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Research Article

DOES MATERNAL PRE-PREGNANCY UNDERWEIGHT AFFECT PREGNANCY OUTCOMES IN SINGLETON PREGNANCIES? OUR EXPERIENCE AT A TERTIARY CARE CENTER IN NORTH KERALA

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ABSTRACT

Objectives: This research was aimed at analyzing the burden of maternal pre-pregnancy underweight and their effects on pregnancy outcomes in a tertiary care center in North Kerala.

Methods: Based on maternal body mass index (BMI) calculated from the pregnant women's reported height and pre-pregnancy weight, all pregnant women were divided into two groups. Underweight pregnant women with a BMI <18.5 kg/m^2 at the time of conception formed group A (n=44) and women with a normal weight at conception (BMI between 18.5 and ≤24.9 kg/m^2) formed Group B (n=155).

Results: Underweight women had two fold more chances of delivering an low birth weight infant. (AOR 2.2, 95% CI, 1.12 3–4.475). Being underweight did not influence any other maternal or perinatal outcomes and there was rare incidence of gestational diabetes mellitus (OR, 0.937; (95% CI, 0.4–2.29), pregnancy-induced hypertension (OR, 0.970; 95% CI, 0.2–2.9).

Conclusions: Pre-conception counseling for underweight women, emphasizing the importance of proper physical activity and healthy eating to gain adequate weight in antenatal period can help avert pre-term deliveries with healthy neonates of normal birth weight.

keywords: Pregnancy, Underweight, Body mass index, Neonatal, Maternal, Outcomes.

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INTRODUCTION

In India, 52% possess normal body mass index (BMI) range, while the remaining are either underweight or overweight. Maternal pre-pregnancy weight is well known to influence maternal and perinatal outcomes [1,2] as well as the child and adult future health [3,4]. A BMI <18.5 kg/m^2 is defined as underweight. Maternal underweight multiplies the risks of low birth weight (LBW), premature birth, fetal growth restriction (FGR), SGA, and is also associated with perinatal morbidity and mortality [5]. Gestational underweight has in long-term sequelae lead to certain chronic illnesses (diabetes mellitus Type 2, hypertension, coronary artery disease, and stroke) in adulthood. In a country like India, where maternal underweight remains more common than obese mothers, FGR neonates are at risk for low Apgar scores, meconium aspiration, seizures, respiratory complications, extended hospital and NICU stays, and long-term sequelae, including metabolic syndrome and neurologic deficits in the new-born [6,7]. Quantifying the prevalence of underweight and associated pregnancy morbidities in any community is crucial to pick up pregnancies at higher risk of adverse outcomes. This will in turn facilitate the strategic planning of health-care services by targeting the at risk population with much needed healthcare [8] and preventive measures [9].

Objectives

The objectives of this analysis are the following: (1) To estimate the prevalence of underweight in a cohort of 199 mothers and (2) to determine the adverse maternal and perinatal outcomes associated with under-weight mothers compared to normal weight ones.

METHODS

Informed consent of the pregnant women was taken. Study approval was obtained from Institutional Ethical Committee and Institutional Research Committee, for formal review and approval of the study conduct. A pre-designed case record form was used for data collection. Information on maternal demographic data, socioeconomic status, education was taken. Maternal age was defined as the completed age in years at conception. Obstetric score and details regarding exact gestational age, medical comorbidities were noted. Interpregnancy interval in case of multigravida was noted. Labor related variables such as induction of labor, outcomes, and gestational age at delivery were highlighted. Birth weight of new-born, NICU admission, hyperbilirubinemia, and length of hospital stay were recorded to assess neonatal morbidity. Height and weight were measured by standard protocol and calibrated instruments. BMI was calculated as weight (kg) divided by height (m^2). Privacy and confidentiality of pregnant women was respected and maintained at all levels and subject name, address, or contacts was not revealed at any stage during the study.

KMCT Medical College is a tertiary care center and patients attending KMCT virtually come from all over Kozhikode, Malappuram, Wayanad. About 85–90% of these women are booked in antenatal clinic of KMCT, while 5–10% are booked outside and <3% seek un-booked emergency delivery. We have 24 h blood bank facilities and excellent emergency obstetric services and round the clock anesthetic services which mainly caters the need of mainly lower and lower middle, mid middle classes of the population. In addition, many private hospitals also refer many complicated cases to our hospital. About 90% those attending the OPD are literate.

Random selection of 199 antenatal patients with singleton pregnancies attending outpatient department of KMCT Medical College, Kozhikode and willing to be a part of this research constituted the study sample. Pregnancies during September 2021 to March 2022 that met the following inclusion criteria were included: (1) Gestational age of 24 weeks or more at the time of delivery, calculated according to the last menstrual period and/or the early foetal ultrasound, (2) singleton pregnancy, (3) documented pre-pregnancy weight and first trimester

height. Exclusion criteria included preterm delivery before 24 completed weeks of gestation, multifetal gestation, previous caesarean pregnancy, and obese pregnant women pre-conceptional BMI higher than 25 kg/m^2.

Based on maternal BMI calculated from the pregnant women's reported height and pre-pregnancy weight, all pregnant women were divided into two groups: Underweight pregnant women with a BMI <18.5 kg/m^2 at the time of conception formed Group A (n=44), women with a normal weight at conception (BMI between 18.5 and ≤24.9 kg/m^2) formed Group B (n=155) New-born weight (in grams) was measured conventionally immediately after delivery. All statistical analyses were performed and were considered statistically significant when analysis yielded p≤0.05.

Ethical considerations

The ethical approval for the research was provided by the following institutions, KMCT Medical College and conducted according to the principles of Helsinki Declaration.

RESULTS

About 75% had <10 kg weight gain in their pregnancy in the underweight group and 28.4% gained more than 10 kg (Table 1).

Underweight women had two fold more chances of delivering an LBW infant/FGR (AOR 5.385, 95% CI, 1.123–4.475). Being underweight did not influence any other maternal or perinatal outcomes. In underweight, there was rare incidence of gestational diabetes mellitus (GDM) (OR, 0.225; (95% CI, 0.219–1.440). There were more 1st time mothers (n=25/44) in the underweight group and more multi gravida (n=81/155) in non-obese group. Anemic and HDP mothers were equally distributed in both the groups (Table 2).

Induction of labor was relatively lesser in underweight mothers compared to normal BMI mothers. Cesarean contributed 20% in both the groups. Pre-term deliveries were 6.8%, slightly on the higher side in the underweight group (Table 3).

One in 4 new-borns (25%) belonging to underweight mothers weighed <2500 g while it was only 16% in normal BMI group. Two babies weighed more than 3800 grams in BMI 18–24.9, while none in underweight group. NICU stay was similar in these babies despite weighing less than normal BMI Mothers. Clinical hyperbilirubinemia was 13.5–13.6% in both groups of new born which did not add to the perinatal morbidity **(**Table 4).

While 9.7% of others had SSI in normal BMI group, only two developed post-operative SSI. Perineal tear was not excessively seen in any particular group (Table 5).

Morbidity of mother in term of hospital stay was not statistically significant **(**Table 6).

DISCUSSION

Maternal underweight and obesity are global health burdens. The prevalence of undernourishment in India came down from over 21% from 2004 to 2006 to around 16% in 2019–2021. According to NFHS 2019–2020, underweight % has reduced from 22.9% to 18.7% in rural zones, but is still a concernin urban areas (5.7–27.2%). In Kerala, 9.7% urban mothers are underweight while 10.4% in mothers hailing from rural areas. Underweight women were 1.3 times more likely to have children with stunting and 1.6 times more likely to experience wasting compared to normal weight women [10]. Evidence states that 12.1% were underweight in Sahu *et al*. and 5.6% in a study at Chennai [11]. 6.60% constituted lean BMI <18.5 in tertiary perinatal center in Hyderabad [12]. Highest incidence of underweight was nearly 40% in Maternal New-born Health Registry, conducted in three Global Network sites in Pakistan, Nagpur, and Belagavi, India [13]. We noted 22.11% of underweight population (n=44/199) in a tertiary care institution in Kozhikode, North Kerala.

Mean age of pregnant women in underweight group was 24.2 years and mean weight gain during pregnancy was 8.41±4.8 kg in the present study. Mean age of pregnant women in underweight group was 25.6 years and mean weight gain during pregnancy was 9.3±5 kg in a

Table 1: Weight gain in under nourished mothers

BMI<18.5		**BMI 18–24.9**			
Variable	**Under weight n=44**	**Non-obese n=155**	**p-value**	**Odds ratio**	**Chi-square**
Weight gain in kg {K-J}					
<10 kg	33 (75.0%)	111 (71.6%)	0.657	1.1 (0.553-2.559)	0.197
>10 kg	11 (25.0%)	44 (28.4%)			

Table 2: Maternal variables in under nourished mothers

Variable-maternal	**Underweight n=44**	**Non-obese n=155**	**p-value**	**Odds ratio**	**Chi--square**
Maternal age					
>35	1 (2.3%)	9 (5.8%)	0.344	0.3 (0.046–3.062)	0.897
<35	43 (97.7%)	146 (94.2%)			
OBS score					
Primigravida	25 (56.8%)	74 (47.7%)	0.288	1.4 (0.734–2.828)	1.129
Multigravida	19 (43.2%)	81 (52.3%)			
Morbidity					
Anemia					
Yes	8 (18.2%)	29 (18.7%)	0.937	0.9 (0.406–2.295)	0.006
No	36 (81.8%)	126 (81.3%)			
Hypertension in preg					
Yes	4 (9.1%)	15 (9.7%)	0.907	0.9 (0.293–2.970)	0.014
No	40 (90.9%)	140 (90.3%)			
Gestational diabetes mellitus					
Yes	6 (13.6%)	34 (21.9%)	0.225	0.5 (0.219–1.440)	1.470
No	38 (86.4%)	121 (78.1%)			
Fetal growth restriction					
Yes	20 (45.5%)	42 (27.1%)	**0.020***	2.2 (1.123–4.475)	**5.385**
No	24 (54.5%)	113 (72.9%)			

p Value<0.05 is considered statistically significant.

Table 3: Labor-related variables in under nourished mothers

Variable-labor related	Underweight n=44	Non-obese n=155	p-value	Odds ratio	Chi-square
Induction of labor					
Spontaneous	31 (70.5%)	98 (63.2%)	0.376	1.3 (0.672–2.864)	0.785
Induced	13 (29.5%)	57 (36.8%)			
Cesarean					
Yes	9 (20.5%)	31 (20.0%)	0.947	1.0 (0.448–2.363)	0.004
No	35 (79.5%)	124 (80.0%)			
Gestational age in wks					
GA <37 wks	3 (6.8%)	7 (4.5%)	0.537	1.5 (0.383–6.249)	0.381
GA >37 wks	41 (93.2%)	148 (95.5%)			

Table 4: Fetal outcomes in under nourished mothers

Variable-fetal	Underweight n=44	Non-obese n=155	p-value	Odds ratio	Chi-square
Birthweight <2499 g*					
Yes	11 (25.0%)	25 (16.1%)	0.177	1.7 (0.775–3.879)	1.820
No	33 (75.0%)	130 (83.9%)			
Birthweight >3800 g					
Yes	---------	2 (1.3%)	0.449	----------	0.574
No	44 (100%)	153 (98.7%)			
Neonatal parameters					
NICU stay					
Yes	12 (27.3%)	43 (27.7%)	0.951	0.9 (0.461–2.070)	0.004
No	32 (72.7%)	112 (72.3%)			
Hyperbilirubinemia					
Yes	6 (13.6%)	21 (13.5%)	0.988	1 (0.380–2.674)	0.000
No	38 (86.4%)	134 (86.5%)			

Table 5: Morbidities in under nourished mothers

Variable-morbidity	Under nourished n=44	Non obese n=155	p-value	Odds ratio	Chi-square
Surgical site infection					
Yes	2 (4.5%)	15 (9.7%)	0.282	0.4 (0.098-2.022)	1.155
No	42 (95.5%)	140 (90.3%)			
Urinary tract infection					
Yes	8 (18.2%)	32 (20.6%)	0.719	0.8 (0.362-2.017)	0.129
No	36 (81.8%)	123 (79.4%)			
Perineal tear					
Yes	13 (92.9%)	8 (88.9%)	0.742	1.6 (0.089-29.781)	0.109
No	1 (7.1%)	1 (11.1%)			

Table 6: Hospital stay in under nourished mothers

Variable	Under nourished n=44	Non-obese n=155	p-value	Odds ratio	Chi square
Hospital stay in days-mean					
<5	35 (79.5%)	113 (72.9%)	0.373	1.4 (0.641-3.261)	0.793
>5	9 (20.5%)	42 (27.1%)			

similar research in Chennai [11]. Pre-pregnancy maternal weight was 46.61 kg in undernourished group with mothers weighing 58.09 kg in the other category.

MORBIDITIES-FETAL We found that underweight women showed increased risk for FGR and LBW infants in comparison to normal weight patients [11]. In addition, underweight women gaining less weight than recommended were shown to be at two-fold risk of delivering LBW infants than those who met the recommendations. Hence, the risk for LBW in underweight women was high and statistically significant. This finding is worth mentioning as LBW/FGR is associated with a range of morbidities such as inhibited growth and cognitive development and chronic diseases later in life [14].

MATERNAL-Underweight women are known to deliver preterm infants [11] which was not seen in the present study where the mean gestational age was 38.1 weeks similar to normal BMI (38.64 weeks). This finding is in discordance with the results of similar studies [14-16]. Comparing normal weight with pre-pregnancy underweight, decrease in frequency of GDM, and pregnancy-induced hypertension is pronounced in this research as in various other articles [17,18]. Being underweight seemed to have a protective effect on the development of pregnancy induced hypertension-adjusted OR 0.6 (95% CI 0.5, 0.7) for pre-eclampsia in Sohinee Bhattacharya *et al.* [19] and Sebire *et al.* [20]. On the contrary, the negative association between low BMI and maternal anemia in Hu *et al.* due to poor nutrition, including iron, folic acid, and other micronutrient deficiencies was not seen in the present study [21]. Apart from the slightly increased risk of having a baby with low birthweight, the mothers with BMI < 20 appeared to be at a lower risk of developing labor complications or maternal medical morbidity compared even to women with BMI in the normal range in similar research by Sebire *et al* [20]. reinforced by the present study. While a low maternal BMI has been previously identified as a risk factor for adverse pregnancy outcomes in various studies [22,23], underweight

Table 7: Mean of variables in under nourished mothers

Variable	Value
Maternal age in years	24.20
Maternal weight in kgs	46.61
Gestational age in weeks	38.41
Maternal height in cms	154.15
Operating time in minutes	57.78
Birth weight-baby in gms	2726.93
Hospital stay in days	4.34
Weight gain in kg	8.41

women seemed to generally fare better than women with higher BMIs in the present research.

Shorter operative time (57.78 min) was evidently noted in caesarean delivery done for underweight mothers while cesarean in women with non-obese BMI (68.7 min) had it longer by 11.07 min (Table 7).

The mean birth weight of the infants born to non-obese mothers was significantly higher than birth weight of infants of underweight women (3.0±0.4 kg and 2.9±0.4 kg; p=0.007, respectively) in a study in Chennai, while it was 2.726 kg in underweight mothers and 2.917 kg in mothers with pre-pregnant normal BMI. BMI classification should be based on pre-pregnancy weight and that is the strength of the study. One of the main limitation of the study is the small sample size.

CONCLUSIONS

The estimated pre-pregnancy BMI could be effectively utilized to target BMI and providing pre-pregnancy counseling for reducing the risk of adverse maternal and neonatal outcomes.

RECOMMENDATIONS

Pre-conception counseling for underweight women with due emphasis on the importance of regular physical activity and healthy eating to gain adequate weight in antenatal period could avert pre-term deliveries and target healthy neonates of normal birth weight.

AUTHOR' CONTRIBUTIONS

Dr Heera Shenoy T has prepared the conceptual framework, designed the draft, data collection, and data analysis and Dr Remash K has done manuscript writing. Dr Chellamma V K has helping in final editing.

ETHICAL CONSIDERATIONS

The ethical approval for the research was provided by the following institutions, KMCT Medical College and conducted according to the principles of Helsinki Declaration.

COMPETING INTERESTS

None declared.

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