

# CUIDADO É FUNDAMENTAL

Escola de Enfermagem Alfredo Pinto – UNIRIO

SYSTEMATIC REVIEW OF THE LITERATURE

DOI: 10.9789/2175-5361.rpcfo.v15.11778

## FACTORS ASSOCIATED WITH GESTATIONAL WEIGHT GAIN ABOVE RECOMMENDED: SYSTEMATIC REVIEW

*Fatores associados ao ganho de peso gestacional acima do recomendado: revisão sistemática**Factores asociados con el aumento de peso gestacional arriba recomendado: revisión sistemática*Gabriela Oliveira<sup>1</sup> Fernanda Garcia Gabira<sup>1</sup> Elizabete Regina A. de Oliveira<sup>1</sup> 

### ABSTRACT

**Objective:** to estimate the factors that are related to gestational weight gain above the recommended level. **Method:** the search was carried out in May 2021 in the following databases: LILACS, PubMed and COCHRANE, with the descriptors: “Pregnant women”; “Gestational weight gain”; “Pregnancy”; “Gestation”; “Risk Factors”; “Socioeconomic Factors”. The study protocol was registered at PROSPERO under number CRD42021258655. The selection of articles was carried out with a focus on the guiding question “Which factors are associated with gestational weight gain above the recommended?”. Selected articles were analyzed using the “JBI Critical Appraisal Checklist” and “Grading of Recommendations Assessment, Development and Evaluation” systems. **Results:** 15 articles were selected. The most prevalent factors were: pre-pregnancy weight, tobacco use, parity and family income. **Conclusion:** estimating these factors contributes to obtaining a better gestational period, childbirth and postpartum period.

**DESCRIPTORS:** Pregnancy; Pregnant woman; Gestational weight gain; Risk factors.

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Received: 03/18/2022; Accepted: 08/26/2022; Published online: 02/03/2023

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**How cited:** Oliveira G, Gabira FG, Oliveira ERA. Factors associated with gestational weight gain above recommended: systematic review. *R Pesq Cuid Fundam* [Internet]. 2023 [cited year month day];15:e11778. Available from: <https://doi.org/10.9789/2175-5361.rpcfo.v15.11778>



## RESUMO

**Objetivo:** estimar os fatores que estão relacionados ao ganho de peso gestacional acima do recomendado. **Método:** a busca foi realizada em maio de 2021 nas bases de dados: LILACS, PubMed e COCHRANE, com os descritores: "Pregnant women"; "Gestational weight gain"; "Pregnancy"; "Gestation"; "Risk Factors"; "Socioeconomic Factors". O protocolo do estudo foi registrado na PROSPERO sob o nº CRD42021258655. A seleção dos artigos foi realizada com foco na pergunta norteadora "Quais fatores estão associados ao ganho de peso gestacional acima do recomendado?". Artigos selecionados foram analisados pelos sistemas "JBI Critical Appraisal Checklist" e Grading of Recommendations Assessment, Development and Evaluation. **Resultados:** foram selecionados 15 artigos. Os fatores mais prevalentes, foram: peso pré-gestacional, uso de tabaco, paridade e renda familiar. **Conclusão:** estimar esses fatores contribui para a obtenção de um melhor período gestacional, parto e período pós-parto.

**DESCRITORES:** Gravidez; Gestantes; Ganho de peso na gestação; Fatores de risco.

## RESUMEN

**Objetivo:** estimar los factores que se relacionan con el aumento de peso gestacional por encima del nivel recomendado. **Método:** la búsqueda se realizó en mayo de 2021 en las siguientes bases de datos: LILACS, PubMed y COCHRANE, con los descriptores: "Mujeres embarazadas"; "Aumento de peso gestacional"; "El embarazo"; "Gestación"; "Factores de riesgo"; "Factores socioeconómicos". El protocolo del estudio fue registrado en PROSPERO con el número CRD42021258655. La selección de artículos se realizó con un enfoque en la pregunta orientadora "¿Qué factores se asocian con un aumento de peso gestacional superior al recomendado?". Los artículos seleccionados se analizaron mediante los sistemas "JBI Critical Appraisal Checklist" y "Grading of Recomendaciones Assessment, Development and Evaluation". **Resultados:** se seleccionaron 15 artículos. Los factores más prevalentes fueron: peso previo al embarazo, tabaquismo, paridad e ingresos familiares **Conclusión:** estimar estos factores contribuye a obtener un mejor período gestacional, parto y puerperio.

**DESCRIPTORES:** Embarazo; Mujeres embarazadas; Ganancia de peso gestacional; Factores de riesgo.

## INTRODUCTION

Overweight, which includes overweight and obesity, is seen as one of the current problems of the world population and is an important focus of change by governmental and medical institutions due to the numerous complications caused in relation to the appearance of diseases, mental health problems, prejudice, and social issues. Overweight is a multifactorial and complex disease that can be developed due to genetic or non-genetic factors and their interactions. According to the latest National Health Survey (IBGE)1 (PNS) 2019, 62.6% of women over the age of 18 are overweight and 29.5% are obese.

During the gestational period the woman's body is undergoing daily changes, weight gain is one of the main modifications resulting from the pregnancy period. These changes are distributed from conception, formation and development of the fetus, the increase in maternal stocks of fat and nutrients, uterine expansion, amniotic fluid, placental volume, growth of mammary glands, retention of extracellular fluid and blood volume. These changes are influenced by nutritional, sociodemographic, obstetric, and behavioral factors.<sup>2,3</sup>

Studies<sup>6</sup> have already identified that women who exceeded the recommended gestational weight gain had a higher risk of developing some comorbidities such as gestational diabetes, hypertension, preeclampsia, and premature birth. Added to this, one must take into account that such an outcome also affects the baby, influencing perinatal mortality, prematurity, and even compromised development, which can generate consequences not only in child life but also in adult life. Therefore, it is essential

that pregnant women have adequate prenatal care and that the team involved is aware of how important it is to maintain the recommended weight gain throughout the gestational period, following the guidelines of the Institute of Medicine (IOM)<sup>7</sup>, as well as the elimination of several factors harmful to health.

Knowing the associated factors that have been found in recent years by researchers makes it possible to guide health actions and indicate possible changes in the lifestyle of women who choose to become pregnant. Thus, through this systematic review, the present study aims to estimate the factors that are related to gestational weight gain above the recommended one that have already been identified by the scientific literature and whether there is a consensus.

## METHOD

The search was performed in May 2021 in the Latin American and Caribbean Health Sciences Literature (LILACS), Biomedical Literature from Medical Literature Analysis and Retrieval System Online (PubMed) and COCHRANE databases. The study protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO)<sup>8</sup> under number CRD42021258655.

The search strategy used in the databases included terms selected on the basis of Health Science Descriptors (DeCS) and Medical Subject Headings (Mesh). The following combinations were used: "Gestational weight gain"; "Weight Gain, Gestational"; "Pregnancy Weight Gain"; "Weight Gain, Pregnancy"; "Maternal Weight Gain"; "Weight gain"; "Gain, Weight"; "Gains, Weight";

"Weight Gains"; "Pregnant women"; "Pregnant Woman"; "Woman, Pregnant"; "Women, Pregnant"; "Pregnancy"; "Pregnancies"; "Gestation"; "Risk Factors"; "Factor, Risk"; "Factors, Risk"; "Risk Factor"; "Population at Risk"; "Risk, Population at"; "Populations at Risk"; "Risk, Populations at"; "Socioeconomic Factors"; "Factors, Socioeconomic"; "Factor, Socioeconomic"; "Socioeconomic Factor"; "Inequality"; "Inequalities", along with the Boolean operators OR and AND.

The PICO<sup>9</sup> strategy (Patient, Intervention, Comparison, and Outcomes) was part of this step in which the Patient was defined as the pregnant women, the Intervention as the factors associated with excess weight gain, and the Outcome as gestational weight gain above recommended.

Inclusion criteria were: articles in English, Portuguese and/or Spanish, published in the last six years, available in full (Free full text), carried out in humans and with a cross-sectional study design, cohorts, clinical trials and case-controls. Exclusion criteria were theses, dissertations, book chapters, systematic or literature review articles, and articles that did not address the objective of interest. All articles found were exported from their databases to the EndNote X9 bibliographic management program.

It was understood that the search period of the last six years could be more appropriate due to the increase in weight gain by women that has been occurring over the last few years, this can be proven by comparing the results of the Pesquisa de Orçamentos Familiares (POF) 2002/2003, POF 2008/2009, PNS 2013 AND PNS 2019, however it is highlighted the increase mainly from PNS 2013, when it is observed that the proportion of women with weight gain exceeds men.<sup>1</sup>

The literature survey was carried out by two reviewers independently. Disagreements were resolved by consensus and, if not possible, were resolved by discussion with a third reviewer. Those studies that did not perform sample calculation, adjust for possible confounding factors, and report a 95% confidence interval were excluded.

After applying the previously developed inclusion and exclusion criteria, the methodological quality of the studies was assessed using the "JBI Critical Appraisal Checklist" of the Joanna Briggs Institute (JBI)10, with a checklist for cross-sectional studies (8 criteria) and cohort studies (10 criteria). In the assessment each question can be answered by means of four options: "Yes (Y), No (N), Unclear (U), Not Applicable (NA)" [i.e., yes (Y), no (N), uncertain (I), and not applicable (NA)]. The risk of bias is calculated based on the number of "Yes" selected, it should be noted that the answer "Not Applicable" is not used in the calculation. Up to 49% is considered a high risk of bias, from 50% to 70% the risk is moderate, and above 70% there is a low risk. Articles that answered the guiding question of this systematic review, "What factors are associated with gestational weight gain above the recommended one?" were included in the review.

Finally, the quality of evidence of the selected articles was analyzed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE)<sup>11,12</sup>, which is a universal, sensitive, and transparent system for grading the quality of evi-

dence and strength of recommendations. The quality of evidence of each article can be classified as: high, moderate, low, or very low, the initial classification being determined by the study design and may change according to subsequent analyses. There are five factors that can decrease the quality of evidence (risk of bias, inconsistency, indirect evidence, imprecision, and publication bias) and three factors that can increase it (large effect magnitude, dose-response gradient, and residual confounding factors).

## RESULTS

A total of 14,052 articles were found in the aforementioned databases. After eliminating duplicate articles, reading titles and abstracts, 114 articles were screened and 31 were analyzed in their entirety. After the analysis of the articles included in the review, their references were also read in order to find articles that were possibly not found during the database search, but no article was included in the review. Figure 1 shows the flowchart with the steps of identification, selection, and inclusion of texts for analysis according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol.<sup>13</sup>

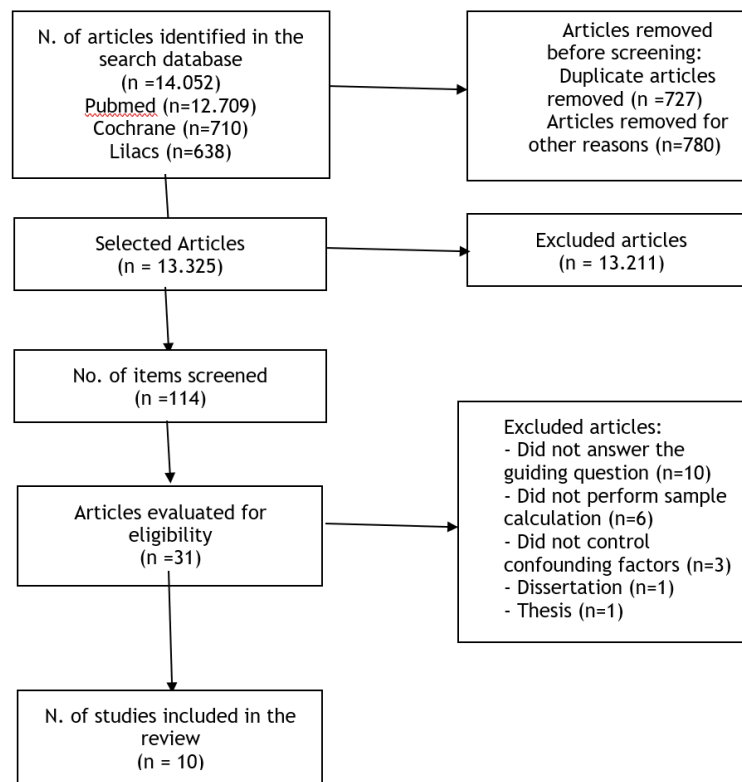
Table 1 presents methodological characteristics and main results of the 10 eligible articles. It is observed that cross-sectional<sup>2,3,14-18</sup> and cohort<sup>19-21</sup> designs were the ones performed in the selected studies. The population sample ranged from 1892 to 2,364,793 pregnant women.<sup>20</sup> Most of the selected studies were produced in the USA<sup>14,16,19,20</sup> and Brazil.<sup>2,3,17,18</sup> Among the studies analyzed, the factor that was present in a greater number of articles was weight during the prepregnancy period.<sup>3,14-17,19,21</sup> Pregnant women who were overweight or obese before pregnancy were more likely to have high weight gain compared to eutrophic pregnant women.

Other factors identified in this review regarding gestational weight gain were socioeconomic status,<sup>3,15,19</sup> maternal age over 20 years,<sup>17,19</sup> parity,<sup>17,21</sup> and others were identified in only one study, such as smoking,<sup>19</sup> work,<sup>2</sup> schooling,<sup>14</sup> stress,<sup>18</sup> single fetus,<sup>19</sup> neighborhood violence,<sup>20</sup> planned weight gain above guidelines.<sup>21</sup>

Table 1 also shows the quality assessment of the studies performed using the JBI "JBI Critical Appraisal Checklist", in which they were classified as low and moderate risk of bias. In Table 2, according to the Grid System, only the variable 'pregnancy weight' was likely to have its quality level raised, given the classification of the criteria magnitude of effect and dose-response gradient.

## DISCUSSION

In general, most studies<sup>3,14-17,19,21</sup> verified the influence of weight before pregnancy. Prepregnancy overweight was associated with excessive weight gain during pregnancy, which is an important warning sign given the several consequences that may arise. The pregnant woman may have a higher risk of hypertension<sup>22</sup>, preeclampsia<sup>22</sup>, anemia and vitamin A4 deficiency, gestational diabetes<sup>23</sup>, and anesthetic complications.<sup>23</sup> As for the baby, the

**Figure 1** – PRISMA 2020 flowchart showing the study selection process**Table 1** – Summary of factors associated with gestational weight gain

Author (Year)	Study Design and Sample	Results	JBI Score
Magalhães et al. <sup>3</sup> (2015), Brazil	Cross-Sectional Study, 328	Factors that were associated with excessive weekly weight gain were family income and pre-pregnancy nutritional status. Greater excessive weekly weight gain among pregnant women with family income less than one minimum wage (PR 2.65; 95%CI 1.18-4.83) and among women who started pregnancy overweight/obese (PR 1.33; 95%CI 1.02-1.76) compared to those with low pre-pregnancy nutritional status/eutrophic.	88,8%
Lindberg et al. <sup>19</sup> (2016), USA	Cohort, 7.385	They were associated with increased risk of excessive weight gain: maternal age 20-24 years (OR 1.20; 95% CI 1.01-1.44) and 25-29 years OR 1.25 (CI 1.10-1.42); being overweight (OR 3.00; 95% CI 2.65-3.40), Class I obesity (OR 3.04; 95% CI 2.59-3.57) or Class II (OR 1.61; 95% CI 1.29-1.99) pre-pregnancy; single fetus (OR 3.41; 95% CI 2.08-5.56) (vs twins); having smoked in the past (OR 1.48; 95% CI 1.31-1.66); living in neighborhood with low economic hardship (OR 1.32; 95% CI 1.08-1.62).	80%
Yeo S.; Crandell JL.; Jones-Vessey K. <sup>14</sup> (2016), USA	Cross-Sectional Study, 191.083	Excessive weight gain was more prevalent in mothers who were overweight (63.3%) (OR 2.44; 95% CI 2.37-2.5) or obese (56.8%) (OR 2.33; 95% CI 2.27-2.4) before pregnancy and education beyond high school (OR 1.05 95% CI 1.02-1.08).	88,8%
Cheney et al. <sup>15</sup> (2017), Australia	Cross-Sectional Study, 2.021	Women with overweight (OR 1.69; 95% CI 1.33-2.14) and obesity (OR 1.64; 95% CI 1.20-2.24) pre-pregnancy were more likely to gain excess weight. Women with low socioeconomic status were more likely to gain overweight (OR 1.89; 95% CI: 1.49-2.41).	87,5%
Galin et al. <sup>20</sup> (2017), USA	Cohort, 2.364.793	Higher neighborhood violence was associated with excessive gestational weight gain (RR 1.04; 95% CI 1.03-1.05). Non-white women had a higher risk of excessive gain associated with neighborhood violence (RR 1.10 95% CI 1.00-1.21).	100%
Manera, F. & Höfelmann, D.A. <sup>17</sup> (2019), Brazil	Cross-Sectional Study, 316	Prevalence of gestational overweight (PR 1.72 95%CI 1.04-2.83) was higher among pregnant women aged 20-34 years and 2.08 times higher (95%CI 1.18-3.66) in those aged 35 years or older. In those who reported three or more pregnancies (PR 1.47 95%CI 1.04-2.09) and who started pregnancy overweight (PR 5.09 95%CI 3.63-7.14).	87,5%
Silva et al. <sup>2</sup> (2019), Brazil	Cross-Sectional Study, 189	Excessive gain was predominant in those who worked (RR=0.90 95% CI 0.84-0.96).	100%
Dolin et al. <sup>16</sup> (2020), USA	Cross-Sectional Study, 508	Women with overweight (RRR: 1.88; 95%CI 1.04-3.40) and pre-pregnancy obesity (RRR: 1.98; 95%CI: 1.08-3.62) were more likely to gain gestational overweight.	100%

**Table 1 – Cont.**

Paulino et al. (2020) <sup>18</sup> , Brazil	Cross-Sectional Study, 386	In multivariate regression analysis, stress almost doubles the probability of gaining excess gestational weight in overweight or obese women (OR 1.75; 95% CI: 1.03-2.96).	100%
McDonald et al. <sup>21</sup> (2020), Canada	Cohort, 970	Nulliparity (OR 1.50; 95%CI 1.04-2.16), being overweight before pregnancy (OR 2.52 95%CI 1.55-4.11), planning excessive gain in pregnancy (OR 2.73 95%CI 1.66-4.47).	90%

risk of stillbirth may be twice as high in obese women when compared to those with normal BMI<sup>24</sup>, there is also a higher risk of macrosomia<sup>25</sup>, besides influencing delivery-related issues such as a higher risk of premature labor and cesarean delivery.<sup>25</sup>

Socioeconomic status, present in some studies,<sup>3,15,19</sup> has been shown to be an association factor. Excessive gestational weight gain was found in pregnant women who had family income below one minimum wage<sup>3</sup> and in those with low socioeconomic status.<sup>15</sup> So was the influence of violence in the neighborhood<sup>20</sup> that was justified by a possible health disparity. However, the author himself states that there is a need for further studies investigating the influence of this factor, since there are few studies addressing issues that justify this relationship.

Poor living conditions are reflected in an inadequate dietary pattern from the nutritional point of view, causing an increase in excessive weight gain.<sup>26</sup> The impact of low income can influence the lack of education and the failure to seek health services for proper nutrition in this period, also contributing to the lack of resources to maintain and ensure proper nutrition. On the other hand, a study<sup>2</sup> found that pregnant women who were in the labor market were associated with being overweight during pregnancy. According to the author, women who do not work may have more time for a healthier diet and for physical activity, while women who work are prone to the stress factor caused by their jobs, which can lead to inadequate consumption of food.

Regarding parity, a non-conclusive factor in this review, it was observed an association of gestational overweight in those who were having their first child<sup>21</sup> and an association in women who reported three or more pregnancies.<sup>17</sup> The weight gain in primigravidae can be an indication of how the weight gain will be in the second pregnancy<sup>27</sup>, which translates into important information to guide actions in these women. Only one study found excessive weight gain in pregnant women with a single fetus when compared to those with twins.

In both articles, excess weight was present in those older than 20 years; in one study,<sup>19</sup> it was identified that after 40 years of age weight gain becomes insufficient, while in the other study,<sup>17</sup> excess weight gain was observed in pregnant women 35 years of age or older. Regarding race, only one study<sup>20</sup> was able to observe a relationship with excessive gestational weight gain and it was in non-white women when associated with violence.

The health of pregnant women is a focus of interest and concern, and their follow-up should be valued. A better understanding of the influence of excessive weight gain during pregnancy, the implications for mother-baby, and how this can affect the health of both is essential. It is important to make it clear that the consequences of being overweight during pregnancy do not stop after the entire gestational process; there is a greater weight

retention after delivery (either for six months or 12 months) in those who are overweight pre-pregnant<sup>29</sup>. After analyzing data from the Helsinki Birth Cohort Study, which is composed of children born between 1934 and 1944 and followed from 1971 to 2010, an association of maternal BMI with cardiovascular disease and type 2 diabetes in their offspring was observed.<sup>32</sup>

The studies that were covered in this review have limitations that were pointed out by their authors. The present review has some limitations that must be acknowledged, such as: studies from the gray literature were not included, which contributes to the loss of information on the subject and the availability of the full text. However, these limitations do not eliminate the relevance of the information discussed.

## CONCLUSION

The systematic review allowed us to estimate the factors that may be associated with overweight gain in pregnant women. The most prevalent are controllable factors such as pre-pregnancy overweight, socioeconomic status and parity, in addition to the pregnant woman's age. Knowing which factors are directly linked to this process contributes to the guidance of the actions of health professionals aiming at the awareness and elimination of these factors and thus being able to have a better gestational period, besides the delivery and postpartum period for both mother and baby.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest for the publication of this article.

## FINANCING

This work was financed by Fundo de Amparo à Pesquisa e Inovação do Espírito Santo (FAPES).

## REFERENCES

1. Instituto Brasileiro de Geografia e Estatística – IBGE. Pesquisa nacional de saúde 2019: atenção primária à saúde e informações antropométricas: Brasil / IBGE, Coordenação de Trabalho e Rendimento, [Ministério da Saúde], 2020 [acesso em 18 de junho de 2021]. Disponível em: <https://biblioteca.ibge.gov.br/visualizacao/livros/liv101758.pdf>.
2. Silva LO, Alexandre MR, Cavalcante ACM, Arruda SPM, Sampaio RMM. Adequate versus inadequate weight gain

**Table 2** – Quality of evidence evaluation according to the GRADE system

QUALITY ASSESSMENT									Quality of evidence (GRADE)
Studies	Delineation	Risk of Bias	Inconsistency	Indirect Evidence	Imprecision	Magnitude of Effect	Dose-Response Gradient	Residual confounding factors	
<b>Pregestational Weight</b>									
7	Observacional	No limitations	Not severe	Not severe	Not severe	Large <sup>1</sup>	It has	Overestimates <sup>2</sup>	⊕⊕⊕○ Moderate
<b>Socioeconomic Situation</b>									
3	Observacional	No limitations	Not severe	Not severe	Not severe	Absent <sup>3</sup>	Does not have	Inconclusive <sup>4</sup>	⊕⊕○○ Low
<b>Smoking</b>									
2	Observacional	No limitations	Not severe	Not severe	Not severe	Absent	Does not have	Inconclusive <sup>5</sup>	⊕⊕○○ Low
<b>Parity</b>									
2	Observacional	No limitations	Not severe	Not severe	Not severe	Absent	Does not have	Inconclusive <sup>6</sup>	⊕⊕○○ Low
<b>Maternal age above 20 years</b>									
2	Observacional	No limitations	Not severe	Not severe	Not severe	Absent	Does not have	Inconclusive <sup>7</sup>	⊕⊕○○ Low

**Caption:**

<sup>1</sup> Of the seven articles that found association with prepregnancy weight, three<sup>14,19,21</sup> have large effect magnitude and one<sup>17</sup> has very large magnitude, with CI precision around the effect;

<sup>2</sup> Of the seven articles that found association with prepregnancy weight, five<sup>3,15,16,17,21</sup> overestimate the effect;

<sup>3</sup> Only one<sup>3</sup> of the three studies show large magnitude of effect;

<sup>4</sup> Of the three studies, only two<sup>3,15</sup> were able to classify the confounding factors, with one<sup>3</sup> underestimating the effect and the other<sup>15</sup> overestimating it;

<sup>5</sup> The classification of confounding factors for this variable was inconclusive because it was possible to classify only one study<sup>17</sup>;

<sup>6</sup> The classification of confounding factors for this variable was inconclusive because one study underestimated<sup>21</sup> the effect and another overestimated<sup>17</sup>;

<sup>7</sup> The classification of confounding factors for this variable was inconclusive because it was only possible to classify one study<sup>17</sup>;

- and socioeconomic factors of pregnant women followed up in primary care. *Rev Bras Saúde Mater Infant.* [Internet]. 2019 [cited 2021 may 5];19(1) Available from: <https://www.scielo.br/j/rbsmi/a/9BVqdgCnGfGscLNSfd4zQ3B/?format=pdf&lang=pt>.
3. Magalhães EIS, Maia DS, Bonfim CFA, Netto MP, Lamounier JA, Rocha DS. Prevalência e fatores associados ao ganho de peso gestacional excessivo em unidades de saúde do sudoeste da Bahia. *Rev Bras Epidemiol.* [Internet]. 2015 [acesso em 05 de maio 2021];18(4). Disponível em: <https://doi.org/10.1590/1980-5497201500040014>.
  4. Padilha PC, Saunders C, Machado RCM, Silva CL, Bull A, Sally EOF, et al. Associação entre o estado nutricional pré-gestacional e a predição do risco de intercorrências gestacionais. *Rev Bras Ginecol Obstet.* [Internet]. 2007 [acesso em 05 de julho 2021];29(10). Disponível em: <https://www.scielo.br/j/rbgo/a/TdxHtdWGCTpdvxcbcqnZY6r/?format=pdf&lang=pt>.
  5. Ovalle A, Martínez MA, Fuentes A, Marques X, Vargas F, Vergara P, et al. Obesity, a risk factor for ascending bacterial infection during pregnancy. *Rev Med Chil.* [Internet]. 2016 [cited 2021 jul 7];144(4). Available from: <http://dx.doi.org/10.4067/S0034-98872016000400008>.
  6. Van Der Burg JW, Allred EM, Kuban K, O'shea TM, Dammann O, Leviton A. Maternal obesity and development of the preterm newborn at 2 years. *Acta Paediatr.* [Internet]. 2015 [cited 2021 jun 24];104(9). Available from: <https://doi.org/10.1111%2Fapa.13038>.
  7. Rasmussen KM, Yaktine AL, Institute of Medicine (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines. *Weight Gain During Pregnancy: Reexamining the Guidelines.* Washington (DC): National Academies Press (US). [Internet]. 2009 [cited 2021 jun 24]. Disponível em: <https://www.ncbi.nlm.nih.gov/books/NBK32813/>.
  8. National Institute for Health Research. PROSPERO: International prospective register of systematic reviews. [cited 2021 jun 24]. Available from: <https://www.crd.york.ac.uk/prospero/>.
  9. Munn Z, Stern C, Aromatraris E, Lockwood C, Jordan Z. What kind of systematic review should conduct? A proposed typology and guidance for systematic reviewers in the medical and health sciences. *BMC Med Res Methodol.* [Internet]. 2018 [cited 2021 abpr 17];18(1). Available from: <https://doi.org/10.1186%2Fs12874-017-0468-4>.
  10. The Joanna Briggs Institute. Checklist for Systematic Reviews and Research Syntheses. The Joanna Briggs Institute Critical Appraisal tools for use in JBI Systematic Reviews. [Internet]. 2017 [cited 2021 apr 26]. Available from: <http://joannabriggs.org/research/critical-appraisal-tools.html>.
  11. Diretrizes metodológicas: Sistema GRADE – Manual de graduação da qualidade da evidência e força de recomendação para tomada de decisão em saúde / Ministério da Saúde, Secretaria de Ciência, Tecnologia e Insumos Estratégicos, Departamento de Ciência e Tecnologia. – Brasília: Ministério da Saúde, 2014 [acesso em 22 de abril de 2021]. Disponível em: [https://bvsm.sau.gov.br/bvs/ct/PDF/diretriz\\_do\\_grade.pdf](https://bvsm.sau.gov.br/bvs/ct/PDF/diretriz_do_grade.pdf).
  12. Guyatt G, Oxman AD, Akl Ea, Kunz R, Vist G, Brozek J, et al. GRADE guidelines:1. Introduction GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol.* [Internet]. 2011 [cited 2021 apr 18];64. Available from: <https://doi.org/10.1016/j.jclinepi.2010.04.026>.
  13. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* [Internet]. 2021 [cited 2021 apr 18];372(71). Available from: <https://doi.org/10.1136/bmj.n71>.
  14. Yeo S, Crandell JL, Jones-Vessey K. Adequacy of Prenatal Care and Gestational Weight Gain. *J Womens Health.* [Internet]. 2016 [cited 2021 may 18];25(2). Available from: <https://doi.org/10.1089%2Fjwh.2015.5468>.
  15. Cheney K, Berkemeier S, Sim KA, Gordon A, Black K. Prevalence and predictors of early gestational weight gain associated with obesity risk in a diverse Australian antenatal population: a cross-sectional study. *BMC Pregnancy Childbirth.* [Internet]. 2017 [cited 2021 may 18];17(1). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5590236/>.
  16. Dolin CD, Gross RS, Deierlein AL, Berube LT, Katzow M, Yaghoubian Y, et al. Predictors of Gestational Weight Gain in a Low-Income Hispanic Population: Sociodemographic Characteristics, Health Behaviors, and Psychosocial Stressors. *Int J Environ Res Public Health.* [Internet]. 2020 [cited 2021 may 19];17(1). Available from: <https://www.e-publicacoes.uerj.br/index.php/demetra/article/view/36842/30833>.
  17. Manera F, Höfelmann DA. Excesso de peso em gestantes acompanhadas em unidades de saúde de Colombo, Paraná, Brasil. *Demetra: Alimentação, Nutrição & Saúde.* [Internet]. 2019 [acesso em 23 de maio 2021] ;14. Disponível em: <https://www.e-publicacoes.uerj.br/index.php/demetra/article/view/36842>.
  18. Paulino DSM, Pinho-Pompeu M, Raikov F, Freitas-Jesus JV, Machado HC, Surita FG. The Role of Health-related Behaviors in Gestational Weight Gain among Women with Overweight and Obesity: A Cross-sectional Analysis. *Rev Bras Ginecol Obstet.* [Internet]. 2020 [cited 2021 may 6];42(6). Available from: <https://doi.org/10.1055/s-0040-1712132>.
  19. Lindberg S, Anderson C, Pillai P, Tandias A, Arndt B, Hanrahan L. Prevalence and Predictors of Unhealthy

- Weight Gain in Pregnancy. WMJ. [Internet]. 2016 [cited 2021 may 20];115(5). Available from: <https://doi.org/10.1111%2Fppe.12331>.
20. Galin J, Abrams B, Leonard SA, Matthay EC, Goin DE, Ahern J. Living in Violent Neighbourhoods is Associated with Gestational Weight Gain Outside the Recommended Range. *Paediatr Perinat Epidemiol*. [Internet]. 2017 [cited 2021 may 18];31(1). Available from: <https://doi.org/10.1111%2Fppe.12331>.
  21. McDonald SD, Yu ZM, Blyderveen SV, Schmidt L, Sword W, Vanstone M, et al. Prediction of excess pregnancy weight gain using psychological, physical, and social predictors: A validated model in a prospective cohort study. *PLoS One*. [Internet]. 2020 [cited 2021 may 18];15(6). Available from: <https://doi.org/10.1371/journal.pone.0233774>.
  22. Alba JFF, Páez CM, Sánchez ÁV, Pazos ES, Macías MCG, Negro ES et al. Sobrepeso y obesidad como factores de riesgo de los estados hipertensivos del embarazo: estudio de cohortes retrospectivo. *Nutr. Hosp*. [Internet]. 2018 [cited 2021 may 18];35(4). Available from: <https://dx.doi.org/10.20960/nh.1702>.
  23. Teles, LFS. Relação entre ganho de peso gestacional e composição corporal do concepto. São Paulo. Tese [Nutrição em Saúde Pública]. Faculdade de Saúde Pública da Universidade de São Paulo; 2021 [acesso em 18 de setembro de 2021]. Disponível em: [https://www.teses.usp.br/teses/disponiveis/6/6138/tde-05042021-161019/publico/TelesLFS\\_DR\\_O.pdf](https://www.teses.usp.br/teses/disponiveis/6/6138/tde-05042021-161019/publico/TelesLFS_DR_O.pdf).
  24. Poston L, Caleyachetty R, Cnattingius S, Corvalán C, Uauy R, Herring S, et al. Preconceptional and maternal obesity: epidemiology and health consequences. *The Lancet Diabetes & Endocrinology*. [Internet]. 2016 [cited 2021 sep 24];4(12). Available from: [https://doi.org/10.1016/S2213-8587\(16\)30217-0](https://doi.org/10.1016/S2213-8587(16)30217-0).
  25. Gonçalves CV, Mendoza-Sassi RA, Cesar JA, Castro NB, Bortolomedi AP. Índice de massa corporal e ganho de peso gestacional como fatores preditores de complicações e do desfecho da gravidez. *Rev Bras Ginecol Obstet*. [Internet]. 2012 [acesso em 18 de outubro 2021];34(7). Disponível em: <https://www.scielo.br/j/rbgo/a/LhxQVfcrvk8FBGz8JkYVDqF/?format=pdf&lang=pt>.
  26. Ferreira VA, Magalhães R. Obesidade entre os pobres no Brasil: a vulnerabilidade feminina. *Ciênc. Saúde Coletiva*. [Internet]. 2011 [acesso em 08 de outubro 2021];16(4). Disponível em: <https://www.scielo.br/j/csc/a/8dYt5SQKpNBF4JvpNSL5sZQ/?format=pdf&lang=pt>.
  27. Chin JR, Krause KM, Østbye T, Chowdhury N, Lovelady CA, Swamy GK. Gestational weight gain in consecutive pregnancies. *Am J Obstet Gynecol*. [Internet]. 2010 [cited 2021 oct 5];203(3). Available from: <https://doi.org/10.1016/j.ajog.2009.10.414>.
  28. Hartley E, McPhie S, Skouteris H, Fuller-Tyszkiewicz M, Hill B. Psychosocial risk factors for excessive gestational weight gain: A systematic review. *Women Birth*. [Internet]. 2015 [cited 2021 sep 27];28(4). Available from: <https://doi.org/10.1016/j.wombi.2015.04.004>.
  29. Nast M, Oliveira A, Rauber F, Vitolo MR. Ganho de peso excessivo na gestação é fator de risco para o excesso de peso em mulheres. *Rev Bras Ginecol Obstet*. [Internet]. 2013 [acesso em 02 de agosto 2021];35(12). Disponível em: <https://www.scielo.br/j/rbgo/a/JSyhK3ytGg59HkFnMYg7yKH/?format=pdf&lang=pt>.
  30. Gaillard R, Durmuş B, Hofman A, Mackenbach JP, Steegers EAP, Jaddoe VWV. Risk factors and outcomes of maternal obesity and excessive weight gain during pregnancy. [Internet]. 2013 [cited 2021 oct 9];21(5). Available from: <https://doi.org/10.1002/oby.20088>.
  31. Monthé-Drèze C, Rifas-Shiman SL, Gold DR, Oken E, Sem S. Maternal Obesity and Offspring Cognition: The Role of Inflammation. *Pediatr Res*. [Internet]. 2019 [cited 2021 sep 30];85(6). Available from: <https://doi.org/10.1038%2Ffs41390-018-0229-z>.
  32. Eriksson JG, Sandboge S, Salonen MK, Kajantie E, Osmond C. Long-term consequences of maternal overweight in pregnancy on offspring later health: Findings from the Helsinki Birth Cohort Study. *Annals of medicine*. [Internet]. 2014 [cited 2021 oct 28];46(6). Available from: <https://doi.org/10.3109/07853890.2014.919728>.