Original Research Article

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To study the association of body mass index of mother and anthropometry of new born

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ABSTRACT

Background: India is now facing a double burden with underweight on one side, and a rapid upsurge in overweight, particularly in the urban settings on the other side. With a maternal mortality rate of 174 per100,000 live births and with an infant mortality rate of 38 per 1000 live births, there is an absolute need to focus upon the health of the mothers and thence that of the new-born. So, we planned to study the correlation between the BMI of the mother with that of the outcome of the pregnancy.

Methods: 152 women, who were registered and gave birth in the respective hospitals during the study period were selected randomly and were enrolled for the study. A detailed history was taken on their socio-economic class, obstetric status, diet and body mass index was calculated. And, the anthropometry of the new borns was taken.

Results: Mothers with BMI less than normal had babies of low birth weight in major proportion (86%). Mothers with BMI falling under normal range had 13% low birth weight babies. Mothers with BMI more than normal had 55.5% low birth weight babies, 29.6% normal birth weight babies and also around 15% high birth weight babies.

Conclusions: There is a definite correlation between the BMI of mother and the anthropometry of the child. Any deviation from the normal body mass index of the mother is seen to be related to a change in the anthropometry of the newborn.

Keywords: BMI, Anthropometry, Birth weight, ANC

INTRODUCTION

India is now facing a double burden with underweight with under nutrition on one side, and a rapid upsurge in overweight and obesity, particularly in the urban settings, on the other side. With a maternal mortality rate of 174 per 100,000 live births and with an infant mortality rate of 38 per 1000 live births, there is an absolute need to focus upon the health of the mothers and thence that of the new-born. So, we planned to study the correlation between the BMI of the mother with that of the outcome of the pregnancy.1

Maternal nutrition before and during pregnancy has the most important determinant influence during the development of the fetus.

Poor nutritional status pre-pregnancy and during pregnancy is associated with inadequate weight gain, anemia, retarded fetal growth, low birth weight, still births, preterm delivery, intrauterine growth retardation (IUGR), increased morbidity and mortality rates which may threaten the health and life of the mother and the new born. IUGR babies are at risk of obesity,

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hypertension, insulin resistance and coronary heart disease in later life.

Only maternal age, hemoglobin and placental weight were significantly different between term and pre-term deliveries.

A premature infant will have a lower birth weight than a term infant. Pre-term deliveries occur among lean ($<18.5 \text{ kg/m}^2$), overweight (25-29.9 kg/m²) and obese ($>30 \text{ kg/m}^2$).

Fetal under-nutrition may be due to 2 low pre-gestational maternal weights. Evidence indicates that women with low pre-pregnancy BMI are more likely to have smaller infants than heavier women, even when their gestational weight gain is the same.

Maternal pre-gestational weight was an important factor influencing newborn's birth weight. The strong association observed among pre-term new born HC and pre-pregnancy weight, third trimester weight, third trimester weight gain, gestational weight gain, MUAC indicates that maternal nutritional status before and during pregnancy has an effect on fetal intra uterine growth.

First trimester hemoglobin concentrations were positively associated whereas second and third trimester hemoglobin concentrations were negatively associated with birth weight, crown heel length and placenta weight. Maternal anemia is attributed to chronic deprivation of oxygen to developing fetus.

During the last two decades, there has been an alarming rise in the incidence of obesity all over the world. India is now facing a double burden of this disease with under nutrition and underweight on one side, and a rapid upsurge in obesity and overweight, particularly in the urban settings on the other side. 1,2

The National Family Health Surveys (NFHS) in India indicated an increase in the obesity from 10.6% in 1998–1999 to 14.8% in 2005–2006, while there was only a marginal decrease in the incidence of underweight from 36.2% (1998–1999) to 33.0% (2005–2006). 1-3

Both lean and obese women carry a risk for adverse pregnancy outcomes. An increasing BMI is associated with an increased incidence of pre-eclampsia, gestational hypertension, macrosomia, induction of labour and caesarean deliveries. The BMI is a simple index of the weight-for-height and it is calculated by dividing a person's weight in kilograms by the square of their height in meters (kg/m²).^{4,5}

Underweight (a BMI of <19.9 kg/m²) has been shown to be associated with an increased risk of preterm deliveries,

low birth weight and anaemia and a decreased risk of preeclampsia, gestational diabetes, obstetric intervention and post-partum haemorrhage.^{6,7}

The body mass index (BMI) is a measure of someone's weight in relation to their height. The BMI is equal to a person's weight divided by their height. It is calculated either as:

BMI = (Weight in pounds / Height in inches²) \times 703 or

BMI = (Weight in kilograms / Height in meters²)

The BMI is used to screen persons for weight categories that may lead to health problems.

Table 1: Interpretation of body mass index.

BMI	Category
= <18.5	Underweight
= 18.5-24.9	Normal weight
= 25-29.9	Overweight
30 -34.9	Obese- Class I
35 - 39.9	Obese- Class II
40 and above	Obese- Class III

Nutrition and BMI of mother further effects infants body weight and body measurements.

Anthropometry

Measurement of the human body. In our study baby body weight, crown heel length, mid-arm circumference and head circumference was included for anthropometry. 9-11

Body weight of newborn gives us information that whether newborn is malformed or normal. The normal birth weight of a neonate is 2.7 -4 kg.

Crown heel length depends upon neonate's birth weight and gestational age. This measurement was taken with the help of measuring tape. Normal crown heel length is 44-45 cms.

Head circumference is the most important indicator of neonate's anthropometry. The growth rate of the head circum. reflects its development in later infancy. Measuring tape was applied around the head to see for head circumference. Normal head circumference of newborn is 33-35 cms. ^{6,7}

Objectives

- To study the nutritional status and to study the body mass index of mothers.
- 2. To study the anthropometry of the newborns.

- To assess the association between the body mass index of mothers and anthropometric measures of newborn.
- To promote awareness of proper nutrition during pregnancy to mothers for a healthy outcome of delivery.

METHODS

We undertook the cross-sectional study in the Department of Obstetrics in D.Y Patil Hospital, Kolhapur and at other private hospitals.

152 women, who were registered and gave birth in the respective hospitals during the study period (May 2015 to June 2015) were selected randomly and were enrolled for the study.

A detailed history was taken on their socio-economic class, obstetric status, and diet and regarding the vital investigations they underwent during their antenatal period such as collection of blood count, blood sugar level, ultrasonography, VDRL, HIV and Urine analysis etc. and the body mass index of the mothers was calculated. Plus, the anthropometry of the newborns was taken (head circumference, mid arm circumference, length of the new born) along with clinical examination.

Exclusion criteria

Complicated cases were excluded such as antepartum hemorrhage, threatened abortion, pre-eclampsia, eclampsia, poly/ oligohydramnios/ intrauterine death, elderly grand multipara, prolonged pregnancy, treatment of infertility, stillbirths, three or more spontaneous consecutive abortions, patients who were not willing to give information.

Inclusion criteria

It included the normal ANC cases, patients who were willing to give information.

Data analysis was done using statistical methods.

RESULTS

A study of association of body mass index of 152 pregnant women and the anthropometry of the newborns concludes the following:

Mothers from the age of 19 to 33 participated in the study. Their BMI was calculated and assessed.

The mothers were classified according to their ages in three categories ranging from 19-23, 24-28 and 29-33, as given in Table 2.

Table 2: Classification according to age.

Age	Number of mothers	Percentage (%)		
19-23	53	34.8		
24-28	70	46.0		
29-33	29	19.0		

Table 3: Classification according to body mass index.

Body mass index	Number of mothers	Percentage (%)
<16 (very severely underweight)	03	1.97
16-17 (severely underweight)	17	11.1
17.0-18.5 (underweight)	26	17.1
18.5-25.0 (normal)	78	51.3
25-30 (overweight)	23	14.4
30-35 (obese class 1)	03	1.97
35-40 (obese class 2)	02	1.31
>40 (obese class 3)	00	0.0

Table 4: Classification according to birth weight of babies.

Birth weight of babies	Number of babies	Percentage (%)
1.5 -1.8 (extremely low birth weight)	02	1.3
1.8 -2.2 (very low birth weight)	09	5.9
2.2 -2.7 (low birth weight)	55	36.1
2.7 -4.0 (normal birth weight)	82	53.9
>4.0 (high birth weight)	04	2.6

Table 5: Relationship between body mass index of mothers and birth weight of babies.

Body mass Number of mothers		LBW	Normal birth	High birth	Percentage (%)		
index	Number of mothers	babies	weight babies	weight	LBW	N	HBW
Underweight	46	40	6	00	86	14	0
Normal BMI	78	68	10	00	13	87	0
Overweight	27	15	08	04	55.5	29.6	14.8

DISCUSSION

The mothers who volunteered for the study were from varying socioeconomic groups and were of the ages 19-33. The study included multiparous and primigravidae, both. The major proportion of mothers taken into the study was in the age group of (24-28) that is 46.0% that is 70 out of 152 women. Mothers in the age group of (19-23) were in the proportion of 34.8% that is 53 out of 152 women chosen for the study. Mothers in the age group of (29-33) were in the least proportion of 19.0% that is 29 out of 152 women. The mothers of the lower socioeconomic groups had malnutrition or lower body mass index, as expected.

The mothers were classified accordingly into 8 groups.

<16: Very severely underweight

16 -17: Severely underweight

17 - 18.5: Underweight

18.5 - 25.0: Normal

25 – 30: Overweight

30 – 35: Obese Class 1

35 – 40: Obese Class 2

>40: Obese Class 3

Mothers who fell under severely underweight category were in the number of 3 out of 152 women (1.97% of the women chosen for the study). Mothers under the severely underweight category were in the number of 17 out of 152 women (11.1% of the women chosen for the study). Mothers under the underweight category were in the number of 26 out of 152 women (17.1% of the women chosen for the study). Mothers under the normal category were in the number of 78 out of 152 women (51.3% of the women chosen for the study). Mothers under the overweight category were in the number of 23 out of 152 women (14.4% of the women chosen for the study). Mothers under the Obese Class 1 were in the number of 03 out of 152 women (1.97% of the women chosen for the study). Mothers under the obese class 2 were in the number of 02 out of 152 women (1.31% of the women chosen for the study).

Major proportion of babies born to the mothers was in the normal category of birth weight that is 2.7 - 4.0 kg, in a number of 82 out of 152 babies (53.9%).

Low birth weight babies were in the number of 55 out of 152 babies (36.1%).

There were also very low and extremely low birth weight babies in a number of 09 and 02 out of 152 babies (5.9% and 1.3% respectively).

Babies born to the mothers also fell under the category of high birth weight in a number of 04 out of 152 babies (2.6%).

There is a definite association between the body mass index of mother and the anthropometry of the newborn.

Mothers with BMI less than normal (underweight) had babies of low birth weight in major proportion (86%) and normal birth weight babies around 14%.

Mothers with BMI falling under normal range had 13% low birth weight babies and 87% normal birth weight babies. Mothers with BMI more than normal (overweight) had 55.5% low birth weight babies, 29.6% normal birth weight babies and also around 15% high birth weight babies.

Underweight mothers = more number of low birth weight babies

Mothers with normal BMI = more number of normal birth weight babies

Overweight mothers = high birth babies seen in this category only.

A definite relationship between the body mass index of mother and anthropometry of newborn is thus concluded.

A study conducted by researchers in Poland, in 2004 included 139 cases of pregnant women with physiological pregnancy. The pregnant women were divided into groups according to their body weights at early pregnancy, which was expressed by body mass index. Analyzing the body mass index of the women at early pregnancy, underweight women were in a number of 55 (39.5%), proper body weight at 66 cases (47.8%), overweight at 12 cases (8.63%) and the fatness at 6 cases (4.32%). The best delivery state of babies has been found out in the group of women with proper body weight. ¹²⁻¹⁵

Another cross sectional study was performed in Zahedan City. Two hospitals situated in the city were selected based on their approval and cooperation. Five hundred healthy pregnant women in the age group 16-40 years were selected for this study. Findings showed that the mean height, weight, fundal height, and haemoglobin of

pregnant women were 156.4 cm, 62.6 kg, 34.2 cm, and 11.1g/dl respectively. Nutrient intake was computed based on 24 hour recall method. The results showed that, the mean intake of energy was 1802 Kcal/day. The intake of protein, calcium, iron, zinc and magnesium were 70.7 g, 544.0 mg, 16.1 mg, 10.6 mg and 266.0 mg respectively. 16,17 Percentage adequacy of nutrient intakes with reference to RDA recommendation showed 95% and 80% of subjects had sufficient RDA intakes, while energy, calcium, iron and zinc intake considered as insufficient. The mean birth weight of neonates was 3.0 kg and 13% of neonates showed low birth weight. Maternal height, weight, fundal height and haemoglobin level were significantly correlated with birth weight of neonates. Energy, protein and calcium intakes in the third trimester were significantly correlated with birth weight of neonates. Using the binary logistic regression analysis fundal height, haemoglobin level and energy intake of pregnant women were considered as predictor factors of birth weight of neonates. 18-20

CONCLUSION

From the study, we conclude that there is a definite correlation between the body mass index of mother and the anthropometry of the child.

Other factors that contribute to the low birth weight of the babies are infections during pregnancy which are often not noted because of late ANC registrations and another factor involves the medical disorders of mothers including hypertension, toxemias etc. which need early medical attention. It is as given below.

Mothers with BMI less than normal (underweight) had babies of low birth weight in major proportion (86%) and normal birth weight babies around 14%.

Mothers with BMI falling under normal range had 13% low birth weight babies and 87% normal birth weight babies.

Mothers with BMI more than normal (overweight) had 55.5% low birth weight babies, 29.6% normal birth weight babies and also around 15% high birth weight babies.

This study concludes that knowledge and awareness about this growing issue is the best form of prevention available. Women of reproductive age and those who are planning motherhood must be made aware of maintaining a body mass index within the normal range so as to deliver a healthy mature baby without any complications.

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REFERENCES

- International Institute for Population Sciences. National Family Health Survey (NFHS-2), 1998-99: India. Mumbai: International Institute for Population Sciences; 2000: 438.
- International Institute for Population Sciences. National Family Health Survey (NFHS-3), 2005-06: India. V. II. Mumbai: International Institute for Population Sciences; 2007:168.
- International Institute for Population Sciences. National Family Health Survey (NFHS-3), 2005-06: India. V. I. Mumbai: International Institute for Population Sciences; 2007: 540.
- 4. Bhadra M, Mukhopadhyay A, Bose K. Overweight and obesity among Adult Bengalee Hindu women of Kolkata, India. Hum Ecol. 2005;13:77–83.
- 5. Mendez MA, Monteiro CA, Popkin BM. Overweight exceeds underweight among women in most developing countries. Am J Clin Nutr. 2005;81:714–21.
- 6. Morley, David. Pediatric Priorities In the Developing World, Butterworths; 1973: 1-470.
- 7. Achar ST, Yankauer A. Studies of birth weight in South Indian infants. Indian J Chld Hlth. 1962:11:157.
- 8. The search for a prematurity level in. Colombo, Ceylon Amar Singhe, P. G. and Dissanayke, P. (1958). Cited by DeSilva, C.C., Fernando, P. V. D. and Guanarante, C. D. (1962).
- Arora S, Rao RN, Rao RMV. Birth weights of infants in low socio-economic groups in Bombay. Indian J Chld Hlth. 1963;12:612.
- 10. Athavale VB. Some observations on temperature in the newborn. Indian J Chld Hlth. 1963;12:381.
- 11. Bakwin H, Bakwin M. Body built in newborn infants. Hum Biol. 1952;4:1.
- 12. Baxi PG. The problem of prematurity. J Indian Med Ass. 1960;34:346.
- 13. Balfour MK, Talpade SK. The maternity conditions of women mill workers in India. Indian Med. Gaz. 1930;65:241.
- 14. Chaudhuri A. Mortality rate and its relationship to maturity weight level. Indian J Pediat. 1955;22:145.
- 15. Chopra DR, Speetjens A. Anthropometry of the newborn and incidence of prematurity. Burma Med J. 1963;11:225.
- 16. Crosse VM. The Premature Baby, 4th Ed. J. A. Churchill Ltd. London; 1957:1.
- 17. Rao MN, Bhattacharjee B. Physiological "norms" in Indians. Indian J Pediatr. 1952;19:1.

- 18. Das G. Report of the enquiry into the bearing of premature and immature births on infant mortality in Bombay (1946–1948). Indian Council of Med. Res. 1951.
- 19. DeSilva CC, Fernando PVD, Guanarante CD. The search for a prematurity level in Colombo, Ceylon. J Trop Pediat. 1962;8:29.
- 20. Durham EC. Premature Infants, Page 3 Second Ed. Paul. B. Hoeber. Inc. New York, U.S.A. 1955.

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