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Review

Pregnant women smokers at risk of children's obesity in Asia Pacific: A systematic review

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Abstract

The prevalence of obesity in children is a concern regarding the health implications that arise in the future. Prevention-based interventions on risk factors are directed at achieving the 3rd SDG's goal of reducing premature mortality from non-communicable diseases. Women who smoke during pregnancy are contributors to the increase in Body Mass Index (BMI) or obesity in children. The study aims to analyze the relationship between maternal smoking during pregnancy and childhood obesity in Asia Pacific countries. A literature review was identified by Pubmed, the Lancet, and Science Direct. The review is limited to original research conducted in the Asia Pacific region and limited to 2010 to 2020. The article was screened and extracted using the PRISMA flow chart. A total of 5 articles that met the criteria were reviewed, consisting of 3 articles with a prospective cohort design, one article with a population-based survey, and one article with a cross-sectional design. The article's results showed that maternal smoking during pregnancy has been shown to significantly influence the occurrence of obesity in children. Women who smoke during pregnancy are associated with obesity in children in the Asia Pacific region. This contributes to the risk factors that cause obesity in children and provides information for policymakers and health professionals in making anti-smoking programs or interventions for mothers during pregnancy.

Keywords: pregnant women, smoking, obesity, children, SDGs.

Introduction

The increasing prevalence of obesity in children is a concern in terms of the health implications it has. Obesity in children is associated with cardiovascular disease [1], endocrine [2] and breathing [3] in childhood, and this risk tends to continue into adulthood. In addition, it is also related to premature death, namely the time of death that occurs before the age of 55 years [4]. Most premature deaths from noncommunicable diseases occur in low- and middle-income countries [5]. Interventions are needed to achieve the 3rd SDG's goal, namely by 2030, reducing the number of premature deaths from infectious diseases through prevention and treatment, taking into account risk factors [6]. In a simple definition, the cause of overweight and obesity in childhood is an energy imbalance between calories consumed and calories expended. Several factors underlie this, including a shift in diet towards an increased intake of energy-dense foods high in fat and sugar, instant processed foods (fast food), and decreased levels of physical activity [7]. The potential risk factors for childhood obesity are many and complex. Mothers who smoke during pregnancy have been shown to be a risk factor for low birth weight and small babies for gestational age [8] and as a possible contributor to an increase in Body Mass Index (BMI) or obesity in later life [9]. The mechanism of the relationship between maternal smoking during

pregnancy and increased BMI of the child is that exposure to nicotine and carbon monoxide has been shown to cause placental vasoconstriction and fetal hypoxemia, leading to low early birth weight [10]. Low birth weight infants have been shown to experience rapid growth in infancy and are at high risk for overweight and obesity in adolescence and adulthood [11]. Intrauterine nicotine exposure causes changes in hypothalamic-pituitary impulse control that affect satiety [12]. The relationship between obesity and high BMI indicators in children and smoking parents has been shown in previous studies [13], which is common in both high-income and low- and middle-income countries. However, the study results [14] concluded that the association between maternal smoking before delivery and childhood obesity was independent of birth weight. Therefore, confounding factors, including socio-economic and lifestyle factors, become a concern in this relationship. Several studies have shown that mothers who smoke during pregnancy have different sociodemographic and anthropometric characteristics from nonsmokers. In addition, based on children's eating patterns also show differences in families who do not smoke [15].

This study aims to analyze the relationship between maternal smoking during pregnancy and the risk of obesity in children through a systematic review of several studies conducted in Asia Pacific countries published from 2010 to 2020.

Material and methods

Data source

Articles are identified through several databases: Pubmed, The Lancet, and Science Direct. A search was conducted to identify articles relevant to the research objectives. The keywords used to identify relevant articles are:

"Pregnancy"[Mesh] OR "pregnanc*"[tw] OR "maternal"[tw] OR "mother"[tw] OR "pregnant"[tw] AND "Smoking"[Mesh] OR "smoking"[tw] OR "cigarette"[tw] OR "nicotine"[tw] OR "smoker*"[tw] OR "tobacco"[tw] AND "Pediatric Obesity"[Mesh] OR "childhood"[tw] OR "offspring"[tw] OR "infant"[tw] OR "children"[tw] OR "adolescent"[tw] OR "teen"[tw] OR "obesity"[tw] OR "overweight"[tw] OR "body mass index"[tw] OR "weight"[tw] OR "height"[tw] OR "fatness"[tw] OR "adiposity"[tw].

All articles that come up in search results with that keyword are listed. The study was limited to articles reporting original research published from 2010 to 2020. Studies that did not include aspects of maternal smoking, pregnancy, BMI, obesity, children and adolescents were excluded. Research results showing outside the Asia Pacific region are excluded. Based on the diversity of research methods resulting from the search, the research is not limited to a particular design, fulfilling the articles worthy of being selected according to the research objectives (Figure 1).

Data extraction

In data extraction, we excluded articles published outside of 2010 to 2020; as many as 6420 articles were identified—and as many as 6316 articles after excluding duplicate articles. Then, the articles in the title and abstract that do not contain smoking, pregnancy, obesity, children, and adolescents and the remaining 583 articles are excluded. Articles that did not explain the place of research in the Asia Pacific region were excluded, as well as the remaining 245 articles. Articles that did not meet the research objectives, including research, reviews/systematic reviews, meta-analysis, commentary, perspective, and full text, were not available, and research results that were not related to the research objectives were excluded, and the remaining 5 articles [16].

Results

After eliminating duplicates, inappropriate titles and abstracts, regions outside Asia Pacific, and articles that did not meet the research objectives, 5 articles that met the inclusion and exclusion requirements were identified. A study [17] shows that the age of mothers with boys ranged from 16 to 42 years (mean 28.9 years); for girls, the age of mothers was 18 to 44 years (mean 28.9). Measurement of the status of pregnant women smoking (smoking, never smoking, or quit smoking) and obesity criteria were measured by BMI trajectories of children aged 1.5 years, 3 years, 5 years, and 6–12 years. Obesity variables were divided into categories for boys: 1) thin, 2) normal, 3) tall, 4) progressively overweight, and 5) progressive obesity. Meanwhile, girls are divided into categories: 1) thin, 2) normal, 3) progressive normal, 4) tall, 5) progressively overweight, 6) progressive obesity. The study showed that mothers who smoked 5.42 times (OR: 5.42; 95%CI: 1.89–15.50) were more likely to have a son in the study showed that the mean maternal age was 28.9 years (SD: 4.3). The mean BMI of mothers before pregnancy was 20.7 kg/m2 (SD: 2.8),

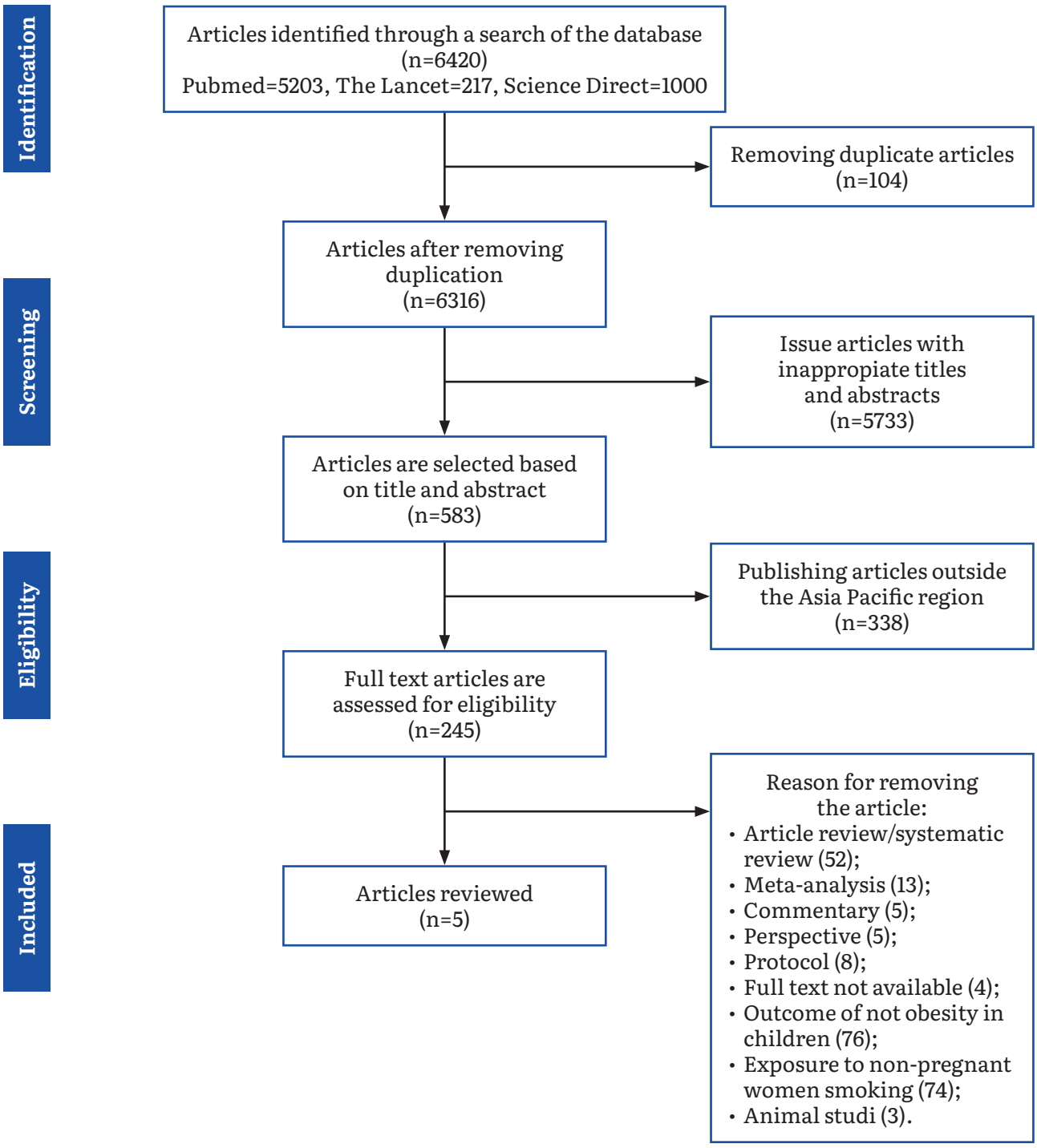

Figure 1: PRISMA flowchart the relationship of mother smoking during pregnancy and child obesity.

and the average birth weight of infants was 3061 grams (SD: 392.7) [18]. The childhood BMI variable was categorized into 4 quartiles based on birth weight. The study explained that mothers who smoked actively during pregnancy were associated with a child's BMI (p=0.007) in the second quartile, namely children who were born weighing 2794 to 3050 grams. In each quartile group, although children born to smoking mothers showed low birth weight, their BMI scores increased around age 3 years. Children of mothers who smoked during pregnancy had a higher BMI than children born to mothers who did not smoke.

Studies by Suzuki describe the collection of data on maternal smoking during pregnancy. BMI examination is carried out on children aged 3 years, 5 years, 7–8 years and 9–10 years by collecting data on children's height and weight and calculated according to WHO standards [19, 20]. Studies have shown that in boys, the BMI value increases with age in months (p<0.0001). However, there was no evidence of an association between

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BMI values and maternal smoking during pregnancy (p=0.7). Regarding the interaction between the age of the child in months and the mother who smoked, there is very strong evidence that the mother who smoked during pregnancy increased the BMI value according to the increase in the child's age in months (p<0.0001). In contrast, in girls, there is strong evidence that BMI values also increase with age in months (p<0.0001). In addition, there is very strong evidence for an association between BMI values and maternal smoking during pregnancy (p=0.0006). However,

Studies by Mitchell *et al.* showed the prevalence of obesity at age 6 years in boys (5.2%) and girls (7.2%) (p=0.09). Among 12-year-olds, the prevalence of obesity in boys and girls was 10.6% and 10.0%, respectively (p=0.09). The average BMI for children aged 6 and 12 was 16.2 kg/m^2 and 20.4 kg/m^2, respectively. Research has shown that 6-year-old children whose mothers smoked during pregnancy have an 85% higher chance of becoming obese. In a sample of 12-year-old children, mothers who smoked during pregnancy increased the odds of being overweight by 65% [21].

Studies conducted in Australia showed that the prevalence of obesity in boys and girls aged 6 years was 5.2% and 7.2%, respectively (P=0.09). Meanwhile, in children aged 12 years, the prevalence of obesity among boys and girls was 10.6% and 10.0%, respectively (P=0.09). The average BMI for children aged 6 years is 16.2 kg/m^2, and for 12 years, it is 20.4 kg/m^2. Smoking during pregnancy was associated with a higher likelihood of obesity among children aged 6 and 12 years (OR=1.99 95%CI=1.05–3.46) and (OR=1.78 95%CI=1.22–2.61) [21].

Studies conducted in New Zealand show the average height (122.3 cm) and weight of children (24.1 kg), while for adolescents, the average height (159.7 cm) and weight (50.5 kg). The average BMI in children is 16.1 kg/m^2, and in adolescents, 19.8 kg/m^2. Studies show that mothers who smoked in the first year of life (yes and no) increased BMI by 0.16 kg/m2 and 0.13 kg/m^2, respectively, which equates to a weight change of less than 0.15 kg for children [22].

Discussion

In this study, we explore the results of research on maternal smoking during pregnancy and childhood obesity in Asia Pacific countries with various study designs and measured components. The literature review aimed to analyze the relationship between maternal smoking during pregnancy and childhood obesity.

In our study, we found that there are limited adequate studies evaluating the association of maternal smoking during pregnancy and childhood obesity in published Asia Pacific countries, which means that there may be more studies on the association of maternal smoking during pregnancy and childhood obesity in these countries, outside the Asia Pacific region. The articles selected in this study can describe the relationship between maternal smoking during pregnancy and childhood obesity in Asia Pacific countries.

In general, obesity and related diseases are considered a problem in Western countries. However, in the last two decades, urbanization in most Asian countries has led to sedentary lifestyle changes and overnutrition that have fueled the obesity epidemic [23].

Studies conducted in Japan, Australia, and New Zealand prove that mothers who smoke during pregnancy have a very high chance of influencing obesity in children. This is in line with the results of a study that showed that the mother's BMI and some bad behaviors during pregnancy had an impact on the child's body mass development pattern. Furthermore, the impact of maternal characteristics during pregnancy shows a different impact between boys and girls [24]. In line with the study results, maternal smoking during pregnancy is associated with obesity in boys [19].

In Japan, 96% of girls experience secondary sexual development at 12 years of age or earlier. Gender differences in social behavior and diet may also help explain the observed gender differences in BMI scores. The results of the analysis of this study revealed that maternal smoking during pregnancy contributes to an increased risk of obesity in boys. This indicates that the impact of maternal lifestyle on developmental patterns may differ by gender [25].

Studies (19) proved that the effect of maternal smoking during pregnancy on BMI values differed by gender. For boys, there is very strong evidence that increased BMI scores are increased by mothers who smoke during pregnancy. Boys' growth is more affected by maternal smoking during pregnancy than girls, and these results are consistent with previous studies [19].

Several studies have shown that girls are less susceptible to adverse environmental factors such as exposure to cigarettes [26]. In addition, one study has shown that prenatal nicotine exposure results in higher testosterone levels in the fetus [27]. Studies prove that androgens play an important role in regulating body fat distribution [28].

A study by Kamiya *et al.* examined differences in the effect of maternal active smoking during pregnancy

on childhood growth based on childhood BMI values using a stratified model analysis stratified by birth weight quartiles. The greatest difference in the effect of maternal smoking on childhood BMI was observed when birth weight was lower than the median value. The study results prove rapid growth during infancy, which can be associated with obesity observed in the second quartile of birth weight [29]. Therefore, in the second quartile of birth weight, maternal active smoking during pregnancy may contribute to the increase in childhood BMI [30].

There are few large Australian studies analyzing the relationship between various risk factors and the prevalence of overweight and obesity in childhood. Study results [21] This is supported by findings from a recent study showing an association between maternal smoking during pregnancy and childhood adiposity [31, 32]. The statement explains that smoking affects childhood obesity through intrauterine exposure. Hormones such as leptin can be a medium for the relationship between smoking and offspring size [33]. Mothers who smoked during pregnancy showed a lower umbilical cord blood hormone profile, causing adverse metabolic results [34]. Mothers who smoke during pregnancy have implications for the danger to the mother and fetus. This is due to other adverse lifestyles that accompany it, such as sedentary behavior, watching television, higher fat consumption, and greater alcohol intake [35].

Lotsfactors, including maternal active smoking during pregnancy, sex of the child, parity, gestational age, maternal age, maternal weight before pregnancy, gestational weight gain, hypertensive disorders during pregnancy, and gestational diabetes, have been associated with infant birth weight [36–39] was 30–36. Therefore, to examine the relationship between maternal active smoking during pregnancy and childhood obesity, it is necessary to consider these factors as confounders.

Maternal smoking during pregnancy is a risk factor for higher BMI in children. However, the study did not explain the content of cigarettes that affect the uterus. For this reason, the proven association could be due to a direct effect of intrauterine cigarette exposure or to confounders due to diet or lifestyle [40].

Conclusion

The advantages of the following review are the systematic search, screening and data extraction strategies. The weaknesses and limitations of the selected study area apply only to the Asia Pacific region. This affects the results of the review to a lesser extent. Thus, it is necessary to further investigate the relationship between pregnant women who smoke and obesity in children in other countries. In conclusion, women who smoke during pregnancy are at risk of increasing their child's BMI, especially in boys. This contributes to the risk factors that cause obesity in children and provides information for policymakers and health professionals in making anti-smoking programs or interventions for mothers during pregnancy.

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Conflict of interest

The authors declare no conflict of interest.

References

1. Herouvi, D., Karanasios, E., Karayianni, C., & Karavanaki, K. Cardiovascular disease in childhood: the role of obesity. European Journal of Pediatrics, 172(6), 721–732, 2013.
2. Darbre, PD. Endocrine disruptors and obesity. Current Obesity Reports, 6(1), 18–27, 2017.
3. Okubo, Y., Nochioka, K., & Testa, MA. The impact of pediatric obesity on hospitalized children with lower respiratory tract infections in the United States. The Clinical Respiratory Journal, 12(4), 1479–1484, 2018.
4. Franks, PW, Hanson, RL, Knowler, WC, Sievers, ML, Bennett, PH, & Looker, HC. Childhood obesity, other cardiovascular risk factors, and premature death. New England Journal of Medicine, 362(6), 485–493, 2010.
5. WHO. Global status report on noncommunicable. diseases 2014. World Health Organization, 2014
6. Ministry of VAT, B. Technical Guidelines for Formulating Action Plans for Sustainable Development Goals (Tpb)/Sustainable Development Goals (SDGs). Technical Guidelines for the Preparation of Action Plans - Edition II Sustainable Development Goals (TPB/SDGs) (Vol. 53). Retrieved from http://www.elsevier.com/locate/scp, 2020.
7. Popkin, BM, Adair, LS, & Ng, SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutrition Reviews, 70(1), 3–21, 2012.
8. Chamberlain, C., O'Mara-Eves, A., Porter, J., Coleman, T., Perlen, SM, Thomas, J., & McKenzie, JE. Psychosocial interventions for supporting women to stop smoking in pregnancy.

 https://doi.org/10.46389/rjd-2024-1239

The Cochrane Database of Systematic Reviews, 2(2), CD001055. https://doi.org/10.1002/14651858.CD001055.pub5, 2017.
9. Ino, T., Shibuya, T., Saito, K., & Inaba, Y. Relationship between body mass index of offspring and maternal smoking during pregnancy. International Journal of Obesity, 36(4), 554–558, 2012.
10. Aycicek, A., Varma, M., Ahmet, K., Abdurrahim, K., & Erel, O. Maternal active or passive smoking causes oxidative stress in placental tissue. European Journal of Pediatrics, 170(5), 645–651, 2011.
11. Howe, LD, Matijasevich, A., Tilling, K., Brion, M.-J., Leary, SD, Smith, GD, & Lawlor, DA. Maternal smoking during pregnancy and offspring trajectories of height and adiposity: comparing maternal and paternal associations. International Journal of Epidemiology, 41(3), 722–732. https://doi.org/10.1093/ije/dys025, 2012.
12. Yanai, J., Pick, CG, Rogel-Fuchs, Y., & Zahalka, EA. Alterations in hippocampal cholinergic receptors and hippocampal behaviors after early exposure to nicotine. Brain Research Bulletin, 29(3-4), 363–368, 1992.
13. Kamiya, M., Suzuki, K., & Yamagata, Z. Effect of maternal active smoking during pregnancy on the trajectory of childhood body mass index: A multilevel analysis using quartiles of birthweight. Tobacco Induced Diseases, 18, 34. https://doi.org/10.18332/tid/119117, 2020
14. Iliadou, AN, Koupil, I., Villamor, E., Altman, D., Hultman, C., Långström, N., & Cnattingius, S. Familial factors confound the association between maternal smoking during pregnancy and young adult offspring overweight. International Journal of Epidemiology, 39(5), 1193–1202, 2010.
15. Rayfield, S., Plugge, E. Systematic review and meta-analysis of the association between maternal smoking in pregnancy and childhood overweight and obesity. J Epidemiol Community Health, 71(2), 162–173, 2017.
16. Swartz, MK. PRISMA 2020: An Update. Journal of Pediatric Health Care, 35(4), 351, 2021.
17. Haga, C., Kondo, N., Suzuki, K., Sato, M., Ando, D., Yokomichi, H.,Yamagata, Z. Developmental trajectories of body mass index among Japanese children and impact of maternal factors during pregnancy. PloS One, 7(12), e51896. https://doi.org/10.1371/journal.pone.0051896, 2012.
18. Kamiya, M., Suzuki, K., & Yamagata, Z. Effect of maternal active smoking during pregnancy on the trajectory of childhood body mass index: A multilevel analysis using quartiles of birthweight. Tobacco Induced Diseases, 18, 34. https://doi.org/10.18332/tid/119117, 2020.
19. Suzuki, K., Kondo, N., Sato, M., Tanaka, T., Ando, D., & Yamagata, Z. Maternal smoking during pregnancy and childhood growth trajectory: a random effects regression analysis. Journal of Epidemiology, 22(2), 175–178. https://doi.org/10.2188/jea.je20110033, 2012.
20. WHO. Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva, Switzerland: World Health Organization, 1998. World Health Organization Technical Report Series, 894, 2015.
21. Gopinath, B., Baur, LA, Burlutsky, G., Robaei, D.,Mitchell, P. Socio-economic, familial and perinatal factors associated with obesity in Sydney schoolchildren. Journal of Pediatrics and Child Health, 48(1), 44–51. https://doi.org/10.1111/j.1440-1754.2011.02181.x, 2012.
22. Mitchell, EA, Stewart, AW, Braithwaite, I., Murphy, R., Hancox, RJ, Wall, C., Beasley, R. Factors associated with body mass index in children and adolescents: An international cross-sectional study. PloS One, 13(5), e0196221. https://doi.org/10.1371/journal.pone.0196221, 2018.
23. Fan, J.-G., Kim, S.-U., & Wong, VW-S. New trends on obesity and NAFLD in Asia. Journal of Hepatology, 67(4), 862–873, 2017.
24. Hejazi, S., Dahinten, VS, Marshall, SK, & Ratner, PA. Developmental pathways leading to obesity in childhood. Health Reports, 20(3), 63, 2009.
25. Gorog, K., Pattenden, S., Antova, T., Niciu, E., Rudnai, P., Scholtens, S., ... Zlotkowska, R. Maternal smoking during pregnancy and childhood obesity: results from the CESAR Study. Maternal and Child Health Journal, 15(7), 985–992, 2011.
26. Stroud, LR, Papandonatos, GD, Shenassa, E., Rodriguez, D., Niaura, R., LeWinn, KZ, Buka, SL. Prenatal glucocorticoids and maternal smoking during pregnancy independently program adult nicotine dependence in daughters: a 40-year prospective study. Biological Psychiatry, 75(1), 47–55. https://doi.org/10.1016/j.biopsych.2013.07.024, 2014.
27. Zhao, J., Leung, JYY, Lin, SL, & Schooling, CM. Cigarette smoking and testosterone in men and women: A systematic review and meta-analysis of observational studies. Preventive Medicine, 85, 1–10, 2016.
28. Zerradi, M., Dereumetz, J., Boulet, M.-M., & Tchernof, A. Androgens, body fat distribution and adipogenesis. Current Obesity Reports, 3(4), 396–403, 2014.
29. Druet, C., Stettler, N., Sharp, S., Simmons, RK, Cooper, C., Davey Smith, G., ... Kuh, D. Prediction of childhood obesity by infancy weight gain: an individual-level meta-analysis. Pediatric and Perinatal Epidemiology, 26(1), 19–26, 2012.
30. Kamiya, M., Suzuki, K., Yamagata, Z. Effect of maternal active smoking during pregnancy on the trajectory of childhood body mass index: A multilevel analysis using quartiles of birthweight. Tobacco Induced Diseases, 18, 34. https://doi.org/10.18332/tid/119117, 2020.
31. Rayfield, S., & Plugge, E. Systematic review and meta-analysis of the association between maternal smoking in pregnancy and childhood overweight and obesity. J Epidemiol Community Health, 71(2), 162–173, 2017.
32. Li, L., Peters, H., Gama, A., Carvalhal, MIM, Nogueira, HGM, Rosado-Marques, V., & Padez, C. Maternal smoking in pregnancy association with childhood adiposity and blood pressure. Pediatric Obesity, 11(3), 202–209. https://doi.org/10.1111/ijpo.12046, 2016.
33. Timmermans, SH, Mommers, M., Gubbels, JS, Kremers, SPJ, Stafleu, A., Stehouwer, CDA, Thijs, C. Maternal smoking during pregnancy and childhood overweight and fat distribution: the KOALA Birth Cohort Study. Pediatric Obesity, 9(1), e14–e25, 2014.
34. Fleisch, AF, Rifas-Shiman, SL, Rokoff, LB, Hivert, M.-F., Mantzoros, CS, Oken, E. Associations of maternal prenatal smoking with umbilical cord blood hormones: the Project Viva cohort. Metabolism, 72, 18–26. https://doi.org/https://doi.org/10.1016/j.metabol.2017.04.001, 2017.
35. Suzuki, K., Kondo, N., Sato, M., Tanaka, T., Ando, D., Yamagata, Z. Gender differences in the association between maternal smoking during pregnancy and childhood growth trajectories: multilevel analysis. International Journal of Obesity, 35(1), 53–59, 2011.
36. Chiavaroli, V., Castorani, V., Guidone, P., Derraik, JGB, Liberati, M., Chiarelli, F., & Mohn, A. Incidence of infants born small- and large-for-gestational-age in an Italian cohort over a 20-year

period and associated risk factors. Italian Journal of Pediatrics, 42, 42. https://doi.org/10.1186/s13052-016-0254-7, 2016.

37. León, G., Murcia, M., Rebagliato, M., lvarez-Pedrerol, M., Castilla, AM, Basterrechea, M., Foradada, CM. Maternal thyroid dysfunction during gestation, preterm delivery, and birthweight. The Infancia y Medio Ambiente Cohort, Pain. Pediatric and Perinatal Epidemiology, 29(2), 113–122, 2015
38. Rao, J., Fan, D., Wu, S., Lin, D., Zhang, H., Ye, S.,Pang, M. Trend and risk factors of low birth weight and macrosomia in south China, 2005–2017: a retrospective observational study. Scientific Reports, 8(1), 1–8, 2018.
39. Hinkle, SN, Albert, PS, Mendola, P., Sjaarda, LA, Boghossian, NS, Yeung, E., & Laughon, SK. Differences in risk factors for incident and recurrent small-for-gestational-age birthweight: a hospital-based cohort study. BJOG: An International Journal of Obstetrics and Gynecology, 121(9), 1080–1088; discussion 1089. https://doi.org/10.1111/1471-0528.12628, 2014.
40. Florath, I., Kohler, M., Weck, MN, Brandt, S., Rothenbacher, D., Schöttker, B.,Brenner, H. Association of pre-and post-natal parental smoking with offspring body mass index: an 8-year followup of a birth cohort. Pediatric Obesity, 9(2), 121–134, 2014.

 https://doi.org/10.46389/rjd-2024-1239