



CLINICAL ARTICLE

Maternal obesity and rate of cesarean delivery in Djibouti

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ABSTRACT

Objective: To calculate the prevalence of maternal obesity and to determine the relation between obesity and cesarean delivery in an urban hospital in Djibouti. **Methods:** In an observational cohort study, all women who had a live birth or stillbirth between October 2012 and November 2013 were considered for inclusion. Body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) was calculated throughout pregnancy, and women with a BMI of at least 30.0 were deemed to be obese. Multivariate logistic regression analyses were used to evaluate the relation between cesarean and obesity. **Results:** Overall, 100 (24.8%) of 404 women were obese before 14 weeks of pregnancy, as were 112 (25.2%) of 445 before 22 weeks, and 200 (43.2%) of 463 at delivery. Obesity before 22 weeks was associated with a 127% excess risk of cesarean delivery (adjusted odds ratio 2.27; 95% CI 1.07–4.82; $P = 0.032$). Similar trends were found when the analyses were limited to the subgroup of women without a previous cesarean delivery or primiparae. **Conclusion:** Prevalence of maternal obesity is high in Djibouti City and is related to an excess risk of cesarean delivery, even after controlling for a range of medical and socioeconomic variables.

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1. Introduction

The prevalence of obesity is rising in many countries, including in Sub-Saharan Africa. African countries are now affected by the complications of obesity as well as undernutrition [1–3]. Maternal obesity is positively related with poor delivery outcome [4,5]. Recent international reviews and meta-analyses have shown an excess risk of cesarean delivery in obese women [4,6], and a particularly high rate of cesarean delivery among obese women has been observed in Sub-Saharan Africa, with rates over 50% in some studies [7,8].

Obesity in pregnancy in the Horn of Africa has not been studied. Data regarding obesity in pregnancy are not widely available in Djibouti, although the prevalence of obesity in the country was estimated at 9.4% in 2008 [9].

Because sociodemographic and medical indicators linked with obesity might vary in type and have different associations, these potential confounders should be accounted for in any analysis of obesity in pregnancy [3]. The aim of the present study was to calculate the prevalence of maternal obesity and to determine the relation between obesity and cesarean delivery in an urban hospital in Djibouti, while taking into account a large range of sociodemographic and medical variables.

2. Materials and methods

An observational cohort study was performed in a private maternity center in Djibouti City, Djibouti. All women who went on to have a live

birth or stillbirth after 22 weeks of pregnancy between October 1, 2012, and November 30, 2013, were considered for inclusion in analyses. European expatriate mothers were excluded. All women gave oral consent to be registered in the statistical database and this study was approved by the local ethics committee.

Maternal weight is measured during the first prenatal visit, which should occur before 14 weeks of pregnancy. If the first prenatal visit had been held after 14 weeks, the self-reported weight before 14 weeks was used. Maternal weight was also measured throughout pregnancy and at admission before delivery. Women were deemed to be underweight (body mass index [BMI; calculated as weight in kilograms divided by the square of height in meters]) < 18.5 , in the normal range (BMI 18.5–24.9), overweight (BMI 25.0–29.9), class I obese (BMI 30.0–34.9), or class II obese and over (BMI ≥ 35), according to the WHO criteria [10]. Additionally, because the first prenatal visit might have occurred after the first trimester and because many women might not know their weight [3,11], three categories of obesity were used: obesity before 14 weeks of pregnancy if the BMI was at least 30.0 at first prenatal visit before 14 weeks, obesity before 22 weeks if BMI was at least 30.0 at first prenatal visit before 22 weeks, and obesity at delivery if BMI at delivery was at least 30.0.

BMI before 22 weeks of pregnancy was chosen as the main variable because the amount of missing data was lower than for BMI before 14 weeks, and because previous studies commonly used BMI at first prenatal visit as the main variable regardless of gestational age [7, 11–14]. However, the statistical analyses were repeated for all three categories to preclude an impact of missing data on the results.

Sociodemographic and medical details were prospectively collected during pregnancy and at delivery. Macrosomia was defined as a birth weight of at least 4000 g. Anemia was defined as a blood hemoglobin

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concentration of less than 100 g/L 0–30 days before birth. Hypertension was defined as a blood pressure of at least 140/90 mm Hg prior to pregnancy or during pregnancy. Diabetes included pre-existing diabetes or gestational diabetes, and was diagnosed either by a fasting glycaemia or oral glucose tolerance test. Medically assisted conception included ovulation stimulating hormones, intrauterine insemination, or in vitro fertilization.

Sociodemographic characteristics and pregnancy outcomes were compared in obese and nonobese women by χ^2 tests. A series of multiple logistic regression models were then constructed using cesarean as the outcome variable to evaluate the effects of potential confounders and mediators on the relation between cesarean and obesity. All variables were categorical. The first model adjusted for maternal age of 35 years or more and parity. The second model added medical characteristics to the first model: hypertension, diabetes, anemia, previous stillbirth, previous cesarean delivery, infibulation, medically assisted conception, and maternal height. The third model added characteristics of the neonate to the second model: macrosomia, meconium-stained amniotic fluid, and sex. Finally, the fourth model added socioeconomic variables to the third model: employment, education, and number of prenatal visits (≤ 1 versus ≥ 2). The analyses were repeated for BMI obtained before 14 weeks and BMI at delivery.

Next, two subanalyses were performed by limiting the multivariate models in the subgroup of women without a previous cesarean delivery and in primiparae.

$P < 0.05$ was considered statistically significant. Adjusted odds ratio (ORs) and 95% confidence intervals (CIs) were calculated. The goodness of fit of the multivariate models was assessed by the Hosmer–Lemeshow test, and the presence of interaction was tested. Statistical analyses were performed using Stata 10.0 (StataCorp, College Station, TX, USA).

3. Results

A total of 497 women, and 507 neonates were included. Data regarding BMI before 14 weeks of pregnancy were missing in 93 (18.7%)

women, before 22 weeks in 52 (10.5%) women, and at delivery in 34 (6.8%) women. Overall, 100 (24.8%) of 404 women were classified as obese before 14 weeks of pregnancy, 112 (25.2%) of 445 before 22 weeks, and 200 (43.2%) of 463 at delivery.

Data regarding employment, infibulation, number of prenatal visits, and education were missing for 5 (1.0%), 8 (1.6%), 19 (3.8%), and 28 (5.6%) women respectively. Data for all other variables were missing for less than 0.1% of women. Overall, 203 (43.3%) of 469 women had continued education after high school, 364 (77.3%) of 471 spoke French as a second language, 100 (20.1%) of 497 had had a previous cesarean delivery, 202 (40.6%) of 497 were primiparous, and 43 (8.7%) of 497 had had a previous stillbirth or neonatal death. Moreover, 183 (36.1%) of 507 neonates had meconium-stained amniotic fluid, and 128 (25.8%) of 497 women had premature rupture of membranes at admission. HIV testing was not performed in 110 (22.1%) women. Among the remaining 387 women, 1 (0.3%) was HIV positive.

Table 1 shows the distribution of maternal characteristics and delivery outcomes among women deemed to be obese and nonobese before 22 weeks of pregnancy. A higher proportion of obese women than nonobese women were aged at least 35 years ($P < 0.001$) (Table 1). Additionally, the proportion of obese women who had given birth at least once previously was higher than that of nonobese women ($P < 0.001$) (Table 1). Education and occupational status differed between obese and nonobese women ($P \leq 0.05$), with more obese women having an intermediate education level and being unemployed. A higher proportion of obese women than nonobese women had had a previous stillbirth or neonatal death ($P = 0.045$), and previous cesarean delivery ($P < 0.001$) (Table 1).

During pregnancy, diabetes and hypertension were significantly more prevalent in obese women ($P < 0.05$) (Table 1). With regard to the birth outcomes, significantly more obese women had macro-somic neonates ($P = 0.022$) and delivered by emergency cesarean ($P = 0.016$) (Table 1).

Rates of pregnancy complications increased with BMI class before 22 weeks of pregnancy (Fig. 1, Table 2). Obesity before 22 weeks of

Table 1
Maternal characteristics and pregnancy outcomes in women deemed obese and nonobese before 22 weeks of pregnancy.^a

Characteristics/outcomes	Nonobese (n = 333)	Obese (n = 112)	P value
Aged ≥ 35 years	44 (13.2)	29 (25.9)	<0.001
Parity			<0.001
0	171 (51.4)	15 (13.4)	
1 or 2	121 (36.3)	61 (54.5)	
≥ 3	41 (12.3)	36 (32.1)	
Previous stillbirth or neonatal death within 28 days	24 (7.2)	15 (13.4)	0.045
Previous cesarean delivery	52 (15.6)	40 (35.7)	<0.001
Height < 155 cm	51 (15.3)	22 (19.6)	0.285
Medically assisted conception	7 (2.1)	5 (4.5)	0.182
Anemia before delivery	69/316 (21.8)	16/107 (15.0)	0.125
≤ 1 prenatal visit	5/333 (1.5)	4/107 (3.7)	0.167
Infibulation	109/328 (33.2)	42/109 (38.5)	0.313
Hypertension	16 (4.8)	12 (10.7)	0.026
Diabetes			0.028
Yes	70 (21.0)	35 (31.3)	
Not tested	87 (26.1)	33 (29.5)	
Education			<0.001
None	14/323 (4.3)	7/106 (6.6)	
Attended primary school	33 (10.2)	11 (10.4)	
High school (9th or 12th grade)	114 (35.3)	54 (50.9)	
Higher education	162 (50.2)	34 (32.1)	
Speak French as a second language	254/321 (79.1)	84/107 (78.5)	0.891
No occupation	122/333 (36.6)	52/111 (46.8)	0.05
Emergency cesarean delivery	36 (10.8)	22 (19.6)	0.016
Cesarean section	59 (17.7)	36 (32.1)	<0.001
5-min Apgar score < 7 ^b	22 (6.5)	11 (9.4)	0.298
Meconium-stained amniotic fluid ^b	119 (35.2)	44 (37.6)	0.641
Macrosomia (≥ 4000 g) ^b	17 (5.0)	13 (11.1)	0.022
Delivery before 37 weeks	33 (9.9)	12 (10.7)	0.807

^a Values are given as number (percentage) or number/total number for whom data were available, unless otherwise stated.

^b Neonates considered rather than deliveries (338 from women deemed nonobese and 117 from women deemed obese).

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