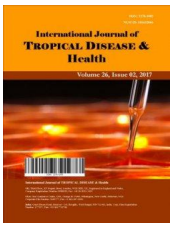

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Outcome of Pregnancy in Patients with Pre-Pregnancy Obesity in Douala, Cameroon

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Authors' contributions

This work was carried out in collaboration with all authors. Authors GEHE, JBN and NNB did the study design, wrote the protocol and first draft of the manuscript. Authors JNP, FNM and PNN did the literature search, cross-checked the statistical analysis and made important inputs in the drafting of the manuscript. Author NNB cross-checked the data entry while author JBN analyzed the data. Author GEHE is the corresponding author. All authors read and approved the manuscript.

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ABSTRACT

Introduction: The prevalence of obesity is increasing worldwide, especially in women of child-bearing age with deleterious effects during pregnancy. This study sort to determine the prevalence of pre-pregnancy obesity, its risk factors, socio-obstetrical profile and obstetric outcomes in Douala, Cameroon.

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Methods: A prospective cohort study was carried in Doula from 1st December, 2014 to 28th February, 2015. An interviewer-administered questionnaire was used to collect data from women at their third trimester of pregnancy. Pre-pregnancy body mass index (BMI) was computed and the women classified according to their BMIs as obese (BMI ≥30kg/m^2) or non-obese (BMI<30 kg/m^2). These two groups of cohorts were followed up during pregnancy and delivery and the obstetric outcomes were recorded. Logistic regression analysis was used in determining factors associated with pre-pregnancy obesity.

Results: Three hundred and fifty participants were enrolled into the study. The prevalence of pre-pregnancy obesity was 14.7% (95% CI: 11.1-18.8). It was associated with a family history of obesity [RR= 2.2 (CI: 1.15-4.43)] and increasing maternal age [RR=4.3(CI:1.59-11.41)]. Meanwhile marital status and parity were related to pre-pregnancy obesity, however, there was no statistically significant associations. Pre-pregnancy obesity was associated with an increased rate of Caesarean section (P=0.04), nonetheless adverse fetal outcomes.

Conclusion: The prevalence of pre-pregnancy obesity in Douala was high. Advanced maternal age, parity, marital status and a family history of obesity were associated with pre-pregnancy obesity. Pre-pregnancy obesity was associated with increased caesarean section rate. Therefore, screening for pre-gestational obesity should be encouraged to decrease the rate of caesarean section.

Keywords: Pre-pregnancy obesity; maternal; fetal; outcomes; Douala.

1. INTRODUCTION

The prevalence of overweight and obesity is rapidly increasing world-wide [1]. They represent important risk factors for various diseases [2] such as cardiovascular diseases, diseases of the central nervous system, gastrointestinal tract, reproductive system etc., as well as increase global death. In the world today, over 1,6 billion adults are overweight and 400 million adults are obese [2,3]. There is a global rise in pre-pregnancy obesity as the prevalence is on the rise in the general population with up to 56.7% of women being obese or overweight before pregnancy or are gaining too much weight during pregnancy [3]. A 2012 demographic health survey across 27 countries in sub-Saharan Africa, revealed that 19.1% of the women were over-weight and 5.3% were obese [4]. More so, a study conducted in four urban towns in Cameroon in 2006, revealed the prevalence of obesity and overweight to be 19.5% and 50% for women respectively. The highest prevalence of pre-pregnancy obesity was recorded amongst the age group of 35 years and above [5]. Furthermore, Mbella in 2002 revealed that 60% of Cameroonian women are obese with a risk of suffering from cardiovascular complications [6]. Overweight and obesity, therefore, present a great challenge to healthcare professionals, especially during the reproductive age.

Maternal obesity, particularly pre-pregnancy obesity, is strongly associated with a continuum of risks for the mother, fetus and neonate [3,7-9]. Some socio-demographic, behavioural and genetic factors have been shown to increase the likelihood of developing pre-pregnancy obesity [2,10,11].

The recommended gestational weight gain (GWG) is determined by pre-pregnancy body mass index (BMI), based on the WHO cut-off points for BMI categories of underweight, normal weight, overweight and obesity in adults. Pre-pregnancy obesity is a BMI greater than 30 kg/m^2 [12]. Despite the rising prevalence of obesity worldwide and the numerous adverse effects of pregnancy experienced by women in our milieu [12], it has not yet been established what proportion of these adverse effects are linked to pre-pregnancy obesity. This study was carried out to determine the prevalence of pre-pregnancy obesity in two hospitals in Douala, identify its risk factors, describe the socio-obstetrical profile of the obese women and assess the effects of pre-pregnancy obesity on pregnancy outcomes.

2. MATERIALS AND METHODS

2.1 Study Design and Study Setting

This prospective cohort study was carried out in the Cité des Palmiers District and Our Lady of Love Catholic Hospital, Douala from 1st December, 2014 to 28th February, 2015. Douala is the economic capital of Cameroon and a cosmopolitan city of 1,338,082 inhabitants [13]. These hospitals are located in the Cité des Palmiers Health District which is one of the thirty

health districts in the Littoral Region, Cameroon. The hospitals provide health care to women of all social classes and have equipped maternities and neonatal units. Furthermore, about 90-120 child births are carried out in each maternity unit monthly. Each of the hospitals has an obstetrician, a pediatrician, six midwives and some auxiliary staff. Ethical clearance for the study was obtained from the Faculty of Health Sciences Institutional Review Board. Administrative authorisation was given by the Regional Delegate of Health and the Chief Medical Officers of both hospitals.

2.2 Study Population and Sampling

All women at the third trimester of pregnancy who opted to deliver in these hospitals were invited for the study by convenient consecutive sampling. The study was explained to them and written consent obtained. Data was obtained from those who had documented pre-pregnancy weight or weights measured on or before thirteen weeks of gestation. The following groups of potential participants were excluded from the study: documented multiple gestations, chronic diseases (such as hypertensive disorders, uncontrolled diabetes mellitus, chronic heart failure, thyroid dysfunction, chronic renal disease or a psychiatric disease treated with neuroleptic), those without documented pre-pregnancy weight or documented weight after the first trimester.

2.3 Sample Size Calculation

The sample size was calculated using the formula for comparing two proportions [14].For a confidence level of 95%, Z_{crit} = 1.96 $Z_{pwr=}$ standard normal deviate for the desired statistical power of 80% = 0.84 The pre-study prevalence of adverse outcome in women with pre pregnancy obesity was estimated at 21.58% while that in women with normal weight was 8.06% = 0.08 [7]. A minimum sample size of three hundred and three pregnant women was required. However, three hundred and fifty participants were enrolled in anticipation for loss to follow up.

2.4 Study Procedure

All participants were recruited from the 1st through 31st of December, 2014 by a consecutive convenient sampling method. The study and its aims were clearly explained to the participants. They were reassured that questionnaires will be coded to ensure confidentiality. Their heights and weights were measured using standard procedures and BMI indices calculated and pre-pregnancy weight and other information obtained from their hospital books and files in the service. The prevalence of pre-pregnancy obesity was obtained and these participants' risk factors and obstetric outcomes were compared between those obese and non-obese. ANC was provided by the obstetrician and the midwives. Appointments were scheduled based on the complications -if any-, diagnosed during the antenatal period. Any complication detected was managed in the units by the obstetrician and nurses. They were then followed up to delivery were other data on maternal and foetal outcomes were obtained. All deliveries took place at the study sites and mother/neonates were followed-up up to 48 hours after delivery. There was no loss to follow-up.

2.5 Data Collection

Data were collected using an interviewer-administered pretested questionnaire which had only minor modifications. Information was obtained on: socio-demographic characteristics, anthropometric data, pre-pregnancy weights; categorized as underweight, non-obese and obese based on BMI and potential confounders (e.g pre-pregnancy hypertension, heart failure, chronic kidney disease etc) and factors associated with pre-pregnancy obesity (physical activity, sedentary life style, vegetable and fruits consumption, skipping breakfast, sweetened snacks between meals, number of meals per day, use of oral contraceptives and family history of obesity). Information on maternal outcomes (pre-eclampsia, eclampsia, and gestational diabetes, type of labor, type of delivery, perineal tear, episiotomy and postpartum haemorrhage) and neonatal outcomes (stillbirth, Apgar score, sex of the baby, birth weight, birth injury and early perinatal death) were also retrieved.

2.6 Data Analysis

The data was analysed using Epi Info™ 7 software. In describing the socio-demographic and obstetric characteristics, measures of central tendencies like mean and median were used. For categorical data, frequencies were computed. Chi-squared and Fisher's tests were used to compare proportions and determine the strength of association between variables. Multi-variate logistic regression analysis was used to identify study variables which were associated with pre-gestational obesity. P-values < 0.05 were considered statistically significant.

3. RESULTS

The prevalence of pregnancy obesity was 14.7% (95% CI 11.1-18.8).

3.1 Socio-Demographic Characteristics of Study Population

The mean age of participants was 27.5 ±5 years, range 16 to 45 years. Two hundred and eleven (60.3%) of the participants were within the 25-34 years age group. Other socio-demographic characteristics of the study population are shown in Table 1.

3.2 Body Mass Indices of the Study Population

The BMI ranged between 16.8 – 43.4 kg/m^2 with a mean of 25.2 ± 4.5 kg/m^2. Of the 350 women, 8 (2.3%) were underweight, 176 (50.3%) had normal weight, 115 (32.9%) were overweight and 51 (14.6%) were obese. Amongst obese women, 37 (10.6%) had class I obesity, 13 (3.7%) class II obesity and 1 (0.3%) was morbidly obese (Table 2).

3.3 Socio-Demographic Factors Associated with Pre-pregnancy Obesity

Increased maternal age was found to be associated with pre-pregnancy obesity. Of the 38 women who were more than 34 years, 9 (26.5%) were obese as opposed to 37 (17.5%) in the age group 25-34 years and 5 (4.8%) in the age group less than 25 years (p = 0.001). The prevalence of obesity was highest in the grand multiparous women 7 (36.8%) when compared to multiparous 32 (14.8%) and primiparous women 12 (10.4%). (Table 3).

3.4 Multivariate Analysis of Risk Factors of Pre-pregnancy Obesity

Following multivariate analysis with logistic regression, participants with a family history of obesity were twice more likely to have pre-pregnancy obesity [RR= 2.2 (CI: 1.15-4.43)]. Furthermore, those with increasing maternal age were four times most likely to have pre-pregnancy obesity [RR=4.3(CI:1.59-11.41)] (Table 4). Noteworthy that advanced maternal age, marital status and parity were related but not statistically significantly associated with pre-pregnancy obesity.

3.5 Life Style Factors Associated with Pre-pregnancy Obesity

The participants physical activity, vegetable consumption, fruit consumption, number of meals per day, a sedentary lifestyle, eating sweetened snacks between meals and use of oral contraceptives were not predisposing factors for pre-pregnancy obesity (Table 5).

Table 1. Socio-demographic characteristics of study population

Parameters		Frequency	Percentage (%)
Age (years)	<25	105	30.0
	25-34	211	60.3
	>34	34	9.7
Marital Status	Single	96	27.4
	Married/cohabiting	253	72.3
	Divorce/separated	1	0.3
Parity	Primiparous	115	32.9
	Multiparous	216	61.7
	Grand multiparous	19	5.4
Occupation	Employed	170	48.6
	Unemployed	108	30.9
	Student	72	20.6
Education	No formal education	1	0.3
	Primary	33	9.4
	Secondary	213	60.9
	Tertiary	103	29.4

Table 2. Body mass indices of study population (N=350)

BMI (kg/m^2)	Frequency	Percentage
Under weight (<18.5)	8	2.3
Normal wt. (18.5< 25)	176	50.3
Overweight (25< 30)	115	32.9
Class I Obesity (30< 35)	37	10.6
Class II Obesity (35<40)	13	3.7
Morbid Obesity (≥ 40)	1	0.3

Table 3. Socio-demographic factors associated with pre-pregnancy obesity

Factors		*BMI <30 (N=299)		*BMI >30 (N=51)		Total	P-value
		No.	%	No.	%	No.	
Age (years)	<25	100	95.2	5	4.8	105	
	25-34	174	82.5	37	17.5	211	0.001 $^{\chi 2}$
	>34	25	65.8	9	26.5	38	
Parity	Primipara	103	89.6	12	10.4	115	
	Multiparous	184	85.2	32	14.8	216	0.010 $^{\chi 2}$
	Grand Multiparous	12	63.2	7	36.8	19	
Marital status	Single	88	29.4	8	8.3	96	
	Married/cohabiting	211	70.6	42	16.6	253	0.008 ^{F}
	Divorced/separated	0	0	1	100	1	
Educational	No formal education	1	100	0	0	1	
Level	Primary	27	9.0	6	18.2	33	0.91^{F}
	Secondary (Ref)	183	61.2	30	14.1	213	
	Tertiary	88	29.4	15	14.6	103	
Occupation	Employed	144	48.2	26	15.3	170	
	Student	66	22.1	6	8.3	72	0.21$^{\chi 2}$
	Unemployed	89	29.8	19	17.6	108	
Family history of obesity	Yes	98	32.8	26	51.0	124	0.01 $^{\chi 2}$
	No	201	88.9	25	11.1	226	

**BMI (Kg/m^2); F: Fischer; χ2: Chi Square test*

Table 4. Multivariate analysis of risk factors of pre-pregnancy obesity

Variable	Bivariate analysis		Multivariate analysis	
	RR* (95%CI)	P-values	Ad RR*(95%CI)	P-values
Age		0.001		0.004
≤25	1.0		1.0	
>25	5.8(0.00-3.24)		4.3(1.59-11.41)	
Marital status		0.04		0.16
Not married	1.0		1.0	
Married	2.1(0.98-4.85)		1.8(0.8-3.89)	
Family history		0.01		0.02
Yes	1.0		1.0	
No	2.1(1.1-3.88)		2.1(1.14-3.89)	
Parity		0.003		0.9
≤1	1.0		1.0	
>1	4.0(1.48-0.80)		1.0(0.49-2.19)	

RR: Relative risk; Ad RR*; Adjusted Relative Risk*

3.6 Pre-pregnancy Obesity and Pregnancy Outcome

The proportion of those who underwent Caesarean delivery was higher 14 (27.5%) in patients with pre-pregnancy obesity compared to their counterparts 46 (15.4%), (p =0.03). Pre-pregnancy obesity was not associated with an increased risk of gestational diabetes, hypertensive diseases in pregnancy, preterm delivery, induced labour, perineal tear; episiotomy or postpartum haemorrhage (Table 6).

3.7 Fetal Outcome of Pregnancy in Women with Pre-pregnancy Obesity

The incidence of stillbirth, macrosomia, small for gestational age in the obese respondents was similar to that of their counterparts. An Apgar score of less than 7 in the first minute of life was higher in the non-obese 18 (6.0%) than in the obese 2(3.9%). (p = 0.75) (Table 7). One of the participants with pre-pregnancy obesity delivered a neonate with brachial nerve palsy.

4. DISCUSSION

We have shown at least 14.7% prevalence of pre-pregnancy obesity in an urban population in Cameroon. Pre-gestational obesity was associated with a family history of obesity and increasing maternal age. Meanwhile, marital status and parity were related but not statistically significant associations with pre-pregnancy obesity. Pre-pregnancy obesity was also associated with an increased rate of Caesarean section. However, pre-pregnancy obesity was not associated with adverse fetal outcomes.

Table 5. Life style factors associated with pre-pregnancy obesity

Factors		*BMI <30		*BMI >30		Total	P-value
		No.	%	No.	%	No.	
Physical activity	< 4 days/week	88	84.6	16	15.4	104	0.35^{F}
	≥ 4 days / week	38	90.5	4	9.5	42	
Vegetable consumption	< 4 days/week	219	85.9	36	14.1	255	$0.53^{\chi 2}$
	≥ 4 days / week	27	81.8	6	18.20	33	
Fruit consumption	< 4 days/week	117	86.7	18	13.3	135	$0.88^{\chi 2}$
	≥ 4 days / week	157	87.2	23	12.8	180	
No. of meals per day	< 3 meals / day	65	83.3	13	16.7	78	$0.55^{\chi 2}$
	≥ 3 meals / day	234	86.0	38	14.0	272	
Sedentary life style	Yes	122	84.1	23	15.9	145	$0.56^{\chi 2}$
	No	177	86.3	28	13.6	205	
Sweetened snacks	Yes	160	85.6	27	14.4	187	$0.93^{\chi 2}$
	No	139	85.3	24	14.7	163	
Oral contraceptive	Yes	24	80	6	20	30	$0.37^{\chi 2}$
	No	275	85.9	45	14.1	320	

$\chi 2$: P-value obtained from the Uncorrected Chi square test.
No: Number of women in each group. Not all participants gave information about certain factors that were considered reliable accounting for the disparity in numbers of respondents in the various groups

Table 6. Maternal outcome of pregnancy with pre-pregnancy obesity

Outcome of pregnancy	Non-obese women (N=299)%		Obese women(N=51)%		P-value
	No.	%	No.	%	
Induced Labor	45	15.1	10	19.6	$0.33^{\chi 2}$
C/S	46	15.4	14	27.5	$0.03^{\chi 2}$
Genital Tear	78	26.1	10	19.6	$0.60^{\chi 2}$
Episiotomy	33	11.0	2	3.9	0.28^{F}
Premature birth	19	6.4	1	20.0	0.33^{F}
GD	2	0.7	1	2.0	0.33^{F}
PPH	13	4.4	4	7.8	0.29^{F}
Pre/eclampsia	18	6.1	4	7.8	0.54^{F}

$\chi 2$: P-value obtained from the Uncorrected Chi-square test; F: P-value obtained from the uncorrected Fischer test
C/S: Caesarean section; GD: Gestational Diabetes; Pre/eclampsia: Preeclampsia or eclampsia; PPH: Post-partum haemorrhage; No : No of participants with the respective parameter

Table 7. Fetal outcome of pregnancy with pre-pregnancy obesity

Outcome of pregnancy	Non-obese women (N=299)		Obese women (N=51)		Total (N=350)		P-Value
	No.	%	No.	%	No.	%	
Still birth	2	0.7	1	2.0	3	0.9	0.38^{F}
Macrosomia	15	5.0	6	11.8	21	6	$0.07^{\chi 2}$
Small for GA	30	10.0	5	9.8	35	10	$0.78^{\chi 2}$
Apgar in 1st min <7	18	6.0	2	3.9	20	5.75	0.75^{F}

χ2: P-value obtained from the Uncorrected Chi-square test. F: P-value obtained from Fisher-Exact test
GA: Gestational Age

The prevalence of obesity of 14.5% was similar to that of Oteng-Ntim et al. [15], lower than the 19.5% reported in Cameroon in 2002 [4], and 44% in a pre-pregnant South African population [16] but higher than 9.6% amongst antenatal clients in Nigeria [17]. This study revealed that 42% of the population was physically active and 58.57% were not sedentary in their life style which probably accounts for the relatively low obesity prevalence. However, the relatively high prevalence of 14.6% when compared to the study carried out in Nigeria [17] could be attributed to the type of foodstuffs consumed in this locality which contain fats.

The age of obese participants was comparable to previous studies [18,19] except those of Scott-Pillai et al. [20] and Yongsi and Ngwa [21]. The high prevalence pre-pregnancy obesity within the age group of 25–34 years was probably due to the fact that this study enrolled women with a short inter-genesique interval since this is the age range for high reproductive activity. Furthermore, the majority of the women aged 25-34 years (75.8%) were either married or cohabiting, thus making it more likely for them to constitute the target population.

The prevalence of 14.6% pregnancy obesity was similar to the result obtained by Jackson et al., 2005 [22] with a prevalence of pre-pregnancy obesity of 10.0%. Amongst the obese women, 98.0% had BMI between 30 and 40kg/m^2 while 1.96% had BMI $\geq$ 40 kg/m^2. This was in contrast to the results obtained by Nana et al. [9] where the prevalence of those with BMI between 30 and 40 was 9.2% and those $\geq$ 40 was 90.8%. The prevalence of underweight was low as in other studies conducted in Cameroon because of the nutritional habits of most Cameroonians and the availability of foodstuffs. There were fewer cases of morbid obesity compared to Nana et al. [9].

The socio-demographic characteristics of the participants contrasted that of the general population as, 17.6% were unemployed, 15.3% employed and 8.3% of students were obese. This is different from the results obtained by Nana et al. [9] where 52.2% were housewives, 46.5% employed and 1.4% were students. The difference is due probably to the difference in the study population as the latter study was carried out among pregnant women with obesity [23].

Thirty women (58.8%) had attained at least secondary education while some 15 (29.4%) proceeded to tertiary education and only 6 (11.8%) stopped at the primary level. This is similar to educational level of the participants by Nana et al. [9]. The high literacy level in this population is consistent with the high literacy level of 64.8% for female Cameroonians [24].

Increasing maternal age was significantly associated with pre-pregnancy obesity. This was consistent with results from other studies in Cameroon by Yongsi [21] and in other countries by Sidik and Rampal, 2009 in Malaysia [10] and Shahi et al. [2]. The increasing prevalence of obesity with ageing especially in women might be due to a change in nutritional habits. This change is more pronounced with women above 34 years. This can be explained by the reproductive changes that mark the life of a woman such as pregnancy, child birth, contraception use, [24]. A family history of obesity was associated with pre-pregnancy obesity, a finding consistent with that of Shahi et al. [2]. This might be linked to genetic predisposition or certain familial habits which make them vulnerable not only to obesity but to other diseases.

Though not statistically significant after multivariate analysis, married/cohabiting women were found to have a higher prevalence of pre-

pregnancy obesity when compared with the single women. This is in line with results obtained in Cameroon by Yongsi in 2014 [21] and by Sidik and Rampal, 2009 in Malaysia [10]. The high prevalence of obesity amongst those living in a union is probably related to a certain ease in living in terms of societal criteria of wellbeing and beauty, as well as social stability.

Obese women had a higher rate of caesarean delivery as opposed to non-obese. This was similar to results obtained by Nana et al*.,* 2009 in Yaoundé [9] and other studies in London and in the UK [20,25]. The increase caesarean rates might be due to macrosomia or failure of induction since the induction rate was high in obese women.

Aforementioned antenatal and intra-partum complications (Table 6) were not associated with pre-pregnancy obesity. Furthermore, no significant adverse fetal outcomes were associated with pre-pregnancy obesity in this study probably because the sample size was small to show uncommon adverse obstetric outcomes.

5. CONCLUSION

The prevalence of pre-pregnancy obesity in Douala was high. Advanced maternal age, parity, marital status and a family history of obesity were associated with pre-pregnancy obesity. Pre-pregnancy obesity was associated with increased caesarean section rate. Therefore, screening for pre-gestational obesity should be encouraged to decrease the rate of caesarean section.

6. STUDY LIMITATIONS

Even though the study was subject to recall bias due to the fact that information on risk factors was obtained from undocumented sources which was based on participants' ability to remember, but this was reduced by confirmation from hospital books and files. As well this information was a bit biased as most women will have to the tendency to give responses suitable to ideal social status (Hawthorne's effects). Furthermore, though the study was carried out only in 2 hospitals in Douala (Berker's bias is inevitable) that do not seem quite representative of the whole town, however, these hospitals receive patients of all social classes for maternal and neonatal care.

The heights measured at the time of interview might not have been pre-pregnancy height, especially for teenage mothers. The sample size being small as was reflected in the wide confidence intervals could not enhanced the detection of some adverse outcomes associated with pre-pregnancy obesity. More robust studies will be necessary to validate our findings.

CONSENT

All participants consented to the study by signing or thumb printing a consent form as per the requirements of the Ethical Review Board of the University of Buea, Cameroon.

ETHICAL APPROVAL

Ethical clearance for the study was obtained from the Faculty of Health Sciences Institutional Review Board (N^{o} 2014/263/UB/FHS/IRB). Administrative authorization was given by the Regional Delegate of Health and the Chief Medical Officers of both hospitals.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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