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Food consumption of Primary Health Care users with chronic non-communicable diseases, according to degree of processing and socioeconomic and demographic characteristics

Consumo alimentar de usuários da Atenção Primária à Saúde, com doenças crônicas não transmissíveis, segundo grau de processamento e características socioeconômicas e demográficas

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ABSTRACT

Objective
To evaluate the dietary intake of primary health care users with noncommunicable chronic diseases, according to the degree of food processing and socioeconomic and demographic characteristics.

Methods
This cross-sectional study was conducted between August and November 2023 with 280 users of primary health care services. Questionnaires addressing socioeconomic and demographic characteristics were administered, along with a qualitative food frequency questionnaire assessing consumption intensity. Foods were categorized into four groups: unprocessed or minimally processed, culinary ingredients, processed, and ultra-processed. Data analysis included descriptive statistics, group comparisons, and hierarchical cluster analysis.

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Results
The average consumption score was highest for unprocessed or minimally processed foods and culinary ingredients (2.80), while processed and ultra-processed foods had lower scores (2.10 and 1.70, respectively). Higher educational level and income were associated with greater consumption of unprocessed or minimally processed foods. In contrast, consumption of ultra-processed foods was more prevalent among adults and individuals not receiving social/assistance or social security benefits. Cluster analysis revealed, within each food category, a predominant and more cohesive group, characterized by the presence of multiple foods but varying consumption intensities.

Conclusion
This study contributes to the understanding of dietary patterns among primary health care users with noncommunicable chronic diseases and highlights the importance of health promotion strategies that address social inequalities and encourage healthier eating habits.

Keywords: Cluster analysis. Unprocessed or minimally processed foods. Ultra-processed foods.

RESUMO

Objetivo
Avaliar o consumo alimentar de usuários da atenção primária à saúde, com doenças crônicas não transmissíveis, segundo grau de processamento e características socioeconômicas e demográficas.

Métodos
Estudo transversal, realizado entre agosto e novembro de 2023, com 280 usuários da atenção primária à saúde. Foram aplicados questionários sobre características socioeconômicas/demográficas, além de um formulário qualitativo de frequência alimentar, com intensidade de consumo, agrupando os alimentos em quatro categorias: in natura ou minimamente processados, ingredientes culinários, processados e ultraprocessados. A análise dos dados incluiu estatística descritiva, comparação entre grupos e análise de cluster hierárquico.

Resultados
O consumo médio (em escore) foi maior para alimentos in natura ou minimamente processados e ingredientes culinários (2,80), enquanto os processados e ultraprocessados apresentaram escores menores (2,10 e 1,70). A maior escolaridade e renda se associaram a maior consumo de alimentos in natura ou minimamente processados. Já o consumo de ultraprocessados foi maior entre adultos e pessoas sem benefícios sociais/assistenciais ou previdenciários. A análise de cluster evidenciou, dentro de cada categoria alimentar, um grupo majoritário e mais coeso, com muitos alimentos presentes, porém, intensidade de consumo variada.

Conclusão
A pesquisa contribui para a compreensão dos padrões alimentares entre usuários da atenção primária à saúde com doenças crônicas não transmissíveis e reforça a importância de estratégias de promoção da saúde voltadas às desigualdades sociais e o incentivo para hábitos alimentares mais saudáveis.

Palavras-chave: *Análise por conglomerados. Alimentos in natura ou minimamente processados. Alimentos ultraprocessados.*

INTRODUCTION

Noncommunicable Chronic Diseases (NCDs) present major challenges for healthcare systems, as they are characterized by a long duration, frequently associated with multimorbidities, and lead to unfavorable outcomes that result in functional limitations and disabilities [1-3]. Among the primary conditions are obesity, hypertension, and diabetes, which according to the *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel, Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey), in Brazil, in 2023, showed a respective prevalence of 24%, 28%, and 10% within the general population [4].

Improving the population's health and nutritional profile is a high priority because these diseases are directly linked to lifestyle and strongly influenced by dietary habits. In this context, the adoption of healthier dietary practices is highlighted, in line with the Dietary Guidelines for the

Brazilian Population, which classifies food products into four categories based on their degree of industrial processing: unprocessed or minimally processed foods, culinary ingredients, processed foods, and ultra-processed foods [5,6].

Unprocessed or foods are obtained directly from plants or animals and undergo no alterations after leaving nature, encompassing items such as vegetables and nuts. Minimally processed foods are also unprocessed or foods that have undergone minor modifications, such as packaging or pasteurization, with unsweetened cereal flakes and milk serving as clear examples. Culinary ingredients, which include salt and sugar, are substances extracted from unprocessed foods to be used as seasonings. Processed foods are manufactured by adding salt or sugar to an unprocessed or minimally processed food, as seen in canned vegetables and cheeses, whereas ultra-processed foods are industrial formulations made from food-derived substances and additives designed to increase palatability and shelf life, such as ice cream and margarine [5,7].

A healthy diet should be predominantly composed of unprocessed or minimally processed foods. Conversely, diets based on ultra-processed products cause excessive caloric intake, weight gain, and promote the development of NCDs [8,9]. In Brazil, according to the *Pesquisa de Orçamento Familiar* 2017-2018 (POF, Household Budget Survey) conducted by the *Instituto Brasileiro de Geografia e Estatística* (IBGE, Brazilian Institute of Geography and Statistics), the consumption of processed and ultra-processed foods has been gaining ground, to the detriment of unprocessed or minimally processed food consumption [10].

National and international evidence has demonstrated that individuals diagnosed with NCDs continue to exhibit inadequate dietary practices, even after the clinical diagnosis of these conditions. In a study conducted in Northeastern Brazil, ultra-processed food consumption among hypertensive and diabetic individuals was significantly associated with factors such as higher income, greater educational attainment, and age below 60 years [11]. In another study conducted in Southern Brazil, a low intake of dietary fiber alongside a high consumption of soda, sugar, salt, and saturated fat was observed among individuals living with NCDs [12]. Similarly, a study conducted in Italy pointed out that individuals with hypertension and diabetes consumed saturated fat, simple carbohydrates, and cholesterol well above nutritional recommendations, while fiber intake remained below the ideal threshold [13].

Furthermore, researchers observe a coexistence of protective and risky dietary behaviors, reinforcing that the presence of NCDs does not automatically guarantee dietary behavior changes, as eating habits are heavily influenced by social, economic, and environmental factors [14]. Because of this, the *Sistema Único de Saúde* (SUS, Unified Health System) has structured the care model for patients with NCDs, prioritizing the entry point and care coordination within Primary Health Care (PHC). Prevention and treatment strategies aim to comprehend the dietary and nutritional context of individuals, promoting feasible behavioral changes within their social, cultural reality, and personal interests [2-3].

Although there is a growing body of research on food consumption in Brazil, little is currently known about this phenomenon in inland municipalities and how local economic, social, and cultural differences influence it [15]. Given this scenario, applied research within the scope of the SUS to understand the dietary patterns of populations with NCDs across diverse social contexts is essential for developing more effective public health policies.

Based on the above, this study aimed to evaluate the food consumption of PHC users with NCDs according to the degree of food processing and socioeconomic and demographic characteristics. The

underlying hypothesis is that food consumption varies according to socioeconomic and demographic factors, directly influencing a higher or lower intake of unprocessed or minimally processed foods and ultra-processed foods.

METHODS

This cross-sectional study was conducted between August and November 2023 with adults and older adults living with NCDs who were users of the PHC network in the municipality of Ponta Grossa, Paraná. The study is part of an interdisciplinary project for the training of PHC managers called Training of PHC managers and health professionals in the state of Paraná to confront noncommunicable chronic diseases: an effectiveness analysis using a qualitative-quantitative approach, also known as CAPACITA DCNT. The project was funded by the Public Call for Proposals by the *Conselho Nacional Brasileiro de Desenvolvimento Científico e Tecnológico* (CNPq, Brazilian National Council for Scientific and Technological Development) / Ministry of Health / *Secretaria de Atenção Primária à Saúde* (SAPS, Primary Health Care Secretariat) / Departamento de Promoção da Saúde (DEPROS, Department of Health Promotion) No. 28/2020 – Training in noncommunicable chronic diseases and their associated risk factors. The project was developed through a partnership among the state universities in Paraná: *Universidade Estadual de Londrina* (UEL, State University of Londrina), *Universidade Estadual de Maringá* (UEM, State University of Maringá), and *Universidade Estadual de Ponta Grossa* (UEPG, State University of Ponta Grossa).

The sample size calculation was performed taking into account the lowest odds ratio (OR) value for the variables hypertension, diabetes, and dyslipidemia, which was 1.67 [95%CI = 1.57-1.79] [16]. With this measure, the OR value was converted into the *R2* statistic. Utilizing the website https://www.escal.site/, an R2 value of 0.020 was obtained, and sample size calculation was then performed using the G*Power software (assuming a statistical power of 1-β = 0.80 and an α value of 0.05), which yielded a minimum sample size of 1064 (a value divided proportionally by municipality size, with Ponta Grossa accounting for 26.2%, n=280). In this calculation, a percentage for sample loss was not applied since a new participant was invited for every refusal. To reach this sample size, 35 participants were selected from 8 *Unidades Básicas de Saúde* (UBS, Basic Health Units), prioritizing those with a higher prevalence of obesity and a higher volume of treated patients across different areas of the city, including rural areas.

Participant recruitment was conducted using convenience sampling. The inclusion criteria were: age greater than or equal to 18 years, presenting with at least one NCD (obesity, diabetes, and/or hypertension), passing through the waiting rooms of the UBS, and reading, agreeing to, and signing the Informed Consent Form.

For data collection, a semi-structured questionnaire was administered by two nutritionists, capturing characteristics such as: sex; age group; area of residence; income; education level; and receipt of social/welfare or pension benefits (*Bolsa Família Program*, Continuous Cash Benefit, and retirement or pension), which was obtained through a closed-ended question (yes/no).

To assess food consumption, a qualitative food frequency questionnaire was utilized, adapted from the *Estudo Longitudinal de Saúde do Adulto* (ELSA-Brasil, Brazilian Longitudinal Study of Adult Health) [17]. The instrument estimates habitual food consumption by incorporating a structured list of foods and preparations with standardized categories of consumption frequency, allowing for the evaluation of dietary intake patterns and intensity. Regarding the original ELSA-Brasil instrument, the following adaptations were made: (I) utilization of a qualitative approach, without portion

size estimation; (II) emphasis on the frequency intensity of food consumption through frequency categories; and (III) selection and adjustment of food items to match the reality of the population. This adapted frequency framework presented seven options for consumption intensity (one – less than once a month or never; two – one to three times a month; three – one to three times a week; four – four to six times a week; five – once a day; six – two to three times a day; seven – four or more times a day). Based on self-reported frequencies, mean consumption scores were calculated for unprocessed or minimally processed foods, culinary ingredients, processed foods, and ultra-processed foods, alongside scores for the four groups by summing the individual food scores and dividing by the total number of food items within each group.

A descriptive analysis of the data was performed, and the Shapiro-Wilk test was applied to test adherence to normality. For variables with a normal distribution, differences between two groups were verified using Student's t-test, and differences among three or more groups were verified using ANOVA followed by the Tukey post hoc test for multiple comparisons. For variables without a normal distribution, differences between two groups were analyzed using the Mann-Whitney U test, and differences among three or more groups were evaluated using the Kruskal-Wallis test.

Cluster analysis was also utilized, employing the agglomerative hierarchical method with average linkage to identify food clusterings based on the four groups of the classification system and socioeconomic/demographic conditions, resulting in 8 distinct analyses: (1) unprocessed foods and socioeconomic conditions; (2) unprocessed foods and demographic conditions; (3) culinary ingredients and socioeconomic conditions; (4) culinary ingredients and demographic conditions; (5) processed foods and socioeconomic conditions; (6) processed foods and demographic conditions; (7) ultra-processed foods and socioeconomic conditions; and (8) ultra-processed foods and demographic conditions. Only the dendrograms from analyses 1, 6, 7, and 8 (which were positively associated with consumption scores) were presented within the results and discussion sections of the study.

For the socioeconomic condition clusters, each variable category was transformed into dummy variables to enable cluster analysis for binary data. For the food clusters (categorical variables), the "Gower" metric was utilized to compute the dissimilarity matrix. The significance level used was 5%, and all statistical analyses were executed within the R 4.1.0 environment (R Core Team, 2021).

Dendrograms were used to present the clusters, displaying their hierarchical structure and showing how elements were grouped based on their similarity. The greater the height of the fusion point between two branches, the greater the difference between the groups. Silhouette plots were also evaluated (values close to 1 indicate that observations are well-classified within their groups, whereas negative values suggest they might reside in inappropriate clusters).

The study was approved by the research ethics committee of the *Universidade Estadual de Londrina* (UEL, State University of Londrina), Paraná (*Certificado de Apresentação de Apreciação Ética* [CAAE, Certificate of Presentation for Ethical Appreciation]: 52812621.0.1001.5231 and protocol number 5.086.586, issued in 2021).

RESULTS

The study population was composed of women (74.3%), individuals with white skin color (75.7%), with an age ranging from 22 to 92 years (59.81±12.95), who were residents of urban areas (87.5%). It was observed that 54.3% of the sample received social/welfare or pension benefits, 61.8% had completed elementary education, and 58.9% presented an income between 1 and 3 minimum wages (Table 1).

Table 1 – Socioeconomic and demographic characteristics of users.

Variable/Category	Frequency	%
Sex		
Female	208	74.3
Male	72	25.7
Skin color		
White	212	75.7
Mixed-race	59	21.1
Black	9	3.2
Age group		
60 years or older	161	57.5
18 to 59 years	119	42.5
Marital status		
Married	151	53.9
Widowed	49	17.5
Single	41	14.6
Divorced	39	13.9
Employment status		
Retired and/or pensioner	108	38.6
Employed (Active)	90	32.1
Homemaker, unemployed, or on leave	82	29.3
Education level		
Elementary school	173	61.8
High school	85	30.3
Higher education	22	7.9
Income*		
Up to 1 MW	94	33.6
1–3 MW	165	58.9
≥ 4 MW	21	7.5
Receipt of benefits		
Overall	152	54.3
Social	23	15.1
Pension	129	84.9
Household area		
Urban area	245	87.5
Rural area	35	12.5

Note: *MW: Minimum Wage: BRL 1,320.00 (2023).

The general analysis of food consumption evidenced that unprocessed foods and culinary ingredients had a mean score of 2.80 (±0.30) and 2.80 (±0.60), respectively. For processed foods, the mean score was 2.10 (±0.40), and for ultra-processed foods, it was 1.70 (±0.40). Considering socioeconomic and demographic characteristics, mean consumption score values for unprocessed or minimally processed foods were found to be very close across the different categories of income (p=0.049) and education level (p=0.021). On average, men consumed more processed foods than women (p=0.042), ultra-processed foods were more highly ingested by those who did not receive social/welfare or pension benefits (p<0.001), and by adults when compared to older adults (p<0.001) (Table 2).

Cluster analysis revealed the presence of 4 distinct clusters for each analysis, featuring a majority and cohesive group across all analyzed scenarios (highest silhouette value and largest number of participants). Within the remaining clusters, there may be overlap and classification uncertainty across part of the data (low or negative silhouette values and/or low number of participants).

The consumption pattern of unprocessed or minimally processed foods according to socioeconomic conditions (Figure 1) had Cluster 1 as the most consistent, with variable consumption intensity (1 up to 7). The highlighted foods in this cluster were: brown rice, coffee/mate tea, herbal

Table 2 – Descriptive statistics of food group scores according to socioeconomic and demographic variables.

Food Group	Income												*p*-value
	Up to 1 MW				1-3 MW				≥ 4 MW				
	M	Mdn	SD	IQR	M	Mdn	SD	IQR	M	Mdn	SD	IQR	
Unprocessed or minimally processed	2.8	2.8	0.4	0.5	2.9	2.9	0.3	0.5	2.9	2.9	0.4	0.5	0.049*
Culinary ingredients	2.7	2.6	0.7	0.2	2.8	2.8	0.6	0.6	2.9	3.0	0.8	0.8	0.289**
Processed foods	2.1	2.0	0.4	0.6	2.1	2.0	0.5	0.6	2.2	2.2	0.4	0.4	0.386**
Ultra-processed foods	1.7	1.7	0.3	0.5	1.7	1.7	0.4	0.5	1.9	1.8	0.5	0.5	0.280**
	Social Welfare or Pension Benefits												*p*-value
	Absent				Present								
Unprocessed or minimally processed	2.9	2.9	0.4	0.5	2.8	2.8	0.3	0.5					0.652***
Culinary ingredients	2.8	2.6	0.6	0.6	2.8	2.8	0.7	0.6					0.790****
Processed foods	2.1	2.0	0.4	0.6	2.1	2.0	0.5	0.6					0.664****
Ultra-processed foods	1.8	1.8	0.4	0.4	1.6	1.6	0.3	0.4					<0.001****
	Education Level												*p*-value
	Elementary School				High School				Higher Education				
Unprocessed or minimally processed	2.8	2.8	0.3	0.4	2.9	2.9	0.4	0.4	2.8	2.9	0.4	0.5	0.021*
Culinary ingredients	2.8	2.8	0.7	0.4	2.8	2.6	0.5	0.6	2.7	2.7	0.7	0.7	0.923**
Processed foods	2.1	2.0	0.4	0.6	2.2	2.2	0.4	0.4	2.2	2.3	0.6	0.6	0.059**
Ultra-processed foods	1.7	1.7	0.3	0.5	1.8	1.8	0.4	0.5	1.7	1.8	0.4	0.3	0.285**
	Sex												*p*-value
	Female				Male								
Unprocessed or minimally processed	2.9	2.9	0.3	0.5	2.8	2.7	0.3	0.4					0.093***
Culinary ingredients	2.8	2.8	0.7	0.6	2.8	2.6	0.6	0.4					0.780****
Processed foods	2.1	2.0	0.4	0.6	2.2	2.2	0.5	0.7					0.042****
Ultra-processed foods	1.7	1.7	0.4	0.5	1.8	1.8	0.4	0.6					0.440****
	Age Group												*p*-value
	Adult				Older Adult								
Unprocessed or minimally processed	2.8	2.8	0.4	0.4	2.8	2.9	0.3	0.5					0.988***
Culinary ingredients	2.8	2.8	0.6	0.4	2.8	2.7	0.7	0.8					0.802****
Processed foods	2.1	2.2	0.4	0.6	2.1	2.0	0.5	0.6					0.737****
Ultra-processed foods	1.8	1.8	0.4	0.4	1.6	1.6	0.3	0.4					<0.001****
	Household Area												*p*-value
	Urban				Rural								
Unprocessed or minimally processed	2.8	2.9	0.3	0.5	2.8	2.8	0.3	0.4					0.369***
Culinary ingredients	2.8	2.6	0.7	0.6	2.8	2.8	0.5	0.4					0.219****
Processed foods	2.1	2.0	0.4	0.6	2.0	2.0	0.4	0.5					0.139****
Ultra-processed foods	1.7	1.7	0.4	0.6	1.6	1.6	0.3	0.4					0.063****

Note: *ANOVA test; **Kruskal-Wallis test; ***Student's *t*-test; ****Mann-Whitney U test. MW: Minimum Wage; M: Mean; Mdn: Median; SD: Standard Deviation; IQR: Interquartile Range.

tea, beef, whole milk, legumes, pasta, eggs, roots, and 100% fruit juice, which were associated with a higher education degree and an income of 4 or more minimum wages. Cluster 2 presented coffee/tea at a consumption intensity of 6 and several foods at intensity 5, associated with an elementary school education, an income of 1–3 minimum wages, and the presence of social/welfare or pension benefits. In turn, cluster 3 presented white rice and legumes (intensity 6) along with coffee/mate

tea and whole milk (intensity 5), associated with a high school education, an income of up to 1 minimum wage, and the absence of social/welfare or pension benefits. Cluster 4 did not relate to any socioeconomic situation.

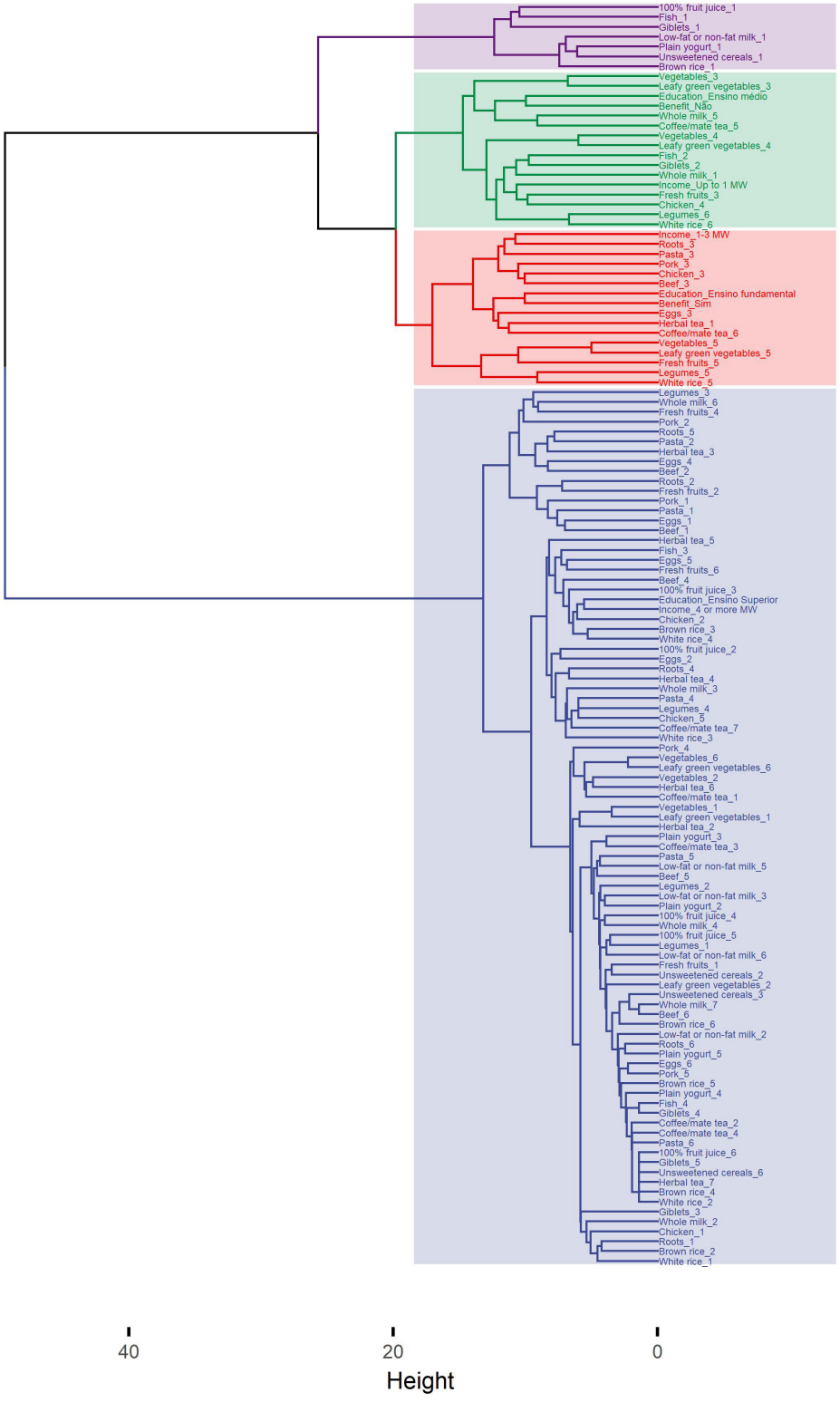


Figure 1 – Dendrogram of the cluster analysis for the unprocessed or minimally processed food group, according to socioeconomic conditions and consumption intensity*. Ponta Grossa, Paraná (2023).

Note: *Consumption intensity: 1 – less than once a month or never; 2 – one to three times a month; 3 – one to three times a week; 4 – four to six times a week; 5 – once a day; 6 – two to three times a day; 7 – four or more times a day.

The consumption pattern of processed foods according to demographic conditions (Figure 2) had cluster 2 as dominant, in which there was also a variable consumption intensity (1 up to 7), with emphasis placed on breads, marmalade, guava paste, fruit compote, and honey, as well as cheeses, associated with a household in a rural area. In cluster 3, there is consumption of breads (intensities 5 and 6) and yellow cheese (intensity 3) associated with the male sex and the adult population. In contrast, in clusters 1 and 4, although the conditions of older age, female sex, and urban area were present, they related exclusively to foods with a consumption intensity of 1.

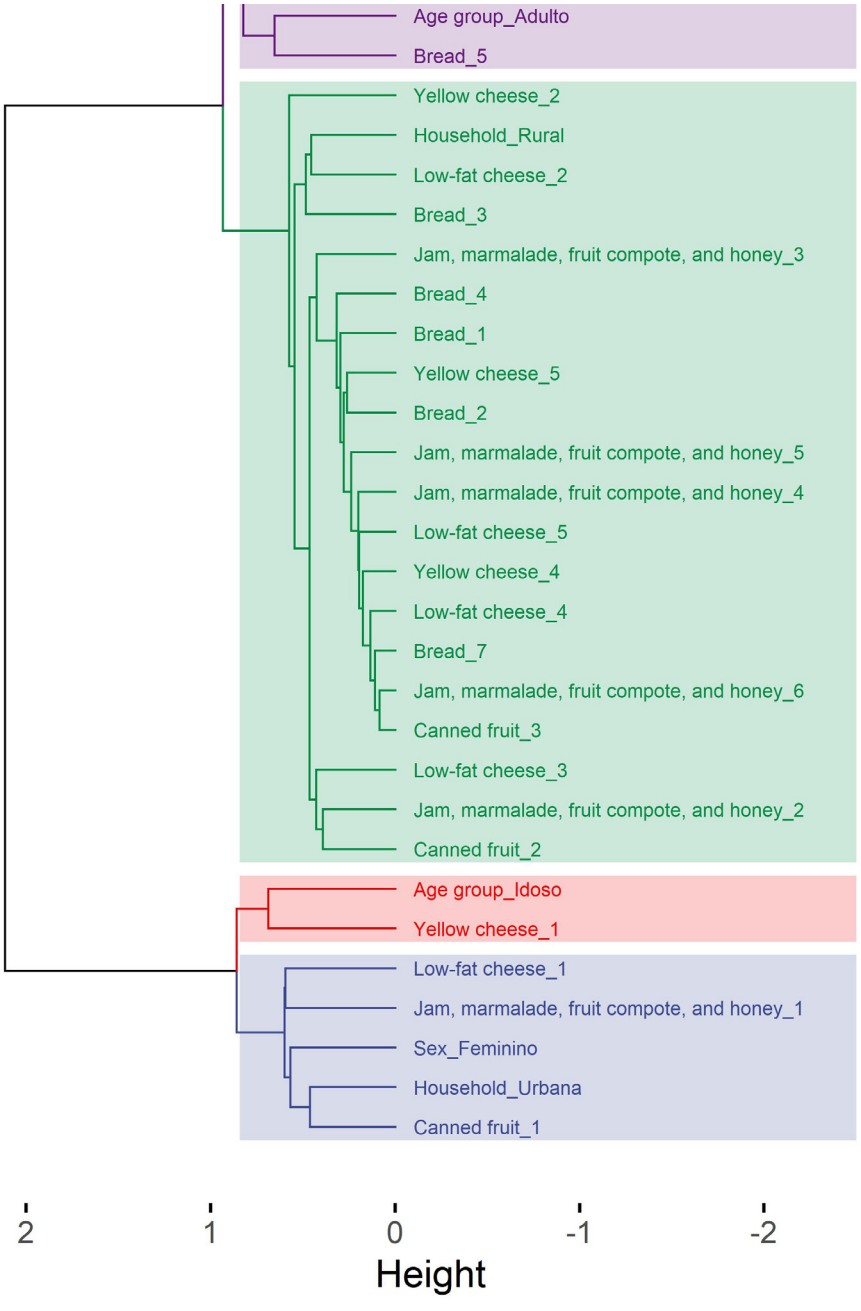


Figure 2 – Dendrogram of the cluster analysis for the processed food group, according to demographic conditions and consumption intensity*. Ponta Grossa, Paraná (2023).

Note: *Consumption intensity: 1 – less than once a month or never; 2 – one to three times a month; 3 – one to three times a week; 4 – four to six times a week; 5 – once a day; 6 – two to three times a day; 7 – four or more times a day.

The consumption pattern of ultra-processed foods according to socioeconomic conditions (Figure 3) and demographic conditions (Figure 4) had, in both cases, cluster 2 as dominant, featuring a variable consumption intensity (2 up to 7), with emphasis on: chocolate powder drink mix, sandwich cookies, flavored yogurt, margarine, ready-made sauce, fruit nectar, and salad dressing, associated with a higher education degree, an income of 4 or more minimum wages, a rural household, and the male sex. Clusters 4 (from both figures) presented foods with relevant consumption, such as margarine (intensity 5) and dairy desserts, sweets in general, soda, processed meat, cake, and plain cookies (intensity 3), associated with a high school education, the absence of social/welfare or pension benefits, and the adult age group. Conversely, clusters 1 and 3, although related to an elementary school education, an income of 1–3 minimum wages, the presence of social/welfare or pension benefits, older age, female sex, and an urban area, presented exclusively foods with very low consumption (intensity 1).

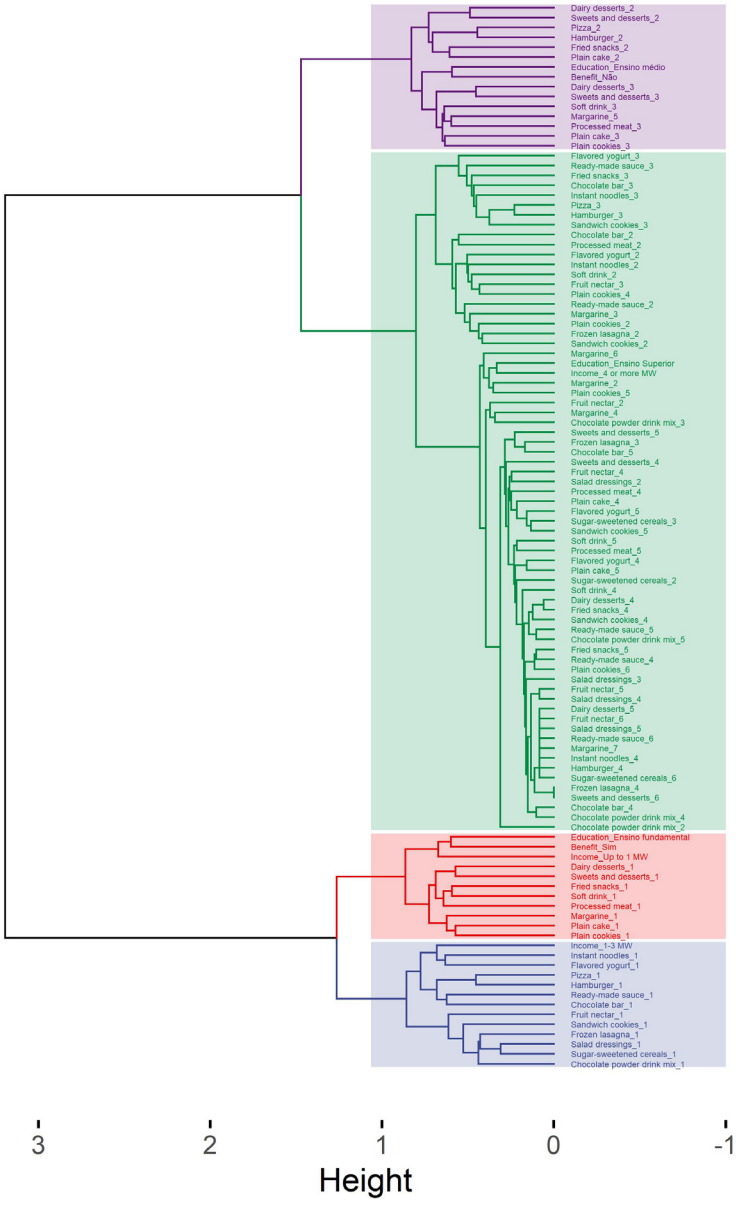


Figure 3 – Dendrogram of the cluster analysis for the ultra-processed food group, according to socioeconomic conditions and consumption intensity*. Ponta Grossa, Paraná (2023).

Note: *Consumption intensity: 1 – less than once a month or never; 2 – one to three times a month; 3 – one to three times a week; 4 – four to six times a week; 5 – once a day; 6 – two to three times a day; 7 – four or more times a day.

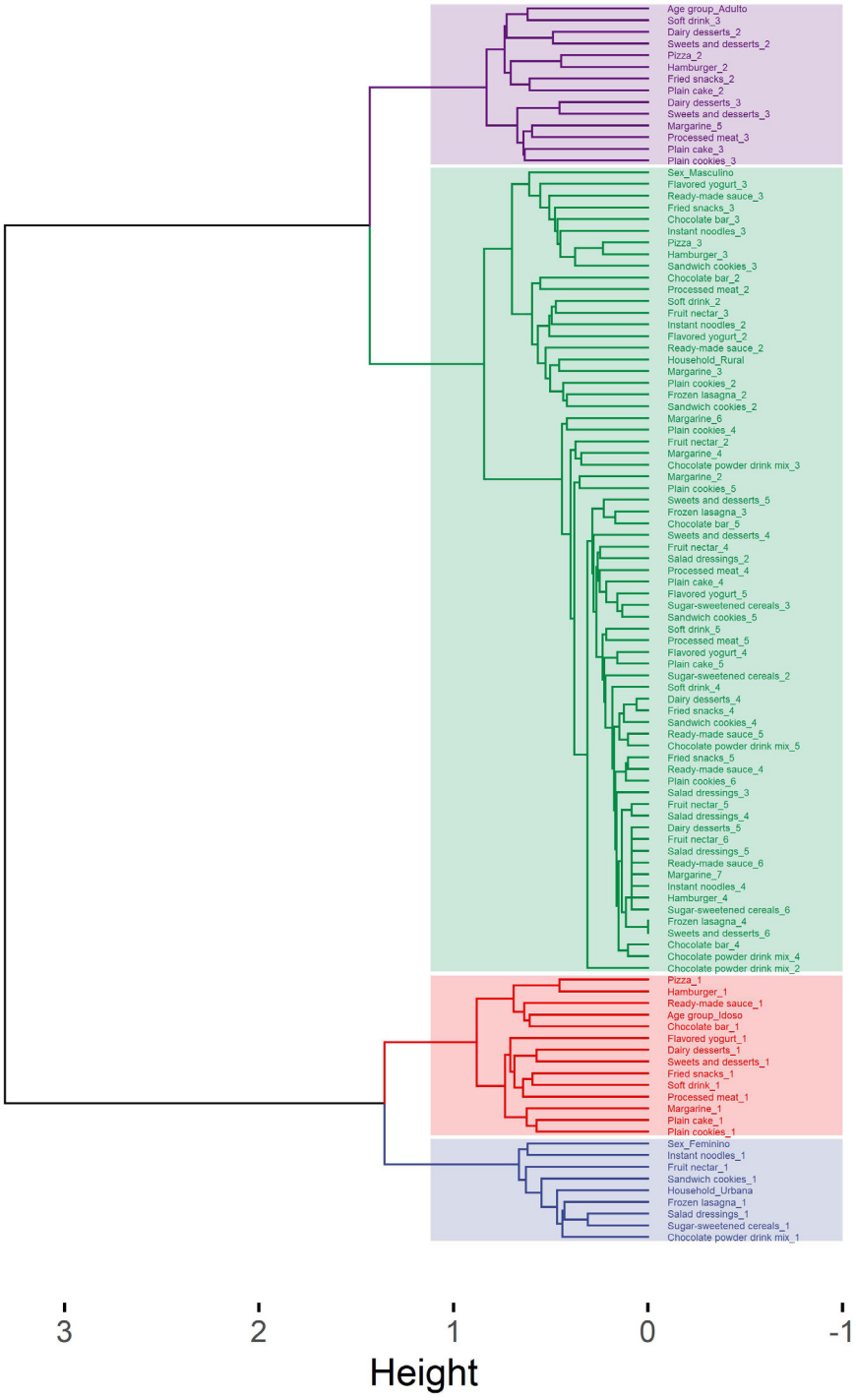


Figure 4 – Dendrogram of the cluster analysis for the ultra-processed food group, according to demographic conditions and consumption intensity*. Ponta Grossa, Paraná (2023).

Note: *Consumption intensity: 1 – less than once a month or never; 2 – one to three times a month; 3 – one to three times a week; 4 – four to six times a week; 5 – once a day; 6 – two to three times a day; 7 – four or more times a day.

DISCUSSION

The descriptive analysis of the consumption scores across food groups revealed that unprocessed or minimally processed foods were more frequently consumed among participants

with higher income and education levels. Conversely, the consumption of ultra-processed foods was more prevalent among adults and those who did not receive social/welfare or pension benefits. It was further observed that men presented a higher consumption of processed foods.

Within the unprocessed or minimally processed food group, a prominent cluster emerged, consisting of brown rice, coffee/mate tea, herbal tea, beef, whole milk, legumes, pasta, eggs, roots, and 100% fruit juice, which were associated with higher education and an income of 4 or more minimum wages. Within the processed food group, the most relevant cluster included breads, jam, marmalade, guava paste, fruit compote, honey, and cheeses, showing an association with rural areas. Among ultra-processed foods, items such as chocolate powder drink mix, sandwich cookies, sweetened and flavored yogurt, margarine, ready-made sauce, fruit nectar, and salad dressing clustered together – demonstrating associations with higher education, an income of 4 or more minimum wages, rural residence, and the male sex.

In our study, we verified that individuals with higher income and education levels tend to present a higher consumption of unprocessed or minimally processed foods. The cluster analysis evidenced this grouping, whose findings resemble those from the latest POF 2017–2018. Brown rice, for instance, may have stood out both because the sample included individuals with chronic conditions like diabetes – which requires stricter dietary control – and due to the trend observed in the POF of increased consumption of this food item within the highest income quartile. Regarding coffee and legumes, although the POF indicates a reduction in consumption as income increases, these foods still figure among the most heavily consumed across all socioeconomic strata. Egg consumption is more frequent in the lower-income quartiles but also shows growth among individuals with higher purchasing power. On the other hand, tea, beef, whole milk, pasta, roots, and 100% fruit juice presented a higher frequency and intensity of consumption within the upper income quartiles [10].

Also, in agreement with our findings regarding education level, Vigitel, in 2023, indicates that the consumption of unprocessed or minimally processed foods increases with education, with the sole exception of beans [4]. The *Pesquisa Nacional de Saúde* (PNS, National Health Survey) of 2019 also points to the same results [18]. This finding suggests a potential relationship between socioeconomic conditions, especially income and education, which either facilitate or hinder access to these foods [19].

In the cluster analysis for the processed food group, an association was observed between the consumption of bread and cheese and rural areas. However, according to the POF 2017–2018, the consumption of these foods is higher among the population residing in urban areas. Regarding honey, guava paste, marmalade, and jam, there are no available data in the POF 2017–2018 to allow for a direct comparison, since these items are grouped within the category of "added foods" [10].

The cluster analysis of ultra-processed foods revealed divergences compared to the POF 2017–2018 data. In the present study, chocolate powder drink mix, sandwich cookies, fruit nectar, and margarine were associated with higher education, an income of 4 or more minimum wages, rural residence, and the male sex. In contrast, while the POF shows these foods are also more heavily consumed by men, their prevalence is higher in urban areas – with the exception of margarine, for which there are no specific data. chocolate powder drink mix, according to the POF, shows higher consumption in the upper income strata, whereas the other items are more frequent in lower income strata, contrasting with the findings of this study. Yogurt consumption was higher in our sample among higher-income men residing in rural areas. In the POF, however, it is predominant among

urban women, with the only similarity being higher consumption in higher-income strata. For ready-made sauces, discrepancies are also observed: while the POF points to similar consumption between sexes without distinction by residence area or income, in the present study, consumption was more frequent among men [10].

The descriptive analysis of this study did not identify a direct association between income, education, and the consumption of processed/ultra-processed foods. However, when indirectly considering a higher income – the group that did not receive social/welfare or pension benefits – a higher consumption of ultra-processed foods was observed. Louzada et al. [20] identified an increase in the consumption of these foods across all income and education strata, with a sharper growth among lower-income and lower-education populations. A similar result was found by Loureiro et al., who reported poorer diet quality within this context. The authors justified this finding based on the expanded access to these foods among the most vulnerable segments (price reductions, increased availability, industry expansion in poorer areas, and the impact of marketing) [15].

The findings from the descriptive statistical analysis of this study also indicate a lower consumption of processed foods among women and of ultra-processed foods among older adults. The influence of sex on dietary choices, although still presenting heterogeneity, may be associated with a greater concern for health, well-being, and cultural patterns that guide dietary decisions [15]. As for the lower consumption of ultra-processed foods among older adults, this behavior reflects an increased awareness regarding dietary habits as age advances. Previous data also point to this trend, recording lower intakes of sodas and other ultra-processed products, as well as a higher consumption of unprocessed or minimally processed foods among older individuals [4,18].

The consumption of processed/ultra-processed foods constitutes a risk factor for the development of cardiovascular diseases, diabetes, overweight/obesity, and metabolic syndrome because they present high energy density, higher concentrations of sodium, sugar, and fat, alongside low contents of fiber, protein, and micronutrients. Furthermore, they generate a higher glycemic response and usually come in large portion sizes, favoring excessive intake [7,21-23]. Potential strategies to discourage their consumption include higher taxation, placement and display restrictions in retail settings, and marketing regulation [24-25].

The descriptive analysis of our study did not observe an association between the consumption of any food group and the place of residence. This fact can be explained by the small sample size residing in rural areas, and because these areas were not located far from a major urban center, nor did it constitute a remote rural regions. Additionally, most of the sample consisted of individuals who did not live in areas of extensive vegetable cultivation, which might otherwise facilitate access. Although differences in food consumption between urban and rural areas still exist, the advancement of urbanization has attenuated them and contributed to the reduction of unprocessed or minimally processed food consumption [26].

When analyzing the set of foods most frequently consumed within the primary clusters of this study, the maintenance of a traditional dietary pattern among PHC network users is generally observed. This pattern seems to reflect not only social inequalities but also dietary preferences and cultural choices. Similar findings were reported by Louzada et al., who highlighted foods such as rice, beans, beef, chicken, coffee, milk, bread, cookies, and margarine among the most consumed [20]. It is important to emphasize that although foods such as brown rice, 100% fruit juice, ready-made sauces, fruit nectar, and salad dressing emerged in the primary clusters of this study, their consumption frequency was low. These items present a higher frequency and intensity of consumption

among upper-income groups – a segment that represents the smallest portion of the sample in the present study.

Also employing cluster analysis, a study by Almeida et al. evaluated food consumption according to the degree of processing in relation to cardiometabolic risk factors and revealed two clusters composed of ultra-processed, processed, and unprocessed or minimally processed foods, without a clear differentiation between groups, with the exception of beans. The findings show that the population's dietary profile is formed by a combination of foods, some protective and others harmful to health [27]. This variety (mixture) of foods was also verified in a study by Loureiro et al., which analyzed the food consumption profile of older adults in a Brazilian city using cluster analysis and evidenced three distinct groups. All of them presented a mixture of healthy indicators (beans, vegetables, and fruits) and unhealthy ones (fatty meats and whole milk) [15]. The same relationship can be inferred for the present study, where the consumption of varied foods within the different categories was observed.

Regarding the weaknesses of the study, we acknowledge selection bias, given that only one of the 8 UBS was from a rural area and participants had to present at least one NCD, unlike national surveys. To mitigate this bias, we sought to include participants from UBS in different regions of the city (representing distinct profiles). Furthermore, it should be noted that because these were individuals with NCDs already monitored by PHC services, better results regarding dietary habits were expected. We also face the limitation of using dietary assessments, which can under- or overestimate food consumption and are memory-dependent. To reduce this limitation, a previously validated and adapted instrument was utilized, alongside its administration by trained nutritionists, contributing to greater reliability of the obtained information.

The strengths of the study include that its findings may contribute to confronting NCDs, as they provide epidemiological data from a medium-sized city, similar to many others in Brazil, which can provide a foundation for professionals and policymakers in implementing and/or improving strategies to combat NCDs within the PHC network. As a future perspective, it is recommended to conduct longitudinal studies that allow for the evaluation of causal relationships between food consumption and NCDs, as well as investigations with larger and more representative samples, including a greater participation of rural populations.

CONCLUSION

The food consumption of PHC users with NCDs is directly related to socioeconomic and demographic factors. Higher income and education levels are associated with a healthier dietary pattern, characterized by a higher consumption of unprocessed or minimally processed foods. Conversely, adults and those who do not receive social/welfare or pension benefits tend to consume more ultra-processed foods.

Cluster analysis revealed, within each category, a majority and highly cohesive group featuring a wide array of foods present, albeit with varying intensities of consumption. This demonstrates the complexity of the dietary habits within this population, which appears to reflect social inequalities alongside cultural choices and dietary preferences.

Despite its limitations, this study contributes to the understanding of dietary patterns among PHC users with NCDs and reinforces the critical importance of health promotion strategies targeted at mitigating social inequalities, while encouraging access to and consumption of healthier foods.

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