

# Implications of the Revised Consensus Body Mass Indices for Asian Indians on Clinical Obstetric Practice

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## ABSTRACT

**Background:** The body mass index (BMI) categories for Asian Indians has been revised based on consensus guidelines. The revised guidelines categorize overweight as a BMI of 23.0 – 24.9 and obesity as a BMI  $\geq$ 25.

**Aim:** To determine the change in prevalence of overweight and obese pregnant women, and maternal and fetal associations with overweight and obese pregnant women classified using the revised consensus guidelines for BMI in Asian Indians.

**Materials and Methods:** A retrospective analysis of case records of pregnant women between January 2010 and December 2012 at a tertiary care institute in India. BMI was classified using the revised consensus guidelines for Asian Indians and the World Health Organization (WHO) criteria. The strength and direction of associations with maternal and fetal outcomes was explored with a multivariate regression model.

**Results:** The prevalence of obesity increased from 11.81% with the WHO criteria to 43.11% with the revised consensus guidelines and led to the re-classification of 1,345 (18.47%) pregnant women from a low risk category to a high risk category. Gestational hypertension, gestational diabetes and large for gestational age babies was associated with overweight or obesity (both Indian and WHO guidelines). Obesity (both Indian and WHO guidelines) was also significantly associated with caesarean sections (adjusted OR 1.23 and 1.51 respectively).

**Conclusion:** The use of the revised guidelines led to a larger classification of high risk Asian Indian pregnant women. Retention of adverse associations of overweight and obesity support adoption of the revised guidelines in obstetric management of Asian Indians.

**Keywords:** Body mass index, Obesity, Overweight, Pregnancy, Guidelines

## INTRODUCTION

Higher body mass index (BMI) is associated with morbidity and mortality especially that related to diabetes mellitus and cardiovascular diseases [1]. In 1997, a WHO expert committee classified a BMI of 25.0 – 29.0 kg/m<sup>2</sup> as overweight, 30 – 34.9 kg/m<sup>2</sup> as obesity and  $\geq$  35 kg/m<sup>2</sup> as morbid obesity [2]. Ethnic specific BMI cut off values, especially for Asian populations, have been proposed to address the higher prevalence of diabetes and cardiovascular diseases and the differing associations of BMI with body fat in different populations [3-7]. Guidelines for obesity and overweight based on body mass indices (BMI) for Asian Indians were revised based on consensus developed through discussions by a Prevention and Management of Obesity and Metabolic Syndrome group [8]. The revised guidelines categorize overweight as a BMI of 23.0 – 24 [9]. and obesity as a BMI  $\geq$ 25 using values lower than the ethnic specific BMI previously advocated for Asian Indians [8].

Obesity in pregnant women is associated with adverse perinatal events including an increased risk of gestational diabetes, pre-eclampsia, infection, and operative deliveries including caesarean sections, wound infection and endometritis and offspring at increased risk for birth defects, macrosomia, and morbidity associated with subsequent childhood obesity [9-18]. The aims of this single centre retrospective study was to firstly assess the impact of the revised guidelines on the prevalence of obesity and overweight in pregnant women and secondly to examine the direction and magnitude of pregnancy outcomes associated with obesity and overweight in this population.

## MATERIALS AND METHODS

The study population included women who delivered singleton babies from January 2010 to December 2012 inclusive at a tertiary perinatal center in Hyderabad, India. Women with multiple pregnancies, referrals from other hospitals, those who came only

for delivery at the institute or were booked after the first trimester of pregnancy or in whom complete data was not available were excluded from the study. The study protocol was approved by the Institutional Review Board and adhered to the tenets of the Declaration at Helsinki.

Body Mass Index (BMI) was derived from booking weight (kilograms) and height (metres). Using this, the patients were categorized as underweight (<18.5 kg/m<sup>2</sup>), normal or lean BMI (18.5–22.9 kg/m<sup>2</sup>), overweight (23.0 –24.9 kg/m<sup>2</sup>) and obese ( $\geq$ 25 kg/m<sup>2</sup>) based on the revised consensus guidelines for India. Their antenatal care included universal screening for diabetes and thyroid dysfunction, first trimester ultrasound screening with nuchal fold thickness at 11–13+6 weeks, targeted imaging for fetal anomalies at 18– 22 weeks and a fetal growth assessment at 32–34 weeks. The following definitions were used; gestational diabetes (GDM) was carbohydrate intolerance with onset or first recognition during pregnancy based on the International Association of Diabetes and Pregnancy Study Groups (IADPSG) [19]. Pre-eclampsia was onset of hypertension after 20 weeks gestation with proteinuria of 1+ or more, and eclampsia was the occurrence of convulsions in a woman with pre eclampsia. Intrapartum complications of interest included 3<sup>rd</sup>/4<sup>th</sup> degree perineal injury. Preterm delivery was defined as delivery before 37 completed weeks of gestation. The babies were classified as appropriate for gestational Age (AGA), small for gestational age (SGA) and large for gestational age (LGA) at birth by a trained neonatologist using appropriate neonatal growth charts developed for this population [20].

## STATISTICAL ANALYSIS

Data was analysed using STATA statistical software version 9.0 (College Station, Tx, USA) [21]. The association of BMI with maternal characteristics was determined using a Wilcoxon Ranksum test as BMI was not normally distributed (Shapiro Wilk test p <0.001). The

Characteristic	Normal BMI (n=3,633)	Lean BMI (n=481)	Overweight (n=2,280)	Obese (n=860)
Mean Maternal Age	26.99 (3.91)	25.38 (3.54)	28.25 (3.98)	28.98 (4.31)
Maternal age >35 years	97 (2.65%)	5 (1.04%)	97 (4.25%)	60 (6.98%)
Primigravid	1,714 (46.79%)	262 (54.47%)	786 (34.47%)	230 (26.74%)
Nulliparous	2,198 (60.01%)	306 (63.62%)	1,092 (47.89%)	350 (40.70%)
>3 abortions	36 (0.98%)	5 (1.04%)	28 (1.23%)	11 (1.28%)
Prior Caesarean	614 (16.76%)	70 (14.55%)	554 (24.30%)	271 (31.51%)
Chronic Hypertension	38 (1.10%)	3 (0.64%)	41 (1.96%)	57 (7.61%)
Prior Diabetes Mellitus	60 (1.93%)	3 (0.68%)	55 (3.23%)	46 (7.89%)
Prior Hypothyroid	255 (8.62%)	10 (2.67%)	232 (12.62%)	122 (17.53%)
Gestational Hypertension	90 (2.57%)	7 (1.49%)	101 (4.69%)	62 (8.22%)
Mild Pre-eclampsia	22 (0.64%)	1 (0.22%)	31 (1.49%)	24 (3.35%)
Severe Pre-eclampsia	89 (2.54%)	6 (1.28%)	50 (2.38%)	22 (3.08%)
Screen positive hypothyroid	149 (4.07%)	22 (4.57%)	116 (5.09%)	48 (5.58%)
Gestational Diabetes	556 (15.43%)	39 (8.16%)	578 (25.98%)	277 (34.03%)
Cesarean section	1566 (42.75%)	167 (34.72%)	1123 (49.25%)	509 (59.19%)
Preterm <37 weeks	409 (11.17%)	66 (13.72%)	283 (12.41%)	132 (15.35%)
Large for gestational age babies	337 (10.81%)	13 (3.10%)	317 (14.94%)	165 (20.15%)

**[Table/Fig-1]:** Characteristics of the 7,284 women included in the study and WHO criteria for Body Mass Index

	Normal BMI	Lean BMI	Overweight	Obese and Morbid Obesity
WHO	3,663 (50.29%)	481 (6.60%)	2,280 (31.30%)	860 (11.81%)
Revised Guidelines for India	2,318 (31.82%)	481 (6.60%)	1,345 (18.47%)	3,140 (43.11%)

**[Table/Fig-2]:** Distribution of body mass index in the study population stratified by the revised consensus guidelines for India and the WHO criteria

association of various BMI cutoff criteria with maternal and fetal adverse outcomes was determined using a multivariate logistic regression model. A p-value <0.05 was considered as statistically significant.

## RESULTS

In the period 2010 – 2012, there were 17,745 singleton deliveries at the study institute including 7,321 (41.26%) women who were booked for antenatal care in the first trimester. Thirty seven (0.51%) of these 7,321 women were excluded from further analyses due to lack of documentation of their BMI. The characteristics of the 7,284 women included for further analyses and stratified by BMI based on the WHO criteria are shown in [Table/Fig-1]. The distribution of BMI, using the revised consensus guidelines for India and the WHO criteria, are shown in [Table/Fig-2]. The revised consensus guidelines for BMI in Asian Indians led to the re-classification of 1,345 (18.47%) pregnant women from a normal category to an overweight category.

Prior hypothyroidism was significantly associated (Wilcoxon ranksum test p=0.02) with pregnant women considered overweight

Characteristic	BMI Category+	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio*(95% CI)
Gestational Hypertension	India (n=43)	1.62 (1.06,2.44)	1.79 (1.08,2.96)
	WHO (n=101)	1.87 (1.40,2.49)	1.89 (1.32,2.73)
Mild Pre-eclampsia	India (n=10)	1.46 (0.65,3.32)	1.75 (0.63,4.86)
	WHO (n=31)	2.35 (1.36,4.04)	2.38 (1.16,4.88)
Severe Pre-eclampsia	India (n=34)	1.09 (0.71,1.67)	1.11 (0.66,1.86)
	WHO (n=50)	0.94 (0.66,1.33)	0.77 (0.48,1.23)
Gestational Diabetes	India (n=244)	1.43 (1.19,1.72)	1.26 (1.02,1.56)
	WHO (n=578)	1.92 (1.69,2.19)	1.69 (1.45,1.97)
Obstetric Anal Sphincter Injury	India (n=13)	0.79 (0.41,1.52)	1.16 (0.57,2.35)
	WHO (n=26)	1.11 (0.68,1.82)	1.42 (0.83,2.44)
Caesarean Section	India (n=598)	1.12 (0.97,1.28)	1.02 (0.85,1.21)
	WHO (n=1123)	1.30 (1.17,1.44)	1.13 (0.98,1.31)
Preterm <37 weeks	India (n=165)	1.19 (0.96,1.47)	1.06 (0.79,1.42)
	WHO (n=283)	1.13 (0.96,1.32)	0.95 (0.75,1.22)
LGA	India (n=161)	1.63 (1.30,2.04)	1.50 (1.11,2.01)
	WHO (n=317)	1.55 (1.31,1.83)	1.36 (1.09,1.70)
Still Born	India (n=11)	1.12 (0.52,2.39)	1.70 (0.64,4.47)
	WHO (n=16)	0.92 (0.49,1.70)	1.16 (0.52,2.58)

**[Table/Fig-3]:** Maternal and fetal associations with overweight pregnant women based on WHO and revised consensus BMI guidelines for India

+ numbers in parenthesis indicate number of women with the condition in each BMI category \* Adjusted for maternal age, parity, chronic hypertension, diabetes mellitus and prior hypothyroidism; Reference category is the normal BMI range for each classification used

Characteristic	BMI Category+	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio*(95% CI)
Gestational Hypertension	India (n=163)	2.75 (1.98,3.82)	2.74 (1.80,4.16)
	WHO (n=62)	3.40 (2.44,4.75)	3.01 (1.86,4.88)
Mild Pre-eclampsia	India (n=55)	1.46 (0.65,3.32)	1.75 (0.63,4.86)
	WHO (n=24)	2.35 (1.36,4.04)	2.38 (1.16,4.88)
Severe Pre-eclampsia	India (n=72)	1.04 (0.73,1.48)	0.89 (0.56,1.82)
	WHO (n=22)	1.22 (0.76,1.96)	1.12 (0.57,2.18)
Gestational Diabetes	India (n=855)	2.47 (2.14,2.85)	2.04 (1.72,2.41)
	WHO (n=277)	2.83 (2.38,3.35)	2.34 (1.89,2.89)
Obstetric Anal Sphincter Injury	India (n=31)	0.94 (0.57,1.57)	1.38 (0.67,2.84)
	WHO (n=5)	0.71 (0.28,1.80)	0.36 (0.05,2.76)
Caesarean Section	India (n=1632)	1.51 (1.35,1.68)	1.23 (1.07,1.43)
	WHO (n=509)	1.94 (1.67,2.26)	1.51 (1.21,1.89)
Preterm <37 weeks	India (n=415)	1.29 (1.09,1.53)	1.01 (0.79,1.29)
	WHO (n=132)	1.44 (1.17,1.78)	1.09 (0.77,1.55)
LGA	India (n=482)	2.12 (1.77,2.54)	1.73 (1.36,2.21)
	WHO (n=165)	2.23 (1.81,2.73)	1.86(1.37,2.53)
Still Born	India (n=25)	1.09 (0.58,2.02)	1.55 (0.66,3.66)
	WHO (n=9)	1.37 (0.64,2.92)	1.52 (0.51,4.59)

**[Table/Fig-4]:** Maternal and fetal associations with obese pregnant women based on WHO and revised consensus BMI guidelines for India

+ numbers in parenthesis indicate number of women with the condition in each BMI category \* Adjusted for maternal age, parity, chronic hypertension, diabetes mellitus and prior hypothyroidism; reference category is the normal BMI range for each classification used

as classified by the revised consensus guidelines for India. Chronic hypertension, prior diabetes mellitus and prior hypothyroidism and maternal age >35 years were significantly associated (Wilcoxon rank sum test; all p values <0.001) with obesity as classified by the revised consensus guidelines for India.

[Table/Fig-3,4] present the factors associated with being overweight or obese (both Indian and WHO guidelines) in a multivariate logistic regression model.

## DISCUSSION

The revised consensus guidelines for BMI in Asian Indians increased the prevalence of obesity and overweight pregnant women and retained significant associations with certain maternal and fetal outcomes. The group of pregnant women previously considered overweight (based on the WHO criteria) was now considered obese. In this study, the prevalence of obesity increased from 11.81% when the WHO criteria was used to 43.11% with the new guidelines. The re-classification reduced the prevalence of pregnant women with normal BMI from 50.29% to 31.82% and led to 18.47% of pregnant women being reclassified as overweight. Thus, nearly one in five pregnant women were added to the pool of mothers "potentially at risk" for adverse events.

Significant associations with obesity (gestational hypertension, gestational diabetes, caesarean sections and large for gestational age babies) were retained with the new classification. However, the association with mild pre-eclampsia that was significant with the WHO criteria lost significance with the revised consensus guidelines for BMI in Asian Indians. The newly classified overweight group, previously considered normal, was indeed a "high risk" group.

The lack of significant association with certain known associations including mild or severe pre-eclampsia with overweight and obesity in this sample may possibly be a true lack of association; however, this study does not have enough power to determine if these observed lack of association is really true. The population in this study was urban middle to upper class seeking care at an advanced tertiary care institute and not representative of most pregnant women in India.

Appropriate weight gain during pregnancy can affect fetal and maternal well-being and several guidelines exist on appropriate weight gain during pregnancy [22-26]. More studies using the newer guidelines for BMI on diverse populations from India to determine the strength and direction of associations with adverse maternal and fetal outcomes, and appropriate gestational weight gain are required.

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