

Relationship between minimally and ultra-processed food intake during pregnancy with obesity and gestational diabetes mellitus

A relação entre consumo de alimentos minimamente processados e ultraprocessados durante a gestação e obesidade e diabetes mellitus gestacional

La relación entre el consumo de comida mínimamente procesada y ultraprocesada durante embarazos con obesidad y diabetes mellitus gestacional

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Abstract

This study aimed to investigate the relationship between food intake (considering the nature, extent, and purpose of food processing) during pregnancy and overweight, obesity, and gestational diabetes mellitus conditions. This is a cross-sectional study conducted among 785 adult women in singleton pregnancies (between 24th and 39th weeks of gestation) in Brazil. Usual food intake was estimated by the Multiple Source Method, using two 24-hour dietary recalls. The food groups of interest in this study were the unprocessed or minimally processed foods and ultra-processed foods. The World Health Organization criteria for the diagnosis of gestational diabetes mellitus and the Atalah criteria for excess weight were used. Adjusted multinomial logistic regression models were used to assess the relationship between energy contribution (%E) from foods with overweight and obesity conditions and, adjusted logistic regression models for gestational diabetes mellitus. In total, 32.1% participants were overweight, 24.6% were obese, and 17.7% of women were diagnosed with gestational diabetes mellitus. After adjustments, an inverse association between the highest tertile of %E from the intake of unprocessed or minimally processed foods and obesity was found [0.49 (0.30-0.79)]. Moreover, a positive association between the highest tertile of %E from ultra-processed food intake [3.06 (1.27-3.37)] and obesity was observed. No association between food intake (considering the nature, extent, and purpose of food processing) during pregnancy and overweight or gestational diabetes mellitus was found. The findings suggest a role of food processing in obesity but not in gestational diabetes mellitus. Further research is warranted to provide robust evidence on the relationship between the role of processed foods in obesity and gestational diabetes mellitus.

Obesity; Gestational Diabetes; Pregnant Women; Industrialized Foods

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Introduction

Maternal obesity and hyperglycemia during pregnancy are recognized risk factors for maternal and fetal morbidities, affecting the child's susceptibility to diseases in adulthood^{1,2,3}. Thus, the identification of modifiable risk factors related to the genesis of such diseases during pregnancy is fundamental.

The NOVA food classification system classified foods according to the nature, extent, and purpose of processing⁴. Foods are categorized into four groups: unprocessed or minimally processed foods, processed culinary ingredients, processed foods, and ultra-processed food and drink products^{4,5}. Growing evidence suggests that a higher intake of ultra-processed foods is associated with higher risks of developing obesity^{5,6,7,8,9}, hypertension¹⁰, cancer¹¹, and others chronic diseases^{12,13}. Given this evidence, the *Guia Alimentar para a População Brasileira*¹⁴ proposes to make unprocessed and minimally processed foods the diet bases.

Nevertheless, studies on the protective effect of unprocessed or minimally processed foods on obesity and chronic diseases are scarce^{7,15}, and results are controversial. In a study conducted in the United Kingdom, a higher intake of unprocessed or minimally processed foods was not associated with body weight⁷. However, a cross-sectional survey found that Lebanese adults with higher adherence to a minimally processed dietary pattern were less likely to have metabolic syndrome, hyperglycemia, and low HDL cholesterol levels¹⁵.

Evidence supports the tendency of women to change their usual food intake to a healthier pattern from pre-pregnancy to the gestational period by decreasing ultra-processed food consumption¹⁶. Ultra-processed foods are energy-dense and nutrient-poor foods⁴, which are recognized risk factors for obesity and gestational diabetes mellitus^{17,18}. Conversely, a greater intake of unprocessed or minimally processed foods reflects a healthy dietary pattern^{7,19,20,21} which could lead to a lower chance of obesity²². However, to the best of our knowledge, only one previous study investigated the role of food processing and weight gain during the pregnancy²³, and no evidence is available about the effect of food intake according to the degree of industrial processing on gestational diabetes mellitus.

Given the relevance of the identification of modifiable risk factors related to the genesis of obesity and gestational diabetes mellitus during pregnancy, and that studies that on the food intake of pregnant women considering the NOVA food classification system are scarce^{16,23}, this study aimed to investigate the relationship between food intake (considering the nature, extent, and purpose of food processing) during pregnancy and overweight, obesity, and gestational diabetes mellitus conditions in pregnant women in Brazil. The hypothesis was that a higher intake of unprocessed or minimally food during pregnancy would be inversely associated with excess body weight and gestational diabetes mellitus.

Methods

A cross-sectional study was conducted with pregnant women attending the public health system of Ribeirão Preto, São Paulo State, Brazil, between 2011 and 2012 for prenatal care, as previously described by Barbieri et al.²⁴. The inclusion criteria were women aged ≥ 20 years, pre-pregnancy body mass index (BMI) $\geq 20\text{kg}/\text{m}^2$ and gestational diabetes mellitus screening after the 24th week of gestation. The exclusion criteria of the study were women with the diagnosis of type 1 or type 2 diabetes mellitus, other chronic diseases, and use of glucocorticoids.

Participants were recruited in five laboratories with the greatest municipality demand from pregnant women to perform the oral glucose tolerance test (OGTT). These laboratories are responsible for the biochemical examinations of individuals attended at the public health care centers. All pregnant women who went to these laboratories between 2011 and 2012 were invited to participate in the study. During the assessment, neither the interviewer nor the pregnant women were aware of the results of the screening for gestational diabetes mellitus.

In total, 1,446 women were contacted, of which 608 were excluded due to the exclusion criteria, 19 declined to participate²⁰, did not complete the OGTT, three women had missing data, and 14 women were diagnosed with type 2 diabetes. Therefore, 785 pregnant women were included in this study.

Gestational age was estimated using the date of the last menstruation and data from ultrasound scan found in medical charts. The gestational age at the time of the interview ranged from 24 to 39 weeks of gestation (70% from 24 to 28 weeks, 21.5% from 29 to 32 weeks, 8.5% \geq 33 weeks).

This study was approved by the Research Ethics Committee of the Center for School Health, Ribeirão Preto Medical School, University of São Paulo (277/10/COORD.CEP/CSE-FMRP-USP). Written informed consent was obtained from all subjects.

Assessment of gestational diabetes mellitus, overweight, and obesity

Blood samples were collected for the conditions of fasting, 1-hour, and 2-hours after the ingestion of 75g of glucose, and the glucose oxidase method was used to determine plasma glucose. Gestational diabetes mellitus diagnosis was based on the 2014 World Health Organization (WHO) criteria²⁵, which requires alterations in at least one glycemic value: fasting from 92 to 125mg/dL, 1 hour after glucose load \geq 180mg/dL, or 2 hours after glucose load from 153 to 200mg/dL. Fasting plasma glucose \geq 126mg/dL or 2 hours after glucose load \geq 200mg/dL are considered pre-pregnancy type 2 diabetes.

Height (m) and weight (kg) were obtained during the OGTT using a portable stadiometer (Sanny, model ES 2040; São Paulo, Brazil), and a digital scale (Tanita, model HS 302; São Paulo, Brazil), respectively. BMI classification was based on the Atalah criteria, which classifies BMI according to gestational age²⁶.

Food intake

The estimated food intake during pregnancy was assessed by two 24-hour dietary recalls (24hR) on non-consecutive days (over a one-week period) by nutritionists, using the multiple passes approach in three stages²⁷. Of the 785 pregnant women initially assessed, 573 (73%) responded to the second 24hR, which is a replication rate of a second measurement considered adequate for estimates of usual intake²⁸.

Nutritional composition of dietary intake was estimated using the *Brazilian Food Composition Table*²⁹. Food classification according to the degree of industrial processing was defined as the recommended by the 2014 *Guia Alimentar para a População Brasileira*¹⁴, which was detailed described by Louzada et al.⁵. Unprocessed are foods that have not undergone any industrial processing (i.e., fresh fruits, beans, fresh meats). Minimally processed are foods that were processed but without added substances, or elements removed (i.e., coffee, natural fruit juices, and pasteurized whole milk). Processed culinary ingredients are used to prepare dishes and meals (i.e., oil, salt, flour). Processed foods are industrially manufactured foods by adding salt, oil, fats, sugar (i.e., canned foods, cheese). Ultra-processed food products are made by the food industry using substances extracted from foods or obtained through chemical syntheses (i.e., soft drinks, sugar-sweetened beverages, crackers, cookies, instant noodles, flavored yogurts, bread with additives)^{4,5}. Handmade preparations and dishes were classified according to the main component. For example, the main ingredient of pasta dishes is pasta itself, and the classification was based on the main component, regardless of the use of sauces. This methodology was previously applied in a similar research⁵. Since the high intake of ultra-processed food products is considered a marker of an unhealthy dietary pattern associated with the risk of chronic diseases³⁰, and the intake of unprocessed or minimally processed foods might be considered a marker of adherence to the recommendations of the *Guia Alimentar para a População Brasileira*¹⁴, the food groups of interest of this study were the unprocessed or minimally processed foods and ultra-processed food products.

The Multiple Source Method (MSM) was used to estimate the usual food intake. MSM is a statistical modeling technique developed by the European Prospective Investigation into Cancer and Nutrition (<https://msm.dife.de/>)^{31,32}, which has been shown to adequately estimate usual food intake among pregnant women³³. The MSM estimates the usual intake of foods and nutrients by the product of the probability of intake and the usual intake, corrected for variability. The correction by the variability on the intake eliminates the need for many replications of dietary surveys^{28,31,32}. The usual intake of unprocessed or minimally processed foods and ultra-processed food products were

expressed as the contribution of total energy intake (%E), considering the relative contribution of foods in each category to the individuals' total energy intake.

Covariates

All women answered to structured questionnaires on age, schooling, parity, self-reported skin color (as a proxy of ethnicity), marital status, family history of diabetes, previous gestational diabetes mellitus and lifestyle (food intake, physical activity, and smoking). Gestational age was estimated using the date of last menstruation and data from ultrasound scan found in medical records. The socioeconomic level of subjects was determined using the Brazilian Economic Classification Criteria, which defines classes from A (highest socioeconomic level) to E (lowest socioeconomic level) based on the purchasing power, and schooling of the head of the family³⁴. The total energy intake (kcal/day) was estimated by the 24hR.

Statistical methods

The estimated sample size was 512 individuals, assuming a prevalence of 20% of gestational diabetes mellitus among Brazilian women attending the public health system³⁵, considering a margin of error of 5%.

The %E from foods was categorized into tertiles. The difference in characteristics of women according to food intake was tested using chi-square for categorical variables, and Kruskal-Wallis or ANOVA with post hoc Bonferroni tests for continuous variables with skewed or normal distribution, respectively.

Multinomial logistic regression models were used to assess the relationship between %E from foods (into tertiles) and overweight, and obesity, considering women with adequate BMI as the reference category, adjusted for age (years), gestational week at the time of the interview, schooling (≤ 3 , 4-8, ≥ 9 years of school), smoking (never smoked, ex-smoker or current smokers), physical activity (minutes per week of walking or exercises), and total energy intake (Kcal/day). During these analyses, 31 underweight women, according to the gestational week, were excluded from the models.

Non-conditional logistic regression models were used to assess the relationship between %E from foods (into tertiles) with gestational diabetes mellitus, adjusted for age, gestational week at the time of the interview, schooling, smoking, physical activity, total energy intake (Kcal/day), parity, gestational diabetes mellitus history (yes/no), family history of diabetes mellitus (yes/no), and BMI adequacy according to the gestational age (underweight, adequate, overweight, and obesity).

Other adjustments were tested in the models (i.e., the social class, marital status, self-reported skin color); nevertheless, those were not associated with the outcomes and did not change the associations. Significance was set at $p < 0.05$ and all analyses were conducted with the IBM SPSS software (version 21.0; <https://www.ibm.com/>).

Results

The mean (SD) age of women was 28 (5) years. Among the participants, 32.1% were overweight, 24.6% were obese, and 17.7% of women were diagnosed with gestational diabetes mellitus. Mean (SD) total energy intake of women was 2,053 (518) Kcal, mean (SD) %E from unprocessed or minimally processed foods was 55%E (13), and the mean contribution of energy from ultra-processed food products was 32%E (13).

Women in the highest tertile (third) of %E from unprocessed or minimally processed foods were older, with lower levels of schooling, and classified into the lowest socioeconomic levels when compared to those classified in the lowest tertile. On the other hand, women in the highest tertile of %E from ultra-processed foods were younger and classified into the highest socioeconomic levels when compared to women into the lowest tertile. Women classified into the lowest tertile (first) of %E from ultra-processed food intake spent more time being physically active when compared to women who

reported diets with a higher %E of ultra-processed foods (Table 1). No difference in self-reported skin color and marital status according to the intake of foods was found (data not shown).

On adjusted multinomial logistic regression models, women classified into the highest tertile of %E from the intake of unprocessed or minimally processed foods had 51% lower chance of obesity, when compared to women in the lowest tertile. On the other hand, women classified into the highest tertile of %E from ultra-processed food intake had a three times higher chance of obesity when compared to women with the lowest intake of these foods. No association between the energy contribution from food intake according to the degree of industrial processing and overweight, and gestational diabetes mellitus was found (Table 2).

Table 1

Characteristics of women according to the energy contribution from unprocessed or minimally processed and ultra-processed food intake during pregnancy. Ribeirão Preto, São Paulo State, Brazil, 2011-2012 (n = 785).

Maternal characteristics	% of energy of unprocessed or minimally processed foods *			% of energy of ultra-processed foods **		
	1 st tertile	2 nd tertile	3 rd tertile	1 st tertile	2 nd tertile	3 rd tertile
Age [mean (SD)]	27 (5)	27 (5)	29 (6) ***	29 (6)	27 (5)	27 (5) ###
Physical activity (min/week) [median (P25, P75)]	40 (0, 130)	40 (0, 120)	60 (0, 150)	60 (0, 150)	40 (0, 120)	40 (0, 120) ###
Schooling (years) [n (%)]						
≥ 9	186 (71)	167 (64)	163 (62) §	161 (62)	178 (68)	177 (68)
Social class [n (%)]						
A + B	57 (22)	61 (23)	36 (14) §	37 (14)	51 (20)	66 (25) §
C	175 (67)	172 (66)	179 (68)	181 (69)	176 (67)	169 (65)
D + E	29 (11)	29 (11)	47 (18)	43 (17)	35 (13)	27 (10)
Smoking [n (%)]						
Current smoker	25 (10)	20 (8)	26 (10)	24 (9)	26 (10)	21 (8)
BMI adequacy [n (%)] §§						
Underweight	14 (5)	9 (3)	8 (3)	10 (4)	12 (5)	9 (3)
Adequate	100 (38)	94 (36)	115 (44)	114 (44)	88 (34)	107 (41)
Overweight	79 (30)	91 (35)	82 (31)	82 (31)	94 (36)	76 (29)
Obesity	68 (26)	68 (26)	57 (22)	55 (21)	68 (26)	70 (27)
Gestational diabetes [n (%)] §§§	44 (17)	41 (16)	54 (21)	54 (21)	42 (16)	43 (16)

%E: energy contribution; BMI: body mass index; SD: standard deviation.

* The [mean (SD); minimum-maximum] of the %E from unprocessed or minimally processed foods into the 1st, 2nd, and 3rd tertiles were [39 (7); 13.2-48.5], [54 (3); 48.6-59.9], and [69 (7); 60.0-91.0], respectively;

** The [mean (SD); minimum-maximum] of the %E from ultra-processed foods into the 1st, 2nd, and 3rd tertiles were [18 (6); 2.5-26.2], [32 (3); 26.3-37.9], and [47 (7); 37.9-74.8], respectively;

*** p < 0.05, ANOVA. Difference between the 2nd and 3rd tertiles, according to Bonferroni's test;

p < 0.05, ANOVA. Difference between the 1st and 2nd tertiles, according to Bonferroni's test;

p < 0.05, ANOVA. Difference between the 1st and 3rd tertiles, according to Bonferroni's test;

p < 0.05, according to Kruskal-Wallis' test;

§ p < 0.05, according to the chi-square test;

§§ According to Atalah criteria ²⁶;

§§§ According to the 2014 WHO criteria ²⁵.

Table 2

Association between the energy contribution from unprocessed or minimally processed and ultra-processed food intake during pregnancy and overweight, obesity, and gestational diabetes. Ribeirão Preto, São Paulo State, Brazil, 2011-2012.

Categories of food intake (%E)	Overweight *		Obesity *		Gestational diabetes **	
	OR	95%CI	OR	95%CI	OR	95%CI
Unprocessed or minimally processed ***						
1 st tertile	1.00 (Ref)		1.00		1.00	
2 nd tertile	1.11	0.73-1.70	0.87	0.56-1.38	0.81	0.51-1.36
3 rd tertile	0.77	0.73-1.70	0.49	0.30-0.79	1.05	0.64-1.73
Ultra-processed #						
1 st tertile	1.00		1.00		1.00	
2 nd tertile	1.63	1.07-2.49	2.09	1.30-3.37	0.78	0.48-1.26
3 rd tertile	1.17	0.75-1.82	3.06	1.27-3.37	0.82	0.49-1.36

%E: %E: energy contribution; 95%CI: 95% confidence interval; BMI: body mass index; OR: odds ratio; Ref: reference; SD: standard deviation.

* n = 754 (31 underweight women, according to the gestational week, were excluded from these analyses). Multinomial logistic regression models, considering women with adequate BMI as the reference. Adjusted by age (years), gestational week at the time of the interview, schooling (≤ 3 , 4-8, ≥ 9 years of school), smoking (never smoked, ex-smoker or current smoker), physical activity (minutes per week of walking or exercises), and total energy intake (Kcal/day);

** n = 785. Non-conditional logistic regression models, considering the normoglycemic women as the reference. Adjusted by age (years), gestational week at the time of the interview, schooling (≤ 3 , 4-8, ≥ 9 years of school), smoking (never smoked, ex-smoker or current smoker), physical activity (minutes per week of walking or exercises), total energy intake (Kcal/day), BMI adequacy (underweight, adequate, overweight, and obesity), parity, gestational diabetes mellitus history (yes/no), and family history of diabetes mellitus (yes/no);

*** The [mean (SD); minimum-maximum] of the %E from unprocessed or minimally processed foods into the 1st, 2nd, and 3rd tertiles were [39 (7); 13.2-48.5], [54 (3); 48.6-59.9], and [69 (7); 60.0-91.0], respectively;

The [mean (SD); minimum-maximum] of the %E from ultra-processed foods into the 1st, 2nd, and 3rd tertiles were [18 (6); 2.5-26.2], [32 (3); 26.3-37.9], and [47 (7); 37.9-74.8], respectively.

Discussion

This study investigated the relationship between food intake (considering the nature, extent, and purpose of food processing) during pregnancy and excess weight, and gestational diabetes mellitus. An inverse association between the energy contribution from the intake of unprocessed or minimally processed foods and obesity was found. Moreover, a positive association between the energy contribution from ultra-processed foods and obesity was verified. Nevertheless, no association between food intake and overweight or gestational diabetes mellitus was found.

The contribution of energy from ultra-processed foods varies greatly across studies. The estimate from this one, 32%E, is lower when compared to most findings in the literature; France, 36%E³⁶; Lebanon, 36%E¹⁵; Canada, 48%E¹⁹; UK, 53%E⁷; USA, 61%E and 58%E^{20,21}; and among young Brazilian adults, 51%E³⁷, and in a previous study on Brazilian pregnant women, 41%E¹⁶. Some of the previous studies conducted in Brazil^{16,37} used a food frequency questionnaire to estimate food intake that was not designed to classify food according to the degree of industrial processing, leading to discrepancies among studies. Nevertheless, the mean intake of ultra-processed foods found in this study was similar to the verified in the *Brazilian Dietary Survey*, 30%, in which food consumption was estimated using two 24hR⁵. Regarding studies conducted in other countries, differences might be inherent to the social-cultural context of eating and food choices. We must note that the NOVA classification is recent and the methodological procedures for its application in epidemiological studies are still being consolidated, which might partly explain discrepancies among studies.

In this study, women characteristics such as age, socioeconomic level, and schooling, differed across industrially processed food intake, corroborating the reports of studies conducted in the UK⁷,

France ¹¹, and Brazil ^{5,16,37}, and corroborated evidence suggesting that older women tend to adopt a healthier lifestyle during pregnancy ¹⁶.

Our findings of a positive association between higher energy contribution of the dietary intake of ultra-processed foods and obesity are consistent with previous reports from observational studies on adults ^{5,8,6,7,9}. A prospective cohort conducted among 45 American pregnant women found a direct association between the energy contribution from ultra-processed foods and weight gain and neonatal adiposity ²³. Several pathways might explain the effect of ultra-processed foods on obesity and other chronic diseases. Those foods are energy-dense, rich in trans fatty acids, and toxic compounds produced by the food processing (i.e., advanced glycation end products); and have nutrients and fiber content ⁴.

The most original finding of our study is the strong inverse association between unprocessed or minimally processed foods intake and obesity. Pregnant women in the highest tertile of %E of these foods had a 51% lower chance of being obese when compared to women classified into the lowest tertile. Although studies previously demonstrated that some unprocessed foods, individually considered, have a beneficial effect on obesity ³⁸ and that individuals with a higher adherence to a dietary pattern composed mostly of minimally processed foods were less likely to have metabolic syndrome, hyperglycemia, and low HDL cholesterol levels ¹⁵, this study is the first to reveal such association among pregnant women. The higher intake of unprocessed or minimally processed foods is considered a marker of the consumption of handmade meals, prepared with nutrient-balanced and satiating foods, dismissing unhealthy ready-to-eat food products and leading to a lower chance of obesity ^{4,14}.

In this study, no association between food intake classified according to the degree of industrial processing and gestational diabetes mellitus was found. Data from a randomized cross-over trial conducted among healthy overweight individuals demonstrated that the consumption of a diet with low advanced glycation end products (which are derived from modern food processing) may reduce the risk of type 2 diabetes by increasing the insulin sensitivity ³⁹. Moreover, ultra-processed foods are energy-dense and nutrient-poor, recognized risk factors for gestational diabetes mellitus ¹⁷. Therefore, it was hypothesized that higher intake levels of ultra-processed foods could be positively associated with gestational diabetes mellitus, which was not confirmed by our data. The lack of association may be partly caused by the observed lower %E from polyunsaturated fatty acids (PUFA) among women classified into the first tertile of ultra-processed foods intake (data not shown) since PUFA was previously demonstrated to be strongly inversely related to gestational diabetes mellitus in this population ²⁴. Moreover, although some evidence has shown the effect of lifestyle exposure during pregnancy on gestational diabetes mellitus risk, the occurrence of the disease may also be influenced by modifiable risk factors (i.e., diet and physical activity) adopted during the pre-pregnancy period ¹⁸, which were not explored in this study.

This study has several strengths such as being the first to investigate the relationship between food intake considering the nature, extent, and purpose of food processing during pregnancy and gestational diabetes mellitus. Trained nutritionists conducted face-to-face interviews, and neither the interviewer nor the participant were aware of the results of the screening for gestational diabetes mellitus. The diagnosis of gestational diabetes mellitus was based on the 2014 WHO criteria ²⁵, which is endorsed by the International Federation of Gynecology and Obstetrics ⁴⁰. The MSM was applied to estimate usual diet using two 24hR providing a more accurate estimative of the dietary intake ³². The main limitation of this study is the cross-sectional design. Dietary under-reporting may have occurred similarly to other studies evaluating food intake. This research was not explicitly designed to classify foods according to the degree of industrial processing, and misclassifications might attenuate the associations. Finally, we cannot rule out the presence of other uncontrolled potential confounders.

Conclusion

In conclusion, our findings support the role of food processing in obesity but not overweight or gestational diabetes mellitus in pregnant women. Further research such as prospective cohort studies and randomized clinical trials, is warranted to provide robust evidence on the relationship between the role of food processing in obesity and gestational diabetes mellitus during pregnancy.

Contributors

D. S. Sartorelli was responsible for the study design, coordination of field work, data analysis and interpretation and writing of the manuscript. L. C. Crivellenti participated in the data collection, analysis and interpretation and revision of the manuscript. D. C. C. Zuccolotto responsible for data collection, analysis and interpretation of the results and final revision of the manuscript. L. J. Franco helped in the study design, interpretation of the results and final revision of the manuscript

Additional informations

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Conflict of interest

The authors declare no conflicts of interest.

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Resumo

O objetivo deste estudo foi investigar a relação entre o consumo de alimentos (considerando a natureza, extensão e propósito do processamento de alimentos) durante a gestação e sobrepeso, obesidade e diabetes mellitus gestacional. Estudo transversal realizado com 785 mulheres adultas com gestações únicas (24^a-39^a semanas de gestação) no Brasil. O consumo usual de alimentos foi estimado usando o Multiple Source Method, usando recordatórios alimentares de 24 horas. Os grupos alimentares de interesse neste estudo foram os alimentos não-processados e minimamente processados e os alimentos ultraprocessados. Os critérios da Organização Mundial da Saúde para diagnóstico de diabetes mellitus gestacional e critérios de Atalah para excesso de peso foram usados. Modelos de regressão logística multinomial foram empregados para avaliar a relação entre a contribuição energética (%E) de alimentos e sobrepeso e obesidade, e modelos de regressão logística ajustados foram usados para diabetes mellitus gestacional. No total, 32,1% das gestantes estavam com sobrepeso, 24,6% com obesidade e 17,7% foram diagnosticadas com diabetes mellitus gestacional. Após ajustes, uma associação inversa entre obesidade e o maior tercil de %E do consumo de alimentos não-processados ou minimamente processados foi encontrada [0,49 (0,30-0,79)]. Além disso, uma associação positiva entre obesidade e o maior tercil de %E do consumo de alimentos ultraprocessados [3,06 (1,27-3,37)] foi observada. Nenhuma associação entre consumo de alimentos (considerando a natureza, extensão e propósito do processamento de alimentos) durante a gestação e sobrepeso ou diabetes mellitus gestacional foi encontrada. Os resultados sugerem o papel do processamento de alimentos na obesidade, mas não na diabetes mellitus gestacional. Pesquisas adicionais são necessárias para fornecer evidências robustas sobre a relação entre o papel do processamento de alimentos na obesidade e na diabetes mellitus gestacional durante a gestação.

Obesidade; Diabetes Gestacional; Gestantes;
Alimentos Industrializados

Resumen

El objetivo del presente estudio fue investigar la relación entre el consumo de comida (considerando la naturaleza, alcance, y propósito del procesamiento de comida) durante el embarazo y el sobrepeso, obesidad, y diabetes mellitus gestacional. Se realizó un estudio transversal con 785 mujeres adultas de embarazos únicos (24^a-39^a semanas de gestación) en Brasil. El consumo habitual se estimó mediante un Multiple Source Method, usando dos encuestas de 24-hour en relación con los hábitos alimentarios. Los grupos de comidas de interés en el presente estudio fueron los mínimamente procesados o sin procesar y los productos de comida ultraprocésada. Se utilizaron criterios de la Organización Mundial de la Salud para el diagnóstico de diabetes mellitus gestacional, y los criterios Atalah para el sobrepeso. Se utilizaron modelos ajustados de regresión logística multinomial para evaluar la relación entre la contribución energética (%E) de comidas con el sobrepeso y la obesidad, y modelos ajustados de regresión logística para la diabetes mellitus gestacional. En total, un 32,1% sufrían sobrepeso, un 24,6% eran obesas, y un 17,7% de las mujeres fueron diagnosticadas con diabetes mellitus gestacional. Tras los ajustes, se encontró una asociación inversa entre el tercil más alto de %E, procedente del consumo de comidas sin procesar o mínimamente procesadas con la obesidad [0,49 (0,30-0,79)]. Asimismo, se encontró una asociación positiva entre el tercil más alto de %E de comida ultraprocésada [3,06 (1,27-3,37)] y la obesidad. No se encontró ninguna asociación entre el consumo de comida (considerando la naturaleza, alcance, y propósito de la comida procesada) durante el embarazo y el sobrepeso, respecto a la diabetes mellitus gestacional. Los resultados sugieren la importancia de la comida procesada en la obesidad pero no así en la diabetes mellitus gestacional. Son necesarias más investigaciones para proporcionar evidencias sólidas sobre la relación entre el papel de la comida procesada en la obesidad y diabetes mellitus gestacional durante el embarazo.

Obesidad; Diabetes Gestacional; Mujeres
Embarazadas; Alimentos Industrializados

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