

What are the Risk Factors for ≥ 4500 g Macrosomia?

NKWABONG Elie^{1,*}, NZALLI TANGHO Guilherme Roger², FOMULU Joseph Nelson¹,

¹Department of Obstetrics & Gynecology; University Teaching Hospital/ Faculty of Medicine and Biomedical Sciences, Yaoundé, Cameroon.

²Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Cameroon.

ABSTRACT

Objective: To identify risk factors for ≥ 4500 g macrosomic babies given that maternal and neonatal complications of macrosomia increase with birth weight.

Design: Cross sectional analytical study.

Setting: The Yaoundé University Teaching Hospital and Central Maternity, Cameroon from October 1st, 2012 to June 30th, 2013.

Population: 42 women who delivered ≥ 4500 g babies and 126 women who delivered babies of 4000 to < 4500 g were recruited.

Methods: Data were analysed using SPSS 18.0. Analyses included the student t-test and the Fisher exact test. The level of significance was $P < 0.05$.

Main outcome measures: Fetal sex and birth weight, gestational age at delivery, maternal age at delivery, parity, mother's pre-gestational body mass index (BMI), weight gain during pregnancy, father's BMI and past history of ≥ 4000 g macrosomia.

Results: Main risk factors for ≥ 4500 g macrosomic babies were maternal weight gain of ≥ 16 kg (OR 4.2, 95%CI 2.0-8.9), maternal age ≥ 30 (OR 3.8, 95%CI 1.8-8.2), post term (OR 2.3, 95%CI 0.9-5.6), past history of ≥ 4000 g macrosomia (OR 1.9, 95%CI 0.9-4.1) and male sex (OR 1.3, 95%CI 0.6-2.8).

Conclusion: To reduce the risk of ≥ 4500 g macrosomic babies, women at risk should make efforts to gain less than 16 kg bodyweight during pregnancies. Moreover, post term pregnancies should be avoided.

Correspondence to: Dr. Elie Nkwabong, P.O. Box 1364 Yaoundé, Cameroon, Tel: (237) 99663843, Fax: (237) 22312567, Email: enkwabong@yahoo.fr

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Introduction

Macrosomia definition is not universally accepted. For some authors, it refers to neonates with birth weight ≥ 4000 g (1-3) while for others it characterizes birth weight ≥ 4500 g (4-6). The reasons for this discrepancy being the low prevalence of neonatal complications observed by some authors when birth weight was < 4500 g compared to ≥ 4500 g (1,7,8). Prevalence of macrosomic babies weighing 4500 g or more varies between 0.5% and 3.4% worldwide (2,6,9,10). There are several complications of macrosomia. Maternal complications are dysfunctional uterine activity, prolonged labor, increased risk of cesarean section, uterine rupture, spontaneous symphysiotomy, obstetrical neuropathy, lower genital tract lacerations (2,11-14). Fetal and neonatal complications include shoulder dystocia, Erb's palsy, fracture of the clavicle or humerus, neonatal asphyxia, hypocalcemia, hypoglycemia, hypomagnesemia, hyperbilirubinemia, increased risk of neonatal infection (due to prolonged labor) and even perinatal death (9,11,12,15). Main risk factors for macrosomia include maternal obesity or overweight, gestational diabetes, excessive weight gain during pregnancy, post term pregnancy and male sex (12). No study has evaluated risk factors for macrosomia of ≥ 4500 g in our setting. Given that complications of macrosomia increases with fetal weight (1,13), knowing in our environment risk factors for macrosomia of ≥ 4500 g might help us taking more care during antenatal care to reduce its incidence and also to be more vigilant during labor, hence, reducing the prevalence of the so many complications mentioned in the literature. The aim of this study therefore was to identify risk factors for macrosomia of ≥ 4500 g in our country.

Material and methods

This cross sectional analytical study was conducted in the maternities of the University Teaching Hospital and the Central Hospital of Yaoundé (Cameroon) from October 1st, 2012 to June 30th, 2013. Women who just gave birth to neonates with birth weight ≥ 4500 g and controls (the first three women who gave birth after the case to neonates with birth weight between 4000 inclusive and 4500 g exclusive) were recruited. This range for controls was chosen because it is the range of macrosomic babies with lower rate of complications mentioned in the literature (1,7,8). Delivery room records helped us in choosing the controls. Variables recorded in both groups were fetal sex and birth weight, gestational age at delivery (confirmed by an ultrasound scan performed before 20 weeks gestation), mother's age at delivery, parity, mother's pre-gestational body mass index (BMI), weight gain during pregnancy (difference between the weight just before delivery and the weight just before conception), father's BMI (calculated when the father came to hospital to visit his wife) and past history of macrosomia. An informed consent was obtained from each woman and her husband. This study was approved by the two institutional ethics committees. Data were analyzed using SPSS 18.0. Fisher exact test and Student t-test were used for comparison where appropriate. P value < 0.05 was considered statistically significant. Results are presented as mean \pm standard deviation (SD) for quantitative data and frequencies for qualitative data.

Results

Forty two women who delivered newborns with birth weight ≥ 4500 g and 126 other women who gave birth to newborns with birth weight between 4000 g inclusive and 4500 g exclusive were recruited.

Birth weight varied between 4500 and 4800 g among the case group with a mean of 4610 ± 69 g as compared to a range from 4000 to 4476 g with a mean

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of 4170 ± 75 g in the control group ($P < 0.0001$). Male newborns were observed in 28 cases /42 (66.7%) in the case group as against 75 /126 (59.5%) in the control group (Odd Ratio (OR) 1.3, 95%CI 0.6-2.8, $P = 0.47$).

Maternal ages ranged from 19 to 40 years with a mean of 29.2 ± 6.0 years in the case group as against a range from 17 to 39 years with a mean of 25.3 ± 5.6 years in the control group ($P = 0.0002$) (Table 1). Macrosomia ≥ 4500 g was observed among 20 women aged ≥ 30 (47.6%) in the case group as against 24 (19.0%) in the control group. OR for ≥ 4500 g macrosomia was 3.8 (95%CI 1.8-8.2) when maternal age ≥ 30 years was compared to < 30 years. Mean parity was 3.4 ± 1.3 and varied between 1 and 7 in the macrosomic group as against a mean of 3.2 ± 1.1 with a range from 1 to 7 in the control group ($P = 0.33$).

Mean mother's BMI was 27.0 ± 2.2 kg/m² and ranged from 22 to 32 kg/m² in the macrosomic group as against a range from 21 to 30 kg/m² with a mean of 25.5 ± 2.0 kg/m² in the control group ($P < 0.0001$) (Table 2). Pre-gestational BMI ≥ 30 was found among eight women (19.0%) who delivered ≥ 4500 g macrosomic babies as against 30 (23.8%) in the control group. Eight women

(19.0%) had pre-gestational BMI < 25 in the macrosomic group as against 46 (36.5%) in the control group. OR

Table 1: Maternal age distribution
BW: Birth weight

Maternal age (years)	Case group (BW ≥ 4500 g)	Control group (BW: 4000-4500 g)
	N (%)	N (%)
<20	8 (19.0)	6 (4.8)
20-<25	6 (14.3)	39 (31.0)
25-<30	8 (19.0)	42 (33.3)
30-<35	12 (28.5)	24 (19.0)
35-<40	6 (14.3)	15 (11.9)
≥ 40	2 (4.7)	0(0)
Total	42 (100)	126 (100)

for ≥ 4500 g macrosomia was 1.5 (95%CI 0.5-4.5) when mother's BMI ≥ 30 was compared to BMI < 25 .

Father's BMI varied between 21 and 29 kg/m² with a mean of 24.9 ± 1.9 kg/m² in the case group as against a range from 20 to 27 kg/m² with a mean of 24.7 ± 1.4 kg/m² in the control group ($P = 1$). Father's BMI ≥ 30 was noticed among 10 women (23.8%) who delivered

Table 2: Distribution of maternal pre-gestational body mass index

BMI (Kg/m ²)	Case group (BW ≥ 4500 g)	Control group (BW: 4000-4500 g)
	N (%)	N (%)
<20	2 (4.7)	9 (7.1)
[20-25[6 (14.3)	37 (29.4)
[25-30[26 (61.9)	50 (39.7)
[30-35[4 (9.5)	26 (20.6)
[35-40[2 (4.7)	3 (2.4)
≥ 40	2 (4.7)	1 (0.8)
Total	42 (100)	126 (100)

BW: Birth weight, BMI: Body mass index.

macrosomic babies and among 31 women (24.6%) in the control group. It was also noticed in the macrosomic group 20 women (47.6%) whose husband BMI was <25 as against 64 (50.8%) in the control group. OR for ≥ 4500 g macrosomia was 1.0 (95%CI 0.4-2.4), $P=1$ when father's BMI ≥ 30 was compared to < 25.

Maternal weight gain during pregnancy ranged from 8 to 25 kg with a mean of 17.3 ± 3.2 in the macrosomic group as against a range from 5.5 to 17 kg with a mean of 14.4 ± 1.8 in the control group ($P < 0.0001$) (Table 3). Twenty four women (57.1%) with bodyweight gain of ≥ 16 kg delivered ≥ 4500 g macrosomic babies as against 30 (23.8%) in the control group. When pregnancy weight gain ≥ 16 kg was compared to <16 kg, OR for ≥ 4500 g macrosomia was 4.2 (2.0-8.9), $P=0.0001$.

Gestational ages ranged from 38 to 44 weeks with a mean of 39.7 ± 1.1 weeks in the macrosomic group as against a range from 37 to 43 weeks with a mean of 38.3 ± 0.8 in the control group ($P < 0.0001$). Post term pregnancies were observed in 10 cases (23.8%) in the macrosomic group and only in 15 cases (11.9%) in the control group (OR 2.3, 95%CI 0.9-5.6, $P=0.08$).

Past history of ≥ 4000 g macrosomia was noticed in 16 cases (38.1%) in the macrosomic group as against 30

(23.8%) in the control group (OR 1.9, 95% CI 0.9-4.1, $P=0.10$).

Discussion

Macrosomic babies with birth weight ≥ 4500 g were more encountered among male sex than among female sex (OR:1.3, 95%CI 0.6-2.8). The ability of male sex for rapid weight gain than female has been observed by many authors (4,5,10).

Mean maternal age for women who delivered ≥ 4500 g macrosomic babies (29.2 years) was significantly higher than that of controls (25.3 years) ($P=0.0002$). When women aged ≥ 30 years were compared to those of <30 years, the OR for delivering a macrosomic baby of ≥ 4500 g was 3.8 (95%CI 1.8-8.2). This has already being shown by some authors who noticed that advanced maternal age was a risk factor, especially women aged 30 to 40 were at increased risk (4). Our study found no relation between parity and macrosomia. This is in contrast with the findings of other authors who observed that multiparity was a risk factor (4,5). This discrepancy might be due to our small sample size. Macrosomic babies who weigh 4500 g or above are not common in our environment. This low prevalence might

Table 3: Distribution of maternal weight gain during pregnancy

Weight gain (kg)	Case group (BW ≥ 4500 g) N (%)	Control group (BW: 4000-4500 g) N (%)
5 to <7	0 (0)	4 (3.2)
7 to <11	8 (19.0)	41 (32.5)
11 to <16	10 (23.8)	51 (40.5)
16 to <20	16 (38.1)	29 (23.0)
20 to 25	8 (19.0)	1 (0.8)
Total	42 (100)	126 (100)

BW: Birth weight

be due to poor nutrition observed in many sub-Saharan countries like Cameroon.

Regarding pre-gestational BMI, we observed that ≥ 4500 g macrosomic babies were more frequent among women with mean BMI of 27 kg/m². This value is a bit higher than the value of pre-gestational BMI ≥ 25 kg/m² found by Heiskanen et al in women delivering ≥ 4500 g macrosomic babies (10). In our series, when women with BMI ≥ 30 were compared to those with BMI < 25 , the OR for delivering a macrosomia of ≥ 4500 g was 1.5 (95%CI 0.5-4.5). This shows that obese women had increased risk of delivering ≥ 4500 g macrosomic babies than women of normal BMI. Paternal BMI was found in our study to have no influence in the occurrence of ≥ 4500 g macrosomia (OR 1.0, 95%CI 0.4-2.4).

Women with past history of delivery of ≥ 4000 g macrosomic babies were more at risk than controls (OR 1.9, 95%CI 0.9-4.1). This is not surprising given that in the same woman birth weight generally increases in subsequent deliveries. A woman who has delivered a baby of 4100 g might deliver another of ≥ 4500 g in the subsequent pregnancies. Other authors found that past history of delivery of a ≥ 4500 g macrosomic baby was a significant risk factor for the delivery of such macrosomic baby in subsequent pregnancies (5,10).

Increased maternal weight gain during pregnancy was a risk factor for ≥ 4500 g macrosomic babies in our study. Indeed, when weight gain ≥ 16 kg was compared to < 16 kg, the OR for delivering a ≥ 4500 g macrosomic baby was 4.2 (95%CI 2.0-8.9). This has already been found by some authors who observed that excessive weight gain was a risk factor (5). This means that increased nutritional input during pregnancy might also be a risk factor for macrosomia.

In our study, gestational age at delivery had an influence on the occurrence of macrosomia since post term (> 42 weeks gestation) deliveries were more associated with ≥ 4500 g macrosomic babies than controls (OR 2.3, 95%CI 0.9-5.6). Some authors too found that prolonged gestation was a risk factor for ≥ 4500 g macrosomia (5). Specifically, a gestational age at delivery > 41 weeks was a risk factor for some (4) while for others it was a gestational age > 42 weeks (10).

Conclusion

Main risk factors for ≥ 4500 g macrosomic babies as shown in this study were maternal weight gain during pregnancy of ≥ 16 kg, maternal age ≥ 30 years, past history of ≥ 4000 g macrosomia, post term and male sex. Henceforth, to reduce the risk of delivering those large babies, mothers at risk should try to gain less than 16 kg bodyweight during pregnancies. Furthermore, post term should be avoided.

Conflict of interest: The authors have none to declare.

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