 2995g in Yoruba ethnic group.

There are several factors interacting to determine the BW of a newborn, so it was not possible to single out any particular factor affecting BW. Poor precision (nearest 50g) of spring type of weighing scale used in our study is another limitation, though daily checking and zeroing the weighing scale before new measurements may eliminate some errors, there could have been some intra-observer error in measurements. Since this study was carried out on a sample of newborn babies in a hospital setting, generalization of the findings to the entire community may be limited. A further and more detailed community-based research in this regards is recommended and may overcome the limitations.

In conclusion, the findings of our study indicated that the mean birth weight of newborns in Maiduguri was 3030±631g, but with a down ward trend (170g). Mean birth weight was higher in males than in females. Igbo newborns had the highest mean birth weight and other anthropometric indices, while the Hausa/Fulani had the lowest mean birth weight and other anthropometric measurements among the various ethnic groups studied in Maiduguri but with a decreasing trend of 145g (Igbo); and 264g (Hausa/Fulani). It could therefore be concluded that, ethnicity and socio-economic status influences the BW of a newborn as well as other newborn anthropometric indices. Improving the socio-economic status especially of the disadvantaged ethnic group is therefore essential.

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