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Research Article

The Association between Mid-Pregnancy Body Mass Index and Socio Economic Status of Women: Evidence from Australia

Sharmina Ahmed* and Jayanthi Thennakoon

Global Food Studies, University Adelaide, Australia

***Corresponding author**

Sharmina Ahmed, Global Food Studies, University Adelaide, Room 5.25, Level 5, Nexus 10, 10 Pulteney Street, Adelaide 5005, Australia, Tel: 61 8 8313 2204; Email: Sharmina.ahmed@adelaide.edu.au

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Keywords

- BMI
- Obesity
- Overweight
- Pregnant women
- Socio-economic status

Abstract

Objective: To examine the association between mid-pregnancy body mass index (BMI) and socio-economic status (SES) of pregnant women in Australia.

Design: A large scale randomized control trial (RCT). Data were analysed using descriptive statistics and multivariate Probit regression models (Probit and Ordered Probit) controlling for maternal age, location of the hospital, and the treatment effect was performed for the analysis.

Setting: Pregnant women who were registered in 5 perinatal centres in Australia between 2005 and 2008 were recruited.

Subjects: 2399 pregnant women with singleton pregnancy at < 20 week gestation.

Results: There was a negative association between mothers' involvement in a professional employment and maternal mid-pregnancy obesity and overweight. Fathers' employment as a professional was also significantly and negatively related to maternal BMI. Mother's education was positively associated with mid-pregnancy BMI. Maternal smoking and drinking behaviour during pregnancy were significantly linked to obesity and underweight, respectively. A significant positive association was found for the Asian and the Aboriginal cohorts.

Conclusions: Lower socio-economic status and poor health behaviours during pregnancy are associated with maternal obesity and overweight. Policies and interventions aiming at improving awareness and uplifting socio-economic status of pregnant women have the potential to lower the likelihood of being obese and overweight during pregnancy.

INTRODUCTION

Overweight and obesity (BMI > 25 kg m^2) are rapidly emerging public health problems posing significant challengers to national healthcare sectors and societies as a whole. The prevalence of overweight and obesity has been steadily increasing in many countries including Australia. In 2011-12, respectively 70 per cent and 56 per cent of males and females in Australia aged 18 years and over were considered overweight or obese signifying an increase of 5 and 6 % points from 1995 [1]. Furthermore, about 34 per cent of pregnant women in Australia were overweight or obese in 2002 [2], and a recent studies from South Australia showed that approximately half of the pregnant women are overweight or obese with 10 per cent of them being morbidly obese [3,4]. This increasing prevalence of obesity among pregnant women is a serious health concern, as it may affect the pregnancy outcome for both mother and the baby and therefore of future generations.

The problems relating to maternal obesity have been well documented in literature. As has been found, the obesity in pregnant women is linked with medical complications [5-7]. According to a study from Sweden maternal overweight is associated with adverse pregnancy outcomes for both mother and the baby [8]. Two Australian studies have also showed that obese pregnant women had an increased risk of gestational diabetes, hypertension (including preeclampsia), induction of labor, caesarean section and preterm birth [2, 9]. Given the

significance of this relationship, it is important to understand the underlying factors influencing maternal obesity.

The causes of overweight and/or obesity are diverse. The individual dietary behaviour is multifactorial depending on individual preferences, socio-economic circumstances [10], market forces [11], occupations [12] and physical infrastructure [13]. Studies from other countries have provided some insights into the underlying socio-economic reasons behind maternal obesity. A recent study from the US shows that the pre-pregnancy obesity is linked with mother's education, age, ethnicity and professional status [14]. It has been found that the factors influencing obesity of pregnant women in the US include ethnicity and socio-economic status among others [15]. While there is ample evidence on implications of maternal obesity or overweight for pregnancy outcomes in Australia, much less is known about the underlying reasons behind the obesity among pregnant women. The socio-economic dimension of the issue has received less attention, and in fact, no study has attempted to explore the issue in relation to Australia. Therefore, the aim of this study is to fill that gap in the literature by exploring the association between the socio-economic characteristics and maternal BMI in Australia by employing a population based cross-sectional study. This study utilized cross-sectional data from the large-scale RCT of DHA supplementation. The trial was designed primarily to evaluate the effect of DHA-rich supplementation during the last half of pregnancy on the number of women with high levels of depressive symptoms and perinatal complications, and to assess whether DHA enhanced the neurodevelopmental outcome of their children.

SUBJECTS AND METHODS

Study Sample

The analysis of this article used data from a multicentre, randomised controlled trial (RCT) where the role of docosahexaenoic acid (DHA) on various pregnancy and birth outcomes of mothers and infants had been tested. The trial conducted at five centres in Australia 9 two in South Australia, and one each in New South Wales, Victoria and Queensland) between 2005 and January 2008 where 2399 pregnant women at <20 week gestation with singleton pregnancies were recruited.[1] The primary outcomes of the trial published elsewhere [16]. After randomization, the initial data were collected from pregnant mothers during their first visits through face-to-face interviews conducted by clinical nurses. Questionnaires included variables on socio-economics characteristics, height, weight, health and lifestyle of pregnant women.

VARIABLES

Dependent variable

The BMI was defined based on the standard formula as weight in kilograms divided by the square of the height in maters. Following the definition of World Health Organization, pregnant women was categorized as underweight (BMI<18.5), normal weight (18.5-24.99), overweight (25.0-29.99) and obese (≥30.0) for the analysis.

Independent variables

Main regressors of the analysis were socio-economic characteristics of the mother including mothers' race, mothers' smoking and drinking behaviour during pregnancy, parental education and occupation. Mothers' education was categorized into secondary or lower, diploma or equivalent, and a completion of a university degree. Occupational status was considered under six categories; as employed in 'professional-', 'clerical-occupations', 'studying', 'parental leave/unpaid domestic work', 'unemployed', and 'others'. Race/ethnic origins, i.e. Caucasian, aboriginal, Asian, and others were categorized individually.

Control variables

The interested parameter estimates were controlled for mothers' age, treatment effect and the location of the hospital.

Statistical Analysis

We performed a multivariate analysis to estimate the association between socio-economic determinants of maternal BMI. Outcome variables were analysed using multivariate probit regression techniques using robust standard errors. The results were interpreted as odds ratios or predicted probabilities representing the odds or probabilities that an outcome will occur given a particular exposure, compared to the odds or probabilities of the outcome occurring in the absence of that exposure. In the first model, ordered probit model was employed to estimate the parameters for the whole sample. The dependent variable BMI was ordered as underweight, normal, overweight and obese for this case. In the subsequent models, the respective parameters were estimated for four separate samples based on the maternal BMI; Underweight, Normal weight, Overweight and Obese. All models were controlled for maternal age, location of the hospital and the treatment effect.

Statistical analysis was carried out using Stata SE Version 12. Statistical significance of the parameter estimates is tested using the probability of test statistics (P Value), which is < 0.10.

Descriptive statistics of the main variables are presented with means and standard deviations (Table 1).

RESULTS

Demographic characteristics

Demographic characteristics of the pregnant women participated in the study are shown in Table 2. Despite that underweight pregnant women appeared to be slightly younger than women in other BMI categories, there were no important differences in the mean age among different groups. Variations were much explicit in education with more underweight and normal weight pregnant women reporting a university degree (28%) than their counterpart of overweight or obese women (20%). The proportions of pregnant women employed in professional occupations were higher for normal (32%), overweight (33%) and obese categories (25%) compared to that for underweight women (10%). The underweight women also tended to be more unemployed. With regards to ethnicity, more Asian and Aboriginal women were found in the underweight category compared to Caucasian women.

1 Out of these enrolled women, 96.7% completed the trial.

Table 1: Demographics of Women with normal BMI compared with overweight and obese women.

Characteristics	Underweight# (n=31)	Normal weight# (n=903)	Overweight# (n=736)	Obese# (n=663)
Age	26.22±6.15	28.97±5.92	29.99±5.41	29.53±5.45
Height (cm)	165.06±7.32	164.56±7.26	164.37±6.94	164.04±6.74
Weight (kg)	48.02±4.18	60.56±6.98	73.70±7.27	95.41±15.27
BMI (kg/m^2)	17.60±0.68	22.31±1.62	27.23±1.41	35.39±4.88
	%	%	%	%
Mothers' continued smoking during pregnancy	29.03	16.06	13.32	20.21
Mothers' continued drinking during pregnancy	12.90	8.42	10.87	7.99
Mothers' education				
-University degree	29.03	28.24	22.69	15.38
-Diploma or equivalent	38.71	41.42	22.69	49.77
-Secondary or lower	32.26	30.12	30.84	34.84
Mothers' occupation				
-Professional	9.58	32.23	32.74	24.59
-Clerical	32.26	28.24	30.57	30.02
-Home duties	22.58	18.49	19.43	24.74
-Student	6.45	5.87	2.99	2.26
-Unemployed	9.68	2.21	0.82	1.66
-Other	0	0.44	0	0.15
Mothers' race				
-Caucasian	61.29	82.95	91.17	92.16
-Aboriginal	9.66	1.22	1.14	2.26
-Asian	22.58	12.40	5.03	3.02
-Others	6.45	3.32	2.31	2.56
# mean±SD				

Table 2: Chi square test: BMI and complications.

BMI	Underweight (bmi<18.5)	Normal weight (bmi >18.5 - <24.9)	Overweight (bmi >25 - <29.9)	Obese (bmi >=30)	p-value of chi-square test
Antenatal complications					
Gestational diabetes (159)	0 0%	34 21.38%	43 27.04%	82 51.57%	0.000**
Preeclampsia (72)	1 1.39%	13 18.06%	20 27.78%	38 52.78%	0.000**
Hypertension(167)	2 1.20%	29 17.37%	54 32.34%	82 49.10%	0.000**
Delivery complications					
Induction (644)	4 0.62%	201 31.21%	213 33.07%	226 35.09%	0.000**
Caesarean (653)	7 1.07%	178 27.26%	209 32.01%	259 39.66%	0.000**
Neonatal pregnancy outcome					
Low birth weight (<2500g) (98)	8 8.33%	42 43.75%	19 19.79%	27 28.13%	0.000**
Respiratory support after birth (203)	4 1.97%	57 28.08%	69 33.99%	73 35.96%	0.000**
** p<.01; *p<.05					

Preliminary findings

According to the study sample data the incidence of maternal medical complications increased with maternal mid-pregnancy BMI. The Chi square analysis in Table 1 shows that the incidence of gestational diabetes, preeclampsia and hypertension has increased with BMI. Compared with women categorized as having normal BMI, more obese and overweight women were diagnosed with gestational diabetes, preeclampsia and hypertension during pregnancy ($p<0.001$). Also, a comparison of induction of labor among different BMI categories demonstrates that women with higher maternal BMI than women with normal maternal BMI, tended to have an induced delivery and/or have a caesarean section ($p<0.001$) (Figure 1). They were also at increased risk of developing postpartum haemorrhage compared with normal weight mothers ($p=0.021$). In addition, the risk of delivering a low-birth weight (< 2500g) infant was significant higher for

obese and overweight women than for normal weight women (p<0.001).

Influence of socio-economic factors on mid-pregnancy BMI

The socio-economic factors associated with maternal BMI are presented in Table 3. The results demonstrated that mother's education was significantly and positively associated with mid-pregnancy BMI indicating that mother's BMI increased with education. It implies women who have higher education level become more obsess than those with lower education level. By looking at the probabilities, the higher the education level of the mother, slightly lower was the strength of the association with BMI. For instance, given all predictors were set to their mean

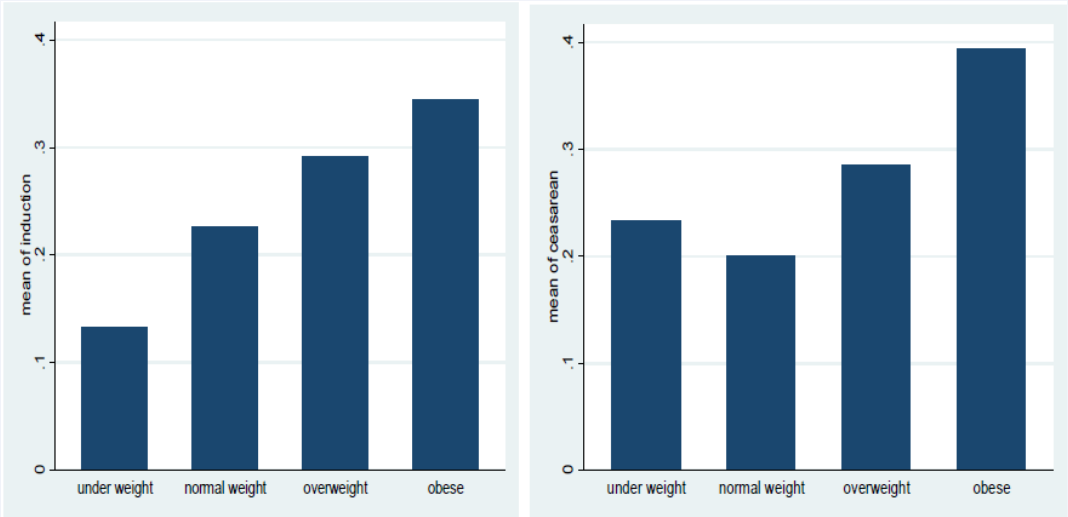

Figure 1 Relationship between mothers' mid pregnancy BMI and induction and caesarean delivery.

Table 3: Multivariate odds ratio analysis of association between maternal BMI and socio demographic characteristics.

variables	Whole sample n= 2372 (p-value)	Under weight n= 31 (p-value)	Normal weight n= 903 (p-value)	Overweight n= 736 (p-value)	Obese n= 663 (p-value)
Mothers' education					
-University degree	0.038* (0.002)	0.093* (0.000)	0.368 (0.375)	1.215* (0.000)	1.075* (0.000)
-Diploma or equivalent	0.025* (0.000)	0.076* (0.001)	0.280 (0.499)	1.258* (0.000)	1.139* (0.000)
-Secondary or lower	0.017* (0.000)	0.067* (0.000)	0.283 (0.496)	1.273* (0.000)	1.152* (0.000)
Mothers' occupation					
-Professional	-0.050 (0.379)	-0.021* (0.020)	0.040 (0.233)	-0.034* (0.004)	-0.048* (0.021)
-Clerical	-0.003 (0.152)	-0.002 (0.751)	0.032 (0.315)	0.015 (0.611)	-0.049* (0.080)
- Home duties	0.002 (0.941)	-0.004 (0.509)	0.005 (0.863)	0.007 (0.981)	0.002 (0.983)
-Student	0.012* (0.009)	0.006 (0.719)	0.156* (0.005)	0.030* (0.005)	0.122* (0.035)
-Unemployed	-0.011 (0.155)	0.012 (0.247)	0.313 (0.234)	-0.126 (0.155)	-0.028 (0.708)
-Other	-0.020 (0.297)	-	0.864 (0.131)		0.091 (0.042)
Mothers' continued smoking during pregnancy	0.001 (0.664)	0.008 (0.134)	0.020 (0.455)	0.058* (0.032)	0.022* (0.042)
Mothers' continued drinking during pregnancy	0.003 (0.204)	0.012* (0.070)	-0.006 (0.848)	0.042 (0.186)	0.046 (0.150)
Mothers' race					

-Caucasian	0.210 (0.731)	0.024 (0.228)	-0.276 (0.578)	0.049 (0.754)	0.192 (0.145)
-Aboriginal	0.170 (0.788)	0.045* (0.038)	-0.355 (0.480)	0.043 (0.789)	0.231 (0.144)
-Asian	-0.441 (0.469)	0.044* (0.021)	-0.052 (0.915)	-0.062 (0.681)	-0.008 (0.958)
-Others	-0.014 (0.982)		-0.211 (0.672)	-0.006 (0.970)	0.148 (0.291)
Fathers' education					
-University degree	-0.033 (0.629)	0.005 (0.593)	0.038 (0.655)	0.123 (0.165)	-0.106 (0.179)
-Diploma or equivalent	0.021 (0.912)	0.007 (0.431)	0.069 (0.397)	0.108 (0.208)	-0.041 (0.580)
-Secondary or lower	0.017 (0.930)	0.006 (0.388)	0.038 (0.639)	0.046 (0.591)	-0.018 (0.833)
Fathers' occupation					
-Professional	-0.127* (0.007)	-0.009 (0.631)	0.054 (0.057)	-0.007* (0.027)	-0.042* (0.059)
-Clerical	-0.302 (0.562)	-0.007 (0.399)	0.072 (0.413)	0.014 (0.651)	-0.021 (0.453)
- Home duties	0.132 (0.217)	-	-0.070 (0.602)	-0.049 (0.707)	0.139 (0.213)
-Student	-0.039 (0.833)	0.001 (0.997)	-0.018 (0.816)	0.199 (0.380)	-0.055 (0.504)
-Unemployed	-0.122 (0.534)	0.005 (0.588)	0.037 (0.582)	-0.043 (0.545)	0.001 (0.985)
-Other	-0.136 (0.485)	-0.006 (0.477)	0.043 (0.607)	0.067 (0.428)	-0.082 (0.286)

Note: Regressions are controlled for treatment effect, age, hospital location; Table presents marginal effects with changes in probabilities.

values, the probability of being overweight and obese was likely to increase by 127 and 115 % points, respectively for a mother with a secondary or lower level of education compared to that for a mother with a university degree (121 and 100 % points, respectively). The ordered Probit analysis for the whole sample has suggested that ordered log-odds of being underweight to obese slightly increased with mother's education when other variables were held constant (from 0.01 to 0.03 % points). Nonetheless, interpretation of results relating to association between maternal underweight and different socio-economic factors should take into consideration the possible bias arising from small number of observation in this BMI group.

Mother's occupation as a professional had a significant negative relationship with her BMI for all categories. Compared with other occupational categories, mothers employed as professionals were less likely to be underweight, overweight or obese by 2, 3 and 4 % points, respectively. A negative association was also found for mothers engaging in clerical jobs in relation to maternal obesity with the probability of 4 % points. Nevertheless, the probability of being overweight and obese was likely to increase by 3 and 12 % points, respectively for student mothers compared to other occupations. Ordered- probit analysis for the whole sample confirmed this finding suggesting that the likelihood of being obese increased from being underweight by 1 % points for student mothers compared with other categories of occupation.

Despite that fathers' education was not significantly linked with mother's BMI, a significant negative association was found for Mothers' BMI and father's involvement in a professional employment. Compared with other occupations in which a father was involved, father's employment in a professional career was to reduce mother's risk of being obese (by .7 % points) and overweight (by 4 % points).

Looking at the maternal BMI in relation to ethnicity, a significant positive association was found for the Asian and the Aboriginal cohorts with generally similar predicted probabilities. The probability of being underweight was likely to increase by 0.04 if the mother was from Asian or aboriginal background. No significant relationship was found for maternal BMI and Caucasian ethnicity.

Significant positive associations were found between maternal smoking and mid-pregnancy BMI. The probability of being overweight and obesity increased by 5 and 2 % points, respectively for smoking mothers compared to non-smoking mothers. With regards to mothers drinking behaviour, we found no evidence to support the link between mothers' drinking behaviour and increased risk of overweight or obese. However, the probability of being underweight increased by 1 % points for those who continue drinking during the pregnancy.

CONCLUSION AND DISCUSSION

Two main findings emerged from this study. Firstly, overweight and obesity were prevalent in more than half of expectant mothers in our study sample. Secondly, a clear socio-economic pattern was found in relation to mid-pregnancy overweight and obesity, with higher odds of being overweight and obese found further down in the social ladder.

The aim of this study was to explore the association between socio-economic factors and maternal BMI. The major strength of this study is that we used a large sample of 2399 pregnant women at < 20 week gestation. The study has found some interesting evidence on mother's and father's occupation in relation to maternal BMI. According to the results pregnant women working as professionals were less likely to be overweight or obese. It is possible that pregnant women involved in a professional career have a higher socio-economic status and a greater awareness of the risks associated with obesity, which may lead to a healthy behaviour during pregnancy. This finding was also supported by other literatures [17,18] who found that among general population in Australia obese women were more likely to be of low socio-economic level compared with women in the normal BMI group. Our findings have also suggested that father's occupation as a professional had a negative relationship with mothers BMI. The underlying mechanism for this negative association can be related to mothers' physiological and psychological wellbeing. Father's involvement in a professional career potentially explains the financial and social stability of the whole household that would reduce the stress and anxiety of the mother. This result suggests that financial and social security would help reducing the risks of being overweight and obese.

With regards to education, the mechanism behind the positive association between maternal BMI and mother's education is unclear. However, the finding is consistent with existing literatures [19,14].

Given the importance of considering smoking and alcohol consumption behaviour during pregnancy as pointed by Bogaerts et al. (2012) [14], we observed a clear relationship between mothers' smoking behaviour and the risk of being overweight and obese which is consistent with those reported in literature [20]. Furthermore, in line with previous studies [21], we found that mother's drinking behaviour is linked with being underweight.

Given that there is an increasing prevalence of overweight and obese among Australian women, the findings of this study are a matter of public health concern. The results highlight the importance of understanding socio-demographic and economic aspect of maternal BMI that can help assessing each pregnant women in an individual context, and planning appropriate utilization of national health services. The results can be used for future awareness programmes aiming at healthy pregnancy BMI, as pregnancy is considered an ideal time for promoting a healthy lifestyle [22]. In Australia, nearly all pregnant women attend antenatal care at regular time intervals. Thus, as mentioned before, policy makers should consider targeted-monitoring of all women's BMI from their first antenatal visit in a way that those with abnormal BMI should receive special attention. A large meta-analysis [23] has pointed out that dietary and lifestyle interventions in pregnancy could improve pregnancy outcomes by controlling excessive weight gain during pregnancy. However, more empirical research with large representative data sets is needed to investigate the impacts of different socio-economic characteristics on maternal outcomes.

There are several limitations to our study. First, despite that this study reports important associations between socio-demographic characteristics of pregnant women and maternal BMI, it is unable to draw conclusions on causal relationships because of the cross-section nature of the data. Secondly, we are unable to link the socio-demographic factors with pregnancy outcomes by employing a robust regression analysis given the limitations of finding an instrumental variable for maternal BMI. Yet another caveat of our estimation is that it might have overlooked the potential correlation between education and drinking and smoking behaviour, which has been found in [24]. Nevertheless, our sample data does not support these correlations. Furthermore, our analysis could be more improved if more detailed information on household states of pregnant women, such as household income, other responsible factors such as food intake and physical activity, psychological health etc. Nonetheless, this study, as a first step to promote a healthy pregnancy BMI, will provide important insights into the association between socio-economic factors and maternal BMI.

REFERENCES

1. Australian Bureau of Statistics (ABS) Gender indicators Australia. 2013.
2. 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; 184: 56-59.
3. Chan A, Scott J, Nguyen AM. Pregnancy outcome in South Australia 2008. Adelaide: Pregnancy Outcome Unit, SA Health, Government of South Australia. 2009.
4. Scheil W, Scott J, Catcheside B, Sage L, Kennare R. Pregnancy Outcome in South Australia 2011. Adelaide: Pregnancy Outcome Unit, SA Health, Government of South Australia. 2013.
5. Gross T, Sokol RJ, King KC. Obesity in pregnancy: risks and outcome. Obstet Gynecol. 1980; 56: 446-450.
6. Johnson JW, Longmate JA, Frentzen B. Excessive maternal weight and pregnancy outcome. Am J Obstet Gynecol. 1992; 167: 353-372.
7. Edwards LE, Hellerstedt WL, Alton IR, Story M, Himes JH. Pregnancy complications and birth outcomes in obese and normal-weight women: effects of gestational weight change. Obstet Gynecol. 1996; 87: 389-394.
8. Cnattingius S, Bergström R, Lipworth L, Kramer MS. Prepregnancy weight and the risk of adverse pregnancy outcomes. N Engl J Med. 1998; 338: 147-152.
9. Doherty DA, Magann EF, Francis J, Morrison JC, Newnham JP. Pre-pregnancy body mass index and pregnancy outcomes. Int J Gynaecol Obstet. 2006; 95: 242-247.
10. Hillsdon M, Foster C, Cavill N. The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews. NHS: Health Development Agency. 2005.
11. Guo X, Popkin BM, Mroz TA, Zhai F. Food price policy can favorably alter macronutrient intake in China. J Nutr. 1999; 129: 994-1001.
12. Preventing Chronic Diseases - A Vital Investment, Geneva: WHO. 2005.
13. Gebel K, King L, Bauman A, Vita P, Gill T, Rigby A, et al. Creating healthy environments: A review of links between the physical environment, physical activity and obesity. Sydney: NSW Health Department and NSW Centre for Overweight and Obesity. 2005.
14. Bogaerts A, Van den Bergh B, Nuyts E, Martens E, Witters I, Devlieger R. Socio-demographic and obstetrical correlates of pre-pregnancy body mass index and gestational weight gain. Clin Obes. 2012; 2: 150-159.

15. Hickey CA. Sociocultural and behavioral influences on weight gain during pregnancy. Am J Clin Nutr. 2000; 71: 1364S-70S.

16. Makrides M, Gibson RA, McPhee AJ, Yelland L, Quinlivan J, Ryan P; DOMInO Investigative Team. Effect of DHA supplementation during pregnancy on maternal depression and neurodevelopment of young children: a randomized controlled trial. JAMA. 2010; 304: 1675-1683.

17. Athukorala C, Rumbold AR, Willson KJ, Crowther CA. The risk of adverse pregnancy outcomes in women who are overweight or obese. BMC Pregnancy Childbirth. 2010; 10: 56.

18. Cameron AJ, Welborn TA, Zimmet PZ, Dunstan DW, Owen N, Salmon J, et al. Overweight and obesity in Australia: the 1999-2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab). Med J Aust. 2003; 178: 427-432.

19. Edvardsson K, Lindkvist M, Eurenius E, Mogren I, Small R, Ivarsson A. A population-based study of overweight and obesity in expectant parents: socio-demographic patterns and within-couple associations. BMC Public Health. 2013; 13: 923.

20. Chiolero A, Faeh D, Paccaud F, Cornuz J. Consequences of smoking for body weight, body fat distribution, and insulin resistance. Am J Clin Nutr. 2008; 87: 801-809.

21. Suter PM. Is alcohol consumption a risk factor for weight gain and obesity? Crit Rev Clin Lab Sci. 2005; 42: 197-227.

22. Phelan S. Pregnancy: a “teachable moment” for weight control and obesity prevention. Am J Obstet Gynecol. 2010; 202: 135.

23. Thangaratinam S, Rogozinska E, Jolly K, Glinkowski S, Roseboom T, Tomlinson JW, et al. Effects of interventions in pregnancy on maternal weight and obstetric outcomes: meta-analysis of randomised evidence. BMJ. 2012; 344: e2088.

24. Smedberg J, Lupattelli A, Mårdby AC, Nordeng H. Characteristics of women who continue smoking during pregnancy: a cross-sectional study of pregnant women and new mothers in 15 European countries. BMC Pregnancy Childbirth. 2014; 14: 213.

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