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NUTRITIONAL STATUS ASSOCIATED WITH NUTRIENT CONSUMPTION IN PREGNANT WOMEN

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ABSTRACT: Objective: to evaluate the consumption of nutrients among pregnant women, associating it with inadequate nutritional status. Method: it is a cross-sectional study with 96 pregnant women from Tocantins, with evaluation of the socioeconomic and current pregnancy profile. Two 24-hour recalls assessed nutrient intake. Results: nutrient supplementation was inadequate in 77% of women; 64% had pre-pregnancy excess weight, and 42% maintained it during pregnancy. The inadequacy of weight gain during pregnancy was observed in 74% and the daily intakes of energy ($p = 0.019$) and lipids ($p = 0.003$) were significantly different between the strata of pre-gestational nutritional status. Of the low weight pregnant women, 60% ingested proteins and 45% consumed energy below the recommendation. Daily macro and micronutrient intakes were inadequate in the population, what influenced negatively gestational weight gain and nutritional status. Conclusion: malnutrition has undesirable consequences for the binomial and should be detected and corrected early.

KEY WORDS: Pregnancy; Nutritional Status; Food Consumption; Prenatal.

ASSOCIAÇÃO DO ESTADO NUTRICIONAL AO CONSUMO DE NUTRIENTES EM GESTANTES

RESUMO: O objetivo do estudo foi avaliar o consumo de nutrientes entre gestantes, associando-o a inadequações do estado nutricional. Estudo transversal, com 96 gestantes do Tocantins, avaliando o perfil socioeconômico e da gestação atual. Dois recordatórios de 24 horas avaliaram a ingestão de nutrientes. A suplementação de nutrientes esteve inadequada em 77% das mulheres; 64% apresentaram excesso de peso pré-gestacional, sendo que 42% o mantiveram durante a gravidez. A inadequação de ganho de peso na gestação foi observada em 74% e as ingestões diárias de energia ($p=0{,}019$) e lipídeos ($p=0{,}003$) foram significativamente diferentes entre os estratos de estado nutricional pré-gestacional. Das gestantes com baixo peso, 60% ingeriram proteínas e 45% consumiram energia abaixo da recomendação. As ingestões diárias de macro e micronutrientes estavam inadequadas na população, influenciando negativamente o ganho de peso gestacional e o estado nutricional. A má nutrição traz consequências indesejáveis para o binômio, devendo ser precocemente detectada e corrigida.

PALAVRAS-CHAVE: Gravidez; Estado nutricional; Consumo alimentar; Pré-natal.

INTRODUÇÃO

According to the Ministry of Health, prenatal care aims to ensure the proper development of pregnancy, for a healthy newborn (NB). In this sense, quality prenatal care must include prevention actions, early diagnosis and treatment of complications in the pregnancy-puerperal cycle. Among these, we highlight the assessment and monitoring of the pregnant woman's nutritional status (NS), following her weight gain (WG) during pregnancy.1

It is noteworthy that the inadequate WG and the lack of micronutrients have been identified as gestational risk factors, being associated with undesirable pregnancy outcomes.[2], [3] Insufficient maternal WG can cause low birth weight (LBW), prematurity, intrauterine growth (PIUG) and increased perinatal morbidity and mortality.4 In turn, excessive WG is closely related to fetal-pelvic disproportion, asphyxia in childbirth, fetal macrosomia and type 1 diabetes in newborns; in pregnant women, it can trigger gestational diabetes (GD), hypertensive diseases of pregnancy (HDP), postpartum weight retention, surgical delivery and increased risk of future obesity.5

Pregnancy NS and WG are influenced by food consumption, which determines the intake of macro and micronutrients. Evidence suggests that inadequate nutrient intakes during pregnancy can trigger adverse health effects of the binomial, such as depressive symptoms in pregnant women, postpartum depression, development of severe preeclampsia, recurrent miscarriage, GD, LBW, birth of small babies for gestational age (GA) and presence of birth defects.6-11

Considering that the assessment of food consumption is an important indirect indicator of NS, assessing nutrient intake during pregnancy is essential to guide changes in eating habits and to prevent undesirable outcomes, reducing the negative consequences for binomial health and improving their quality of life.12,13

In view of the above, the present study aimed to assess the consumption of nutrients among pregnant women monitored in the primary health care of the Unified Health System (SUS), in southern Tocantins, associating the inadequacies found with the lifestyle and maternal NS.

METODOLOGIA

It is a cross-sectional study, with low-risk pregnant women, with assistance in SUS primary health care in the municipality of Gurupi -TO. The municipality of Gurupi has 13 Basic Health Units (BHU) and all pregnant women who consulted between June and November 2018 were invited to participate in the study, with a total of 400 pregnant women approached. Of these, 148 ones agreed to participate in the study, however, after applying the exclusion criteria and due to losses for not performing all the stages of data collection, 96 participants made up the final sample.

Maternal age below 18 years-old, twin pregnancy, the presence of diseases or complications identified during the study, such as diabetes, hypertension, thyroid disorders, absorptive diseases, previous gastric surgery, were the exclusion criteria.

The pregnant women were interviewed initially at UBS and, later, by telephone. A questionnaire was applied with variables on socioeconomic characteristics (age, education, income, occupation, marital status and color), maternal (number of pregnancies, births and abortions; medications in use; period of daily sun exposure and use of sunscreen) and current pregnancy (gestational age (GA), pre-gestational weight and weight gain, allowing assessment of the Pre-Gestational and current Body Mass Index for the GA).

Two food surveys, of the 24-hour recall type (R24h), were applied: the first happened in the first contact with the participant, in person, with the help of a photo album of homemade measures. The second survey was applied within seven days after the first, by telephone, referring to the weekend or holiday, as proposed by Marchioni et al.14

After double typing of each recall, consistency analysis was performed, checking the typed foods and preparations, with special attention to the units of measurement and the presence of outliers for portions, weights, energy and nutrients. The Diet Box program was used to analyze recalls and quantify the levels of nutrients ingested, searching for foods in the chemical composition tables of foods available in the software, in the following order: the food was initially searched in the table proposed by Philippi15, followed by the TACO16 table and, when the food was not found in any of them, the IBGE table was used.17

For each patient, the average consumption of energy, protein, carbohydrates, lipids, fibers and micronutrients was calculated: calcium, iron, phosphorus, magnesium, potassium, sodium, zinc, retinol, thiamine, riboflavin, niacin, pyridoxine, folate , cobalamin, ascorbic acid, calciferol and tocopherol. The adequacy of daily nutrient intake was calculated as proposed by the Dietary Reference Intakes (DRI) 18,19,20, using Microsoft Excel spreadsheets to calculate the magnitude of the difference between the mean intake and the median need (D) and the standard deviation of D (Sdd), according to the equations below.

D= Average of intake – Estimated Average Requirement (median need)

Sdd= $\sqrt{Vn + Vi/n}$

The intrapersonal micronutrient standard deviations used in the calculations were those proposed by Marchioni, Slater and Fisberg13. For calciferol, the intrapersonal standard deviation proposed by Morimoto et al.21 for adult women was used.

The data were tabulated in Microsoft Excel and later analyzed using the Statistical Package of Social Science (SPSS) software version 20.0, being expressed in descriptive statistics. Kolmogorov-Smirnov, Skewness, Kurtosis, Shapiro-Wilk tests and histogram graphs were applied. Associations between variables were assessed using the Chi-square, Fisher's Exact, Analysis of Variance tests, followed by the Tukey and Kruskal-Wallis tests, followed by the Mann-Whitney test. For all analyses, the significance level was set at 5%.

The study followed the ethical precepts of Resolution nº 510, of the National Health Council, of April 7, 201622, and only started after approval by the Research Ethics Committee of the Federal University of Tocantins with the number of opinions: 2,600,381.

RESULTS

The sample consisted of 96 pregnant women who represented all health units in the municipality of Gurupi -TO, with 59.8% of the participants without individual income (22% household services, 30.5% unemployed and 7.3% students), 2.4% were rural workers, 1.2% teachers, 2.4% domestic workers, 6.1% public employees, 6.1% performed temporary services (such as laundress, seamstress, cook), 12.2% were self-employed (traders), 6.1% are secretaries, 2.4% work as physiotherapists. Regarding family income, 75.4% received up to 3 minimum wages and 71.6% of families were composed of up to 4 people. The average monthly income per capital was R $ 708.58 ± 558.88 (n = 27).

The health and sociodemographic profiles of the studied pregnant women can be seen in Table 1, highlighting that the majority were primigravida and 64% had schooling of more than 11 years of formal study, with only 5% having less than 7 years of schooling. The use of supplements was inappropriate for 77.7% of pregnant women, with 20.8% who don't any type of nutrient supplementation and 46.9% taking supplementation differently than recommended (Table 1).

Table 1. Health and sociodemographic characteristics of pregnant women in primary care in the municipality of Gurupi -TO, 2018

Variables	n	Descriptives
Age (years)	96	26.4 ± 5.8a
Eduction (%)	96	-
Incomplete Elementary School	5	5,2[b]
Complete Elementary School	11	11,5[b]
Incomplete High School	16	16,7[b]
Complete High School	44	45,8[b]
Incomplete Higher Education	8	8,3[b]
Complete Higher Education	12	12,5[b]
Marital status (%)	96	-
Single	29	30,2[b]
Married or Stable union	67	69,8[b]
Self-referred skin color (%)	96	-
White	15	15,6[b]
Parda	65	67,7[b]
Yellow	2	2,1[b]
Black	14	14,6[b]

Number of pregnancies	96	1,5 (1,7 - 2,2; mín. 1/ máx. 6)[c]
Number of deliveries	96	0 (0,5 – 0,9; mín. 0/ máx. 5)[c]
Number of abortions	96	0 (0,1 – 0,3; mín. 0/ máx. 3)[c]
Current Gestational Age (weeks)	96	24,8 ± 8,9[a] (mín. 7/ máx. 41)
First trimester of pregnancy	13	13,5[b]
Second trimester of pregnancy	44	45,8[b]
Third trimester of pregnancy	39	40,6[b]
Use of medicines (%)	96	-
No one	20	20,8[b]
Ferrous sulphate	11	11,5[b]
Folic acid	4	4,2[b]
Ferrous sulfate + folic acid	44	45,8[b]
Multi-vitamin	10	10,4[b]
Multi-vitamin + ferrous sulfate	4	4,2[b]
Multi-vitamin + folic acid	1	1,0[b]
Multi-vitamin + ferrous sulfate + folic acid	2	2,1[b]
Sun exposure before 10am (minutes)	96	0 (5,4 – 13,7)[c]
Sun exposure between 10am and 3pm (minutes)	96	0 (3,9 – 12,0)[c]
Sun exposure after 3pm (minutes)	96	0 (1,7 – 8,1)[a]
Moments of sun exposure (%)	96	-
Only before 10am	18	18,8[b]
Only after 3pm	9	9,4[b]
Only between 10am and 3 pm	14	14,6[b]
Before 10am and after 3pm	4	4,2[b]
Before 10am and between 10am and 3pm	7	7,3[b]
After 3pm and between 10am and 3pm	3	3,1[b]
All times	6	6,3[b]
none	35	36,5[b]
Does not use sunscreen	71	74,0[b]
Uses sunscreen, but does not reapply	13	13,5[b]
Uses sunscreen, but reapplies inappropriately	7	7,3[b]
Uses sunscreen and reapplies appropriately	5	5,2[b]

Note: a Averages and standard deviations; b Percentuals; c Medians and 95% Confidence Intervals.

It can also be highlighted that 44.2% of the interviewees had insufficient 25-hydroxycholecalciferol, added to 36.5% of pregnant women who did not have sun exposure, 74% of pregnant women who did not use sunscreen and 94.8% who did not use or did it inappropriately (Table 1).

As for NS and food consumption, it was observed that 64% were overweight and 6% were low pre-gestational weight, and that 42% were still overweight in the current nutritional status (CNS) for GI, but with an increase in low weight to 20%. As for the WG 74% showed inadequacy of the WG during pregnancy, with 39% having insufficient WG and 35% excessive (Table 2).

Table 2. Characteristics of nutritional status and food consumption of pregnant women in primary care in the municipality of Gurupi -TO, 2018

Variables	n	Descriptive analyses
Pré-gestacional BMI* (Kg/m²)	96	25,4 ± 5,5[a]
Classification of pre-gestational BMI (%)	-	-
Low weight	6	6,3[b]
Eutrophy	48	50,0[b]
Overweight	13	24,0[b]
Obesity	29	19,8[b]
Pré-gestacional BMI* (Kg/m²)	96	27,3 ± 5,1[c]
Classification of pre-gestational BMI (%)	-	-
Low weight	20	20,8[a]
Eutrophy	34	35,4[a]
Overweight	22	22,9[a]
Obesity	20	20,8[a]
Minimum expected weight gain (Kg)	96	4,1 (2,9 – 4,6)[c]
Maximum expected weight gain (Kg)	96	5,6 (5,1 – 6,8)[c]
Real weight gain (Kg)	96	4,4 (3,6 – 6,0; mín. 23/ máx. 16)[c]
Classification of real weight gain (%)	-	-
Insufficient	39	40,6[b]
Adequate	22	22,9[b]
Excessive	35	36,5[b]
Serum 25-hydroxyvitamin D	43	32,4 ± 8,6[a]
Nutritional status of vitamin D (%)	43	-
Insufficient	19	44,2[b]
Sufficient	24	55,8[b]
Serum calcium	43	9,4 ± 0,5[a]
Serum phosphorus	43	4,0 ± 0,6[a]
Serum parathormone	43	18,2 ± 8,0[a]
Adequacy to energy needs (%)	96	-
< EER** minimum	62	64,6[a]
Between EER minimum and maximum	25	26,0[a]
> EER maximum	9	9,4[a]
Adequacy to the need for carbohydrates (%)	96	-
< AMDR***	32	33,4[a]
In the AMDR	59	61,6[a]
> AMDR	5	5,3[a]
Adequacy to protein requirements (%)	96	-
< EAR	46	47,9[c]
Between EAR and RDA	16	16,7[c]
> RDA	34	35,4[c]
Adequacy to lipid needs (%)	96	-
< AMDR	9	9,5[c]
In the AMDR	53	55,3[c]
> AMDR	34	35,5[c]

Note: a Averages and standard deviations; b Percentuals; c Medians and 95% Confidence Intervals; *BMI: Body mass index; **EER: Estimated Energy Requirement25; ***AMDR: Acceptable Macronutrient Distribution Ranges25; EAR: Estimated Average Requirement25; RDA: Recommended Dietary Allowances25

Table 3 shows the average daily intakes and probabilities of macro and micronutrient adequacy, as recommended by the RDI.

Table 3. Daily consumption and adequacy of macro and micronutrient intake for pregnant women in primary care in the municipality of Gurupi -TO, 2018

Nutrient	Daily intake	Percent Adequacy to the Recommendation	Classification of the Group's Usual Intake	Individuals with Inadequate Habitual Intake
Energy (Kcal)	1872, 9 ± 700,3[a]	Under the minimum ERR[f]	Inadequate	74,0%
Carbohydrate (g)	222,7 ± 87,7[a]	48,7% ± 11,4[a]	Adequate[d]	38,5%
Proteins (g)	82,6 ± 32,4[a]	18,10% ± 5,3[a]	Adequate[d]	64,6%
Lipids (g)	64,0 (62,6 – 77,3)[b]	32,6% ± 9,0[a]	Adequate[d]	44,8%
Fibers (g)	13,0 (13,9 – 17,9)[b]	Under the AI[e]	Inadequate	-
Calcium (mg)*	463,2 (415,4 – 510,9)[c]	93% (85,5 – 91,2)[b]	Inadequate	91,7%
Phosphorus (mg)*	886,7 (816,4 – 956,9)[c]	70% (71,7 – 79,3)[b]	Inadequate	51,0%
Magnesium (mg)*	196,7 (181,3 – 212,1)[c]	98% (93,4 – 96,8)[b]	Inadequate	96,9%
Iron (mg)	11,6 (11,6 – 14,2)[b]	98% (87,8 – 93,2)[b]	Inadequate	97,9%
Zinc (mg)*	11,5 (10,1 – 12,9)[c]	55,9% (53,9 – 57,9)[c]	Adequada	94,8%
Sodium (mg)	2084,0 (2060,6 – 2628,2)[b]	Under the AI[e]	Inadequate	-
Potassium (mg)*	2082,6 (1922,5 – 2242,7)[c]	Under the AI[e]	Inadequate	-
Retinol (μg)	310,7 (433,2 – 958,4)[b]	65,1% (62,5 – 67,8)[c]	Adequate	88,5%
Calciferol(μg)	1,3 (1,6 – 2,6)[b]	98% (95,9 – 98,2)[b]	Inadequate	97,9%
Tocopherol(mg)*	10,6 (9,1 – 12,0)[c]	85,6% (82,5 – 88,7)[c]	Inadequate	74,0%
Ascorbic acid (mg)	93,5 (88,7 – 196,6)[b]	82,6% (79,5 – 85,7)[c]	Adequate	49,0%
Thiamine (mg)	1,2 (1,2 – 1,6)[b]	78,5% (75,2 – 81,7)[c]	Inadequate	58,3%
Riboflavin (mg)	1,2 (1,2 – 1,8)[b]	85% (74,1 – 81,1)[b]	Inadequate	59,4%
Niacin (mg)*	17,8 (16,1 – 19,4)[c]	85% (73,2 – 80,3)[b]	Adequate	52,1%
Pyridoxine (mg)	1,3 (0,3 – 5,9)[b]	85% (75,3 – 81,7)[b]	Inadequate	72,9%
Folate (μg)	159,2 (157,4 – 198,6)[b]	98% (96,3 – 98,3)[b]	Inadequate	99,0%
Cobalamin (μg)	3,4 (3,6 – 8,1)[b]	60,7% (57,8 – 63,6)[c]	Adequate	78,1%

Notas: * Means were expressed followed by 95% confidence intervals, due to the high number of outliers; ● Percentage of chance of inadequate habitual intake to the recommendation; [a] Means ± Standard deviations; [b] Medians and 95% Confidence Intervals;[c] Means and 95% Confidence Intervals; [d] AMDR: Acceptable Macronutrient Distribution Ranges – Acceptable ranges of percentage distribution of calories consumed among macronutrients in the diet[25]; [e] AI: Adequate Intake - AI is believed to meet the needs of all healthy individuals in a group, but the lack of data or data uncertainty prevents the reliable specification of the percentage of individuals covered by this intake, and it is not possible to conclude about the adequacy of ingestion, when it is lower than the AI25; [f] EER: Estimated Energy Requirement[25].

It was observed that the average daily energy intake was significantly different between the groups of classification of pre-gestational nutritional status (PGNS) (p = 0.019), with pregnant women with low pre-gestational weight ingesting more energy (2457.42 ± 793.72 Kcal/day) than those women with overweight (1615.11 ± 527.97 Kcal/day) (p = 0.038). For the average daily protein and carbohydrate intakes, no significant difference was observed between the PGNS classification groups.

For the average daily intake of lipids, there was a statistically significant difference between the PGNS classification groups (p = 0.003), with low weight pregnant women presenting daily lipid intake (96.50 g; 95% CI: 73.50 - 125.83) significantly higher than those with overweight (46.00 g; 95% CI: 44.48-69.08; p = 0.004) and obesity (49.00 g; 95% CI: 41.38-77, 56; p = 0.011) and pregnant women with normal weight had a daily lipid intake (69.50 g; 95% CI: 65.79 - 87.54) significantly higher than those with overweight (46.00 g; 95% CI: 44

, 48-69.08; p = 0.011) and obesity (49.00 g; 95% CI: 41.38-77.56; p = 0.041).

There was an association between the classification of PGNS and the classification of energy intake, with 84.2% of obese women having an energy intake lower than the estimated minimum energy requirement (EER) (p = 0.006) (Figure 1A). On the other hand, 83.3% of pregnant women with low pre-gestational weight had a protein intake rating lower than the recommended dietary intake (RDI) (p = 0.001) (Figure 1B).

There was no association between the classification of the PGNS and the classification of carbohydrate intake (p = 0.403), nor between the Current nutritional status (CNS) and the adequacy of carbohydrate consumption (p = 0.661).

However, 83.3% of pregnant women with low pre-gestational weight had a lipid intake below 35% of the calories in the diet and 73.9% of those with pre-gestational overweight had a lipid intake between 20-35%, which is considered adequate (p = 0.038). There was no association between CNS and the adequacy of lipid intake (p = 0.179).

When analyzing the CNS, it is observed that 60.0% of low weight pregnant women had a protein intake lower than the recommended dietary intake (RDI) (p = 0.005) (Figure 1C), and 45.0% of these had energy intake lower than the minimum EER25 (p = 0.014) (Figure 1D).

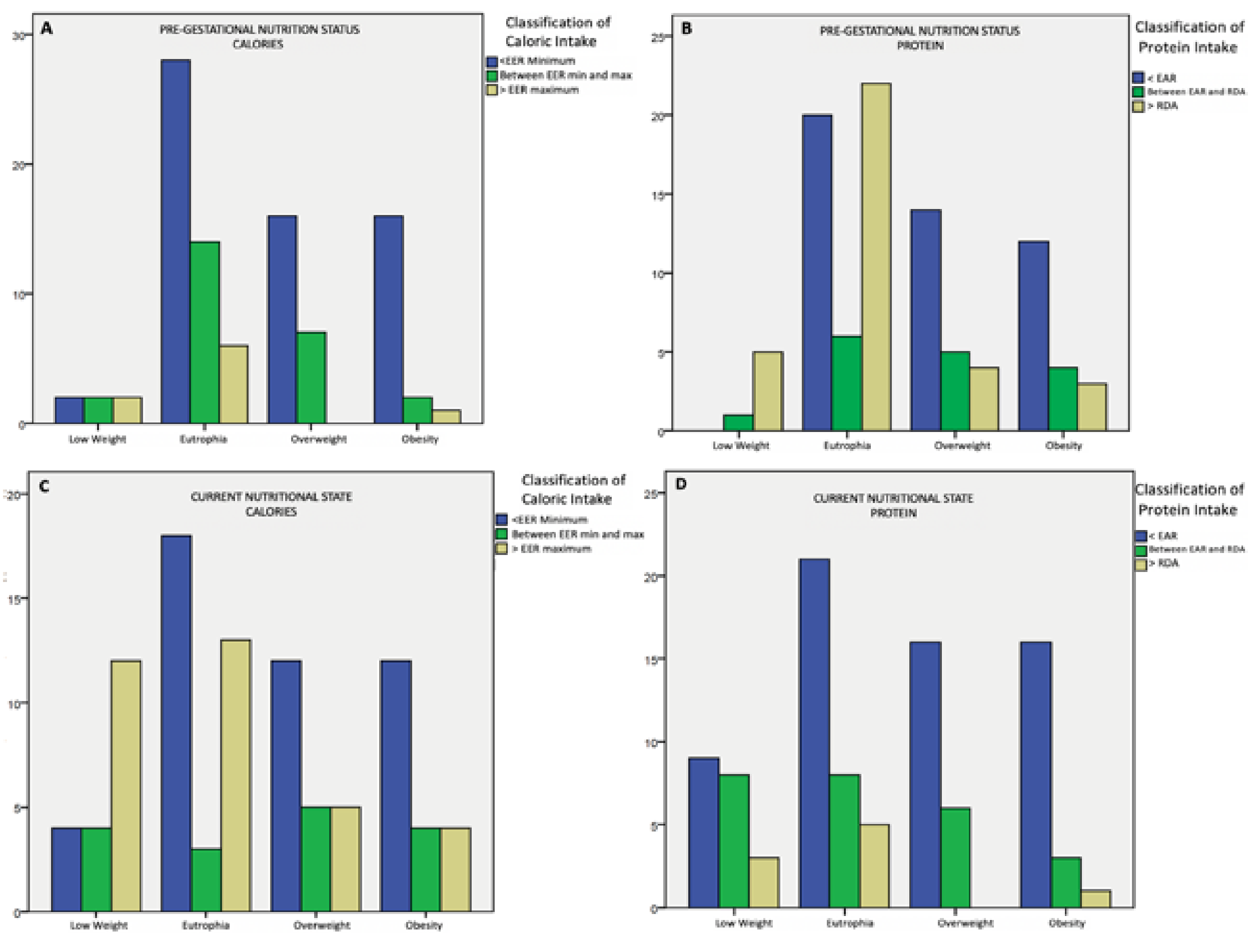

Figura 1. Association between pre-gestational (A and B), current nutritional status (C and D) and protein and energy consumption, by pregnant women in primary care in the municipality of Gurupi -TO, 2018 A and C - Association between Pre-gestational Nutrition Status (A), Current Nutrition State (C) and caloric intake in relation to the Estimated Energy Requirement (EER)25.
B and D - Associations between Pre-gestational Nutrition Status (B), Current Nutrition State (D) and the protein intake in relation to the Estimated Average Requirement (EAR) and the Recommended Dietary Allowance – RDA25

It is noteworthy that there was no association between the adequacy of the gestational GP and the adequacy of intake for the macros and micronutrients studied ($p > 0.05$); and between PGNS ($p > 0.05$) or CNS ($p > 0.05$) and the adequacy of fiber and micronutrient intake Calcium, Iron, Phosphorus, Magnesium, Zinc, Retinol, Riboflavin, Niacin, Pyridoxine, Folate, Cobalamin, Ascorbic acid, Tocopherol and Calciferol. As for the association between PGNS and the adequacy of Thiamine intake, this was not significant ($p = 0.211$), however 75.0% of pregnant women with current obesity had inadequate thiamine intake ($p = 0.044$).

When comparing daily macro and micronutrient intakes, among women in different gestational trimesters, in different CNS classifications, and in different strata of gestational WG, there was no statistically significant difference for any nutrient ($p > 0.05$).

When comparing the probabilities of adequacy of the different micronutrients, among women in the different gestational trimesters and in the different classifications of current gestational NS, no statistically significant difference was observed ($p > 0.05$).

Daily nutrient intakes, when compared among women, in the different CNS classifications, were statistically different for lipid intake ($p = 0.032$), with low weight pregnant women having a median lipid intake (78 g / day; 95% CI: 67.38- 97.21g / day) higher than those with overweight (58 g / day; 95% CI: 45.07- 69.65 g / day; $p = 0.009$) and with obesity (48. 5 g / day; 95% CI: 44.77- 77.12 g / day; $p = 0.015$).

For women in the different strata of gestational WG, only a statistically significant difference was observed for the probability of ingesting thiamine ($p = 0.011$), and those with excessive WG (72.14 ± 15.36%) were likely to have adequate intake. lower than those with insufficient WG (81.28 ± 15.43%; $p = 0.035$) and adequate (83.59 ± 15.92%; $p = 0.022$), with all groups with a high probability of inadequate vitamin intake.

DISCUSSION

Most of the pregnant women studied were primigravidae, highly educated, distributed equally between the three gestational trimesters, with a mean age far from the extremes of maternal age (18 and 35 years-old). As for nutritional status, it was found that the majority had pre-gestational overweight, lower and upper percentages of overweight, compared to a study carried out at UBS in Rio Grande do Sul[23]. In the studies by Alves et al.[24] and Amorin25, evaluating the PGNS, the percentages found for underweight were higher and those for overweight were lower than those of the present study.

The evolution of weight, according to the CNS for GA, showed almost half of pregnant women with excess weight, a reduction in the amount of eutrophic women and an increase in those with low weight. It was identified that the majority obtained insufficient weight gain during pregnancy. The results of the present study were similar to those of studies carried out with pregnant women, in primary health care, in other municipalities in Brazil, for underweight[23,26] and overweight[24,26].

Among the risk factors related to the undesirable obstetric result, the following stand out: nulliparity, since in the first pregnancy the individual risk factors of the woman are unknown; low maternal education, considered when formal education is less than 5 years; the maternal anthropometric NS (low weight, overweight, obesity and inadequate WG), which are associated with IUGR, fetal macrosomia, impaired fetal neurological development, reduced immunological efficiency of the newborn, sequelae in postnatal growth, disorders in kidney functions, lungs and liver of the newborn, higher risk of diabetes, maternal hypertension and obesity, higher risk of defects in neural tube formation[27].

In the studied population, most did not use supplementation of nutrients or supplemented differently from what was recommended[28], that is, they consumed supplements containing only folic acid, or only ferrous sulfate or multivitamin supplement without iron or folic acid, a fact that may have impaired the amount ingested of these nutrients, causing the observed inadequacies.

It should be noted that the Ministry of Health[28] recommends that pregnant women should be supplemented with folic acid, at a dose of 400 μg/day, in the pre-conception period, until the end of pregnancy, aiming at preventing neural tube defects or congenital heart defects[10, 28] and anemia[28].

As for the low serum levels of 25-hydroxycholecalciferol found in this study, when associated with the high prevalence of the probability of inadequate daily intake of calciferol and low sun exposure, they can harm the nutritional status of pregnant women and newborns.

Hypovitaminosis D in pregnant women can lead to macrosomia, gestational diabetes, bacterial vaginosis and pre-eclampsia, in addition to IUGR and preterm delivery[29]. Impacts of calciferol on trophoblastic invasion, blood pressure levels, proteinuria and immunomodulation are also observed, helping to control DHG[30]. Placentally, 25-hydroxyvitamin D is transferred from the mother to the fetus, mainly during the third trimester, showing that maternal dosages reflect fetal levels[31]. Therefore, the transplacental route represents the primary source of 25-hydroxycholecalciferol to the newborn, lasting the stocks acquired from the mother until the eighth week after birth[31].

It is highlighted the calcium, which was supplemented by few of the studied pregnant women and the probability of inadequate daily intake was prevalent in almost all, which was similar to that found in two cohorts with pregnant women in Brazil[32]. This situation is worrying, since that calcium is necessary for bone formation, muscle contraction and hormonal and enzymatic functions[33], and its deficient intake is related to the genesis of HDP[34].

The present study found that all pregnant women had inadequate intake of thiamine. It is noteworthy that the need for thiamine is increased during pregnancy, and its deficiency is associated with PIUG, neuronal cell death, low myelin synthesis, decreased brain weight and other physiological abnormalities in the newborn. Thiamine deficiency during the development of the nervous system interferes with cell proliferation, differentiation and migration, leading to massive neuronal death[35]. In addition, a cohort study indicated that thiamine deficiency during critical stages of fetal development may reflect in adulthood, especially with language impairment[36]. Thus, adequate levels of thiamine are crucial to maintaining normal brain function, especially for the fetus[37].

Considering that the daily intakes of fibers, phosphorus, zinc, sodium, potassium, retinol and cobalamin of the studied population presented a high probability of inadequacy, it should be noted that deficient ingestion of retinol has effects on fetal development, increasing the risk of premature birth, reducing intrauterine growth and decreasing birth weight[33]. Zinc is necessary for normal growth and development of the fetus and placenta, whose deficiency can cause PIUG[33]. Cobalamin deficiency in pregnancy is quite common, especially in developing countries, and low blood levels of this vitamin during pregnancy are strongly associated with premature birth, pre-eclampsia and reduced neurocognitive development[38].

One study showed that pregnant women with pre-eclampsia, associated with high sodium consumption and low potassium intake, are at higher risk of maternal and neonatal morbidity than pregnant women under low consumption of these minerals. He also concluded that birth weight and GA at birth were higher and the frequency of severe pre-eclampsia was lower in pregnant women with lower sodium intake and higher potassium intakes[39].

It was found in the association of NS and nutrient intake, that pregnant women with low pre-gestational weight had higher lipid and total energy intakes, when compared to other NS classifications, and protein intake below the recommendation. Of those with pre-gestational obesity, the majority had lower energy intake than the recommendation. As for CNS, it was found that pregnant women with low gestational weight had, in most cases, lower lipid, protein and energy intakes than recommended, but ingested more lipids daily than those with overweight and obesity.

The relevance of dietary interventions during prenatal care is highlighted, the most accessible time for doctors and health professionals to communicate the importance of healthy eating during pregnancy, through health education strategies.

Despite the policies implemented by the Unified Health System in the area of maternal and child health and nutrition, many women still demonstrate little knowledge about nutritional recommendations and the appropriate WG in pregnancy.

CONCLUSION

The daily intake of macro and micronutrients was inadequate in most pregnant women, and may have influenced the inadequate WG and the decline in maternal nutritional status observed.

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