Original Article

Maternal Obesity as a Risk Factor for Caesarean Section Delivery: A Case-control Study

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ABSTRACT

Background: The rate of obesity is rising in Nepal and it has increased rapidly among women of reproductive age group over the last decade. Similarly, the rate of caesarean section has also shown an increasing trend in the country over the same period. The objective of this study was to identify maternal obesity as a risk factor for caesarean section in Kathmandu valley.

Methods: An analytical case-control design was used to conduct the study. A total of 300 participants, 150 caesarean section deliveries as cases and 150 vaginal deliveries as age-matched controls were selected using purposive sampling technique. Data were collected through interview schedule using a semi-structured questionnaire and medical records review in Paropakar Maternity and Women's Hospital postnatal ward. The Pearson's chi-square test and odds ratio were used to test the association.

Results: The study findings revealed a mean body mass index of 24.32±3.96 among the caesarean section delivery group and 21.94±3.34 among the vaginal delivery group (P< 0.001). Obesity was found in 44.67% of the caesarean section delivery group and 18.67% in the vaginal delivery group. There was a significant association between maternal obesity and caesarean section delivery with adjusted OR 4.14, 95% CI: 2.34-7.20 (P <0.001).

Conclusions: Maternal obesity seems to be a significant risk factor for caesarean section delivery. Health care providers should promote pre-conceptional dietary counselling, regular physical activity and a healthy lifestyle at all levels of health centres. Identification of obesity in the first antenatal visit must be encouraged and offered advice about ideal weight maintenance.

Keywords: Body mass index, caesarean section, maternal obesity, obesity, reproductive age group, vaginal delivery

Access this article Online	ArticleInfo.
QR Code	How to cite this article in Vancouver Style?
Scan Me	Chhetri MK, Dewan P, Shrestha S. Maternal Obesity as a Risk Factor for Cesarean Section: A Case-control Study. Journal of Karnali Academy of Health Sciences. 2021; 4(3)
	Received: 21 June 2021 Accepted: 25 December 2021 Published Online: December 30, 2021
	Source of Support: Self Conflict of Interest: None

INTRODUCTION

Obesity is an increasingly important health problem worldwide including the developing countries.[1]Overweight and obesity are prevalent among women of reproductive age involving 40% to 60% in developed countries and 30% to 40% in developing countries.[2]There is the tendency of increasing obesity compared to the previous study[3] as shown by Nepal Demographic Health Survey (NDHS) where Body Mass Index ≥ 25 (obesity as per Asian guideline)[4,5] in women of reproductive age group has increased from 13% in 2011 to 22% in 2016.[6]

Maternal obesity increases the risk of different pregnancy-related complications such as pre-eclampsia, caesarean section and pregnancies induced hypertension (PIH) and was found to be three times more common in obese women as compared to normal.[7] Worldwide, the caesarean section rate increased from 6.7% in 1990 to 19.1% in 2014.[8]The caesarean section rate in Nepal increased from 5% in 2011 to 9% in 2016.[6] The case-control study conducted in a tertiary level center in Kerala, South India had reported maternal obesity as an independent risk factor for caesarean section. The odds of ending up in caesarean delivery are about 2.8 times more amongst the obese than the non-obese.[9] Similarly, obese women had three times higher risk of caesarean delivery in Nigeria.[10]The prevalence of obesity among reproductive women is increasing in Nepal along with the increasing rate of caesarean section.[11,12,13]Many studies conducted outside Nepal had reported obesity was associated with maternal complications including caesarean section.[14–16]Thus, this study is aimed to assess maternal obesity as a risk factor associated with caesarean section in the Nepalese context.

MATERIALS AND METHODS

An analytical case-control study was done at Paropakar Maternity and Women's Hospital (PMWH) from December 2016 to November 2017. The study population were postpartum mothers who had their antenatal visit in the first trimester at PMWH. Those who had caesarean section delivery were taken as cases and those who had vaginal delivery were taken as controls.

Those with multiple gestations, previous caesarean section, history of the chronic medical disease (diabetes mellitus, hypertension) and grand multipara were excluded from the study. Ethical approval for the implementation of the study was sought from the Institutional Review Boards of the National Academy of Medical Sciences (NAMS) and PMWH. Participants were informed about the objectives, methodology and benefits of the study and written consent from participants were taken.

Non-probability purposive sampling technique was used. Sample size was determined by applying the proportion of obesity in caesarean section group P_1=0.306 and P_2=0.135 proportion of obesity in vaginal delivery group[9] and $Z_{1-\alpha/2}$=1.96 (Significance level of 5%), $Z_{1-\beta}$=1.64 (at power 95%). Therefore, two proportion formula.[17] The sample size came to be 122. Adding non-response rate 20% of 122 = 25. The final sample size was 146, round about 150. Thus 150 cases and 150 controls were included in the study.

The data were obtained from the participants following one to four days after the delivery in the postnatal ward. Age groups were categorized as less than 21 years, 21 to 25 years, 26 to 30 years, 31 to 35 years and more than 35 years. Age group matching was done by selecting a case followed by corresponding control of a similar age group. The data were collected using face-to-face interview through

semi-structured questionnaire and from medical records for anthropometric measurements.

The anthropometric measurements (height and weight) taken in the first trimester were filled from the patient's medical records review and Body mass index (BMI) was calculated. The Asian guideline BMI was followed in this study. As per this guideline, BMI ≥25 kg/m^2 is taken as being obese, and that between 23 to 24.9 kg/m^2 was taken as being overweight.[4, 5] Maternal obesity is defined as abnormal or excessive fat accumulation which is measured by BMI at the first trimester of pregnancy. Maternal obesity is considered for BMI ≥25 kg/m^2.

The data collection tool was developed through extensive literature review and consultation with subject experts. The tool consisted semi-structured questionnaire divided into two parts: Part I: Included socio-demographic characteristics of the cases and controls.

Part II: Consisted of questions related to the antenatal history of the cases and controls:

the age of marriage, age at first childbirth, gravida, parity, number of children, number of abortions, last menstrual period date, first antenatal check-up, number of times of antenatal check-up and anthropometric measurement.

Content validity was maintained by reviewing the tools with an advisor and subject experts. The English version of the tool was developed and translated into the Nepali language. Forward and backward translation of the tool was done by the language experts to remain the same concept of the questionnaire. Pretesting of the tool was done among 15 cases and 15 controls of the sample at the same setting and some modifications were done accordingly. Those participants were excluded from the study for final analysis.

Data were entered in Microsoft Excel and were analysed using Statistical Package for Social Sciences (SPSS) version 16. Mean, median, standard deviation and non-parametric Chi-square tests were used during analysis. The odds ratio was used to find out the strength of association between risk factor obesity and caesarean section. Stratified analysis Cochran Mantal Haenszel method was used to control the confounding variable and calculate the adjusted odds ratio. A p-value of ≤0.05 at a 95% confidence interval was used to report the statistical significance.

RESULTS

A total of 300 respondents, 150 cases and 150 controls were included in the present study. The mean age of the respondents was 25.68±4.19 and 25.45±4.23 among caesarean sections and vaginal deliveries respectively. Nearly half of the respondents were educated up to secondary level education among caesarean sections (46.98%) and vaginal deliveries (48.32%). Hinduism was the most followed religion among cases (82.66%) and controls (86.0%). More than half of the cases (56.67%) and controls (64%) were homemakers. Regarding ethnicity, 29.33% of the respondents in cases and 32.0% in controls were from disadvantageous Janajati groups. Higher proportions of the respondents (74.00%) were from the municipality in the caesarean section as well as among vaginal delivery (72.67%) groups. (Table 1)

The antenatal history of the cases and controls are shown in Table 2. Most of the caesarean section deliveries (66.00%) were primigravida whereas in vaginal deliveries only 47.33% were primigravida. Similarly, most of the caesarean sections (76.67%) were primiparous and among vaginal deliveries, about half (54.67%) were primiparous. There was a significant difference with regards to gravida (P=0.001) and parity (P<0.001)

between caesarean section and vaginal delivery groups. The majority of the cases (89.33%) and controls (87.33%) had more than 4 ANC visits. (Table 2)

Nearly half of the respondents 67 (44.66%) were obese among caesarean sections whereas only 28 (18.66%) were obese among vaginal deliveries. Similarly, 52 (34.66%) participants among caesarean sections and 82 (54.66%) among vaginal deliveries had normal BMI. There was a statistically significant difference between the caesarean sections and vaginal deliveries concerning BMI. (Table 3)

Regarding obesity, 67 (44.67%) participants with caesarean section were obese whereas only 28 (18.67%) participants were obese among the vaginal delivery group. Maternal obesity was found to be a significant risk factor for caesarean section in this study (P<0.001) with obese women having 3.51 times chances of having caesarean section as compared with non-obese women (95% CI: 2.08-5.92) when adjusted for parity using the Cochran Mantal Haenszel technique the association increased in magnitude and remained statistically significant with adjusted OR 4.14 (95% CI: 2.34-7.14). (Table 4)

Table 1: Socio-demographic Characteristics of the Participants

Characteristics	Cases (n, %)	Controls (n, %)
Age Group		
≤ 20	19 (12.67)	20 (13.33)
21-25	58 (38.67)	57 (38.00)
26-30	59 (39.33)	58 (38.67)
31-35	12 (8.00)	13 (8.67)
>35	2 (1.33)	2 (1.33)
Mean age ±S.D.	25.68±4.19	25.45±4.23
Educational Level (n=149)		
Pre-Primary	6 (4.03)	10 (6.71)
Basic (1to class 8)	41 (27.52)	47 (31.54)
Secondary (9 to 12)	70 (46.98)	72 (48.32)
Bachelor & above	32 (21.48)	20 (13.42)
Religion		
Hinduism	124 (82.66)	129 (86.00)
Buddhism	18 (12.00)	13 (8.67)
Islam	2 (1.33)	1 (0.67)
Christianity	6 (4.00)	7 (4.67)
Occupation		
Services	32 (21.33)	24 (16.00)
Agriculture	5 (3.33)	13 (8.67)
Homemaker	85 (56.67)	96 (64.00)

	Business	20 (13.33)	10 (6.67)
	Others	8 (5.33)	7 (4.67)
Ethnicity			
	Brahmin	35 (23.33)	30 (20.00)
	Chhetri	25 (16.67)	22 (14.67)
	Advantageous Janajati	26 (17.33)	32 (21.33)
	Disadvantageous Janajati	44 (29.33)	48 (32.00)
	Madhesi	8 (5.33)	2 (1.33)
	Dalit	12 (8.00)	16 (10.67)
Residence			
	Municipality	111 (74.00)	109 (72.67)
	Rural Municipality	39 (26.00)	41 (27.33)

Table 2: Antenatal History of the Participants

Characteristics		Cases (n, %)	Controls (n, %)	Test Statistics	*p*-value
Gravida					
	Primigravida	99 (66.00)	71 (47.33)	10.642	0.001*#
	Multigravida	51 (34.00)	79 (52.67)		
Parity					
	Primiparous	115 (76.67)	82 (54.67)	16.100	<0.001*#
	Multiparous	35 (23.33)	68 (45.33)		
Number of ANC Visit					
	Up to4	16 (10.67)	19 (12.67)	0.291	0.589#
	More than 4	134 (89.33)	131 (87.33)		

*P-value significant at ≤0.05 level, #Pearson's Chi-square test

Table 3: Body Mass Index (BMI) of the Participants

Characteristics		Cases (n, %)	Controls (n, %)	Test Statistics	*p*-value
Body Mass Index					
Obese ≥ 25		67 (44.66)	28 (18.66)	28.071	<0.001
Overweight (23-24.9)		25 (16.66)	23 (15.33)		
Normal (18.5-22.9)		52 (34.66)	82 (54.66)		
Underweight <18.5		6 (4.00)	17 (11.33)		

*P-value significant at ≤0.05 level, Pearson's Chi-square test

Table 4: Association of Obesity with Type of Delivery

Body Mass Index	Cases (n, %)	Controls (n, %)	OR (95% CI)	Adjusted OR	Test Statistics	p-value
Obese	67 (44.67)	28 (18.67)	3.51 (2.08-5.92)	4.14 (2.34-7.20)	23.430	<0.001
Non-obese	83 (55.33)	122 (81.33)				

*P-value significant at ≤0.05 level, OR: Odds Ratio, CI: Confidence Interval, Pearson's Chi-square test

DISCUSSION

This study explored the association between maternal obesity and the chances of having a caesarean section in the Nepalese context. According to the revised consensus guideline of BMI, the study found that about half of the respondents (44.66%) were obese in the caesarean section group whereas 18.66% were obese among the vaginal delivery group. The average BMI among caesarean sections was 24.32±3.96 ranging from 16.66 to 41.31 while the average BMI among vaginal deliveries was 21.94±3.34 ranging from 13.83 to 34.55 which is significantly different. It is also consistent with the study done in India where a significant difference in different classification of BMI was found between caesarean section and vaginal delivery groups.[9] This similarity may be due to similar food patterns, culture, and lifestyle activities.

The present study found maternal obesity as a significant risk factor for caesarean section with obese women having 3.51 times the chances of having caesarean section as compared with non-obese women. These findings are in coherence with the findings of the study in Kerala, India, where maternal obesity was a significant risk factor for caesarean section with the odds of ending up with caesarean section was 2.8 times more amongst obese group than non-obese group[9] as well as similar to Kutchi, Chellammal and Akila.[16]

Another retrospective study done by Graham et al[18] also concluded that obese women had 2.01 times the adjusted odds of caesarean delivery compared with the normal-weight women. Similarly, the study by Sheiner et al[19] found a significant association between maternal obesity and caesarean section even after controlling for possible confounders, using the Mantal Haenszal technique.

A meta-analysis concluded that the risk of caesarean section was increased among obese women with ORs 2.05.[20] Another systematic review and meta-analysis also highlighted that the risk of caesarean section was increased with ORs 2.26 times in obese women compared with normal BMI women.[21]Other several studies have also found similar finding.[19, 22, 23, 24]Hence, the above findings conclusively prove that obesity is a significant risk factor for caesarean section. The increase in caesarean section among obese women may be due to increased cholesterol deposits in the myometrium of the women affecting contraction. Another cause might be an increase in the maternal soft tissue inside the pelvis narrowing the birth canal and increasing difficult birth especially in a macrosomic infant, or poorer response to oxytocin administration.[21] Therefore, effort should be made to prevent and reduce obesity in the reproductive age group before conception through dietary counseling, regular physical activity and a healthy lifestyle (uptake of

exercise, meditation, yoga, avoiding smoking and alcohol). Targeting optimal weight during pregnancy is an important step to achieve normal physiological pregnancy course and childbirth which may contribute to a significant decrease in ceasrean section.

This study was a small-scale study, limited to a tertiary hospital, done in a short period. Hence the result might not be generalized to the whole population. In this study, height and weight of women were recorded in early pregnancy during the antenatal visit in the first trimester. The values recorded in early pregnancy are in approximation to pre-pregnancy weight which may be subject to bias. Due to the limited time, the study couldn't be done well matching for parity and socioeconomic status of pregnant women attending all at the first trimester. A prospective cohort study is recommended for future research.

CONCLUSION

There is an association between maternal obesity and caesarean section delivery. Maternal obesity is a significant risk factor for caesarean section with the risk of caesarean section four times more among the obese group than the non-obese group. Obesity is a modifiable risk factor that can be minimized to prevent maternal complications. It would be ideal to promote pre-conceptional counselling by health professionals regarding weight control and weight reduction through a healthy lifestyle, balanced diet, and regular physical activities to prevent the complication of obesity in reproductive years. The findings of the study might benefit concerned authorities to make policy and guidelines addressing the prevention and treatment of obesity.

Acknowledgments: The authors would like to acknowledge all the study participants for their cooperation and contribution. The authors would like to thank Dr. Muna Maharjan for her support in language editing

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