

# THE PREVALENCE OF ABNORMAL BODY MASS INDEX (BMI) AND COMPARISON OF THE WHO GENERAL AND ASIAN STANDARD BMI CLASSIFICATION AMONG FIRST TRIMESTER SOUTH INDIAN WOMEN

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## ABSTRACT

### BACKGROUND

Nutrition plays an important role in a woman's ability to sustain her pregnancy. Nearly 54% of Asian pregnant women were found to be at increased risk of inadequate energy intake. During pregnancy, a woman requires an extra 300-400 kcal/day, restriction of which leads to adverse maternal and foetal outcomes. Less is known about the impact of gestational weight gain in conjunction with BMI on perinatal outcomes in healthy pregnant women without other co-morbidities.

The objectives of the study were to assess the prevalence of abnormal BMI in early pregnancy and to compare the two standards of BMI classification namely, the WHO classification for the general population and the revised classification for Asian Population.

### MATERIALS AND METHODS

This study was a prospective descriptive study. The study was done during the months of August and September 2016 in a tertiary care hospital in South India. All pregnant women who registered in the hospital for antenatal care, prior to 12 weeks and 6 days were recruited. The profiles of the enrolled pregnant women were collected using a proforma and the values of BMI for each class from the WHO general classification system was compared to the corresponding class of the WHO classification system for the Asian population. The sample size needed for this study was estimated to be 384, assuming a prevalence of 50%, absolute precision of 5% and 95% confidence interval.

### RESULTS

The participants' age ranged from 18 to 44 years with a mean age of  $26.0 \pm 4.4$  years. Of the pregnant mothers, 185 (46.3%) were multiparous and 215 (53.7%) were nulliparous. Out of the total of 400 pregnant mothers, 293 (73.3%) patients lived in an urban and 107 (26.7%) lived in rural areas. There were 176 (44%) graduates, 213 (53.3%) who had studied till atleast 5<sup>th</sup> standard and 11(2.7%) with no basic education. Thus among the participants, 97.3% had some form of basic education.

### CONCLUSION

1. Based on the WHO general standard of BMI classification, 201(50.2%) mothers were of ideal BMI, 57 (14.2%) were underweight, 95 (23.8%) were overweight and 47 (11.8%) were obese. 2. On comparing the two methods of WHO BMI classification (general and Asian), it was evident that the Asian classification classified more number of mothers to be in the higher risk category (137 (34.2%) were of ideal BMI, 123 (30.8%) were overweight and 83 (20.8%) were obese) 3. Of the 400 participants 199 (49.8%) had abnormal BMIs by general standards and 263 (65.8%) by the Asian standard.

### KEYWORDS

Body Mass Index, Asian Standard BMI.

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### BACKGROUND

Nutrition plays an important role in a woman's ability to sustain her pregnancy. Nearly 54% of Asian pregnant women were found to be at increased risk of inadequate

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energy intake.<sup>1</sup> During pregnancy, a woman requires an extra 300-400kcal/day,<sup>2</sup> restriction of which leads to increased mental deficits, decreased physical growth of baby and an overall failure to thrive in the mother. Studies regarding the body mass index (BMI) in pregnancy have frequently been based on the body mass index prior to pregnancy. A closely associated entity to BMI is gestational weight gain (GWG). The Institute of Medicine (IOM) had a publication regarding optimal weight gain in pregnancy based on the pre-pregnancy BMI.<sup>3</sup> It was recommended that weight gain for each class of BMI should be as follows:



Pre-pregnancy BMI	Recommended Weight Gain in kgs
< 19.8	12.5 – 18.0
19.8 - 26.0	11.5 - 16.0
26.1 – 29.0	7.0 - 11.5
> 29	7

**Table 1**

As per the BMI categories proposed by WHO, the advised weight gain was as follows<sup>4</sup>

Pre-pregnancy BMI	Recommended Weight Gain in kgs
< 18.5	12.5 – 18.0
18.5 - 24.9	11.5 - 16.0
25.0 – 29.9	7.0 - 11.5
≥ 30.0	5 – 9

**Table 2**

The weight gain recommended by both WHO and IOM across the classes of BMI were similar. What differed was their cut off values for each category of BMI.

Less is known about the impact of gestational weight gain in conjunction with BMI on perinatal outcomes in healthy pregnant women without other co-morbidities. Data from prospective cohort studies showed that normal weight women had a higher significant risk of gaining less weight than what was recommended.<sup>5</sup> Women with lower gestational weight gain had an increased risk for preterm birth, low birth weight, small for gestational age babies and a decreased risk for caesarean birth.<sup>6</sup> A population-based study was done in the United States of America involving 124,348 pregnant women to assess their GWG. It was found that 35.8% of them had GWG as per IOM recommendations, 44.4% gained more than and 19.8% gained less than recommended. Majority of those who fell within the recommended GWG category belonged to the underweight and normal weight category to begin with. Overweight and obese women comprised most of the group that had above the recommended amount of weight. They also reported that 53.4% of their study population had normal pre pregnancy BMI.<sup>7</sup> This analysis highlighted the continued need for clinical and public health efforts to develop and scale up effective strategies to ensure women enter pregnancy at a healthy weight. Aim of this study was to assess the prevalence of abnormal BMI in early pregnancy in women attending the antenatal OPD and to compare the two standards of BMI classification namely, the WHO classification for the general population and the revised classification for Asian Population.

**MATERIALS AND METHODS**

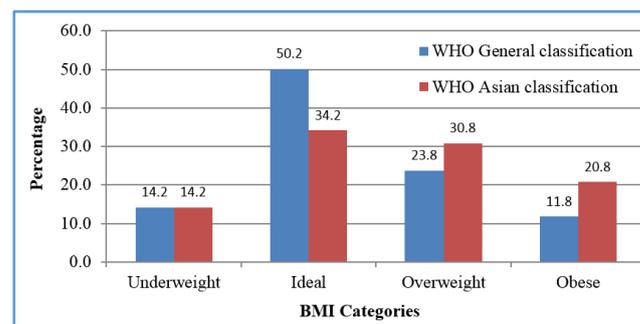
This study was a prospective descriptive study. All pregnant women who registered for antenatal care in the outpatient department prior to 12weeks and 6 days of gestation and unbooked (less than 3 antenatal visits during the ongoing pregnancy at time of presentation to the obstetrician) women who had first trimester height and weight recorded

and were admitted directly into the labour room or the obstetric wards were recruited. The study was done during the months of August and September 2016 in a tertiary care hospital in South India. Institutional ethics committee approval was obtained and informed consent was documented for all patients enrolled into the study. Patient data was collected using a proforma. The BMI was calculated using the formula: weight in kilograms divided by square of the height in meters and women were placed into one of the 4 categories (underweight, normal, overweight, obese) based on the WHO general classification<sup>8</sup> as well as the Asian classification<sup>9</sup> for comparison.

The profile of pregnant women with abnormal BMI was collected. This was then correlated with demographic and obstetric risk factors. Also, the values of BMI for each class from the WHO general classification system was compared to the corresponding class of the WHO classification system for the Asian population. The sample size needed for this study was estimated to be 384, assuming a prevalence of 50%, absolute precision of 5% and 95% confidence interval. The data were analysed by SPSS software version 20.0; differences between socio demographic variable and BMI was compared using Chi-square test and p <0.05 was considered statistically significant.

**RESULTS**

The participants’ age ranged from 18 to 44 years with a mean age of 26.0 ± 4.4 years. Of the pregnant mothers 185 (46.3%) were multiparous and 215 (53.7%) were nulliparous. Out of the total of 400 pregnant mothers 293 (73.3%) patients lived in an urban and 107 (26.7%) lived in rural areas. There were 176 (44%) graduates, 213 (53.3%) who had studied till atleast 5<sup>th</sup> standard and 11(2.7%) with no basic education. Thus among the participants 97.3% had some form of basic education. Forty four women (11%) were employed and the remaining 356 (89%) were unemployed. Only 7 (1.8%) and 3 (0.8%) woman had history of diabetes mellitus and systemic hypertension, respectively (Table 3). By the WHO general population standard there were 57 (14.2%) mothers in the underweight BMI category, 201 (50.2%) with ideal body weight, 95 (23.8%) in the overweight BMI category and 47 (11.8%) in the obese BMI category (Figure 1).



**Figure 1. Distribution of BMI according to the Different WHO Categories**

The distribution among the BMI classes of the nulliparous and multiparous mothers was not markedly different and was statistically not significant ( $p = 0.24$ ). The number of patients from the urban areas were almost three times more than those from rural areas. About 11.3% underweight mothers, 50.5% ideal weight mothers, 25.6% overweight mothers and 12.6% obese mothers were from the urban area while 22.4% underweight mothers, 49.5% of ideal weight mothers, 18.7 % of overweight mothers and 9.3% of obese mothers were from the rural areas. There was a significant association between place of residence and BMI ( $p=0.03$ ).

There was no association between education and BMI ( $p=0.72$ ), (Table 4)). The distribution of BMI classes between the unemployed and employed mothers was similar and was statistically not significant ( $p=0.33$ ), (Table 4)).

According to the Asian BMI standard 57 (14.2%) mothers were underweight, 137 (34.2%) were normal weight, 123 (30.8%) were overweight and 83 (20.8%) were obese. When comparing both the classification systems, the percentage of women in the underweight BMI category was the same, 14.2% (57). The number of women in the obese BMI category by Asian standards was almost twice as much as the number when categorized by the standards for the general population (83 (20.8%) and 47 (11.8%)). In this study, on comparison, 100 (25.0%) mothers had shifted from a lower BMI category to a higher BMI category. There were 64 (31.8%) mothers in the normal category by general standard who entered into the overweight category by Asian standard and 36 (37.9%) overweight mothers who entered into the obese category (Table 5).

Characteristic	Number	%
<b>Residence</b>		
Urban	293	73.3
Rural	107	26.8
<b>Education</b>		
Basic education	11	2.7
School (atleast 5 <sup>th</sup> standard)	213	53.3
Graduates	176	44.0
<b>Occupation</b>		
Unemployed	356	89.0
Employed	44	11.0
<b>Diabetes mellitus</b>	7	1.8
<b>Hypertension</b>	3	0.8

**Table 3. Baseline Characteristics of Study Participants**

Variables	WHO General Categories of BMI				Total	p Value
	Underweight (< 18.5 kg/m <sup>2</sup> )	Ideal (18.5-24.9 kg/m <sup>2</sup> )	Overweight (25.0-29.9 kg/m <sup>2</sup> )	Obese (≥ 30.0 kg/m <sup>2</sup> )		
<b>Residence</b>						
Urban	33 (11.3)	148 (50.5)	75 (25.6)	37 (12.6)	293 (100.0)	0.03
Rural	24 (22.4)	53 (49.5)	20 (18.7)	10 (9.3)	107 (100.0)	
<b>Education</b>						
No basic education	2 (18.2)	6 (54.5)	2 (18.2)	1 (9.1)	11 (100.0)	0.72
School (atleast 5 <sup>th</sup> standard)	35 (16.4)	105 (49.3)	46 (21.6)	27 (12.7)	213 (100.0)	
Graduates	20 (11.4)	90 (51.1)	47 (26.7)	19 (10.8)	176 (100.0)	
<b>Occupation</b>						
Unemployed	54 (15.2)	180 (50.6)	82 (23.0)	40 (11.2)	356 (100.0)	0.33
Employed	3 (6.8)	21 (47.7)	13 (29.5)	7 (15.9)	44 (100.0)	

**Table 4. Association between Selected Socio Demographic Variables and BMI according to the WHO Category**

WHO General Categories of BMI	WHO Asian Standard Categories of BMI				Total (%)
	Underweight (< 18.5 kg/m <sup>2</sup> )	Ideal (18.5-22.9 kg/m <sup>2</sup> )	Overweight (23.0-27.5 kg/m <sup>2</sup> )	Obese (> 27.5 kg/m <sup>2</sup> )	
Underweight (< 18.5 kg/m <sup>2</sup> )	57	0	0	0	57 (14.2)
Ideal (18.5-24.9 kg/m <sup>2</sup> )	0	137	64	0	201 (50.2)
Overweight (25.0-29.9 kg/m <sup>2</sup> )	0	0	59	36	95 (23.8%)
Obese (≥ 30.0 kg/m <sup>2</sup> )	0	0	0	47	47 (11.8)
Total (%)	57 (14.2)	137 (34.2)	123 (30.8)	83 (20.8)	400 (100.0)

**Table 5. Comparison of BMI According to the different WHO Categories**

## DISCUSSION

The number of pregnant mothers from the urban areas were almost three times more than those from rural areas. This might have been due to the fact that the hospital is located in an urban area and also because the referrals from the peripheral rural centers and from Institutional outreach centers were managed in subcenters or secondary hospitals which were equipped with trained staff and facilities. Hence few women from the rural centres attended institutional facilities.

More pregnant women from the rural area were found to be underweight, compared to the urban women who were either overweight or obese, as has been shown in the NFHS Surveys.<sup>10</sup> The incidence of underweight pregnant mothers was higher among people residing in the rural areas. Conversely overweight and obese classes of BMI were seen more in urban areas. The proportion of underweight mothers in the rural population was almost double that of the urban population. In a study in south east Nigeria among 3167 pregnant women, the proportion of women residing in urban areas and who were obese was significantly higher than the proportion residing in rural areas (15.4% vs. 2.4%).<sup>11</sup> Similarly the proportion of overweight and obese mothers in our study was higher in the urban population and was statistically significant ( $p=0.03$ ).

When considering educational status, the study revealed that the majority of the mothers had some basic form of education (schooling). When the level of education was compared with the various BMI categories, it was observed that most of the women across all categories of BMI had basic education in the form of schooling. Aside from the fact that giving health education for them would be an easier task for the health care provider, this educational background would enable them in identifying themselves, those changes that could be alarming and that could point towards a possible evolving complication of pregnancy like impending signs of eclampsia, decreased fetal movements etc.

The proportion of nulliparous mothers was slightly higher than multiparous mothers in the population under study (46.3% vs. 53.7%). When considering the BMI distribution among them, although other studies have shown that overweight and obesity is seen more in multiparous women and that BMI may increase with each successive pregnancy,<sup>12</sup> this trend was not observed in this study.

The majority of the pregnant mothers (89%) were unemployed. When employment status was studied within the BMI categories, it was observed that, in all the categories, less than 10% of the pregnant mothers were employed. This may be due to the fact that, many of the pregnant mothers believed that a sedentary lifestyle was good for the health of the growing fetus.

Based on the BMI classification by the WHO general standard, there were almost as many number of mothers with abnormal BMIs as there were with ideal BMIs. About 49% of the study population had an abnormal BMI (underweight, overweight and obese). The significance of this result is that about 50% of the population fall under the

high risk category requiring a closer surveillance throughout their antenatal period. Also, there were more underweight mothers than obese. In a study done in England similar findings were noted.<sup>13</sup>

When using the WHO general standard for obesity, 47 (11.8%) classified as obese. However, this increased to 83 (20.8%) when using the Asian standard. Similarly, the overweight category increased from 95 (23.8%) to 123 (30.8%). The ideal group decreased from 201 (50.2%) to 137 (34.2%). This implied that, although as a developing country the problem of under nutrition may be of greater magnitude than obesity, an overview of abnormal body mass indices showed that more mothers fell into the overweight category. Overweight, otherwise known as the pre-obesity stage, is a forerunner of obesity, posing similar health hazards. On one hand, as the cut off for underweight women in the Asian classification remained the same, the numbers in this category remained the same. But on the other, there was a higher percentage of women who fell into the overweight group (123 (30.8%) as compared to 95 (23.8%)) and the percentage of women in the obese group had almost doubled, as compared to the percentage in the general population standards. This would imply that women in our population, who would otherwise be considered to be of normal BMI by the WHO general standards, would now be considered as overweight and those who were considered overweight would be considered obese. This was the same trend that was seen in other studies that compared the 2 standards.<sup>14</sup> In practice, this would mean closer and more careful surveillance of a greater number of pregnant women, more frequent antenatal visits, more investigations and more number of interventions. Hence, the take home message would be that the WHO general classification would be inappropriate to use for calculating the BMI of Asian pregnant women because it underestimated their BMI. Instead the WHO Asian classification should be used as it identified more number of women with high risk pregnancy due to an abnormally high BMI {Of the 400 participants 199 (49.8%) had abnormal BMIs by general classification and 263 (65.8%) by the Asian classification}.

## CONCLUSION

1. Based on the WHO general standard of BMI classification, 201(50.2%) mothers were of ideal BMI, 57 (14.2%) were underweight, 95 (23.8%) were overweight and 47 (11.8%) were obese.
2. On comparing the two methods of WHO BMI classification (general and Asian) it was evident that the Asian classification classified more number of mothers to be in the higher risk category (137 (34.2%) were of ideal BMI, 123 (30.8%) were overweight and 83 (20.8%) were obese).
3. Of the 400 participants 199 (49.8%) had abnormal BMIs by general standards and 263 (65.8%) by the Asian standard.

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