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Contribution of Ultra-processed Food to the Daily Food Intake of HIV-positive and HIV-Negative Women during Pregnancy

Contribuição dos alimentos ultraprocessados no consumo alimentar diário de mulheres soropositivas e soronegativas para o HIV durante a gestação

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Abstract

Objective To assess the daily dietary intake and energy contribution of ultra-processed foods among women who are positive and negative for the human immunodeficiency virus (HIV) during pregnancy.

Methods This case–control study included 77 HIV-positive and 79 HIV-negative puerperal women between 2015 and 2016. The socioeconomic and maternal demographic data were assessed, and a food frequency questionnaire (FFQ) adapted for pregnant women was applied. The Fisher exact test and the Mann-Whitney test were applied to detect differences between the groups. Linear regression was used to assess the associations between the intake of ultra-processed food and energy, macro- and micronutrients, with values of $p < 0.05$ considered significant.

Results The HIV-positive group was older ($p < 0.001$) and had lower income ($p = 0.016$) and level of schooling ($p < 0.001$) than the HIV-negative group. Both groups presented similar average food intake: 4,082.99 Kcal/day and 4,369.24 Kcal/day for the HIV-positive and HIV-negative women respectively ($p = 0.258$).The HIV-positive group consumed less protein ($p = 0.048$), carbohydrates ($p = 0.028$) and calcium ($p = 0.001$), and more total fats ($p = 0.003$). Ultra-processed foods accounted for 39.80% and 40.10% of the HIV-positive and HIV-negative groups' caloric intake respectively ($p = 0.893$). The intake of these foods was associated with a higher consumption of carbohydrates ($p < 0.001$), trans fat ($p = 0.013$) and sodium ($p < 0.001$), as well as lower protein ($p < 0.001$) and fiber intake ($p = 0.022$).

Keywords
- HIV
- pregnancy
- micronutrients

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Conclusion These findings demonstrate that the energy consumption and ultra-processed food intake were similar in both groups, which reinforces the trend toward a high intake of ultra-processed food in the general population. The intake of ultra-processed food was positively associated with the consumption of carbohydrates, trans fat and sodium, and negatively associated with the consumption of protein and fiber.

Resumo

Objetivo Avaliar o consumo alimentar diário e a contribuição dos alimentos ultra-processados na dieta de gestantes soropositivas e soronegativas para o vírus da imunodeficiência humana (HIV).

Métodos Estudo de caso–controle com 77 puérperas soropositivas e 79 soronegativas entre 2015 e 2016. Analisaram-se dados socioeconômicos e demográficos maternos, e aplicou-se um questionário de frequência alimentar (QFA) adaptado para gestantes. Utilizou-se o teste exato de Fisher e o teste de Mann-Whitney para detectar diferenças entre os grupos. A regressão linear avaliou a associação entre o consumo de ultraprocessados e de energia, macro e micronutrientes. Valores de $p <$ 0,05 foram considerados significativos.

Resultados O grupo de puérperas soropositivas foi mais velho ($p < 0{,}001$), com menor renda familiar ($p = 0{,}016$) e escolaridade ($p < 0{,}001$) quando comparado com o grupo das soronegativas. Ambos os grupos apresentaram médias de consumo semelhantes, com 4.082,99 Kcal/dia entre as puérperas soropositivas e 4.369,24 kcal/dia entre as soronegativas ($p = 0{,}258$). Observou-se que as puérperas soropositivas consumiam menos proteínas ($p = 0{,}048$), carboidratos ($p = 0{,}028$) e cálcio (p = 0,001), e mais gorduras totais ($p = 0{,}003$). Os ultraprocessados corresponderam a 39,80% das calorias entre as soropositivas, e a 40,10% entre as soronegativas ($p = 0{,}893$). O consumo destes alimentos esteve associado a um maior consumo de carboidratos ($p < 0{,}001$), gordura trans ($p = 0{,}013$) e sódio ($p < 0{,}001$), e a um menor consumo de proteínas ($p < 0{,}001$) e fibras ($p = 0{,}022$).

Conclusão Esses achados demonstram que o consumo de energia e de alimentos ultraprocessados foram semelhantes nos dois grupos, o que reforça a tendência ao consumo elevado de alimentos ultraprocessados na população geral. O consumo de alimentos ultraprocessados foi positivamente associado ao consumo de carboidratos, gorduras trans e sódio, e negativamente associado ao consumo de proteínas e fibras.

Palavras-chave
- HIV
- gestação
- micronutrientes

Introduction

Recent data from the World Health Organization (WHO) indicate that there are 36.7 million people living with the human immunodeficiency virus (HIV) in the world. Sub-Saharan Africa is the most severely affected region, with 1 in every 20 adults infected.[1] In Brazil, approximately 734,000 people are living with HIV, and the national prevalence is of 0.39%. The state of Rio Grande do Sul, in Southern Brazil, has the highest HIV infection rates in the country, with a prevalence of 0.8%. Data from the Brazilian Ministry of Health collected between 2000 and 2014 revealed that there were 92.210 HIV-positive pregnant women nationwide, 30.8% of whom lived in the Southern region of the country, and the city of Porto Alegre, the capital of Rio Grande do Sul, ranked first among Brazilian cities in terms of infection rate.[2]

According to McCoy et al,[3] in Africa, poor diet during pregnancy among HIV-positive women is associated with an increased risk of vertical transmission. HIV-positive pregnant women have increased energy and nutritional needs, due to their illness and to the demands of gestation.[3] An inadequate dietary intake, deficient in micronutrients and macronutrients, could increase the risk of vertical transmission and progression of the disease, increase the chance of opportunistic infections, and affect the effectiveness of antiretroviral drugs.[4]

Since the 1980s, changes in the food system on the national and global levels have led to the increased production, availability, accessibility and commercialization of foods and beverages that have undergone some type of processing. However, such processing is largely ignored in dietary assessments and recommendations, as well as in epidemiological studies.[5] Ultra-processed foods generally contain added sugars, fats and substances derived from food constituents or that have been synthesized in the laboratory. They are poor in micronutrients and high in caloric density.[6] This type of processing confers to the food properties that lead to excessive consumption. Considered hyper-palatable foods, they activate the nucleus accumbens, which is responsible for the sensation of pleasure and well-being. In addition, they come in many different sizes, have a long shelf-life, are easy to transport, and are ready for consumption, unlike many fresh foods.[7]

Studies have shown that the energy contribution of this type of food has increased significantly over the recent years, while the consumption of fresh or minimally-processed foods has decreased. This increase occurs in every economic stratum, although it tends to be higher among those with lower income, and is associated with increased obesity, chronic diseases and nutritional deficiencies.[8]

In light of the lack of studies on HIV-positive pregnant women, the importance of adequate food intake during gestation and the recent increase in ultra-processed food consumption, the relevance of increasing knowledge about HIV, gestation and nutrition is justified. A better understanding of the subject will enable more relevant diet counseling for HIV-positive women during gestation, which will result in adequate fetal development.[9] Thus, the objective of the present study was to evaluate the daily dietary intake and energy contribution of ultra-processed foods in HIV-positive and HIV-negative pregnant women.

Methods

This cross-sectional, case–control study was conducted with 77 HIV-positive and 79 HIV-negative postpartum women from July 2015 to August 2016. The study is part of a larger project on the repercussions of social and anthropometric factors during the gestation of HIV-positive puerperal women on newborn birth weight. The inclusion criteria were: postpartum women aged > 18 years, diagnosed or not with HIV, who gave birth at a university hospital in Porto Alegre, could answer the questionnaires, and who voluntarily consented to participate. Women with chronic diseases, such as diabetes, systemic arterial hypertension or nephropathies, as well as those who gave birth with twins, were excluded. The data collection was performed in the immediate postpartum period at the obstetric unit of the aforementioned hospital.

The data were collected as part of a larger project based on the study by Bassichetto et al (2013)[9] on HIV-positive pregnant women in São Paulo, which investigated the birth weight of neonates exposed to HIV. The sample size calculations were performed using the WinPepi® software (https://www.brixtonhealth.com/pepi4windows.html, Jerusalem, Israel), version 11.43, considering a 90% power and a significance level of 5%. The sample size was determined to be composed of least 160 subjects, 80 in the HIV-positive group, and 80 in the HIV-negative group. Pregnant women whose caloric intake was higher than 8,795.38 calories per day were excluded because they represented extreme and isolated caloric values in the sample. Thus, the final population consisted of 77 HIV-positive and 79 HIV-negative women.

The data collection was performed by a nutritionist or a previously trained intern. The HIV-positive participants were selected using the inclusion and exclusion criteria, while the HIV-negative participants were selected among occupants of the same hospital bed vacated by the HIV-positive participants. Maternal anthropometric data were collected from medical records, the socioeconomic and demographic data were collected using specific questionnaires, and the dietary intake was evaluated using a semi-quantitative food frequency questionnaire (FFQ) validated for use among pregnant women.[10]

The ultra-processed food intake variable was based on frequency and quantity of consumption, and calculated according to the standardized portion for each food. The FFQ validated for Brazilian pregnant women involved 8 consumption frequency options: "more than 3 times/day"; "2 to 3 times/day"; "1 time/day"; "5 to 6 times/week"; "2 to 4 times/week";"1 time/week"; "1 to 3 times/month"; and "never/almost never".[10] The food list consisted of 104 food items, including foods classified as ultra-processed according to the Food Guide for the Brazilian population, for which standardized portions are offered as a means of evaluating the quantity consumed. According to their classification in the Food Guide for the Brazilian population, the following foods were considered ultra-processed: bread, cookies, cake, salted crackers, French fries, potato chips, popcorn, yogurt, light yogurt, sauces, hamburgers, pizza, mayonnaise, savory and sweet snack products, ice cream, candy, chocolate, pudding, dulce de leche, soft drinks, artificial juice, ham, condensed milk, canned soup, sugary breakfast cereals and chicken nuggets.[11] The foods in the FFQ were divided into three groups (fresh, processed and ultra-processed). The daily food consumption and energy contribution of ultra-processed foods was assessed using the Statistical Package for the Social Sciences (SPSS, SPSS Inc., Chicago, IL, US), version 18.0. The contribution of ultra-processed foods was represented by the sum of the means of the foods belonging to this group.

The social characteristics of the population of the study were defined according to the Brazilian Economic Classification Criterion (CCEB, in Portuguese) points system, which was developed by the Brazilian Association of Research Companies (ABEP, in Portuguese) and updated in 2015, in which a correspondence was made between scores for specific criteria and economic strata, which were classified as A-B, C or D-E.[12]

The data were analyzed using the SPSS. The categorical variables are presented as means of absolute numbers (n) and percentages (%), the symmetric continuous variables are presented as mean and standard deviation (SD), and the asymmetric continuous variables are presented as median and interquartile ranges [25-75 percentile]. The Chi-squared test or the Fisher exact test was used to detect differences between proportions and means. The Student *t*-test or the Mann-Whitney test was used to detect differences between means and medians. Linear regression analyses were used to identify the direction and statistically significant associations between tertiles of caloric intake from ultra-processed foods and nutritional indicators, with and without adjustments for confounding variables (race, social class, age, marital status and level of schooling). The first tertile represents the lowest total caloric intake, the macronutrients and the micronutrients, while the third tertile represents the highest consumption averages. For all analyses, a significance level of 5% ($p < 0.05$) and a 95% confidence interval (95%CI) were used.

The present study was approved by the Ethics in Research Committee (case 15-0249) of Hospital de Clínicas de Porto Alegre. All participants signed a free and informed consent form in duplicate, with one copy going to the participant and the other to the organizers of the project. Participant anonymity was ensured through the use of data coding and identification numbers.

Results

The sample consisted of 156 postpartum women, 77 HIV-positive and 79 HIV-negative. The characterization of the sample, consisting of HIV-positivity or HIV-negativity and the socioeconomic and demographic characteristics, is shown in ►**Table 1**. There was a statistically significant difference regarding ethnicity: 54.5% of the HIV-positive women and 77.2% of the HIV-negative women were white ($p = 0.005$). Compared to the HIV-negative group, the HIV-positive group had more women of the lowest social class ($p = 0.016$) who lived without a partner ($p < 0.001$) and had lower schooling ($p < 0.001$).

No statistically significant difference was found between the groups regarding the total energy consumption, which averaged 4,082.99 ± 1,488 Kcal/day and 4,369.24 ± 1,656.25 kcal/day for the HIV-positive and HIV-negative groups respectively ($p = 0.258$). Statistically significant results were observed regarding the consumption of macro- and micronutrients, with HIV-positive women presenting a lower intake of protein ($p = 0.048$), carbohydrates ($p = 0.028$) and calcium ($p = 0.001$), and a higher total fat intake ($p = 0.003$) than the HIV-negative group (►**Table 2**). The energy contribution of ultra-processed foods in the daily consumption was of 39.80% and 40.10% in the HIV-positive and HIV-negative groups respectively ($p = 0.893$). There was a significant difference in the calcium intake, with lower consumption in the HIV-positive group ($p = 0.012$). There was no statistically significant difference in daily energy consumption or macronutrient consumption between the groups ($p = 0.893$).

Regarding the HIV-positive participants' total energy intake, 2,241.71 ± 849.61kcal were derived from carbohydrates, 48.20% of which came from ultra-processed foods. A mean of 1,296.82 ± 572.66 kcal came from fats, 33.08% of which were from ultra-processed foods. A mean of 533.38 ± 191.64 kcal were from proteins, 26.17% of which came from ultra-processed foods, which was statistically significant compared with the HIV-negative group ($p = 0.034$).

Since the caloric intake of ultra-processed foods was similar in both groups, the association between the consumption of ultra-processed foods and the consumption of macro- and micronutrients was calculated for the whole sample. ►**Table 3** shows how the sample (n = 156) was divided into tertiles. Each tertile consisted of 52 puerperae: tertile 1 corresponds to the lowest energy consumption from ultra-processed foods, tertile 2, to intermediate consumption, and tertile 3, to the highest consumption. The unadjusted regression analysis showed a positive association between ultra-processed food consumption and the percentage of carbohydrates ($p = 0.002$), trans fats ($p = 0.017$) and sodium ($p < 0.001$), and a negative association between ultra-processed food consumption and the percentage of protein ($p < 0.001$) and fiber ($p = 0.019$). When adjusted for age, schooling, social class, ethnicity and marital status, there were positive associations between ultra-processed food consumption and the following: percentage of carbohydrates, with 3.89% (95%CI: 1.463 to 6.3) in tertile 3; trans fats, with 0.95 g (95%CI: 0.199 to 1.7) more in tertile 3; and sodium, with 1,697.32 mg (95%CI: 991.62 to 2,403.02),] more in tertile 3. The negative association with the protein percentage remained after the adjustment, with 2.96% (95%CI: -3.79 to -2.12), less in tertile 3, and fiber, with 12.05 g (95%CI: -22.36 to - 1.74) less in tertile 3.

Table 1 Demographic and socioeconomic characteristics of HIV-positive and HIV-negative puerperae

Family and maternal characteristics	HIV+ (n = 77)	HIV- (n = 79)	*p*-value
	n (%)	n (%)	
Ethnicity			0.005[a]
White	42 (54.5%)	61 (72.2%)	
Non-white	35 (45.5%)	18 (22.8%)	
Social class			0.016[a]
A-B (upper classes)	5 (6.5%)	18 (22.8%)	
C (middle class)	59 (76.6%)	50 (63.3%)	
D-E (lower classes)	13 (16.9%)	11 (13.9%)	
Lives with partner			< 0.001[a]
Yes	49 (63.6%)	72 (91.1%)	
No	28 (36.4%)	7 (8.9%)	
	Mean ± SD	Mean ± SD	
Maternal age (years)	28.75 ± 5.95	25.53 ± 5.02	< 0.001[b]
Number of Prenatal appointments	8.64 ± 3.71	8.61 ± 3.95	0.963
Schooling (years)	8.55 ± 2.24	10.04 ± 2.31	< 0.001[b]

Abbreviations: HIV, human immunodeficiency virus; HIV-, HIV-negative; HIV +, HIV-positive; SD, standard deviation.
Notes:
[a]Chi-squared test = percentage and absolute frequency.
[b]Student *t*-test = mean ± SD; $p < 0.05$.

Discussion

The objective of the present study was to evaluate the daily dietary intake and the energy contribution of ultra-processed foods in HIV-positive women during gestation, comparing it with that of HIV-negative women. The results show that energy consumption and ultra-processed food consumption were similar in both groups, which reinforces the trend toward high consumption of ultra-processed food in the general population. The multiple regression analysis showed that

Table 2 Contribution of ultra-processed foods to the daily consumption of energy and macro- and micronutrients in HIV-positive and HIV-negative puerperae

	Total (n = 156) mean ± SD	HIV+ (n = 77) mean ± SD	HIV- (n = 79) mean ± SD	*p*-value
Energy				
Total Kcal/day	4,227.95 ± 1,576.92	4,082.99 ± 1,488.00	4,369.24 ± 1,656.25	0.258
Kcal from ultra-processed food/day	1,752.78 ± 1,049.36	1,695.02 ± 1,002.20	1,809.07 ± 1,096.83	0.499
Macronutrients				
% TEV of carbohydrates	56.32 ± 6.44	55.01 ± 6.37	57.28 ± 6.35	0.028
Kcal carbohydrates	2,373.79 ± 924.84	2,241.71 ± 849.61	2,502.52 ± 981.01	0.078
% ultra-processed carbohydrates	46.70 ± 15.73	48.20 ± 14.49	45.23 ± 16.81	0.240
% TEV of protein	13.66 ± 2.57	13.25 ± 2.34	14.06 ± 2.73	0.048
Kcal protein	570.41 ± 216.13	533.38 ± 191.64	606.49 ± 233.17	0.034
% ultra-processed protein	26.50 ± 12.13	26.17 ± 11.96	26.82 ± 12.36	0.738
% TEV of fat	30.10 ± 5.88	31.50 ± 6.11	28.73 ± 5.34	0.003
Kcal fat	1282.09 ± 571.09	1296.82 ± 572.66	1267.73 ± 572.88	0.752
% Ultra-processed fat	35.45 ± 15.37	33.08 ± 16.10	37.76 ± 14.34	0.057
Micronutrients				
Total calcium (mg)	1236.71 ± 633.61	1067.17 ± 562.30	1401.96 ± 658.55	0.001
Ultra-processed calcium (mg)	448.01 ± 304.42	386.24 ± 263.52	508.21 ± 330.23	0.012
Total zinc (mg)	18.83 ± 8.10	17.55 ± 7.54	20.07 ± 8.48	0.051
Ultra-processed zinc (mg)	5.05 ± 3.37	4.73 ± 3.34	5.36 ± 3.38	0.244
Total iron (mg)	23.61 ± 10.20	22.47 ± 9.63	24.72 ± 10.67	0.169
Ultra-processed iron (mg)	10.89 ± 7.57	10.55 ± 7.57	11.23 ± 7.60	0.572
Total sodium (mg)	4769.87 ± 1,986.85	4735.38 ± 1,995.72	4,803.49 ± 1,990.33	0.831
Ultra-processed sodium (mg)	2,532.47 ± 1,577.90	2,485.45 ± 1,619.28	2,578.30 ± 1,545.47	0.715

Abbreviations: HIV, human immunodeficiency virus; HIV-, HIV-negative puerperae; HIV +, HIV-positive puerperae; Kcal, kilocalorie; mg, milligram; SD, standard deviation; TEV, total energy value.
Notes: Statistical test = Student's *t*-test; mean ± SD; $p < 0.05$

ultra-processed food consumption was positively associated with the consumption of carbohydrates, trans fats and sodium, and negatively associated with the consumption of protein and fiber.

Regarding the characterization of the sample, there were more non-white than white HIV-positive women. In line with this, Konopka et al[13] conducted a study whose sample of 139 HIV-positive pregnant women in Southern Brazil consisted of 43.2% of non-whites. In the study by Filgueiras et al,[14] the sample of 237 HIV-positive pregnant women in the state of Paraíba had a non-white prevalence of 77.79%. We observed that a large number of HIV-positive postpartum women (36.4%) reported having no fixed partner. This reflects the social risk to which HIV-positive pregnant women are exposed, since they have less emotional support in this period, which is characterized by several changes in the psychological state. Konopka et al[13] also found that 41.7% of the HIV-positive women in their study had no partner. With respect to age, the mean age of the HIV-positive women in our sample was greater than that of the HIV-negative women (28.75 ± 5.95 versus 25.53 ± 5.02 years respectively). Corroborating this finding, Romanelli et al[15] observed an average age of 29.1 years among HIV-positive postpartum women. The high average age among the HIV-positive group might be explained by their higher parity; Koenig et al[16] associated HIV infection with higher rates of pregnancy.[13–16]

The literature describes HIV-positive pregnant women as having low schooling in general. In the present study, their average schooling was equivalent to elementary school (8.55 ± 2.24 years). Recent data from the Brazilian Ministry of Health reflect our findings, indicating that the majority of Brazilians with HIV have only 5 to 8 years of schooling. A recent study by Yaya et al[17] associated low schooling with less knowledge about HIV and, consequently, greater susceptibility to contracting the infection. Filgueiras et al[14] found that 55.3% of the HIV-positive pregnant women in their study only had elementary education. Konopka et al[13] reported an even larger number in Southern Brazil (which is the region with highest national rates of virus detection): 64.8% of their sample of 139 HIV-positive pregnant women had only up to 8 years of schooling.[2,13,14,17]

Due to the scarcity of studies on food intake among HIV-positive women, the average daily energy consumption of this population during pregnancy has not been described in the

Table 3 Association between tertiles of ultra-processed food consumption (% of total energy) and consumption of macro- and micronutrients among HIV-positive and HIV-negative puerperae

	Unadjusted β* (95%CI)		
Independent variable	**Tertile 1**	**Tertile 2**	**Tertile 3**
% TEV of carbohydrate	1	1.58 (-0.86 to 4.01)	3.82 (1.38 to 6.26)
p-value	–	0.203	0.002
%TEV of protein	1	-1.58 (-2.45 to -0.71)	-3.10 (-3.97 to -2.22)
p-value	–	< 0.001	< 0.001
% TEV of fat	1	0.41 (-1.88 to 2.70)	-0.65 (-2.93 to 1.66)
p-value	–	0.725	0.579
Polyunsaturated fat (g)	1	3.32 (-1.64 to 8.28)	3.44 (-1.52 to 8.40)
p-value	–	0.188	0.173
Monounsaturated fat (g)	1	6.52 (-4.89 to 17.93)	10.16 (-1.25 to 21.56)
p-value	–	0.260	0.080
Saturated fat (g)	1	167.33 (-421.14 to 755.80)	452.49 (-135.98 to 1,040.96)
p-value	–	0.575	0.131
Trans fat (g)	1	0.87 (0.11 to 1.63)	0.93 (0.17 to 1.69)
p-value	–	0.025	0.017
Calcium (mg)	1	54.78 (-190.56 to 300.12)	179.54 (-65.80 to 424.88)
p-value	–	0.660	0.150
Zinc (mg)	1	0.51 (-2.66 to 3.67)	0.29 (-2.87 to 3.45)
p-value	–	0.752	0.858
Iron (mg)	1	1.10 (-2.80 to 4.99)	4.93 (1.03 to 8.82)
p-value	–	0.577	0.013
Sodium (mg)	1	649.71 (-74.33 to 1373.75)	1710.78 (986.74 to 2434.82)
p-value	–	0.078	< 0.001
Fibers (g)	1	-9.95 (-20.32 to 0.417)	-12.40 (-22.77 to -2.03)
p-value	–	0.060	0.019
	Adjusted β* (95%CI)		
Independent variable	**Tertile 1**	**Tertile 2**	**Tertile 3**
% TEV of carbohydrate	1	1.58 (-0.807 to 3.97)	3.89 (1.46 to 6.30)
p-value	–	0.194	0.002
%TEV of protein	1	-1.43 (-2.26 to -0.614)	-2.96 (-3.79 to -2.12)
p-value	–	0.001	< 0.001
Trans fat (g)	1	0.89 (0.145 to 1.63)	0.95 (0.199 to 1.70)
p-value	–	0.019	0.013
Sodium (mg)	1	599.35 (-96.73 to 1,295.44)	1,697.32 (991.62 to 2,403.02)
p-value	–	0.091	< 0.001
Fibers (g)	1	-9.89 (-20.07 to 0.27)	-12.05 (-22.36 to -1.74)
p-value	–	0.056	0.022

Abbreviations: 95%CI, 95% confidence interval; g, gram; HIV, human immunodeficiency virus; mg, milligram; TEV, total energy value.
Notes: Statistical test = linear regression. *Adjusted for age, schooling, social class, ethnicity and marital status.

literature. However, Buss et al[18] applied an FFQ to 578 pregnant women in Southern Brazil, finding an average energy consumption of 2,776 kcal/day. However, these authors excluded individuals whose consumption was lower than 800 kcal or higher than 4,800 kcal, since these values were outside the Institute of Medicine's recommendations for gestation, which require a 300 kcal increase in total energy beginning in the second trimester. The mean energy consumption in their study was lower than in ours (4,082.99kcal), which might be explained by the exclusion of higher values or by the fact that most pregnant women in their study were not in the third trimester, in which the energy requirements are greater than in the first trimester.[18,19]

Corroborating our findings regarding the consumption of ultra-processed foods (that is, approximately 40% of the total calories), Bielemann et al[20] applied an FFQ to 4,202 young adults in the city of Pelotas, in the state of Rio Grande do Sul, Southern Brazil, and found that 51.2% of their intake came from ultra-processed foods. Canella et al[5] investigated the foods and beverages purchased for domestic consumption by 190,159 Brazilians from 55,970 families who participated in the 2008-2009 Family Budget Survey, and found that 25.5% of the daily energy consumption came from ultra-processed foods. This number, which was much lower than our findings, might be explained by the fact that their data did not include food eaten out of the house.[5,20]

Another recent Brazilian cross-sectional study that verified the food quality of adolescents and adults found that 20.4% of the calories came from ultra-processed foods.[21] Costa et al,[22] in their review of 26 articles on ultra-processed food consumption, reported that the main source of energy was derived from these foods.

Considering the consumption of ultra-processed food during gestation, a Brazilian study (Alves-Santos et al.) with 189 pregnant women found that 43.1% of the daily calories came from this type of food. Corroborating these data, Rohatgi et al[23] found that that 63.2% of the energy consumption of pregnant women in the United States was based on processed and ultra-processed foods. This work reinforces our findings: most pregnant women are getting their calories from ultra-processed foods, which can worsen the health outcomes for them and their children.[23,24]

Regarding the association between the consumption of macro- and micronutrients and HIV positivity, the HIV-positive group had a lower intake of protein, carbohydrates and total fat, as well as a lower calcium intake. There were no statistically significant differences between macro- and micronutrients, except for calcium, which was lower in the HIV-positive group. When we divided ultra-processed food consumption into tertiles, we found a higher consumption of carbohydrates, total fat, trans fat and sodium, and a lower consumption of protein and fiber in women who consumed more ultra-processed foods. Corroborating these findings, Costa Louzada et al,[25] who analyzed the diet of the Brazilian population based on data from the 2008-2009 Family Budget Survey and using two 24-hour intervals to analyze the energy consumption from ultra-processed foods, found excessive consumption of calories, trans fat and sodium, as well as a low consumption of protein and fiber. Bielemann et al[20] also observed that the higher consumption of ultra-processed food products was associated with lower consumption of protein and fiber and higher consumption of trans fat and sodium.[20,25] Rohatgi et al[23] showed that most of the carbohydrates, fats, sugars and sodium consumed by the pregnant women in their study came from ultra-processed foods.[23]

Adequate nutrition during gestation is known to be related to fetal outcomes, and it may influence the health of the baby throughout life. Carbohydrates are important in determining fetal growth, as are lipids, which act in the formation of utero-placental structures and in the development of the central nervous system and retina. However, high consumption of trans fat is associated with obesity and chronic diseases, and has no nutritional benefits. Protein consumption should increase according to trimester, since it is responsible for tissue formation.[5,26]

The balanced intake of macro- and micronutrients during pregnancy is among the most important aspects of adequate fetal development. Micronutrients play an important role during pregnancy. Calcium, which is responsible for bone growth and formation, is not produced endogenously, and is derived from dietary sources. It is known that some factors can alter its absorption, such as fiber and fat intake, for example, and fats are present in high amounts in ultra-processed food. Calcium consumption was lower in the HIV-positive group than in the HIV-negative group (386.24 mg versus 508.21 mg respectively), and was below the recommended levels for pregnant women, which can lead to nutritional deficiencies and negative outcomes, such as impaired bone formation.[19,27,28]

Sodium, which is an essential mineral to regulate the intra- and extracellular fluids, also regulates blood pressure. The main source of this mineral is food. Excessive sodium intake during pregnancy can cause edema and lead to high blood pressure, a factor that increases risk during pregnancy. The sodium consumption among our participants was well above the recommended 1,500 mg/day, averaging 4,735.38 mg/day and 4,803.49 mg/day in the HIV-positive and HIV-negative groups respectively.[13,20]

The present work demonstrates the need for nutritional education during gestation, especially among seropositive individuals, who already have different energy needs due to their illness, as well as a greater risk of negative neonatal outcomes. The effectiveness of an educational intervention in pregnant women and primary prevention have already been elucidated in the literature, such as in a recent study (Rohatgi et al.) conducted in São Paulo, which showed an improvement in eating practices and, consequently, a reduction in the consumption of ultra-processed foods. Recent cohort studies (Gomes et al.) that accompanied women during the gestational period also demonstrated that the consumption of ultra-processed foods was reduced with the advancement of gestation, and was replaced by fresh or minimally-processed foods. This outcome reinforces that feeding is a key factor for the maternal and neonatal outcomes.[23,29,30]

As limitations of the present study, we point out the sample size calculation, which was performed for a larger study. Since this was a cross-sectional study, we were not able to establish cause and effect relationships; thus, longitudinal investigations are necessary to confirm its results. The sample consisted of HIV-positive puerperae, a population that has not yet been studied using validated instruments and techniques. Although the frequencies and distributions may not represent the population in general, it is believed that the associations observed in the present study are easily generalizable.

Conclusion

In the present study, food consumption among HIV-positive and HIV-negative puerperae was similar. Ultra-processed foods contributed greatly to the total energy consumption of both groups, and this high consumption was directly associated with higher consumption of carbohydrates, trans fat and sodium, as well as lower consumption of protein and fiber. This demonstrates the need for a broader view of pregnant women, especially those who are HIV-positive, since adequate feeding during pregnancy is closely associated with maternal and fetal outcomes. Health care professionals must improve the care for pregnant women with HIV and have a differentiated perspective on their care and follow-up.

Contributors

Agostini CO, Zoche E, Corrêa RS, Chaves EBM, Corleta HvE and Bosa VL contributed to the conception and design of the present study, to the data collection, or to the analysis and interpretation of data, as well as to the writing of the article or to the critical review of the intellectual content and to the final approval of the version to be published.

Conflicts of Interest

The authors have none to declare.

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