

Original Research Article

Study of the effect of maternal body mass index (BMI) on perinatal outcome

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Abstract

Introduction: India is facing a double burden of under nutrition and underweight on one side, and a rapid rise in obesity and overweight, particularly in the urban settings on the other side. The aim of the present study was to examine the association of the maternal Body Mass Index (BMI) and the obstetric and the perinatal outcomes in singleton pregnancies.

Materials and methods: A total number of 100 cases were taken. All the cases were primigravida with singleton pregnancy and were booked. Patients with preterm delivery or any medical disorder like cardiac disease, hypertension, chronic renal diseases and endocrinal dysfunctions, pre eclampsia, eclampsia, gestational diabetes mellitus were excluded from the study. Patients with their BMI calculated in first trimester delivering in Dhiraj General Hospital were taken. Mode of delivery, birth weight of babies, APGAR score were noted.

Results: In present study, we found that maternal BMI showed association with the birth weight of their babies. We found direct linear correlation between maternal BMI and perinatal outcome. We found no association between maternal BMI with mode of delivery and APGAR score

Conclusion: It can be concluded from our study that mother's with low BMI tend to give birth to babies with lower birth weight and mothers with higher BMI, in absence of complications, tend to give birth to babies of higher birth weight.

Key words

BMI, Body Mass Index, Mother, Perinatal outcome.

Introduction

India is facing a double burden of under nutrition and underweight on one side, and a rapid rise in obesity and overweight, particularly in the urban settings on the other side. It becomes important to study the effect of maternal BMI on pregnancy outcome as the foetus solely depends on mother for its growth and development. The aim of the present study was to examine the association of the maternal Body Mass Index (BMI) and the obstetric and the perinatal outcomes in singleton pregnancies.

Material and methods

The study was done in Dhiraj General Hospital, Vadodara, Gujarat in Obstetrics and Gynecology Department. This was an observational study. Patients were selected according to the inclusion criteria. Routine investigations like complete hemogram, urine analysis, blood grouping and Rh typing, random blood sugar, blood urea, serum creatinine, liver function tests, HIV, HBsAg was carried out. A total number of 100 cases were taken. A complete history regarding present and past illness along with clinical examination was performed. Patients were categorised as following during first trimester BMI. It was calculated as $BMI = (\text{weight in kilograms} / \text{height in meters}^2)$

Group 1 (underweight)	<19.8 kg/m ²
Group 2 (normal)	19.9-24.9 kg/m ²
Group 3 (over weight)	25-29.9 kg/m ²
Group 4 (obese)	≥30 kg/m ²

Maternal and neonatal variables were noted. Maternal outcome variables included mode of delivery, rate of Cesarean delivery. Neonatal variables included birth weight of baby, APGAR score at 1 and 5 minutes, and admission to N.I.C.U.

Inclusion criteria

- Singleton pregnancy
- Primigravida
- Booked patients

Exclusion criteria

- Multifetal gestation
- Preterm deliveries
- Patients with known medical complications like diabetes mellitus, cardiac disease, hypertension, chronic renal diseases and endocrinal dysfunctions, pre eclampsia, eclampsia, gestational diabetes mellitus.

Results

There were 46% of patients with normal BMI, 33% of patients were underweight, 16% of patients were overweight and 5% were obese as per **Table - 1**.

Mean birth weight of the babies of Group 1 (under weight) was 2.08 ± 0.51 kg and mean birth weight of group 4 (obese) was 3.05 ± 0.38 as per **Table - 2**.

Increase in pre pregnancy BMI increased the birth weight of babies linearly ($r > 0.5$). We found direct linear correlation between maternal BMI and perinatal outcome. Babies born to underweight mothers (mean BMI - 18.355) had mean birth weight 2.083 kg. Babies born to overweight (mean BMI - 26.619) and obese mothers (mean BMI-31.6) had birth weight 2.829 kg and 3.058 kg respectively as per **Table - 3**.

We found no correlation between mode of delivery and pre pregnancy BMI (p value 0.38) as per **Table - 4**.

There was no difference in the APGAR score in all the four groups (p value 0.13) as per **Table - 5**.

Only 6 babies had neonatal complications. One neonate in each Group 1 and 2 had mild asphyxia, one baby of Group 1 had severe asphyxia and two babies of group 3 had meconium stained liquor. From Group 4, one had thick meconium stained liquor. Out of 6 three babies were admitted to neonatal intensive care unit and all of them were discharged healthy.

Table - 1: Distribution of patients by different categories of BMI.

Groups	BMI (kg/m ²)	Frequency	Percentage
Group 1 (underweight)	<19.8	33	33%
Group 2 (normal)	19.9-24.9	46	46%
Group 3 (overweight)	25-29.9	16	16%
Group 4 (obese)	≥ 30	5	5%

Table - 2: Distribution of different groups of patients according to birth weight of the baby.

Groups	Birth weight		Mean birth weight (kg)
	≤2.5 kg	>2.5 kg	
Group 1 (n=33)	23 (69.69%)	10 (30.30%)	2.08±0.51
Group 2 (n=46)	16 (34.78%)	30 (65.22%)	2.68±0.24
Group 3 (n=16)	4 (25%)	12 (75%)	2.82±0.37
Group 4 (n=5)	1 (20%)	4 (80%)	3.05±0.38

(Chi square 13.9429, p value 0.002)

Table - 3: Correlation between mean of birth weight with maternal BMI.

Groups	Weight (kg)		BMI (kg/m ²)		Correlation coefficient (r)
	Mean	SD	Mean	SD	
Group 1	2.083	0.514	18.355	1.070	0.673
Group 2	2.685	0.248	22.404	2.064	0.588
Group 3	2.829	0.373	26.619	2.359	0.543
Group 4	3.058	0.386	31.6	1.140	0.747
Total	2.517	0.421	22.201	3.971	0.555

Table - 4: Distribution of different groups in terms of mode of delivery.

Groups	Mode of delivery			
	Vaginal delivery	Mean weight (kg)	LSCS	Mean weight (kg)
Group 1 (n=33)	22 (66.67%)	2.10	11 (27.27%)	2.14
Group 2 (n=46)	37 (80.43%)	2.53	9 (19.56%)	2.79
Group 3 (n=16)	12 (75%)	2.88	4 (25%)	3.02
Group 4 (n=5)	2 (40%)	2.75	3 (60%)	3.09

(Chi square 3.0187, p value 0.38)

Table - 5: Distribution of different groups in terms of APGAR score of baby at the end of 5 minutes.

Groups	APGAR Score	
	≤7	>7
Group 1 (n=33)	10 (30.30%)	23 (69.69%)
Group 2 (n=46)	6 (13.04%)	40 (86.95%)
Group 3 (n=16)	6 (37.5%)	10 (62.5%)
Group 4 (n=5)	1 (20%)	4 (80%)

(Chi square 5.49, p value 0.13)

Discussion

The period of intrauterine growth and development is one of the most vulnerable periods in the human life cycle. The weight of the infant at birth is a powerful predictor of infant's growth and survival. Low birth weight babies are more prone for neuro-developmental and growth impairment, neonatal infections, feeding difficulties, hyperbilirubinemia. Also, maternal obesity is linked with macrosomic infants [1] which increases the chances of childhood obesity [2], which in turn, increase the risk of the child having future problems with diabetes, heart disease and stroke.

In present study, we found that maternal BMI showed association with the birth weight of their babies. We found that whatever be the cause of low BMI-either undernourishment or genetic predisposition, under-weight mothers are associated with increased risk to give low birth weight babies. This co relates well with the study conducted by Han Z, et al., 2011 [3] and Wieslaw Maciej Kanadys (2007) [4] which also mentions that "low maternal weight was associated with increased prevalence of low birth weight".

In our study all the mothers having any complications or any underlying medical illness were excluded. We found that Obese and overweight mothers tend to give birth to babies with higher birth weight. This correlates well with the study conducted by Bianco and co workers, 1998 [5]; Cedergren, 2004 [6]; Isaacs and associates, 1994 [7].

There are various studies that shows that women who were overweight, obese, or morbidly obese had increased chances for induced labour, Cesarean section delivery, low APGAR score, low birth weight [8]. This could be because maternal obesity is associated with risk factors like gestational diabetes, placental insufficiency, pregnancy-related hypertension, and pre eclampsia [9-11].

Diabetes in pregnancy causes hyper insulinemia in the fetus which increases fetal metabolic rate and oxygen requirement in the presence of several factors such as hyperglycemia, ketoacidosis, preeclampsia, and maternal vasculopathy, which can reduce placental blood flow and fetal oxygenation contributing to intrauterine asphyxia [12, 13]. Hypertensive disorders, in pregnancy are associated, with low birth weight, preterm delivery and increased rates of Small for gestational age [14]. Rate of Cesarean delivery is higher because of increased use of induction of labor [15].

Thus presence of the above complications like gestational diabetes, placental insufficiency, pregnancy-related hypertension increases the chances of induced labor, Cesarean section delivery, low birth weight and low APGAR score. However, in our study, we found no association between maternal BMI with mode of delivery and APGAR score which could be because of the fact that all the cases included in our study had no complications or any underlying medical illness.

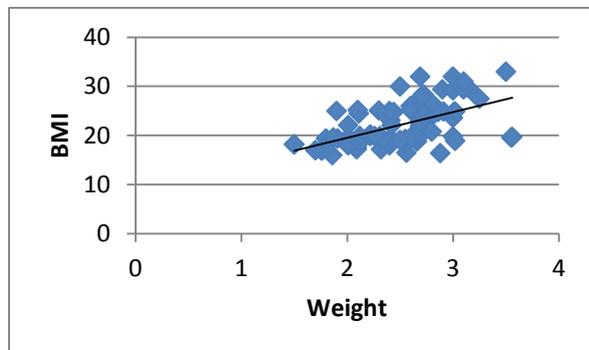
In present study, there was direct linear relation between maternal BMI and birth weight of the babies as per **Chart - 1**. However this applies to that woman who does not develop any complications in current pregnancy. Thus it can be concluded from our study that mother's with low BMI tend to give birth to babies with lower birth weight and mothers with higher BMI, in absence of complications, tend to give birth to babies of higher birth weight. But the prediction of birth weight to mothers having higher BMI during the antenatal period cannot be made, as the birth weight of the baby will also depend upon whether there is development of complications during the antenatal period.

Conclusion

It can be concluded from our study that mother's with low BMI tend to give birth to babies with lower birth weight and mothers with higher BMI,

in absence of complications, tend to give birth to babies of higher birth weight.

Chart – 1: Linear relation between maternal BMI and birth weight of the babies.



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