Better Predictor of Adverse Pregnancy Outcome: Asian or WHO International Cutoff? A Single-Centre Prospective Study

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Received: 6 August 2015 / Accepted: 23 November 2015 / Published online: 7 January 2016
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Abstract

Objectives To compare the Asian Indian body mass index (BMI) and waist circumference (WC) with World Health Organization (WHO) BMI and WC in the prediction of

adverse maternal and perinatal outcome in overweight and obese women.

Materials and Methods Prospective analysis of 239 women booked within 10 weeks of pregnancy and followed till delivery at our centre was performed.

Results The mean age of the study group was 26.08 years, of which elderly gravida was 1.3 %. Overall, 17.6 % were overweight, 29.7 % were obese, and 42.7 % had abdominal obesity as per Asian Indian BMI and WC cutoff, whereas only 8.5 % were obese, and 14.2 % had abdominal obesity as per WHO. In high-risk group, gestational diabetes was commonest complication (20 %). Compared to WHO, Asian Indian BMI cutoff has statistically significant predictability for gestational diabetes, preeclampsia and its complications, labour induction, and Caesarean section rate. On the other hand, Asian WC has the best predictability only for preeclampsia and its complications. Sensitivity, specificity, and negative predictive

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value of Asian BMI were 82, 55 and 96 % when compared with 60.7, 72.3 and 92 % of WHO BMI.

Conclusion Categorising women using Asian BMI, an increase in the prevalence of obesity by threefold is noted. Asian BMI and WC have high sensitivity in predicting adverse maternal and foetal outcomes and should be widely implemented in obstetric practice.

Keywords Asian Indian BMI · Asian WC · WHO BMI · Comparison · Pregnancy outcome

Introduction

The World Health Organization has described obesity as one of today's most neglected public health problems, affecting every region of the globe [1]. Obesity in recent days is a major threat to the society, and it is increasing, especially in the urban population. This is due to the drastic change in the socioeconomic conditions, lifestyle modification and food habits during the last decade. It is a well-known risk factor for diabetes, hypertension, coronary heart disease, stroke and adverse pregnancy outcome. In India, over 30 million are overweight or obese. 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 [2]. Indian states are currently facing the double burden of under nutrition as well as over nutrition. According to the NFHS, the percentage of women aged 15–49 years who are overweight or obese increased from 11 % in NFHS-2 to 15 % in NFHS-3. In South India, Tamil Nadu (24.4 %) ranks second in obesity following Kerala (34 %) [3]. The current WHO cutoff points [4] for body mass index (BMI) and waist circumference (WC) do not provide an adequate basis for taking action on risks related to overweight and obesity in many populations in Asia as these are largely based on the morbidity and mortality data from the white Caucasian populations. Relation between the BMI and percentage of body fat depends on the age and sex and differs across ethnic groups. Asian Indians are at high risk at lower BMI group. Hence, 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. As per revised guidelines, BMI > 25 kg/m² is categorised as obese and WC > 80 cm as abdominal adiposity [5]. WC is least implemented in pregnancy, but it is a reliable marker and measure of abdominal adiposity [6]. There are many studies based on increased BMI and adverse pregnancy outcome. But many of those studies are done with WHO international cutoffs. In this study, we have analysed the pregnancy outcome with revised Asian

cutoffs and compared the results with WHO International cutoff outcome to determine the best predictor of maternal and perinatal outcome among the both.

Methodology

This is a prospective study done in the Department of Obstetrics and Gynaecology in a ESIC Medical College and PGIMS, Chennai, South India, Tamil Nadu. Study period is 1 year, and 239 women were enrolled in the study from March 2013 to February 2014.

Ethical committee approval was obtained prior to the study. All pregnant women having their antenatal visit within 10 weeks of pregnancy and having their delivery at our hospital were included. Women with BMI less than 18 kg/m², multiple pregnancies, hyperemesis gravidarum, with co-existent medical disorders—diabetes, hypertension, thyroid disorders, epilepsy, bronchial asthma, congenital heart disease, chronic kidney disease, and connective tissue disorders were excluded. Informed consent was obtained from all the patients who were willing to participate in the study. Demographic details and detailed history were collected using a questionnaire, and details such as literacy, socioeconomic status, and anthropometric measurements were recorded. Height was measured without shoes by a wall-mounted measuring tape with an accuracy of 0.5 cm. Weight was measured in a standard weighing scale with an accuracy of 100 g. Waist circumference was measured using non-stretchable flexible tape in horizontal position, just above the iliac crest, at the end of expiration, with the subject standing erect and looking straight forward and observer sitting in front of the subject. BMI was calculated using Quetelet's index.

Participants were divided according to both WHO International BMI and WC, and Asian Indian BMI and WC.

Asian Indian BMI	WHO International BMI
Normal—18–22.9 kg/m ²	Normal—20.0–24.9 kg/m ²
Overweight—23.0–24.9 kg/m ²	Overweight—25.0–29.9 kg/m ²
Obese > 25 kg/m ²	Obese > 30 kg/m ²

WC more than 80 cm is considered as abdominal obesity as per Asian Indian criteria, whereas 88 cm is the cutoff point as per international criteria. Antenatal advice was given to the women after initial examination, and antenatal investigations like haemoglobin, urine albumin, blood sugars, urine culture and sensitivity, blood grouping and typing, HIV, HBsAg, and VDRL were done. Dietary

counselling and recommended weight gain advice were given to all patients as per their BMI. Antenatal checkups were performed once in a month till 28 weeks, fortnightly till 34 weeks and then weekly till delivery. Haemoglobin was repeated at 20 weeks, at 32 weeks and at term. Weight, blood pressure and urine albumin estimation was carried out at each antenatal visit. Foetal growth assessed by maternal weight gain, obstetric examination and ultrasonography. Patients with haemoglobin less than 10 gm/dl were considered anaemic. Blood sugars > 140 mg/dl after 2 h of 75 grams of glucose challenge were diagnosed as gestational diabetes (GDM) as per DIPSI guidelines. Gestational hypertension (GHT), Preeclampsia (PE)—eclampsia, was diagnosed as per national high blood pressure education and working group. Antenatal progress was noted. Intrapartum and labour details were recorded. Postnatal and neonatal details were also noted.

Outcome Measure

Primary outcome measured were gestational diabetes, GHT, PE—eclampsia, antepartum haemorrhage, preterm labour, prelabour rupture of membranes.

Secondary outcome measured were labour induction, Caesarean section rate, postpartum haemorrhage, postpartum sepsis, thromboembolism, lactation problems, small for gestational age, large for gestational age, prematurity, and NICU admissions.

The statistical analysis of the data was carried out using Pearson Chi-square test using SPSS software version 18. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of Asian and WHO cutoff in predicting antenatal complications, intrapartum variables and postnatal and neonatal complications were calculated.

Results

The mean age of the study group is 26.02 years. Age distribution of the study group as per Asian cutoffs is shown in Table 1. Parity, educational qualification and socioeconomic status was comparable in all the groups. Out of 239 women, 52.7 % (126/239) were normal, 17.6 % (42/239) overweight, and 29.7 % (71/239) were obese as per Asian BMI. Only 8.5 % were obese as per WHO International cutoff. Prevalence of abdominal adiposity was 42.7 % as per Asian cutoff when compared to 14.2 % according to WHO cutoff. Categorisation of the study group as per Asian and WHO cutoffs is shown in Fig. 1. Out of 152 women considered normal as per WHO cutoff, 42 were reclassified as overweight and 51 women turned obese from overweight. Study population added to the high-risk pool after applying Asian standards is shown in Table 2.

Table 1 Age distribution among the study group as per Asian cutoffs

Age (years)	Normal (n=)	Overweight (n=)	Obese (n=)	WC <72 cm	WC 73–79 cm	WC >80 cm
<19	4	1	–	4	–	1
20–25	62	19	31	46	27	39
26–30	52	20	24	23	29	44
31–35	7	2	14	4	3	16
>35	1	–	2	1	–	2

Fig. 1 Study group as per Asian and WHO BMI

Table 2 Addition to high-risk group

WHO BMI	Asian Indian BMI			Total
	Normal	Overweight	Obese	
Normal	110	42		152
Overweight			51	51
Obese			20	20
Total	110	42	71	

Numbers in Italics indicates number of subjects added to high risk pool

Table 3 Antenatal complications in the study group

Antenatal complications	Normal (%)	Overweight (%)	Obese (%)	p value
Miscarriage	5.5	14.3	4.2	ns
Anaemia	17.5	14.3	11.3	ns
GDM	6.3	14.3	23.9	0.002
GHT	0.8	–	7.1	0.002
PE	1.6	9.5	5.6	0.006
PTL/PROM	13.5	14.3	8.5	ns
IUGR	3.2	4.8	2.8	ns
IUD	0.8	–	–	ns

Statistically significant complications are noted in italics

Among the antenatal complications, anaemia was the most common (26.4 %) followed by gestational diabetes mellitus (22.6 %) and preterm labour (21.1 %). GDM,

Fig. 2 Spectrum of complications among normal and high-risk group. *PTL* Preterm labour, *PROM* prelabour rupture of membranes, *IUGR* intrauterine growth restriction, *IUD* intrauterine demise

Fig. 3 Labour induction among the study group

GHT and its complications were high in the high-risk group which was statistically significant (p value 0.002). Antenatal complications among the study group are shown in Table 3. In the normal group, 51 % had no complications, whereas 67 % had complications in the high-risk [overweight and obese] group. Spectrum of complications in normal- and high-risk group is shown in Fig. 2.

Among the intrapartum variables, labour induction was high in the obese group (52.4 %) compared with 22.6 % in normal group and is statistically significant (p value 0.01). Similarly, labour induction was high in the abdominal adiposity group with 51.2 %. Labour onset among normal, overweight and obese in the study group is shown in Fig. 3. Caesarean section rate was high in the obese group. 55.9 % underwent Caesarean section (CS) in the obese group compared to 40 % in the normal group. Similarly in women with normal WC, 36.9 % underwent CS, whereas women with abdominal adiposity 52.9 % landed in CS. Complications such as postpartum haemorrhage, wound infection and subinvolution were higher in the obese group but were not statistically significant. Neonatal complications such as respiratory distress syndrome, prematurity and Neonatal jaundice were high in the obese group but were not statistically significant. Neonatal complications among the study group are shown in Table 4.

On applying WHO cutoff in defining the high-risk group, there is twofold chance of missing out the risk population. The sensitivity and NPV of Asian BMI in detecting GDM is 82 and 96 % when compared to 60.7 and 92.7 % of WHO BMI, respectively. Similarly, Asian BMI has a sensitivity and NPV of 86.6 and 98.4 %, respectively, in detecting GHT, PE and complications. The sensitivity, specificity, PPV and NPV of Asian and WHO cutoffs in detecting the statistically significant complications such as GDM and GHT are shown in Table 5.

Discussion

Obesity is drastically increasing in both rural and urban areas. Studies show that prevalence of obesity is 19.8 % and overweight 27.7 % with highest in the age group of 30–39 years [7]. Mean age of our study group is 26.02 years. Prevalence of obesity is more in 20- to 25-year age group. There is a steady increase in abdominal adiposity from 20 to 25 years age group and highest in 26- to 30-year age group. Out of 239 women, 29.7 % were obese as per Asian BMI which is almost four times higher than WHO BMI estimation. Similarly, abdominal obesity increases from 14.2 to 42.7 % on applying Asian WC cutoff. This result is comparable with Asiz et al. [8] study where the obesity increased from 11.8 to 43 %. WHO cutoffs are mainly based on the Western standards, and Asian Indians are at high risk at lower BMI due to increased abdominal obesity, increased subcutaneous and intraabdominal fat deposition and increased ectopic site fat deposition.

Among the antenatal complications, GDM and GHT/complications are statistically significant in the high-risk group. These results are similar to the Dasgupta et al. [9] study with 17 % GDM and 28.4 % GHT in obese group

Table 4 Neonatal complications

Complications	Normal (n=)	Overweight (n=)	Obese (n=)
Respiratory distress syndrome	8	4	16
Prematurity	2	2	4
Sepsis	1	–	2
Neonatal jaundice	–	–	5
Hypoxic ischaemic encephalopathy	1	–	3
Transient tachypnea	2	–	2
Congenital heart disease	–	–	1
Subarachnoid haemorrhage	–	1	1
Neonatal death	1	1	2

Table 5 Predictability of GDM and GHT by Asian and WHO cutoffs

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
GDM				
Asian BMI	82	55	19	96
WHO BMI	60.7	72.3	23.9	92.7
Asian WC	74.1	62	22.5	94.1
WHO WC	16.1	86	14.7	87.3
GHT and complications				
Asian BMI	86.6	53.9	10.9	98.4
WHO BMI	60	70.1	12.6	96
Asian WC	68.7	59.1	10.8	96.3
WHO WC	41.1	87.8	20.5	95.1

Asian cutoffs having better predictability are shown in italics

and Shabnam et al. [10] study with 35 % GHT risk in obese women. Spectrum of complications in the normal and high-risk group is strikingly different. In the normal group, anaemia was the most common complication followed by Preterm labour/PROM, whereas in the high-risk group, GDM was the commonest. Obesity is an independent risk factor for maternal complications like GDM, GHT and IUGR. This is due to hyperinsulinemia and hyperlipidemia in obese patients resulting in enhanced oxidative stress with decreased prostacyclin and more peroxide production resulting in vasoconstriction and platelet aggregation resulting in hypertensive disorders of pregnancy and its complications [9].

There is about twofold increase in labour induction among the obese group (52.4 vs. 22.6 %). This result is concordant with Meenakshi et al. [11] study with 30.9 % induction in the obese group. Caesarean section rate is also high in high-risk group with 55.9 % and is comparable with studies by Vinayagam et al. and Habiba et al. with Caesarean rate of 22 and 48 %, respectively [12, 13].

Among the postnatal complications, though not statistically significant, postpartum haemorrhage, wound infection and subinvolution are high in the high-risk group. This is comparable with Usha kiran et al. [14] study and is attributed to large placental area, macrosomia, large volume of distribution and decreased bioavailability of uterotonic agents [15]. Respiratory distress syndrome, prematurity and neonatal jaundice are high in the obese women similar to Meenakshi et al. [11] study.

In our study, there is twofold increase in prevalence of obesity and abdominal adiposity on applying Asian cutoffs. In Asiz et al. study, three- to fourfold undercategorisation of high-risk patients was observed as per the previous criteria especially in case of GHT, GDM, severe preeclampsia, macrosomia and Caesarean section rates. Asian BMI has high sensitivity and NPV in predicting gestational diabetes, GHT and complications. Similarly, Asian WC cutoff of less than 80 cm (Asian WC) has better predictability values especially for GDM and GHT when compared to WHO WC of >88 cm. Hence, Asian BMI and WC identify the high-risk women better than WHO cutoffs.

Limitation

Small sample size.

Conclusion

Asian cutoffs have the better predictability for adverse maternal and perinatal outcome. As we Asian Indians are at higher risk at lower BMI, Asian cutoffs of BMI and WC should be implemented widely in the first booking visit to identify the high-risk women. Early identification and management of the high-risk group reduce the incidence of maternal and perinatal adverse outcome.

Compliance with Ethical Standards

Conflict of interest All the authors declare that they have no conflict of interest.

Ethical standards All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Declaration of Helsinki 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study.

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