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The relationship between preterm birth and underweight in Asian women

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ABSTRACT

Although vast improvements have been made in the survival of preterm infants, the toll of preterm birth (PTB) is particularly severe in Asia, with the Indian subcontinent leading the preterm birth rate. Despite the obesity epidemic, maternal underweight remains a common occurrence in developing countries. An association between maternal underweight and preterm birth has been reported in developed countries. A review of epidemiological studies in Asian women in whom association between maternal body mass index (BMI) and risk of PTB was measured, indicated no significant association between low maternal BMI and preterm birth. A hindrance in comparison of these studies is the use of different cut-off point for BMI in defining maternal underweight. As a commentary on published studies it is proposed that that country-specific BMI cut points should be applied for defining underweight for Asian women for the purpose of evaluating the association between maternal underweight and preterm birth.

1. Introduction

Preterm births (PTB) are those that occur at less than 37 weeks of gestational age. PTB is a dominant cause for perinatal mortality and morbidity in newborns. It accounts for more than half the long-term morbidity and 75% of perinatal mortality [1]. Five to 25% of births worldwide and 12–13% of all births in the United States are preterm [2]. Though all countries are affected, the global distribution is skewed. The toll of PTB is particularly severe for Africa and Asia, where more than 85% of all preterm births occur [3]. The rates are highest in Africa (11.9%) followed by North America (10.6%) and Asia (9.1%). Latin America and the Caribbean are midrange (8.1%), and Oceania (6.4%) and Europe (6.2%) are the lowest [3]. There is a significant difference in rates of preterm birth in two of the largest countries in Asia. India has a PTB rate of 20.9% as compared to 7.4% in China [4]. In developing countries, PTB is the cause of 40–75% of neonatal deaths. The potentially serious health consequences of this outcome underscore the public health importance of preventing PTB by identifying and correcting modifiable risk factors [5,6].

Despite extensive examination of prenatal risk factors associated with preterm birth, understanding of the etiologies and mechanisms leading to preterm birth are inconclusive. Most of the interventions designed to reduce the rate of preterm birth have been applied during the prenatal period and have produced disappointing results. Haas et al. have suggested that the focus on the prenatal period alone may be too narrow, and by the time a woman is pregnant, efforts to modify health behaviors or to improve health status may not be effective [7]. A broader perspective on women's health status before pregnancy may be necessary to improve our understanding of the etiology of preterm birth. A failure to address the consequences of poor health status prior to pregnancy, such as a low pre-pregnancy body weight, may be partially responsible for the failure to reduce preterm birth [7].

It is of interest to note that only two indicators of maternal nutritional status during pregnancy have shown a consistent positive association with infant birthweight: maternal prepregnancy weight for height and weight gain during pregnancy [8]. Body mass index (BMI), defined as wt/ht^2, is a simple, useful index for retrospectively evaluating long term health status of women in clinical settings. Even though pre-pregnancy BMI may have a genetic as well as a nutritional component; still a low pre-pregnancy BMI is considered a marker for minimal nutrient reserves [9]. Although much recent research in developed countries has focused on the association between high maternal BMI and adverse pregnancy outcomes, in many developing countries maternal underweight remains more common than overweight and therefore represents a more important risk factor for poor birth outcomes. Women with a low pre-pregnancy BMI are at a higher risk for a number of adverse pregnancy outcomes including preterm birth and intrauterine growth retardation. This association has been reported independently of other major risk factors such as race, smoking,

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alcohol intake, etc. [10]. Among the maternal characteristics reported in women who deliver preterm, the role and mechanism of maternal nutritional status before and during pregnancy, particularly, maternal pre-pregnancy weight/BMI is still emerging [11,12]. There are many risk factors associated with PTD [1]. The emphasis for the current study was restricted to association between maternal underweight and PTD.

The proportion of underweight women in South Asia (people originating from the Indian subcontinent) is very high as compared to Japan and other developed countries. In the Indian subcontinent, according to the latest figures available from WHO, 32.9% of women were underweight. Of these women, 6% were severely underweight, 8% were moderately underweight and 19% were mildly underweight [13]. In spite of both high rates of underweight and preterm births in Asia, particularly in India, Bangladesh and Pakistan, very few comprehensive studies have been conducted to evaluate the association between PTB and underweight as indicated by low BMI [14].

The objective of this article is to examine whether women's health status, as measured by low pre-pregnancy BMI, is associated with the risk of PTB in Asian women. Here, valid research studies conducted to evaluate the association between PTB and maternal pre-pregnancy BMI are explored and possible mechanisms for a lack of association between PTB and low pre-pregnancy BMI in Asian women are discussed.

2. Prevalence of underweight in Asian women

Before evaluating the association between PTB and low maternal body weight, it is necessary to define maternal underweight as it applies to Asian women. In 1990, the United States Institute of Medicine established new weight gain recommendations during pregnancy using BMI as the preferred way to classify women into pre-pregnancy weight categories. These guidelines were revised in 2009 [15]. Accordingly, many previous studies have defined low pre-pregnancy BMI as <18.5. This cut-off value, which includes women who are underweight to varying degrees was published with the acknowledgment that there was no scientific basis on which to accept or reject any of the existing reference standards [16]. Emerging evidence suggests that South Asians and Chinese suffer from elevated risk of type 2 diabetes and dyslipdemia even with a normal BMI according to IOM criteria. An explanation for this is that non-Europeans have a relative excess of adipose tissue or deficit of lean body mass compared to Europeans for a given BMI [17,18]. A WHO expert consultation addressed the debate about interpretation of recommended BMI cut-off points for determining underweight, overweight and obesity in Asian populations and considered whether population-specific cut-off points for BMI are necessary [19]. The consultation concluded that the current WHO BMI cut-off points of <16 (severe underweight), 16–16.9 (moderate underweight), 17–18.49 (mild underweight), 18.5–24 (normal), >25 (overweight), 25–29 (pre-obese), ≥30 (obese), 30–34.9 (obese class I), 35–39.9 (obese class II), and >40 obese (class III) should be retained as the international classification [19]. For continuity, particularly in countries with concurrent problems of under-nutrition and over-nutrition, the distribution should continue to be presented as a continuum beginning with BMI <16 through the BMI category of >40.

3. Association between PTB and low BMI in developed and developing countries

In the late 1990s and early 2000s, various investigators have conducted studies to evaluate the relationship between PTB and maternal prepregnancy body weight or BMI due to the growing prevalence of overweight and/or obesity first in developed and, later even in developing countries. The emphasis in these investigations has been on maternal overweight and or obesity as a risk factor for various types of PTB. Surprisingly, most of these studies have not emphasized the effect of maternal underweight as a risk factor for PTD, even though a large number of pregnant women live in poor conditions in large populous countries with high fertility rates. Torloni et al. [20] conducted a comprehensive systematic review of the literature with meta-analysis in 2009 to evaluate the association between maternal BMI and risk of PTD. The results were reported from studies published since 1968 and were stratified in three gestational age categories for all types of PTBs [20]. These investigators provided detailed risk analysis for normal weight and several categories of obesity in pregnant women. Crude and adjusted odds ratios for PTB were calculated using normal BMI (18.8–24.9). Of the 39 studies included in this review, the results indicated that for normal weight (pre-obese) and obese I (BMI, 30–34.9) women the risk of moderate PTB was elevated to AOR 1.2 (95% C.I. = 1.04–1.38) and 1.60 (95% C.I. = 1.32–1.94) respectively. The risk of moderate PTB for obese II (BMI, 35–40) and obese III (BMI >40), was increased even higher, AOR = 2.43 (95% C.I. = 1.46–4.05) and AOR = 2.27 (95% C.I. = 1.76–2.94) respectively. However, data for women with low prepregnancy (BMI <20) was not presented at all [20].

In 2010, Han et al. published a comprehensive systematic review and meta-analysis of studies of maternal underweight and the risk of preterm birth and low birth weight. A total of 78 studies involving 1,025,794 women were included in this review [21]. The overall risk of PTB was increased in the cohort studies of underweight women. The adjusted relative risk (ARR) was reported to be 1.29, 95% confidence interval (C.I.) 1.15–1.46, as were the risk of spontaneous PTB (ARR = 1.32, 95% C.I. 1.10–1.57) and induced PTB (ARR = 1.21, 95% C.I. 1.07–1.36). In developed countries, underweight women had an increased risk of PTB (RR = 1.22, 95% C.I. 1.15–1.30), but not in developing countries (RR = 0.99, 95% C.I. 0.67–1.45). These findings were generally supported across the continuum of study designs and variations in definitions of maternal underweight, as well as for both crude and adjusted data. However, Han et al. [21] did not discuss or provide any explanation for the lack of significant association in PTB and underweight in women from developing countries. Similarly, several recent studies have evaluated the association between maternal growth and socioeconomic measures with infant birth weight but have failed to tease out the effect of maternal undernutrition as indicated by low BMI or underweight and risk of PTB or low birth weight [22–24].

In the following section, a few studies which have evaluated the risk of PTB in women with low prepregnancy BMI or underweight are discussed.

4. Association between PTB and low BMI in Asian women

Though this study is neither a systematic review nor a meta-analysis, the studies evaluating the association between underweight (low BMI) and PTB in women from the Indian subcontinent, China, Hong Kong, Nepal and Korea which met or came close to the eligibility criteria as recommended by the consensus statement of Meta-analysis of Observational Studies in Epidemiology (Moose) Group [25] and also used by Han et al. [21] were selected for further evaluation. Tables 1 and 2 provide a summary and comparison of results of these studies. Very briefly, eligibility criteria are concerned with appropriateness of any quantitative summary of data; search strategy; degree to which coding of data from the articles was specified and objective; assessment of confounding, study quality and heterogeneity; use of statistical methods; and display of results. The authors of the Moose Group developed a checklist summarizing recommendations for reporting meta-analysis of