Association between mealtimes of first and last meals and food consumption in pregnant women

Associação entre o horário da primeira e última refeição com o consumo alimentar de gestantes

Asociación entre la hora de la primera y última comida con el consumo de alimentos de las gestantes

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Abstract
Eating an early first meal and a tendency towards morningness have been associated with healthy eating habits. The objective of the study was to investigate the association between mealtimes of first and last meals and food consumption of pregnant women. Methods: A cross-sectional study with 111 pregnant women who use a public health service. Sociodemographic, nutritional and health data were collected from medical records. Food consumption was assessed by habitual dietary intake. Nutritional value was determined with the DietPro® program (version 6.1) and diet quality was assessed through Diet Quality Index Adapted for Brazilian Pregnant Women (IQDAG).. The study was approved by the Research Ethics Committee of Universidade Federal de Viçosa (No. 4.098.560). Results: The mean age was 34.3 (±5.5) years. Pregnant women who had a late first meal and an early last meal (*PR*:2.55; 95% CI 1.41-4.63) presented a higher prevalence of vitamin B12 deficiency. On the other hand, pregnant women who had a late first meal and an early last meal (*PR*:4.74; 95%CI 1.50-15.04), and those who had late first and last meals (*PR*:4.31; 95%CI 1.37; 13.58), presented a higher prevalence of having an inadequate number of meals. Conclusion: Pregnant women who eat late have a higher prevalence of vitamin B12 deficiency and eating ≤3 meals during the day compared to those who eat early. The result reinforces the need for approaches to prenatal care based on mealtimes and nutrition aimed at improving the dietary profile of this population.
Keywords: Pregnancy; Food consumption; Meals; Diet; Quality.

Resumo
O horário mais cedo da primeira refeição e uma tendência do cronotipo matinal tem sido associado a hábitos alimentares saudáveis. O objetivo foi investigar associação entre o horário da primeira e última refeição e o consumo alimentar de gestantes. Métodos: Estudo transversal com 111 gestantes atendidas em um serviço público de saúde. Os dados foram coletados nos prontuários. O consumo alimentar foi avaliado por meio de um recordatório da dieta habitual, o valor nutricional foi determinado pelo Programa DietPro® versão 6.1, a qualidade da dieta foi avaliada utilizando o Índice de Qualidade da Dieta Adaptado para Gestantes Brasileiras (IQDAG). O estudo foi aprovado pelo

Comitê de Ética da Universidade Federal de Viçosa (Nº 4.098.560). Resultados: A média da idade foi 34,3 (±5,5) anos. As gestantes que fizeram a primeira refeição do dia mais tarde e a última cedo (RP 2,55; IC 95% 1,41-4,63), tiveram maior prevalência de inadequação de vitamina B12. Por outro lado, gestantes que fizeram a primeira refeição tarde e a última cedo (RP:4,74; IC95% 1,50-15,04), e as que fizeram a primeira e a última refeição tarde (RP:4,31; IC95% 1,37; 13,58), tiveram maior prevalência de inadequação no número de refeições. Conclusão: As gestantes que fazem refeições mais tarde tem maior prevalência de inadequação de vitamina B12 e de fazer ≤3 refeições durante o dia em relação as que fazem refeições mais cedo. Desta forma, reforça-se a necessidade de abordagem sobre os horários das refeições e a nutrição durante a atenção pré-natal.
Palavras-chave: Gestação; Consumo alimentar; Refeições; Dieta; Qualidade.

Resumen
Una primera comida más temprana y una tendencia del cronotipo matutino se han relacionado con hábitos alimenticios saludables. El objetivo fue investigar la asociación entre la hora de la primera y última comida y el consumo de alimentos de las gestantes. Métodos: Estudio transversal con 111 gestantes atendidas en un servicio público de salud. Los datos se recogieron de las historias clínicas. El consumo de alimentos se evaluó mediante un registro de dieta regular, el valor nutricional se determinó mediante el Programa DietPro® versión 6.1 y la calidad de la dieta se evaluó mediante el Índice de Calidad de la Dieta Adaptado para Mujeres Embarazadas Brasileñas (IQDAG). El estudio fue aprobado por el Comité de Ética de la Universidad Federal de Viçosa (Nº 4.098.560). Resultados: La edad media fue de 34,3 (±5,5) años. Las mujeres embarazadas que hicieron su primera comida del día más tarde y su última comida temprano (PR 2,55; IC 95% 1,41-4,63) tuvieron una mayor prevalencia de insuficiencia de vitamina B12. Por otro lado, las gestantes que comieron tarde la primera comida y la última comida temprano (RP: 4,74; IC 95% 1,50-15,04), y las que comieron tarde la primera y la última comida (RP: 4,31; IC 95% 1,37 ; 13,58), tuvo mayor prevalencia de insuficiencia en el número de comidas. Conclusión: Las gestantes que comen más tarde tienen una mayor prevalencia de insuficiencia de vitamina B12 y de realizar ≤3 comidas durante el día en comparación con las que comen más temprano. De esta manera, se refuerza la necesidad de abordar los tiempos de alimentación y nutrición durante el prenatal.
Palabras clave: Embarazo; Consumo de comida; Comida; Dieta; Calidad.

1. Introduction

The food consumption of pregnant women can be affected by cultural factors, beliefs, taboos and physiological changes(Africa & Chakona, 2019). Recently, mealtime has been shown to interfere with food consumption and gestational parameters. Eating an early first meal and a trend of morningness have been associated with healthier eating habits(Sato-mito et al., 2011; Gontijo et al., 2019).

A balanced breakfast can be important for the improvement of general diet quality(Murakami et al., 2018), (Hill et al., 2019). A study showed that skipping breakfast during pregnancy is associated with low blood levels of eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), β-carotene and low urine levels of urea nitrogen and potassium(Shiraishi et al., 2019). A cohort study of pregnant women found that those who had their first meal early consumed a higher percentage of energy and carbohydrates during breakfast, whereas this level was lower level during dinner, in addition, they had a better diet quality in terms of consumption of whole fruit and full components of fruit (Gontijo et al., 2020).

Food consumption during inappropriate circadian timing can result in adverse health effects while eating too late can result in weight gain (Loy et al., 2020; McHill et al., 2017). Also, a lower number of meals has been related to premature rupture of membranes and increased risk of preterm birth (Englund-Ögge et al., 2017),(Hernández-Díaz et al., 2014; Siega-Riz et al., 2001). Thus, the assessment of food consumption throughout pregnancy allows us to determine whether it is a protective or risk factor for adequate pregnancy development, as well as identify factors that interfere with its quality(Lisboa et al., 2017). In this context, the present study aims to investigate the association between food consumption and mealtimes of first and last meals of pregnant women monitored through the nutritional care of mother and infant project (PROAMI), Viçosa, Minas Gerais.

2. Methodology

Design and sampling

This study is an analytical cross-sectional study whose sample comprised pregnant women monitored through the nutritional care of mother and infant project (PROAMI), Viçosa, Minas Gerais. The data consist of consultations carried out between December 2015 and March 2020. Data was extracted from medical records by a nutritionist and a trained nutrition student. The exclusion criteria are the following: no information about pregnant women's diet as regards quantity, preparation method and measures, and energy intake below 500 kcal/day or above 3500 kcal/day(Loy et al., 2017). From a total of 116 medical records, 4 pregnant women were excluded for not having information on amounts of food or measures and 1 for having a daily energy intake above 3500 kcal. Thus, the final sample was 111 pregnant women. The study was approved by the Ethics Committee for Research with Human Beings of Universidade Federal de Viçosa (No. 4.098.560).

Sociodemographic and health variables

Sociodemographic and health data were obtained through a structured questionnaire containing the following variables: age, gestational age, number of children, parity, marital status, level of education, occupation and health profile (low weight gain, excessive weight gain, gestational diabetes, arterial hypertension, pre-eclampsia, nausea, vomiting and information regarding supplement use, the practice of exercise, alcohol consumption and smoking).

Anthropometric variables

Pre-pregnancy weight was self-reported. The pregnant women in the first trimester who did not remember their pre-pregnancy weight were assessed with their current weight. The current weight was measured on a digital platform weighing scale (Marte), with an accuracy of 0.2g to 100g. Height was measured using a stadiometer (Stanley) with an accuracy of 0.1 cm. Pre-gestational BMI was classified according to WHO cutoff points (Atencao & Atenção Básica. – 1. ed. rev. – Brasília : Editora do Ministério da Saúde, 2013).Gestational nutritional status was calculated according to gestational age based on the date of last menstruation (LMP) to be exact and/or date of delivery predicted by ultrasound examination. The classification of underweight, normal weight, overweight and obese was done according to the cutoff points proposed by Atalah, which assesses body mass index per gestational week (World Health Organization, 1995; Atalah et al., 1997).

Dietary intake

Food consumption was assessed using habitual dietary intake collected at first nutrition consultation, regardless of gestational age. To calculate the nutritional value of food consumed, the DietPro® program (version 6.1) was used. The Brazilian Chemical Food Composition Table (TACO) and the United States Department of Agriculture Research Service Table (USDA) were used to estimate the investigated nutrients (energy, carbohydrate, protein, lipid, saturated fat, polyunsaturated fat, trans fat, vitamins A, C, B1, B2, B3, B6, B12, zinc, iron, folate and calcium) (USDA/DHHS, 2005),. To control the effect of energy consumption on the evaluated nutrients, the residual method was used (Willett & Stampfer, 2009). The inadequacy of macronutrients was assessed using the Acceptable Macronutrient Distribution Range (AMDR). The micronutrients were evaluated by Estimated Average Requirement (EAR) or Adequate Intake (AI) when EAR values were not available. To assess the consumption of fruits, the servings recommended by the food pyramid for well-nourished pregnant women aged between 19 and 30 years were used (Demétrio, 2010). The number of meals was considered inadequate for ≤ 3 meals a day (De Almeida et al., 2004; Pinho-Pompeu et al., 2020).

Mealtimes

The mealtimes of first and last meals was classified into: "early" and "late" using the medians of mealtimes, accordingly 4 groups were obtained (early-early; early-late; late-early; late-late) (Gontijo et al., 2019). The median time of the first and last meals was 7:15 am (0:00 am; 7:30 am) and 8:30 pm (7:30 pm; 10:00 pm) respectively.

Diet quality

Diet quality was assessed using the Diet Quality Index Adapted for Brazilian Pregnant Women (IQDAG), which was developed based on the recommendations of the Ministry of Health (2012). The IQDAG has 9 components: vegetables, legumes, fresh fruits (servings/1,000 kcal), fiber, omega 3, calcium, folate, iron and the percentage of total calories from ultra-processed foods (Crivellenti et al., 2018). The final score index was obtained by the sum of all components and has a maximum value of 100 points. The IQDAG score was categorized into tertiles, adopting the first tertile as reference (Crivellenti et al., 2018).

Statistical analyses

Statistical analyses were performed using STATA for Windows, version 13.0. Descriptive analysis was conducted using the mean, standard deviation, median and interquartile range, n (%). The normality of the variables was tested by the Shapiro Wilk test. ANOVA and Kruskal-Wallis tests were used for continuous variables with and without normal distribution, respectively, followed by Dunn's post-hoc test for the comparison of food consumption among the four mealtime groups. Besides the chi-square test, the Fisher's exact test and chi-square test for trends were applied to the categorical variable. To investigate the association between the mealtimes of first and last meals (explanatory variable) and food consumption (outcome variable), Poisson regression was conducted. For the bivariate analysis, the model utilized the variables with $p<0.20$ obtained by the Backward strategy. The final model was adjusted for age, education, pre-pregnancy BMI, and physical activity and nausea in the past 30 days. The statistical significance adopted in all analyses was 0.05.

3. Results and Discussion

The characteristics of the pregnant women according to groups are shown in Table 1. The pregnant women in the early-early and early-late groups had a higher number of meals compared to the late-early and late-late groups. The presence of disease was more frequent in the late-early and late-late groups. For the other variables analyzed, no difference was found among the groups.

Table 1. Characterization of pregnant women according to mealtimes. Viçosa, MG, 2020. (n = 111).

Variable	Time of first and last meals				
	Early-early(n=37)	**Early-late(n=20)**	**Late-early(n=30)**	**Late-late (n=24)**	**P value**
Age (years)	35 (5,4)	33 (5,7)	33 (5,2)	35 (5,6)	0,32
Level of education					
Incomplete primary education	3 (37,4)	2 (25,0)	2 (25,0)	1 (12,5)	0,99
High school graduate	14 (26,9)	11 (21,2)	17 (32,7)	10 (19,2)	
University graduate	20 (32,2)	7 (13,7)	11 (21,6)	13 (25,5)	
Marital Status					0,62
No partner	23 (36,1)	5 (13,9)	12 (33,3)	6 (16,7)	
Has a partner	24 (32,0)	15 (20,0)	18 (24,0)	18 (24,0)	
Occupation					0,37
Employed	10 (45,5)	5 (22,7)	4 (18,2)	3 (13,6)	
Unemployed	26 (29,6)	15 (17,1)	26 (29,6)	21 (23,9)	
Smoking habit					0,32
Yes	0 (0,0)	1 (50,0)	1 (50,0)	0 (0,0)	
No	37 (34,3)	19 (17,8)	29 (26,9)	23 (21,3)	
Alcohol intake					0,25
Yes	0 (0,0)	1 (33,3)	2 (66,7)	0 (0,0)	
No	37 (34,6)	19 (17,8)	28 (26,2)	23 (21,5)	
Pre-gestational BMI					0,29
Excess weight	15 (40,5)	5 (13,5)	12 (32,4)	5 (13,5)	
Without excess weight	22 (29,7)	15 (20,3)	18 (24,3)	19 (25,7)	
Gestational BMI					0,80
Excess weight	13 (36,1)	6 (16,7)	11 (30,6)	6 (16,7)	
No excess weight	24 (32)	14 (18,7)	19 (25,3)	18 (24)	
Present illness					**0,04**
Yes	1 (12,5)	4 (50,0)	3 (37,5)	0 (0,0)	
No	36 (35,0)	16 (15,5)	27 (26,2)	24 (23,3)	
Parity					0,11
Primiparity	25 (30,1)	13 (15,7)	27 (32,5)	18 (21,7)	
Multiparity	12 (42,9)	7 (25,0)	3 (10,7)	6 (21,4)	
Nausea in the past 30 days					0,17
Yes	7 (23,3)	7 (23,3)	12 (40,0)	4 (13,3)	
No	29 (37,2)	13 (16,7)	18 (23,1)	18 (23,1)	
Physical activity					0,19
Yes	13 (30,2)	12 (27,9)	11 (25,6)	7 (16,3)	
No	24 (35,8)	8 (11,9)	19 (28,4)	16 (23,9)	
Supplementation					0,76
Yes	35 (33,0)	19 (17,9)	28 (26,4)	24 (22,6)	
No	2 (40,0)	1 (20,0)	2 (40,0)	0 (0,0)	
Number of meals	6(5;6)[a]	6 (5,5; 6)[a]	5(4;6)[b]	5(4;5)[b]	**0,002**

Data presented as mean (standard deviation), median (interquartile range) or relative frequency (%). * P values obtained from the ANOVA and Kruskal-Wallis test for continuous variables with and without normal distribution, respectively, and Pearson's chi-square test or Fisher's exact test and chi-square for trend for the categorical variables. Early-Early, early first meal and early last meal; Early-late, early first meal and late last meal; Late-early, late first meal and early last meal; Late-late, late first meal and late last meal. Different letters in the groups [(a,b,c)] indicate a statistically significant difference between the comparison groups. Fonte: Autores, (2020)

Vitamin A consumption was higher in the early-late group than in the early-early and late-early group. A higher intake of vitamin B2 and lower intake of vitamin B12 were also observed in the late-late group compared to the late-early group (Table 2).

Table 2. Association between time of first and last meals, energy intake, macro and micronutrient intake of pregnant women Viçosa, MG, 2020 (n = 111).

Variable	Time of first and last meals				
	Early-early (n=37)	Early-late (n=20)	Late-early (n=30)	Late-late (n=24)	P value
Total energy (kcal)	1632,2 (1295,1; 1989,9)	2211 (1404; 2580,7)	1821 (1399,6; 1951,8)	1946,9 (1653,2; 2085,7)	0,15
Protein (g)	70,3 (61,5;82,9)	70,6 (35,5;86)	64,4 (50,8;83,9)	75,7 (57;105,2	0,57
Lipids (g)	50,6 (40,2;58,2)	55,4 (39,1;73,9)	54,7 (43,5;66,7)	55 (44,6;68,1)	0,66
Carbohydrate (g)	225,6 (191,7;274,1)	219,8 (182,7;281)	217,9 (182,6;261,9)	259,5 (222,2;297,7)	0,25
Vit A (µg)	150,1 (83,5; 217,9)[ac]	261,3 (176,9; 461,5)[b]	197,2 (76,7; 314)[c]	212,9 (135,4; 401,8)[bc]	**0,01**
Vit C (mg)	97,4 (52,4; 157,3)	138,2 (87,1;262,2)	101,1 (54,6; 149,7)	113,1 (86,9; 155,5)	0,22
Vit B1(mg)	1,1 (0,7;1,6)	1,2 (0,7;2,4)	1,1 (0,7;1,6)	1,1 (0,7;1,7)	0,85
Vit B2 (mg)	1,2 (1,0;1,7)[a]	1,2 (0,6;1,6)[ab]	0,9 (0,7;1,3)[b]	1,4 (1,2;2,0)[a]	**0,02**
Vit B6(mg)	152,4 (139,3;161,5)	149,9 (120,4;162,9)	150,2 (140,6;164,2)	142,5 (138,4; 153,4)	0,50
Vit B12 (µg)	9,2 (7,7; 11)[a]	9,9 (4,9;12,8)[ab]	12,0 (9,2;13)[b]	7,1 (4,2 ; 10,7)[a]	**0,01**
Zinc (mg)	9,2 (6,4;11,8)	9,1 (8,5; 12,2)	8,0 (5,3;11,6)	11,0 (6,8;16,4)	0,17

Data presented as mean (standard deviation) and median (interquartile range). P values obtained from the ANOVA and Kruskal-Wallis test for continuous variables with and without normal distribution, respectively, followed by Dunn's post-hoc. Early-Early, early first meal and early last meal; Early-late, early first meal and late last meal; Late-early, late first meal and early last meal; Late-late, late first meal and late last meal. Different letters in the groups [(a,b,c)] indicate statistically significant difference between the comparison groups.

The consumption of fresh fruit was higher for the group of pregnant women who had their first and last meals early compared to the early-late and late-early groups. The rest of the components and the total score of the IQDAG did not differ among the four groups (Table 3).

Table 3. Association between Diet Quality Index Adapted for Pregnant Women (IQDAG) and its components with the time of first and last meals, Viçosa, MG, 2020 (n = 111).

Variable	Time of first and last meals				
	Early-early (n=37)	**Early-late(n=20)**	**Late-early (n=30)**	**Late-Late(n=24)**	**P value**
IQDAG components					
Fresh fruits(g)	138,6 (78,6;256,3)[a]	87,7 (78,6;176)[b]	87,7 (78,6;214,9)[b]	122,4 (78,6;13,9)[ab]	**0,03**
Legumes (g)	213,9 (76,4, 213,9)	182,9 (76,4; 213;)	213,9 (76,4; 213,9)	141,4 (75,8; 213,9)	0,92
Vegetables (g)	4,3 (4,3;26,8)	9,9 (4,3;26,9)	19,2 (4,3;74,0)	13,6 (4,3;79,9)	0,55
Omega 3 (g)	1,7 (0,3;3,1)	1,8 (0,2;3,4)	1,2 (0,1;2,9)	2,2 (1,4;3,7)	0,20
Calcium (mg)	599,5 (346,6;802)	344,1 (216,8;815,4)	431,2 (337,7; 687,6)	618,2 (430,8;1018,9)	0,05
Fiber(g)	14,5 (9,6;22,2)	18,6 (6,4;25,6)	20,5 (14,2;28,2)	8,5 (7,1;19,5)	0,09
Iron (mg)	7,7 (6;10,3)	8,3 (3,9;9,8)	7,0 (6,1;9,1)	9,0 (7,5;11,6)	0,23
Folate (μg)	24,0 (9,6;48,9)	5,3 (1,8;24,8)	17,9 (9,5;30,6)	17,7 (4,9;44,0)	0,06
UPP foods (TEV%)	19,6 (4,2;40,1)	18,8 (4,2;43)	34,3 (4,2;224)	30,6 (4,2;74,8)	0,44
Total IQDAG	64,7 (41,8;80,7)	57 (42,2;90,1)	56 (37;80,8)	64,8 (41,1;82,3)	0,74

Values presented as median (interquartile range) for variables without normal distribution whereas variables with normal distribution presented as mean and standard deviation. Ultra-processed (UPP); total energy value (TEV); Diet Quality Index Adapted for Pregnant Women (IQDAG). P values obtained from the ANOVA and Kruskal-Wallis tests for continuous variables with and without normal distribution, respectively, followed by Dunn's post-hoc. Different letters in the groups (a,b) indicate statistically significant difference between the comparison groups. Fonte: Autores (2020).

After adjusting for confounding factors, vitamin A and B2 consumption were not associated with mealtimes. But the prevalence of vitamin B12 deficiency was higher in pregnant women who ate their first meal late and last meal early (PR: 2.55; 95%CI: 1.41; 4.63) compared to those who have their first and last meals early. Likewise, the prevalence of inadequate number of meals (≤ 3 hours) was higher in pregnant women who have a late first meal and an early last meal (PR: 4.74; 95%CI: 1.50; 15.04) and for those who eat their first and last meals late (PR: 4.31; 95%CI 1.37; 13.58) (Table 4).

Table 4. Association between the time of first and last meals and inadequacy of macro and micronutrients in pregnant women, Viçosa, MG, 2020(n = 111).

Variable		Time of first and last meals		
		Early-late (n=20)	Late-early (n=30)	Late-late (n=24)
Carbohydrate inadequacy (%TEV)	Model 1	1,07 (0,64; 2,25)	1,10 (0,83; 2,40)	0,86 (0,51; 1,93)
	Model 2	1,04 (0,57; 1,87)	1,08 (0,76; 2,40)	0,85 (0,41; 1,77)
Protein inadequacy (%TEV)	Model 1	1,85 (0,816; 4,20)	0,77 (0,28; 2,12)	0,96 (0,36; 2,61)
	Model 2	1,43 (0,64; 3,20)	0,74 (0,27; 2,02)	0,54 (0,16; 1,80)
Lipid inadequacy (%TEV)	Model 1	1,23 (0,82; 1,84)	0,88 (0,56; 1,39)	0,88 (0,54; 1,44)
	Model 2	1,14 (0,75; 1,72)	0,85 (0,53; 1,35)	0,77 (0,45; 1,30)
Vitamin A inadequacy (µg)	Model 1	0,97 (0,87; 1,09)	1,03 (0,97; 1,08)	0,94 (0,82; 1,07)
	Model 2	0,96 (0,83; 1,12)	1,01 (0,95; 1,08)	0,97 (0,85; 1,11)
Vitamin B6 inadequacy (mg)	Model 1	0,98 (0,78; 1,23)	1,04 (0,87; 1,24)	0,87 (0,67; 1,13)
	Model 2	1,01 (0,80; 2,89)	1,04 (0,87; 1,25)	0,89 (0,60; 1,18)
Vitamin B12 inadequacy (µg)	Model 1	1,30 (0,53; 2,57)	**2,34 (1,29; 4,46)**	0,62 (0,22; 1,75)
	Model 2	1,51 (0,67; 3,35)	**2,55 (1,41; 4,63)**	0,70 (0,24; 2,00)
Omega 3 inadequacy (g)	Model 1	0,72 (0,33; 1,56)	1,24 (0,73; 2,10)	0,87 (0,44; 1,71)
	Model 2	0,76 (0,35; 1,65)	1,36 (0,80; 2,31)	1,04 (0,56; 1,96)
Zinc inadequacy (mg)	Model 1	1,03 (0,75; 1,41)	0,91 (0,66; 1,21)	0,63 (0,41; 1,02)
	Model 2	0,93 (0,68; 1,27)	0,84 (0,61; 1,15)	0,65 (0,39; 1,02)
Calcium inadequacy (mg)	Model 1	1,05 (0,82; 1,33)	1,07 (0,87; 1,32)	1,08 (0,87; 1,34)
	Model 2	0,98 (0,78; 1,25)	1,02 (0,84; 1,25)	1,11 (0,89; 1,38)
Fresh fruit inadequacy (g)	Model 1	1,04 (0,82; 1,24)	1,02 (0,82; 1,23)	1,07 (0,87; 1,34)
	Model 2	0,99 (0,77; 1,29)	0,99 (0,80; 1,24)	1,11 (0,88; 1,41)
Iron inadequacy (mg)	Model 1	0,79 (0,52; 1,19)	0,79 (0,52; 1,19)	0,72 (0,47; 1,11)
	Model 2	0,81 (0,59; 1,13)	0,80 (0,56; 1,14)	0,70 (0,42; 1,20)
Folate inadequacy (µg)	Model 1	1,22 (0,92; 1,63)	1,06 (0,78; 1,44)	0,84 (0,56; 1,26)
	Model 2	1,36 (1,00; 1,84)	1,07 (0,79; 1,47)	0,84 (0,57; 1,25)
Meals ≤ 3	Model 1	0,62 (0,07; 5,60)	**4,52 (1,38; 14,83)**	**3,60 (1,02; 13,64)**
	Model 2	0,63 (0,08; 4,98)	**4,74 (1,50; 15,04)**	**4,31 (1,37; 13,58)**

Prevalence Ratio (PR) and 95% confidence interval according to Poisson regression. Model 1: gross; Model 2: adjusted for age, level of education, gestational body mass index, physical activity, and nausea in the past 30 days. Early-early was considered as the reference group. Percentage of total energy value (%TEV). Nutrient adequacy was considered as a reference category. Fonte: Autores (2020).

Discussion

In this study, it was observed that having a late first meal and early last meal was positively associated with vitamin B12 deficiency. Likewise, having a late first meal and an early last meal, and eating the first and last meals late were positively associated with eating 3 or fewer meals a day.

In the present study, it was also observed that the frequency of illnesses was higher in the early-late and late-early groups, probably because these groups have a higher concern about food and health, as they must take medications, which mostly starts early.

Vitamin B12 is essential for hematological and neurological functions (Bae et al., 2015). Maternal deficiency in vitamin B12 has been associated with an increased risk of adverse pregnancy outcomes such as neural tube defects, premature birth and intrauterine growth retardation(Molloy et al., 2008), as well as an increased risk of diabetes mellitus compared to those with vitamin B12 sufficiency (Kouroglou et al., 2019). This shows the importance of adequate vitamin B12 intake and nutritional status during pregnancy for good fetal growth and development.

In this study, food intake less than or equal to 3 meals was observed for pregnant women who had late first meal and early last meal, as well as for those who ate their first and last meals late. Other studies found that pregnant women who ate less than three main meals during the day had a higher risk of premature rupture of membranes followed by preterm delivery (Englund-Ögge et al., 2017; Paoli et al., 2019). Evidence shows that having several meals in small portions a day is associated with lower BMI, possibly due to the consumption of a lower density diet and an improvement in nutritional quality. Furthermore, eating fewer meals may be associated with eating out and at late hours, which can be characterized by energy-rich foods with low nutrient density such as fried foods, alcohol consumption and lower amounts of foods with high nutrient density such as fruits and vegetables (Misan et al., 2019; Aljuraiban et al., 2014). Therefore, positive results have been observed when foods eaten late are small in amount, rich in nutrients and low in energy and/or macronutrients (Kinsey & Ormsbee, 2015). In addition, changes in meal frequency and timing have the potential to influence energy and macronutrient intake (Englund-Ögge et al., 2017; Paoli et al., 2019).

Eating an early first meal has been associated with eating more calmly, and probably eating more adequately in terms of quantity and quality of essential nutrients, thus favoring pregnancy(Gibney et al., 2018)., as breakfast contributes around 20% of total energy intake and increases the intake of various nutrients (Gaal et al., 2018; Shiraishi et al., 2019).

A study suggests that carbohydrate intake at late hours may be associated with metabolic risk during pregnancy, especially among women who were obese before pregnancy (Henriksen, 2008; Chandler-Laney et al., 2016). Therefore, it has often been pointed out that pressure associated with time, long working hours and lifestyle habits can be the main factors that contribute to unhealthy eating, including having a late last meal (Englund-Ögge et al., 2017).

A study recommends that prenatal nutritional assessment should consider and explain the fact that the mealtime of the first meal may be related to a more adequate diet, patterns with greater food intake in the morning and less intake in the evening, thus improving diet quality (Gontijo et al., 2019). In this sense, prenatal nutritional monitoring becomes essential, as the assessment of food consumption during pregnancy allows the early detection of nutritional problems that can be corrected, avoiding losses during pregnancy (Lisboa et al., 2017).

The strength of the study lies in the coverage of a recent and less explored topic, which can help in the development of prenatal nutritional monitoring strategies. There is a lack of evidence on the relationship between food consumption and mealtimes, therefore, this work seeks to help fill this knowledge gap. The study had as limitations the use of secondary data, which only allowed the attainment of existing information in medical records. The pre-pregnancy weight was self-reported, which may be subject to underestimation. In addition, the sample size can be a limiting factor to identify differences among the groups. Another limitation is the cross-sectional design that does not allow the establishment of a causal relationship between

exposure and outcome.

4. Conclusion

The results show that pregnant women who eat late have a higher prevalence of inadequacy in vitamin B12 and having 3 meals or less during the day compared to those that have early meals. Thus, it reinforces the need to explore mealtimes and nutrition during prenatal care, aimed at improving the profile of food intake and consequently, the health of this population. More articles that relate meal times and diet quality and pregnancy outcomes are important to clarify these relationships, in addition to helping to propose effective strategies for pregnancy success.

Acknowledgments

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