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Original Article

Prevalence and outcome of fetal macrosomia at the University of Maiduguri Teaching Hospital: A case - control study

Aisha B. kyari,[1] Mairo U. Mandara,[2] Dauda A. Katagum,[3] Babagana Bako,[3] Bilkisu Isa.[2]

[1]Department of Obstetrics and Gynaecology, University of Maiduguri Teaching Hospital, Maiduguri, Borno State, Nigeria. [2]Department of Obstetrics and Gynaecology, College of Medical Sciences, University of Maiduguri, Maiduguri, Borno State, Nigeria. [3]Department of Obstetrics and Gynaecology, College of Medical Sciences, Federal University of Health Sciences, Azare, Bauchi State, Nigeria.

Correspondence to: Dr Aisha B. Kyari, Department of Obstetrics and Gynaecology, University of Maiduguri Teaching Hospital, Maiduguri, Borno State, Nigeria **Email:** ayeshakyari@gmail.com **Phone:** +2348032838148

Abstract

Background: The birth of macrosomic babies (those with a birth weight of ≥4000 grams) is always a cause for concern for both patients and obstetricians due to the associated increase in perinatal morbidity and mortality. **Objectives:** To determine the prevalence and risk factors of fetal macrosomia and compare the outcomes of macrosomic babies' and normal birth weight babies' deliveries. **Methodology:** A case-control study design was employed to compare the outcomes of deliveries from macrosomic babies and those with normal birth weight from January 1, 2019, to December 31, 2020, at the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria. The labour, antenatal, and postnatal wards registers were used to obtain the hospital numbers of the patients, which were then used to retrieve their folders from the medical records department. Information was extracted from the folders using a proforma design for the study. For each macrosomic baby delivery, the next normal-weight baby delivery was taken as a control. Data obtained was analyzed using SPSS version 25, and the results were presented as simple percentages in a frequency table. Chi-square and student t-test were used for statistical analysis as appropriate. A p-value of < 0.05 was considered statistically significant. **Results:** There were 216 deliveries of macrosomic babies out of 6556 deliveries during the study period, giving a prevalence of 3.3%. The mean birth weight of the babies was 4.33 kg. Compared to mothers who deliver normal-weight babies, mothers of macrosomic babies were significantly older than 35 years ($P < 0.001$) and grandmultiparous ($P < 0.001$). There was a higher rate of cephalopelvic disproportion ($P<0.001$) and increased risk of Caesarean delivery ($P=0.006$) in the mothers of macrosomic babies compared to mothers who gave birth to normal-weight babies. The majority of the macrosomic babies were males ($P<0.001$) and were more likely to have more birth trauma, perinatal asphyxia, and admission to the special care baby unit with P values of 0.010, 0.001, and <0.001, respectively. **Conclusion:** The prevalence of fetal macrosomia was 3.3%, with a predilection for male fetuses. Fetal macrosomia was associated with advanced maternal age and grandmultiparity. Deliveries of macrosomic babies should be conducted in a tertiary centre and by an experienced obstetric team, given the increased risk of operative delivery, birth trauma, shoulder dystocia, and PPH.

Keywords: *Complications, Delivery, Fetal, Macrosomia, Neonatal, Risk factors, Maiduguri*

Introduction

A newborn with excessive birth weight is referred to as macrosomic, which is commonly defined as a birth weight of 4000g (4kg) or more, regardless of gestational age, or as a birth weight that exceeds the 90th percentile for gestational age after adjusting for neonatal sex and ethnicity. [1-3] It occurs in 1-10% of all deliveries.[1] Hispanic women have a higher risk of fetal The prevalence of fetal macrosomia has risen globally, macrosomia than Caucasians, African Americans, and Asian women.[4-10] In Nigeria, fetal macrosomia is higher in the southern than the northern part of the country.[7,11]

Pregnancies complicated by fetal macrosomia are classified as high risk because of the associated increased maternal and fetal morbidity and mortality. especially in developed countries where it has

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increased by 15-20% over the past decade due to higher rates of maternal obesity and type II diabetes. In Africa, Uganda has a prevalence of 8.4%, Algeria has 14.9%, and Nigeria's rates vary from 6.9% in Lagos to 2.1% in Sokoto. Rising maternal obesity and sedentary lifestyles may contribute to increasing prevalence even in developing regions.

There are many factors linked to fetal macrosomia, including increased pre-pregnancy weight, excessive weight gain during pregnancy, poorly managed maternal diabetes, obesity, carrying male fetuses, a history of delivering macrosomic infants, prolonged pregnancies, and the parents' height and weight. Additionally, racial, genetic, and ethnic factors also play a role. [4, 6, 8.] These risk factors can be utilised to identify patients at risk of having macrosomic babies so that their antenatal care and delivery can be adjusted to mitigate the morbidities associated with delivering macrosomic babies. [2, 7, 9]

Antenatal and peripartum fetal weight estimation, along with assessing maternal risks, can detect many of the women at risk of delivering macrosomic babies. [1, 2] An ultrasound scan has a margin of error of 10% to 15%, which translates to an error of 300 to 500 grams. It can be employed in the ANC ward to estimate fetal weight to assist in determining the possible route of delivery and also in the labour ward to determine fetal weight and alert the accoucheurs to the impending delivery of a macrosomic baby. This ensures that the best hands are available at the time of delivery to reduce the morbidity and mortality associated with it. Accurate identification and detection of women at risk of delivering macrosomic babies is essential, as their deliveries may be associated with complications such as CPD, shoulder dystocia, birth trauma, fetal distress/asphyxia, a higher rate of SCBU admissions, and operative deliveries. Other maternal complications include genital trauma, obstetric anal sphincter injury (OASIS), postpartum haemorrhage (PPH), and uterine rupture. The severity of these complications correlates with the weight of the fetus. These morbidities could be mitigated when an experienced accoucheur conducts delivery, or if vaginal delivery is bypassed in favor of caesarean section. Elective induction of labour for suspected fetal macrosomia is discouraged, as current evidence suggests that it doubles the risk of caesarean delivery without decreasing shoulder dystocia and other complications.[1,11-16] Even though the cost of elective caesarean delivery makes it undesirable in low-income countries, it may sometimes be borne in favour of the better maternal and fetal outcome when compared to a complicated vaginal delivery of a macrosomic baby.[1-3]

Furthermore, modifying the risk factors can help reduce the complications of delivering a macrosomic baby. One significant modifiable risk factor is maternal obesity and type II diabetes, both of which are increasingly common among women worldwide. A study by Gezawa et al.[17] in Maiduguri revealed that a substantial proportion of the women are either overweight or obese. Additionally, the UMTH, as the primary tertiary hospital offering comprehensive amenities and inpatient services in Maiduguri, attracts many affluent women, most of whom are obese, for antenatal care and delivery.

The study aimed to determine the prevalence and risk factors of fetal macrosomia and compare the outcomes of macrosomic babies' and normal birth weight babies' deliveries over two years (2019-2020) at the University of Maiduguri Teaching Hospital, Borno State, Nigeria. The outcome will be used to guide our practice, including counselling women on lifestyle modifications that might lower the occurrence of macrosomia.

Materials and methods

This was a case-control study of macrosomic and normal (control) deliveries conducted from January 1, 2019, to December 31, 2020, in the Department of Obstetrics and Gynaecology at the University of Maiduguri Teaching Hospital. The labour, antenatal, and postnatal wards registers were used to obtain the hospital numbers of the patients, which were then used to retrieve their folders from the medical records department. Information was extracted from the folders using a proforma design for the study. All infants were weighed using a digital scale with a margin of error of 5g; a birth weight of ≥ 4000g was classified as macrosomic, while a 2500-3999g weight was considered normal. Exclusions were made for underweight births (birth weight <2.5kg) and multiple gestations. For each macrosomic infant, the subsequent delivery of a normal-weight infant recorded in the registers was used as a control. Maternal records obtained included socio-demographic characteristics (such as age and educational level of both patients and their spouses) and obstetric histories (including parity and gestational age at delivery). Labour and delivery events were also gathered, encompassing SFH in terms of delivery and complications (such as cephalopelvic disproportion, shoulder dystocia, genital trauma, PPH, and uterine rupture). The condition of the newborns was categorized as normal, birth asphyxia, birth trauma, neonatal death (NND), or admission to the special care baby unit (SCBU), depending on the diagnosis made by

the attending neonatologist. All maternal characteristics, labour and delivery events, and complications in these macrosomic deliveries were compared with those of normal birth weights. Data analysis was performed using a statistical package for the social sciences (SPSS) version 25 (IBM SPSS Statistics), with results presented as simple percentages in a frequency table. The student t-test and chi-square or Fisher's exact test were employed for statistical analysis as appropriate. A P-value of < 0.05 was deemed statistically significant.

Ethical clearance for the study was obtained from the Research and Ethics Committee of the UMTH, Maiduguri.

Results

During the study period, 6556 deliveries were recorded at the University of Maiduguri Teaching Hospital, out of which 216 were of macrosomic babies, giving a prevalence of 3.3%.

One hundred and eighty folders were retrieved following ethical clearance obtained from the hospital ethical committee, which gave a retrieval rate of 83.7%.

However, 39 of the case notes had incomplete information and were therefore excluded from the analysis; thus, only 141 macrosomic deliveries with the same number of controls were presented.

Table 1 shows the sociodemographic characteristics of the patients studied. Mothers of macrosomic babies were significantly older than 35 years (29.8% vs 7.1%, P<0.001). The majority of the women studied had a tertiary level of education, and there was no statistically significant difference in the level of education between the two groups (p=0.071). Housewives constituted 73.3% of the women studied. Twenty-four (16.1%) were civil servants in the macrosomic group, similar to that of the normal birth weight group of 21 (14.0%), with P=0.071. There was a remarkable difference in the occupations of patients' spouses studied. Significantly more of the spouses of the mothers who gave birth to macrosomic babies were businessmen compared to the spouses of the women who delivered normal birth babies (51.9% versus 33.3%), with P=0.021. The majority of the patients in the macrosomic group were grand multiparous compared to the mothers in the normal birth weight group (73.0% versus 2.8%), and the difference was statistically significant with p<0.001. Similarly, the mean gestational age at delivery and Symphysofundal heights were significantly higher in the macrosomic group compared to the normal birth group, 40.48±1.29 weeks vs 39.5±1.02 weeks and 40.36±1.72 cm vs 37.93±1.02 cm, respectively. The differences were statistically significant.

Table 1: Sociodemographic characteristics of the patients studied.

Variable	Pregnancies with macrosomia (n=141) (%)	Pregnancies with normal birth weight (n-141) (%)	χ^2/student-t test	P-value
1. Age				
<35	99 (70.2)	131 (92.9)		
≥35	42 (29.8)	10 (7.1)	24.14	<0.001
2. Educational level (maternal)				
Tertiary	48 (34.0)	54 (38.4)		
Secondary	23 (16.3)	35 (24.8)		
Primary	12 (8.5)	14 (9.9)	8.62	0.071
Quranic	24 (17.0)	11 (7.8)		
None	34 (24.2)	27 (19.1)		
3. Occupation				
Housewife/unemployed	102 (73.3)	102 (73.3)		
Civil servant	24 (16.1)	21 (14.0)		
Businesswoman/trader	10 (7.1)	10 (7.1)	2.13	0.711
Student	3 (2.1)	7 (5.0)		
Self-employed	2 (1.4)	1 (0.6)		
4. Spouse's occupation				
Businessman/trader	73 (51.9)	47 (33.3)		
Civil servant	47 (33.3)	70 (49.6)		
Self-employed	14 (9.9)	14 (9.9)	11.53	0.021
Student	3 (2.1)	3 (2.1)		
Unemployed	4 (2.8)	7 (5.1)		
5. Booked	94 (66.7%)	104 (73.8%)	3.50	0.321
6. Parity				
0	8 (5.7%)	54 (38.3%)		
1-4	30 (21.3%)	83 (58.9%)	150.59	<0.001
>5	103 (73.0%)	4 (2.8%)		
7. GAD				
Mean ± SD.	40.48±1.29	39.5±1.02	58.07	<0.001
8. SFH				
Mean ± SD.	40.36±1.72	37.93±1.02	150.62	<0.001
9. **Intrapartum presentation**				
Vertex	141 (100)	132 (93.6)		
Breach	0	4 (2.9)	6.27	0.099
Others*	0	5 (3.5		

GAD—gestational age by date, SD-standard deviation, SFH—symphysio-fundal height, Others—transverse lie, oblique lie

Expectedly, normal delivery with no complication was higher in the normal weight group compared to the macrosomic deliveries (64.3% vs 46.1%, p=0.007). Cephalopelvic disproportion was significantly higher in the macrosomic group than in normal birth weight babies (24.1% vs 6.4%, p<0.001), as shown in Table 2. There was a statistically significant difference in the mode of deliveries in the two groups (p=0.006), with caesarean section being common in the macrosomic babies. Also, more of the macrosomic babies had shoulder dystocia compared to the normal birth weight babies (11.3% versus 0.7%), and the difference was statistically significant. Perineal tear and PPH were also common in the macrosomic birth group compared to the normal birth weight group, 14.9% versus 4.3% and 17.0% versus 1.4%, respectively. While the rates of Episiotomy and uterine rupture in both groups were (36.2% vs 31.4%) and (2.1% vs 0.7%), and the differences were not statistically significant.

The mean birth weight of macrosomic and normal birth weight babies was 4.33±0.34kg and 3.19±0.37kg, respectively, with p<0.001. Seventy-five (53.2%) of macrosomic babies were normal and had no complications compared with 122 (86.5%) in the normal birth babies. A statistically significant gender difference was observed, with a higher proportion of

males in the macrosomic group compared to those with normal birth weight (69.5% vs. 47.5%, p<0.001). Birth trauma was more common in macrosomic babies than in those with normal birth weight, at rates of 6.4% compared to 0.7%, with a p-value of 0.010. Birth asphyxia with low Apgar scores at the fifth minute of life occurred in 44.6% of cases, compared to 13.4% among normal-weight babies, while SCBU admissions were 33.3% versus 4.3%. These differences were statistically significant, as presented in Table 2. Perinatal death was higher among macrosomic infants (2.8% vs 1.4%); however, the difference was not statistically significant with P = 0.414.

Table 2: Labour, maternal, and fetal outcomes of macrosomic and normal birth babies studied.

Variable	Pregnancies with macrosomia (n=141) (%)	Pregnancies with normal birth weight (n-141) (%)	χ^2	P-value
1. CPD	34 (24.1)	9 (6.4)	16.95	<0.001*
2. Mode of delivery				
VD	84 (59.6)	111 (78.7)	12.52	0.006*
OVD	4 (2.8)	3 (2.1)		
CS	53 (37.6)	27 (19.2)		
3. Shoulder dystocia	16 (11.3)	1 (0.7)	14.08	<0.001*
4. Episiotomy	51 (36.2)	44(31.4)	0.71	0.401
5. Perineal tear	21 (14.9)	6 (4.3)	9.10	0.003*
6. PPH	24 (17.0)	2 (1.4)	20.34	<0.001*
7. Uterine rupture	3 (2.1)	1 (0.7)	1.01	0.314
8. Birth trauma	9 (6.4)	1(0.7)	6.577	0.010*
9. Gender				
Male	98 (69.5)	67 (47.5)	15.65	<0.001*
Female	43 (30.5)	74 (52.5)		
10. Birth Asphyxia	63 (44.6)	19 (13.4)	32.89	<0.001*
11. SCBU admission	47 (33.3)	6 (4.3)	38.73	<0.001*
12. Perinatal death	4 (2.8)	2 (1.4)	0.667	0.414

CPD-cephalopelvic disproportion, VD-vaginal delivery, OVD-operative vaginal delivery, CS-cesarean section, PPH-post-partum haemorrhage, SD- standard deviation, SCBU—special care baby unit

Discussion

The prevalence of fetal macrosomia in this study was 3.3% (33/1000). Our prevalence is higher than the rates reported in other Northern Nigeria centres (2.1% in Sokoto[12] and 2.9% in Jos[19]) but lower than the prevalence figures from Southern Nigeria (5.5% in Benin, 6.9% in Lagos[11], and 8.4% in Enugu[1]). International studies show even higher rates (4.5% in Saudi Arabia and 6.5% in Ghana).[4] These disparities likely reflect distinct regional patterns, where Northern Nigeria's lower prevalence may be associated with traditional dietary patterns (millet/sorghum-based diets), lower obesity rates, and less urbanized populations compared to Southern Nigeria's urban centres, which have higher-calorie diets and sedentary lifestyles. [1,11,21,22] The intermediate prevalence observed in our study likely indicates changing epidemiological trends in Maiduguri. Here, population displacement and shifts in urban diets during the insurgency have resulted in a distinct combination of risk profiles for macrosomic births, drawn from both Northern and Southern Nigeria. [23] National vital statistics data, however, reported a decline in the prevalence of fetal macrosomia in developed countries, probably due to increased awareness, preterm delivery, multiple gestation, and induction of labour.[4] Although the exact cause of fetal macrosomia remains unexplained, probable causes include advanced maternal age, obesity, uncontrolled maternal diabetes, a rise in maternal pre-pregnancy weight, and excessive maternal weight gain during pregnancy. [4,6,8] Mothers of macrosomic babies were significantly older than the controls in this study. However, the prevalence of advanced maternal age in this study is lower than the 60% reported by Najafian et al. among Iranian women[20] and the 82.5% reported by Akindele et al. in Abuja.[18] This difference may likely be due to early marriage and the consequent early commencement of obstetric careers in the study area. In northern Nigeria, little girls are considered mature once they start menstruating and can therefore be given in marriage at an early age. [24]

We observed no notable differences in the education and occupations of mothers in both cases and control groups. However, spouses of mothers who delivered macrosomic infants had higher employment rates compared to those in the control group. This indicates that larger babies tend to be born into affluent families within a higher social class. Mothers in these families are typically better nourished and may lead a more sedentary lifestyle.[17,18] Furthermore, women from higher social classes exhibit better health-seeking behaviour and greater adherence to antenatal medications and services.[18] In this study, a parity of five or more (grand multiparity) demonstrated a strong association with fetal macrosomia, which aligns with the results from other researchers.[1,5,18,21] Increased parity correlates with improved placental function, particularly in areas where malaria is prevalent, owing to maternal adaptation and more effective placental management of parasitaemia.[25]

Having an advanced gestational age at delivery leads to macrosomic babies, as the fetus continues to grow in the uterus.[1] Thus, macrosomia is closely tied to increased gestational age at delivery, with macrosomic babies in this study displaying a mean gestational age of 40.48 weeks ± 1.29. This finding also aligns with previous research.[10,11,20] However, this contrasts with studies by Akindele et al.[18] and Abdul et al.[21], conducted in Abuja and Zaria, respectively, which found no significant link between gestational age and birth of macrosomic babies. Furthermore, male fetuses are predominant in the macrosomic group within this study, which agrees with the findings reported by Adegbola et al.[11] in Lagos and Nassar et al.[22] in Lebanon. Male fetuses are associated with heightened insulin sensitivity, insulin-like growth factor-1 (IGF-1), and various cytokines that could accelerate their growth in utero. Additionally, males' greater neonatal fat-free muscle mass may contribute to this effect.[8] Therefore, male fetuses have 2.2 times the odds of macrosomia compared to female fetuses.[10]

Macrosomic babies had higher cesarean delivery rates than the control group. The cesarean section rate observed in this study surpasses the 27.8% reported by Nassar et al.[22] in Lebanon and the 27.3% by Ezegwui et al.[1] in Enugu. Yet, it remains lower than the 51% and 67% reported by Olokor et al.[5] in Edo and Akindele et al.[18] in Abuja. The higher CS rate may be due to good supervision of labour and early detection of CPD and prompt interventions that are necessary to reduce avoidable injuries and morbidities to both mother and fetus. [5] Moreover, some women carrying macrosomic fetuses are identified antenatally through both clinical and ultrasound methods, then receive counselling and opt for elective cesarean sections. Women with mild macrosomia (estimated fetal weight of 4000-4500 g) were allowed a trial of vaginal delivery after due counselling. Additionally, some patients still prefer vaginal delivery because of their strong aversion to cesarean section. This choice allows for a trial of vaginal delivery, which may ultimately be unsuccessful, leading to the necessity for abdominal delivery.

Shoulder dystocia, one of the dreaded complications of vaginal delivery, was seen more in the macrosomic group than in the control group in this study (11.3% vs 0.7%, p=0.001). Our shoulder dystocia rate amongst the macrosomic births is similar to the 15.5% reported by Nassar et al. in Lebanon[22] but higher than the 2.1% reported by Ezegwui et al. in Enugu. [1] This rate is very high, and it is essential to counsel mothers contemplating vaginal delivery with suspected macrosomic fetuses in our setting. Avoiding shoulder dystocia is a desirable obstetric goal due to the complications that lead to fetal injury (transient or permanent), maternal injury, and medico-legal cases. [18-22] Birth trauma has consistently been higher in the macrosomic group in most studies; our study was no different. Birth asphyxia and other neonatal complications necessitating SCBU admission were higher in the macrosomic group in this study when compared with the control group. Hence, all deliveries of macrosomic babies were attended by a neonatologist to offer immediate neonatal care. The SCBU admission rate was 33.3%, lower than the 43.3% reported by Akindele et al.[18] in Abuja; however, it is higher than the 2.7-9.3% reported in developed countries.[15,18] The high SCBU admission in macrosomic babies is not unexpected, given the heightened risk of hypoglycemia requiring glucose monitoring. [11,18] There was no significant difference in the perinatal death in our study between the macrosomic babies and the controls, but higher perinatal mortality has been reported from Lagos[11] and Benin.[5]

Perineal injury and PPH were significantly higher amongst the macrosomic deliveries. The perineal tear rate in this study is lower than the 29.8% reported by Nassar et al. [22] from Lebanon but higher than the 1.9% reported by Ezegwui et al. [1] in Enugu. The higher rate of perineal injury is despite deliveries being taken by experienced accoucheurs and episiotomy being given as necessary. Episiotomies should be performed promptly when indicated to prevent perineal tears;

they serve to safeguard against perineal tearing and should be utilized judiciously during deliveries of macrosomic neonates.

The PPH is probably due to uterine distension and large placental size in mothers who delivered macrosomic babies. This highlights the need for vigilance during the delivery of macrosomic babies, an increased readiness to implement active management of the third stage of labour, and emergency preparedness in case the PPH occurs. Our finding of PPH contrasts with that of Olokor et al.[5] in Benin, where no significant difference in PPH rate was found between the cases and controls.

Conclusion and recommendation

The prevalence of neonatal macrosomia is 3.3%, with a predilection for male fetuses. The condition is associated with advanced maternal age, grand multiparity, and affluence. Deliveries of macrosomic neonates must be conducted by an experienced obstetrician who is adequately prepared for operative delivery, shoulder dystocia, birth asphyxia, and trauma. He or she should also take precautions against PPH, perineal tears, and uterine rupture during the delivery of a macrosomic fetus. Additionally, paediatricians should be present during delivery due to the increased risks.

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