THE JOURNAL OF OBSTETRICS AND GYNECOLOGY OF INDIA

The Journal of Obstetrics and Gynecology of India (May–June 2018) 68(3):173–178
https://doi.org/10.1007/s13224-017-1000-9

ORIGINAL ARTICLE

Importance of Adopting BMI Classifications Using Public Health Action Points to Delineate Obstetric Risk Factors Resulting in Worsening Obstetric Outcomes Among Asian Population

Muniswaran Ganeshan[1] · Mohamad Adam Bujang[2] · Shahrul Aiman Soelar[3] · Shamala Devi Karalasingam[4] · Harris Suharjono[1] · Ravichandran Jeganathan[5]

Received: 2 August 2016 / Accepted: 20 April 2017 / Published online: 4 May 2017

About the Author

Muniswaran Ganeshan is a Maternal Fetal Medicine Specialist and an Obstetrician and Gynaecologist currently practising in Hospital Kuala Lumpur. He is the unit lead for the Maternal Fetal Medicine Unit, Hospital Kuala Lumpur, since March 2016. He is actively involved in research and training in obstetric emergencies and has also won numerous regional awards. He has been involved in editing numerous national guidelines and has presented in various regional and international conferences.

Muniswaran Ganeshan is Maternal Fetal Medicine Specialist, Obstetrician and Gynaecologist, Sarawak General Hospital, Ministry of Health Malaysia, Kuching, Sarawak, Malaysia. Mohamad Adam Bujang is Research Officer and Statistician, Clinical Research Centre, Sarawak General Hospital, Jalan Hospital, Ministry of Health Malaysia, 93586 Kuching, Sarawak, Malaysia. Shahrul Aiman Soelar is Research Officer and Statistician, Clinical Research Centre, Hospital Sultanah Bahiyah, Ministry of Health Malaysia, Kuching, Kedah, Malaysia. Shamala Devi Karalasingam is Consultant Obstetrician and Gynaecologist, National Clinical Research Centre, Ministry of Health Malaysia, Kuala Lumpur, Malaysia. Harris Suharjono is Head of Department Obstetrics and Gynaecology, Sarawak General Hospital, Ministry of Health Malaysia, Kuching, Sarawak, Malaysia. Ravichandran Jeganathan is Head of Department Obstetrics and Gynaecology, Hospital Sultanah Aminah, Ministry of Health Malaysia, Kuching, Johor, Malaysia.

✉ Mohamad Adam Bujang
adam@crc.gov.my

Muniswaran Ganeshan
gmuniswaran@yahoo.com

1 Sarawak General Hospital, Ministry of Health Malaysia, Kuching, Sarawak, Malaysia

2 Clinical Research Centre, Sarawak General Hospital, Jalan Hospital, Ministry of Health Malaysia, 93586 Kuching, Sarawak, Malaysia

3 Clinical Research Centre, Hospital Sultanah Bahiyah, Ministry of Health Malaysia, Alor Setar, Kedah, Malaysia

4 National Clinical Research Centre, Ministry of Health Malaysia, Kuala Lumpur, Malaysia

5 Hospital Sultanah Aminah, Ministry of Health Malaysia, Johor Bahru, Johor, Malaysia

Abstract

Aims The aim of this study is to compare obstetric outcomes between overweight and class 1 obesity among pregnant women in their first pregnancy based on WHO's BMI cut-offs and the potential public health action points identified by WHO expert consultations specific for high-risk population such as Asians.

Methods This is a retrospective cohort review of data obtained from the Malaysian National Obstetrics and Gynaecology Registry between the year 2010 and year 2012. All women in their first pregnancy with a booking BMI in their first trimester were included in this study. The association between BMI classifications as defined by the WHO cut-offs and the potential public health action points identified by WHO expert consultations towards adverse obstetric outcomes was compared.

Results A total of 88,837 pregnant women were included in this study. We noted that the risk of adverse obstetric outcomes was significantly higher using the public health action points identified by WHO expert consultations even among the overweight group as the risk of stillbirths was (OR 1.2; 95% CI 1.0,1.4), shoulder dystocia (OR 1.9; 95% CI 1.2,2.9), foetal macrosomia (OR 1.8; 95% CI 1.6,2.0), caesarean section (OR 1.9; 95% CI 1.8,2.0) and assisted conception (OR 1.9; 95% CI 1.6,2.1).

Conclusion A specifically lower BMI references based on the potential public health action points for BMI classifications were a more sensitive predictor of adverse obstetric outcomes, and we recommend the use of these references in pregnancy especially among Asian population.

Keywords Asians · Clinical outcomes · Body mass index (BMI) · Screening · WHO

Introduction

The obesity epidemic is a significant global health burden and a modern health challenge [1, 2]. Previous research had found that about one in four to one in five pregnant women are obese [1–3]. The adverse physical and psychosocial effects of obesity in pregnancy have already been well established, and body mass index (i.e. BMI) is commonly adopted as an essential risk stratification tool in obstetrics [4].

Body mass index is a simple index measure of weight and has been widely used to define and classify different levels of obesity. Although the use of BMI as a disease indicator has to be specifically tailored for different population, the WHO BMI classifications remain a universal standard that adequately reflects the percentage of fat and the risk of negative health outcomes [5]. However, findings from several past studies had already suggested that a BMI classification system that is tailored to specific socio-demographic characteristics within a population may be a more accurate reflection of different levels of health risk. This was found to be particularly true for the Southeast Asians [6]. For example, a lower BMI cut-off was thought to be more appropriate for Southeast Asians in the risk stratification and guidance of patients in primary risk management for metabolic diseases.

Thus, the primary aim of this retrospective cohort review was to compare the difference in the detection of adverse obstetric outcomes during the first childbirth between the WHO's BMI classification system and another classification system that was based on public health action points identified from WHO expert consultation (which had lower principal cut-off points that were more specifically tailored to the Asian population). The secondary aim of this review was to assess the strength of association of BMI as an independent screening tool for various obstetric outcomes.

A further specific aim of this retrospective cohort review was to evaluate the versatility of using WHO's BMI cut-offs to detect the prevalence of worsening obstetric outcomes due to both overweight and class 1 obese pregnancy. An attempt would then be made to further improve the application of WHO's BMI cut-offs to also serve as a useful predictor of adverse obstetric outcomes due to obesity, because we hereby endeavour to minimize risks of both maternal and foetal mortality and morbidity due to obesity in pregnancy. By doing so, we may possibly also strengthen the validity of using BMI as an essential tool to improve risk stratification in primary prevention of obstetric complications.

Methodology

This was a 36-month retrospective cohort review of data obtained from Malaysian pregnant women during their first childbirth. A sample of data from mothers during the first childbirth was preliminary obtained to identify all possible confounding effects and other maternal and foetal characteristics, so that it would subsequently be eliminated. The entire data set was obtained from the National Obstetrics Registry of Malaysia (NOR), and the study period was from year 2010 to year 2012. This study was registered with the National Medical Research Register, and its NMRR ID was 25530.

Variables and Measurements

The objective of this review was to compare differences in adverse maternal and foetal outcomes of pregnant women

between various BMI classifications which include the WHO's BMI classification, and the BMI classification based on potential public health action points identified by WHO expert consultation [5]. The WHO expert consultation had identified 23.0, 27.5, 32.5 and 37.5 kg/m^2 as the potential public health action points. Therefore, based on these new potential public health action points which had been identified by WHO expert consultation, our next focus was to examine the utility of BMI cut-offs for 23.0 and 27.5 kg/m^2, which were specifically regarded as the BMI cut-offs for overweight and class 1 obesity for the Asian population.

Since it is envisaged that a BMI classification system that is more specifically tailored to the Asian population and its socio-demographic characteristics will be a more accurate indicator for diagnosing overweight and obesity among Asians, we used these references to evaluate the association with adverse obstetric outcomes among Malaysians.

Therefore, we now defined the independent variables of overweight and class 1 obesity by both WHO's BMI classifications (25.0 for overweight and 30.0 for class 1 obesity) and the BMI classification based on potential public health action points identified by WHO expert consultation (23.0 for overweight and 27.5 for class 1 obesity). Throughout this research study, booking BMI or BMI documented in the first trimester was used.

Outcomes

The primary outcomes were caesarean section, shoulder dystocia, foetal macrosomia, stillbirth, instrumental deliveries, Apgar score at 5 min, anaemia and assisted conception. All these outcome measures were expressed as categorical binary data.

Statistical Analysis

Since all the outcome measures were expressed as categorical binary data, binary logistic regression analysis was performed. Odds ratios were calculated to indicate the magnitude and statistical significance of the association between BMI and the clinical outcomes. All data were analysed using SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp).

Results

Data obtained from a total of 88,837 patients were analysed. The incidence of various clinical outcomes is presented in Fig. 1. The clinical outcome with the highest incidence was anaemia (33.1%), followed by caesarean section (27.2%) and instrumental delivery (7.2%). The incidence of all the other clinical outcomes was less than 3%, and the clinical outcome having the lowest incidence was shoulder dystocia (0.1%).

The association between the two different BMI classification systems (i.e. WHO's BMI cut-offs and cut-offs provided by potential public health action points identified by WHO expert consultation) for both overweight and class 1 obesity and eight selected clinical outcomes is presented in Figs. 2 and 3. The odds ratios calculated from both the Asian BMI cut-offs and WHO's BMI cut-offs were found to be almost identical when a comparison was made between the association of clinical outcomes with two of the BMI cut-off classifications, namely "at least overweight" and "non-overweight" (Fig. 2).

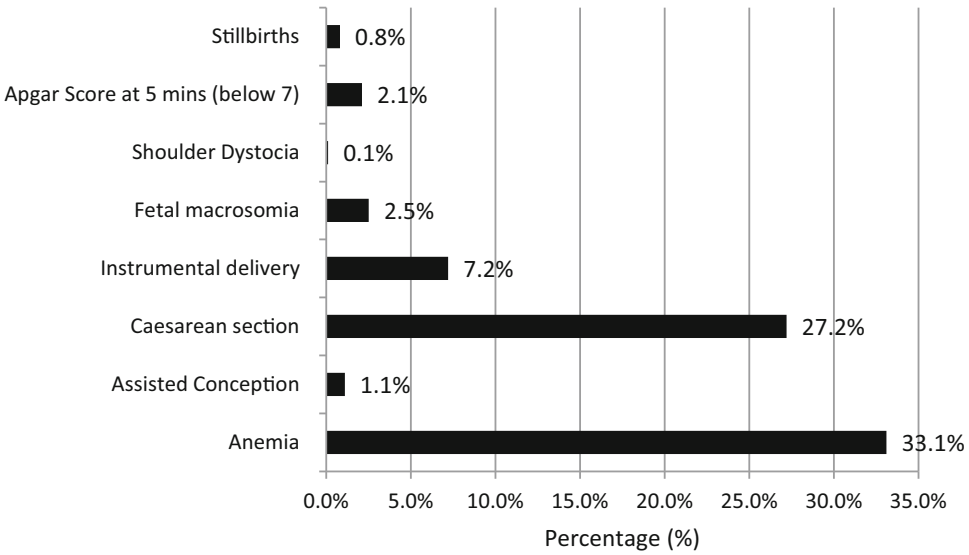

Fig. 1 Prevalence of maternal and foetal outcomes

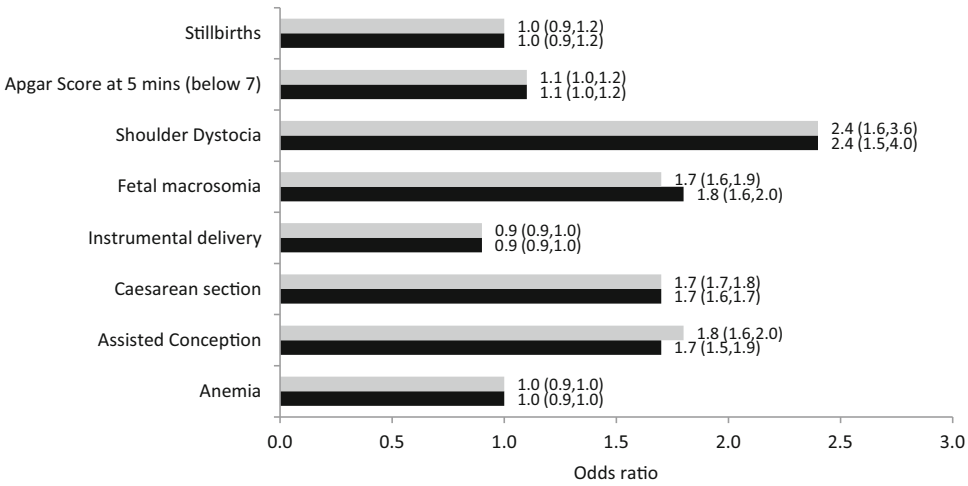

Fig. 2 Comparison of the effect size (odds ratio) between at least overweight versus non-overweight based on public health action points that are identified from WHO expert consultation (*black* in colour) and BMI cut-off from WHO's classification (*grey* in colour)

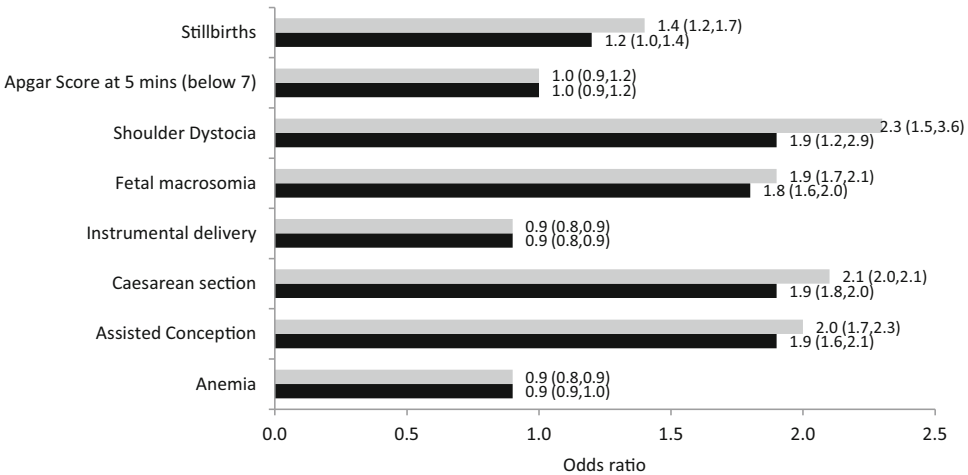

Fig. 3 Comparison of the effect size (odds ratio) between at least obese class 1 versus non-obese class I based on public health action points that are identified from WHO expert consultation (*black* in colour) and BMI cut-off from WHO's classification (*grey* in colour)

However, it was found that several clinical outcomes have resulted in a higher odds ratio when WHO's BMI cut-off was used to compare with "at least class 1 obese" and "non-class 1 obese" (Fig. 3). Examples of these clinical outcomes includes stillbirth [i.e. OR (95% CI) of 1.4 (1.2,1.7) (calculated from the WHO's BMI classification system) versus 1.2 (1.0,1.4) (calculated from the Asian BMI classification system)]; shoulder dystocia [i.e. OR (95% CI) of 2.3 (1.5,3.6) (calculated from the WHO's BMI classification system) versus 1.9 (1.2,2.9) (calculated from the Asian BMI classification system)]; caesarean section [i.e. OR (95% CI) of 2.1 (2.0,2.1) (calculated from the WHO's BMI classification system) versus 1.9 (1.8,2.0) (calculated from the Asian BMI classification system)]; assisted conception [i.e. OR (95% CI) of 2.0 (1.7,2.3) (calculated from the WHO's BMI classification system) versus 1.9 (1.6,2.1) (calculated from Asian BMI classification system)].

Despite the above results, these were only very slight differences because the 95% confidence intervals of these odds ratios had overlapped between the two BMI classifications (namely "at least class 1 obese" and "non-class 1 obese") and all the other calculated odds ratios were found to be almost identical.

Discussion

Body mass index (BMI) is well known to be an essential prognostic factor of clinical outcomes. So, some researchers have debated about specific BMI cut-offs which should be the targets or intervention to improve clinical outcomes [7, 8]. Previous studies have found that diseases due to obesity commonly occurred at much lower BMI cut-offs in the Asian population, compared to the patient populations from both Europe and America [7] despite the current WHO recommendations for universal classification although with an advice that each country should work towards their own population specific targets [5].

It is globally recognized that the health implications of obesity are considerable for both the mother and baby during pregnancy and beyond and must therefore be given due medical attention. So, in order to advance further, the principal aim should now be shifted to focus on the determination of a specific BMI classification that will appropriately delineate the association between BMI and obstetric outcomes. This BMI classification system should ideally be based on a reference range that is both sensitive and clinically relevant. Being clinically relevant, it will enable the clinicians to gauge the clinical significance of the BMI cut-offs for various categories (and the differing levels of health risk associated with them) in order for them to implement the necessary and appropriate primary preventive measures.

Therefore, the association between the clinical outcomes of pregnant mothers who were classified as overweight and as "class 1 obesity" with their respective BMIs was evaluated to determine the sensitivity of the BMI classification system as a predictor of adverse maternal and foetal outcomes. A further comparison was made between the sensitivities of the WHO's BMI classification system (which is recommended for universal use internationally) and the Asian BMI classification, which has a lower BMI cut-off point, but is perceived to be more specifically tailored for Asian population.

In addition, although it is well known that WHO's BMI classification is a more sensitive predictor of adverse outcomes in the class 1 obese pregnant women, however, this retrospective cohort review found there was no obvious difference between the association of obstetric outcomes of those pregnant women who were classified as overweight or class 1 obese, regardless of whether their BMI categories were based on the WHO's or the Asian BMI classification.

Despite the above, this retrospective cohort review also found that although the Asian BMI classification system has a lower BMI cut-off for class 1 obese pregnant women than the WHO's, it was found that the odd ratios were invariably more than one for some obstetric outcomes such as stillbirths, shoulder dystocia, foetal macrosomia, caesarean section and assisted conception. This clearly shows that the Asian BMI cut-offs are better able to delineate the association between the BMI and prevalence and risk of adverse obstetric outcomes, and so healthcare providers can more promptly recognize such risk and act upon them accordingly.

Therefore, our results have therefore supported the contention that the principal BMI cut-off points of all the different BMI categories based on the Asian BMI classification system should ideally be used for the Asian population, especially for distinguishing between the categories of "overweight" and "class 1 obese" [6]. Previous studies had already found that BMI was a reliable screening tool for health risks due to obesity, and hence, the impact of increasing BMIs on both adverse maternal and foetal outcomes of pregnant women had already been reported elsewhere [9–14].

The above is now corroborated by the findings obtained from this retrospective cohort review, in that they also lend support to the fact that BMI can improve risk stratification and guidance of primary prevention of obstetric complications. This is because an increased BMI has an association with foetal macrosomia, caesarean sections, shoulder dystocia, stillbirth and the need for assisted conception. Therefore, since BMI is found to be an accurate measurement index for diagnosing obesity that has been shown to improve risk stratification and guidance of primary prevention of obstetric complications, it should also be used as a screening tool for risk stratification of all pregnant women in the implementation of primary prevention of obstetric complications.

Conclusion

In summary, BMI is found to be an essential risk stratification tool in obstetrics because an increasing BMI has found to exert a significant adverse effect on both maternal and foetal outcomes among pregnant woman. In particular, this retrospective cohort review has found that the BMI references based on potential public health action points identified by WHO expert consultation are more sensitive in predicting adverse obstetric outcomes related to obesity and these should ideally be the new pre-pregnancy targets to improve pregnancy outcomes.

Acknowledgements The authors would like to acknowledge the Director General of the Ministry of Health for the continuous support of the NOR registry. Special thanks to all the hardworking nationwide NOR committee members who have also extensively contributed in terms of data collection and ensuring a complete registry. Besides that, we would like to extent our appreciation to Mr Hon Yoon Khee for his effort to proofread this manuscript.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest for this study.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethics approval was obtained from the Malaysian Research Ethical Committee (MREC), Ministry of Health (MOH), and was approved by National Medical Research Register with NMRR ID: 25530.

Informed Consent This study used available data from the registry, and hence, informed consent was not necessary for this study.

References

1. World Health Organization (WHO). Overweight and Obesity 2015. 2015.
2. National Institute for Health and Clinical Excellence. Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children. London: National Institute for Health and Clinical Excellence (NICE); 2006.
3. Heslehurst N, Ells LJ, Simpson H, Batterham A, Wilkinson J, Summerbell CD. Trends in maternal obesity incidence rates, demographic predictors, and health inequalities in 36,821 women over a 15-year period. BJOG Int J Obstet Gynaecol. 2007;114(2):187–94. doi:10.1111/j.1471-0528.2006.01180.x.
4. Chu SY, Kim SY, Lau J, Schmid CH, Dietz PM, Callaghan WM, Curtis KM. Maternal obesity and risk of stillbirth: a metaanalysis. Am J Obstet Gynecol. 2007;197(3):223–8. doi: 10.1016/j.ajog.2007.03.027PMID17826400.
5. World Health Organization expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363:157–63. doi: 10.1016/S0140-6736(03)15268-3.
6. Low S, Chin MC, Ma S, Heng D, Deurenberg-Yap M. Rationale for redefining obesity in Asians. Ann Acad Med Singapore. 2009;38:66–74 **(PMID 19221673)**.
7. Misra A. Ethnic-specific criteria for classification of body mass index: a prospective for Asian Indians and American Diabetes Association Position Statement. Diabetes Technol Ther. 2015;17(9):667–71.
8. Nuzhat A, Sailaju DK, Praveen KN. Implications of the revised consensus body mass indices for Asian Indians on clinical obstetric practice. J Clin Diagn Res. 2014;8(5):OC01–3.
9. Bhattacharya S, Campbell DM, Liston WA, Bhattacharya S. Effect of body mass index on pregnancy outcomes in nulliparous women delivering singleton babies. BMC Public Health. 2007;7:168–76.
10. Callaway LK, Prins JB, Chang AM, McIntyre HD. The prevalence and impact of overweight and obesity in an Australian obstetric population. Med J Aust. 2006;194:56–9.
11. Dodd JM, Grivell RM, Nguyen A, Chan A, Robinson JS. Maternal and perinatal health outcomes by body mass index category. Aust N Z J Obstet Gynaecol. 2011;51:136–40.
12. Schrauwers C, Dekker G. Maternal and perinatal outcome in obese pregnant patients. J Matern Fetal Neonatal Med. 2009;22:218–26.
13. Sukalich S, Mingione MJ, Glantz C. Obstetric outcomes in overweight and obese adolescents. Am J Obstet Gynecol. 2006;195:851–5.
14. Weiss JL, Malone FD, Emig D, Ball RH, Nyberg DA, Comstock CH, et al. Obesity, obstetric complications and cesarean delivery rate—a population-based screening study. Am J Obstet Gynecol. 2004;190:1001–7.