








## Dietary patterns in a nursing team measured by principal component analysis\*

Padrões alimentares medidos por análise de componentes principais em equipe de enfermagem

Patrones dietéticos medidos por análisis de componentes principales en un equipo de enfermería

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### ABSTRACT

**Objective:** To characterize the dietary pattern of nursing professionals at a public hospital in Rio de Janeiro, RJ, Brazil. **Method:** A sectional study with nursing professionals (nurses, technicians and nursing assistants). Two 24-hour food recall records were applied, totaling 459 foods, being reduced to 24 food groups. Food patterns were identified using the Principal Component Analysis technique, followed by orthogonal varimax rotation. A Scree Plot graph indicated three factors to be extracted and loads > +0.30 were adopted to define dietary patterns. **Results:** A total of 309 professionals participated. The sample consisted of 85.8% of female individuals. The patterns were named “traditional” which included rice (0.747), beans (0.702) and meat (0.713); “healthy”: vegetables (0.444), greens (0.450), fruits (0.459), bananas and oranges (0.379), and “snacks”: sugar (0.661), bread (0.471), cakes and cookies (0.334), non-alcoholic drinks (0.727). **Conclusion:** The results highlight the “traditional” food pattern of Brazilian food consumption based on the combination of rice, beans and meat. Future studies may investigate the effect of dietary patterns on health outcomes among nursing workers.

### DESCRIPTORS

Feeding Behavior; Nursing Team; Feeding; Adult.

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## INTRODUCTION

The population's eating pattern involves cultural, social, economic and demographic factors, making eating complex and dynamic. The food globalization process determined by technological progress in the food industries, in the modernization of agriculture and urbanization favors a reorganization of eating habits and practices, as well as the consumption of meals outside the home<sup>(1)</sup>.

Research on food and health has traditionally had an evaluation of the macro and micronutrients of isolated foods as its main emphasis, being able to disregard the interactions between them, which are not taken into account. Since one eats a variety of foods and not just specific nutrients or food items, the focus has recently shifted more to analyzing dietary patterns<sup>(2)</sup>.

Studying dietary patterns enables associations between food combinations and health conditions, for example. In addition, analyzing dietary patterns also has the ability to reduce the number of foods consumed in food consumption analyzes to a small number of components, with items being correlated with each other and presenting a significant representation of the total diet<sup>(3)</sup>.

In investigations of dietary patterns, there has been a significant increase in the consumption of ultra-processed foods and sugary drinks, and the manufacture of which involves several processing steps and techniques and various ingredients, many of them exclusively for industrial use<sup>(4)</sup>. In a study of temporal trends considering the home supply of ultra-processed products in Canada and Brazil, the authors found a growing availability of these foods in the studied countries, observing a faster pace in Brazil<sup>(5)</sup>. The consumption of ultra-processed products increased from 20.8% to 25.4% in the period between 2002-2003 and 2008-2009<sup>(6)</sup>.

Studies on food evaluation have identified patterns made up of fresh, processed and ultra-processed foods. Four patterns were found in a study carried out among adults in the city of Ribeirão Preto, São Paulo state, Brazil, with the first recording the consumption of sugar, sweets and soft drinks, the second vegetables, fruits and skimmed dairy products, the third fried foods, fish and roots, and finally beans, cereals and vegetable fat<sup>(7)</sup>.

The patterns found in a sample of women from Caxias do Sul, Rio Grande do Sul state, Brazil, included: fruits, vegetables, rice, beans, milk, pizza, strudel/pastry (*cuca*), cake, fresh juice, fish, whole grain bread, vegetable soup, pasta, cassava and meat<sup>(8)</sup>. The data from the 2008-2009 National Food Survey showed three dietary patterns: coffee, breads, oils and fats, and cheeses; the second: rice, beans and other legumes, and meat; and the last pattern identified sandwiches, processed meats, soft drinks, snacks and pizzas<sup>(9)</sup>.

Modified work and family structures has intensified and simplified the act of eating, generalizing cultures and traditions which were previously specific to each region or state. Thus, when assessing dietary trends with a reference to patterns, it will be possible to observe eating behavior and these findings will consequently contribute to promoting an adequate and healthy food and nutrition<sup>(10)</sup>. Health

professionals, especially nurses, have been described as having high work intensity and obesity. The objective of this investigation was to characterize the dietary pattern of nursing professionals.

## METHOD

### STUDY DESIGN

This is a sectional study that is part of the research "Night work and risk factors for cardiovascular diseases: in nursing teams", coordinated by the Laboratory of Education in Environment and Health, Oswaldo Cruz Institute, Oswaldo Cruz Foundation.

### POPULATION

The population consisted of nursing professionals and was estimated at 1369 individuals according to information from the Hospital's Human Resources Department.

The sample was adjusted for finite populations considering a conservative prevalence of 50%, a sampling error of 5% and a confidence level of 95%, resulting in 330 nursing workers. Of these, 14 (4.2%) professionals refused to participate and 07 (2.1%) were not found, totaling 309 interviews.

### DATA COLLECTION

Participants were asked to answer a multidimensional questionnaire and had their anthropometric measurements taken, and they were also approached by trained nutritionists to report their food consumption in the 24-hour period using the 24-hour food recall record on two distinct and non-consecutive days in an interval of seven days, in rooms reserved at work stations.

### DATA ANALYSIS AND PROCESSING

The variables used to describe the sample's sociodemographic characteristics were: gender: female and male; self-declared race/color: black, brown, white/yellow; age groups: 24 to 30, 31 to 40, 41 to 50, 51 to 60 and 61 to 69; marital status: married, separated/widowed, single; education: incomplete high school, complete high school, higher education and post-graduation; categories/position: nurse, nursing technician and nursing assistant; family income: R\$901 to 2700, R\$2701 to 4500, R\$4501 to 7200, R\$ > 7201; smoking habit: smoker, ex-smoker and never smoked. For classification of nutritional status, the Body Mass Index (BMI) was estimated according to the 1998 recommendation of the World Health Organization (WHO), considering the cut-off points for adult individuals with an adequate BMI < 24.9 kg/m<sup>2</sup>, BMI between > 25kg/m<sup>2</sup> and < 29.99 kg/m<sup>2</sup> overweight and BMI > 30 kg/m<sup>2</sup> obesity.

The classification and coding used for the foods and preparations reported and described in the instruments were similar to those used in the Table of Referred Measures for Foods Consumed in Brazil<sup>(11)</sup>, in which the quantity in grams or milliliters associated with the aforementioned measure used to serve the food was identified according to each type of product and form of preparation. The foods were entered into a

Microsoft Office Excel® spreadsheet, resulting in 459 foods and/or preparations. The grouping of foods/preparations was carried out respecting the nutritional similarity, resulting in 24 food groups (FGs). To analyze the attenuated average of the consumed foods, the FGs were submitted to the Multiple Source Method (MSM) web-software, developed by the Epidemiology Department of the German Institute of Human Nutrition Potsdam-Rehbrückeem. This procedure reduces the intrapersonal variability of consumption data, especially those foods rarely consumed by the study population<sup>(12)</sup>.

The Kaiser-Meyer-Olkin index (KMO) and the Bartlett test were applied to assess the factorability of the data. Principal Component Analysis (PCA) was the multivariate technique used to identify patterns. This technique enables identifying the underlying structure in a data matrix (patterns), considering the correlations or covariances of the variables in question. The reduction to a smaller number of variables called “components” or “factors” was carried out in order to maximize the power of explaining of the set of variables and enable identifying subgroups<sup>(13)</sup>.

The number of components to be extracted was defined using the Castell's plot test (scree plot) technique. The components were rotated using varimax orthogonal rotation<sup>(13)</sup>.

The food patterns as well as the food groups were defined by nutritional similarity of the food, and the food groups

described in the literature in the identification stage of the patterns and those which obtained component loads  $\geq +0.30$ <sup>(13)</sup> were weighted. The analyzes were performed using the IBM SPSS Statistics 20 software.

## ETHICAL ASPECTS

The study was approved based on the guidelines of Resolution 466/12 of the National Health Council by the Research Ethics Committee of *FIOCRUZ-IOC* under the current opinion 635/11 of 2019. The research participants signed a free and Informed Consent Form (ICF).

## RESULTS

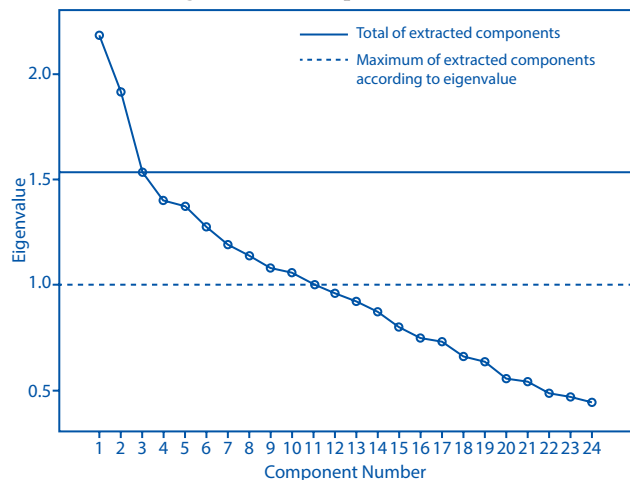
A total of 309 nursing professionals participated in the study. The participants were mostly female (85.8%), the nursing assistant category concentrated 49.5% of the total of workers, the age group between 24 to 50 years old represented 64.1%, while the race/color self-declared with highest percentage was white/yellow with (40.5%). Only 28.5% of professionals were in the highest income range (R\$ > 7,201.00). Regarding nutritional status, 63.8% of nursing professionals were classified as overweight.

The food groups which have been aggregated for submission to PCA are shown in Table 1.

**Table 1** – Food groups according to the food consumed by the nursing staff of a public hospital in the city of Rio de Janeiro – RJ, Brazil, 2015.

Foods or food groups	Aggregate foods
Sugar	Refined and brown/raw.
Rice	Needle, parboiled.
Banana and orange	Banana and orange.
English potato	English potato.
Sugary and soy drink	Guava, apple and traditional soy drink, soft drinks, soft drink (powder), tonic water, traditional mate, canned juice.
Non-alcoholic beverage	Tea and coffee.
Cakes and cookies	Cakes, biscuit, sweet bread, pies, swiss roll, muffin, cupcake and brownie.
Beef, pork and poultry	Breaded filet, wings, breast, drumstick, spring chicken, shredded chicken salad, chicken wing thigh, thigh, chicken, <i>lagarto</i> (round steak), stroganoff, chuck steak, meatloaf, kebab, filet mignon, breaded steak, <i>picanha</i> , pork chops, pork rib.
Cereals and seeds	Popcorn, hominy, canned corn, oatmeal, <i>farofa</i> (toasted manioc flour) and <i>pirão</i> , quinoa, chia, granola, oats, tabbouleh, flaxseed, sunflower seed and pasta.
Sweets and desserts	Apricot, banana and guava jam, chocolate, candies, chewing gum, sugary cereal and processed cereal, whey protein cereal bar and cornflakes.
Fast Food and Industrialized Preparation	Hamburger, sandwich, cheesecake, croquette, pizza, meat pies, esfiha, hot dog, instant noodles, lasagna.
Beans	Black, brown, red.
Cold cuts and sausages	Turkey blanquet, turkey breast, bologna, salami, roast beef, ham, sausage, <i>linguiça</i> , kani, meatball, hamburger meat, hot dog, steak.
Fruit	Tangerine, strawberry, persimmon, mango, plum, grape, avocado, kiwi, pear, watermelon, pineapple, tomato, raisins, papaya, apple.
Greens	Arugula, kale, spinach, bell pepper, onion, cauliflower and carrot
Greens	Lettuce and tomato.
Legumes and derivatives	Pea, chickpea and lentil soup.
Vegetable oil and fat	Margarine, mayonnaise, soy oil, sour cream, coconut oil and safflower capsule, soy vegetable oil, olive oil.
Egg	Chicken eggs.
White and wholewheat bread	French, white and whole, bun, Syrian.
Fish and seafood	Hake fillet, canned tuna, salmon, cod, sardine, shrimp stew, squid, shrimp.
Dairy products	Cheese in general and cream cheese, whole milk, yogurt, curd cheese, catupiry butter.
Natural Juice	Orange, lemonade, coconut water, sugarcane juice.
Roots and tubers	Sweet potatoes, cassava, yams and beets.

The KMO (0.55) and Bartlett ( $p < 0.00$ ) indicators showed an acceptable correlation for the PCA performance. The Scree plot test (Figure 1) performed on the IBM SPSS Statistics 20 software indicated the extraction of three components selected according to the cut-off point (sudden fall or elbow).



**Figure 1** – Scree plot indicating the number of components to be extracted – nursing professionals from a public hospital in Rio de Janeiro, Brazil.

Table 2 shows the patterns extracted in the PCA, Cronbach’s alpha and the percentage of the total variance.

**Table 2** – Result of the principal components analysis for dietary patterns in the nursing staff of a public hospital – Rio de Janeiro, RJ, Brasil, 2015.

Food groups	Food patterns		
	Traditional*	Healthy*	Snack*
Sugar	0.140	-0.012	<b>0.661</b>
Rice	<b>0.747</b>	0.096	0.052
Banana and orange	-0.027	<b>0.379</b>	0.130
Potato	<b>0.348</b>	-0.134	0.051
Sugary and soy drinks	0.050	<b>-0.549</b>	-0.152
Non-alcoholic drinks	0.063	0.294	<b>0.727</b>
Cakes, cookies and pastries	0.036	-0.218	<b>0.334</b>
Beef, pork and poultry	<b>0.713</b>	0.051	0.001
Cereals and seeds	-0.219	-0.130	0.081
Sweets and desserts	-0.100	<b>-0.297</b>	0.006
Fast food and industrialized preparations	0.039	<b>-0.530</b>	-0.058
Beans	<b>0.702</b>	0.098	0.049
Cold cuts and sausages	-0.140	<b>-0.329</b>	-0.008
Fruit	-0.194	<b>0.459</b>	<b>-0.422</b>
Greens	0.094	<b>0.450</b>	-0.252
Vegetables and greens	-0.040	<b>0.444</b>	-0.124
Legumes and derivatives	-0.154	0.001	-0.125
Vegetable oil and fat	0.202	-0.009	0.187
Eggs	-0.158	0.153	-0.010
White and whole wheat breads	-0.118	0.127	<b>0.471</b>
Fish and seafood	<b>-0.322</b>	0.228	0.029
Dairy products	-0.043	0.205	0.022
Roots and tubers	-0.008	0.226	0.001
Natural juices	0.060	-0.081	-0.069
Cronbach’s alpha	0.574	0.40	0.422
Variance (%)	8.53	7.98	6.95
Total variance (%)	8.53	16.51	23.47

\* The dietary patterns were named after the loads generated considering values  $> + 0.30$ . Bold loads highlight the FGs which make up each pattern.

The FGs with positive loads above 0.30 in the first component were: rice (0.747), beans (0.702), potatoes (0.348), beef, pork and poultry (0.713), while the fish and seafood group (-0.322) presented a negative load.

In the second component, the FGs positively loaded vegetables and greens (0.444), greens (0.450), fruits (except bananas and oranges) (0.459), bananas and oranges (0.379), non-alcoholic beverages (0.294) and negatively loaded sweets and desserts (-0.297), cold cuts and sausages (-0.329), sugary drinks and soy (-0.549) and fast food and ready meals (-0.530).

In the third component there were positive loads for added sugar (0.661), white and whole wheat breads (0.471), cakes and cookies (0.334) and non-alcoholic drinks (0.727); those with negative loads were fruits (except bananas and oranges) (-0.422). The conformation of the loads in the components described above suggests that the first component reflects a “traditional” eating pattern, the second a “healthy” eating pattern and the third a “snack” eating pattern.

Seven FGs (legumes and broths; roots and tubers; cereals and seeds; eggs; dairy products and curd; natural juices; and finally vegetable oils) did not reach the cut-off point, therefore they did not contribute to the interpretation of dietary patterns derived by PCA.

Cronbach’s alpha ranged from 0.4 to 0.57 and the three components retained in the PCA individually explain approximately 8% of the variance of the FGs, and together 23.47% of the total variance.

## DISCUSSION

The nutritional transition process which mainly consists of modifying the diet in the Brazilian population, was also observed in the dietary patterns identified among nursing professionals, characterizing food in a “traditional”, “healthy” and “snack” way.

The data analyzed in the first studies of dietary patterns conducted in 1982 were from surveys carried out between 1968 and 1978 in the United States of America (USA), in which the authors described dietary patterns composed of: milk, soups, sugar-free drinks, eggs, vegetables, cereals, vegetables, desserts, meat products, fish and oils. The authors found no variation in the dietary pattern during the studied periods, having remained the same since 1968<sup>(14)</sup>.

Dietary patterns were observed in 1998 on food consumption data for the populations of Northern California, Utah, and Minnesota with intake of high levels of red meat, processed meat, fast food, refined grains and foods containing sugar and low levels of vegetables and fruits, calling them the Western Diet Pattern, and a pattern composed of vegetables and fruits, whole grains, white meat or fish designated Prudent<sup>(15)</sup>.

Two patterns were identified in the survey carried out in the USA with the population of nurses: the Prudent pattern with a high intake of fruits, vegetables, fish, poultry and grains; and the Western pattern with a high intake of red and processed meats, sweets, french fries and refined grains<sup>(16)</sup>.



In relation to the present study, the first dietary pattern obtained was “traditional”, composed of rice, beans and meats.

Studies on dietary patterns in Brazil characterized the components which hold typical foods of Brazilian consumption, such as: rice, beans, manioc root, sugar, and flour as a Traditional pattern<sup>(7-10)</sup>.

The second component found in this study was the “healthy” pattern with the following foods: vegetables and greens, fruits and bananas and oranges.

The dietary pattern of women from São Leopoldo, Rio Grande do Sul state, presented the following foods: kale, cauliflower, cabbage, brussels sprouts, pumpkin, carrot, orange, banana, papaya, apple, bergamot, other green vegetables and salty crackers, named the “healthy” pattern<sup>(17)</sup>.

The third component was called the “snack” pattern, and it highlighted foods of sugar/sweets, white and whole wheat breads, cakes, cookies, pastries and non-alcoholic drinks.

The food choice is based on the eating habits acquired from family life, the region, the neighborhood they reside in, income, psychological status, and culture, as well as the environment in which the individual attends, works or lives; these aspects can contribute to dietary changes<sup>(18)</sup>. Food consumption pattern in Brazil is associated with the food consumed in each region<sup>(18)</sup>.

Foods in this study were ordered according to the dietary pattern with the highest habitual intake among nursing professionals: rice (90g), beans (113g), potatoes (58g) and meat products of animal origin (53g), followed by vegetables and greens (72g), vegetables (23g), fruits (98g), bananas and oranges (98g); and in the third pattern, sugar consumption (28g), white and whole wheat breads (67g), cakes and cookies (44g), and tea and coffee (193 ml). The weight indicated refers to consumption per individual.

The Brazilian food survey carried out between 2008-2009 composed of a probabilistic sample identified the foods most frequently reported by the Brazilian population: rice (84.0%), coffee (79.0%), beans (72.8%), salt bread (63.0%) and beef (48.7%), the consumption of juices and soft drinks (39.8%), soft drinks (23.0%) and less presence of fruit (16.0%) and vegetables (16.0%)<sup>(19)</sup>.

The studies found on the food consumption of nursing teams indicate that these professionals replace their food with sandwiches and snacks<sup>(20)</sup>. However, among the patterns identified in this study, the “snack” pattern explained a lower percentage (%) of variance, and therefore these types of foods were not prevalent in the professionals’ diet. These findings can be partially explained due to the fact that the population under study is mainly female and has higher education. Studies with women demonstrate a significant association between age and food consumption of fruits and vegetables, education and the “traditional” pattern<sup>(8)</sup>. Regarding income, the results indicated that women with a high level of education, with a per capita income of 2.60-41.67 minimum monthly salaries, and belonging to economic classes A and B had a higher consumption in healthy patterns<sup>(17)</sup>.

The dietary patterns found in this study were similar to those described in the Brazilian literature and explained 23% of the total variance of 24 FGs.

Two patterns were evaluated using the data from the 2008-2009 Brazilian food survey which explain 42% of the variance<sup>(21)</sup>. However, the percentage of total variance in another study was 20.92<sup>(22)</sup>.

The percentages of explained variance change according to the number of food groups used in the analyzes and the number of study participants, and the higher the percentage of variance, the better the explanation of the variability of the items<sup>(13)</sup>.

The instruments used to collect food consumption have limitations, and the minimum amount to be applied must be two 24h food recall records<sup>(23)</sup>.

The diets of the participants in this study was quite heterogeneous, however the amount/portion or number of participants consuming the same food was minimal in relation to the total number of participants, and so we had a reduction in the correlations between food items. The details of the preparations consumed by the participants depend on memory, which may result in information bias. In addition, women knowing the beneficial or harmful effect of a certain food could increase and/or omit their consumption. The results must be analyzed according to the characteristics of the studied group. The generalization of the results requires analysis in different small and medium-sized public and private hospital institutions to verify the pertinence of the findings.

“Food has undergone a very rapid transformation worldwide as part of a culture that has also changed. Within a broader process, which is the development of Western industrial civilization, cultural, food and social expressions have also been influenced by this accelerated process<sup>(24)</sup>.”

The study limitations were in relation to the percentage of female participants (85.8%), this being a particular feature of the profession, and the amount of 24-hour food recalls applied for analysis of usual consumption and the subjectivity of the results by the PCA method in the food pattern evaluation. In addition, the variability explained in the three retained components resulted in 23.47%, which is considered low in this study; however, the literature has not established the ideal percentage of variance explained by the components retained in studies on the identification of dietary patterns.

The strength of this study is expressed in the possible monitoring and identification of a trend in the eating behavior of this population and in enabling evaluating future interventions.

## CONCLUSION

The dietary pattern of nursing professionals was classified as “traditional”, based on the combination of: rice, beans and meat, as these foods are characteristic of the Brazilian population. However, it is important to carry out more in-depth studies, since more than 60% of the population was overweight and obese. Future studies may investigate the effect of dietary patterns on health outcomes among nursing workers.

## RESUMO

**Objetivo:** Caracterizar o padrão alimentar dos profissionais de enfermagem de um hospital público do Rio de Janeiro. **Método:** Estudo seccional, com profissionais de enfermagem (enfermeiros, técnicos e auxiliares de enfermagem). Dois recordatórios alimentares de 24 horas foram aplicados, totalizando 459 alimentos, sendo reduzidos a 24 grupos alimentares. Identificaram-se os padrões alimentares com a técnica de Análise de Componentes Principais, seguida da rotação ortogonal varimax. O gráfico Scree Plot indicou três fatores a serem extraídos e cargas  $> +0,30$  foram adotadas para definição dos padrões alimentares. **Resultados:** Participaram 309 profissionais. A amostra foi composta por 85,8% dos indivíduos do sexo feminino. Os padrões foram nomeados de “tradicional” que incluiu arroz (0,747), feijão (0,702) e carnes (0,713); “saúdável”: legumes (0,444), hortaliças (0,450), frutas (0,459), banana e laranja (0,379), e “lanche”: açúcar (0,661), pão (0,471), bolos e biscoitos (0,334), bebida não alcoólica (0,727). **Conclusão:** Os resultados destacam o padrão alimentar “tradicional” de consumo de alimentos brasileiros baseado na combinação arroz, feijão e carnes. Estudos futuros poderão investigar o efeito dos padrões alimentares sobre desfechos de saúde entre os trabalhadores de enfermagem.

## DESCRITORES

Padrões Alimentares; Equipe de Enfermagem; Alimentação; Adulto.

## RESUMEN

**Objetivo:** Caracterizar el nivel de alimentación de los profesionales de la enfermería en un hospital público de Río de Janeiro. **Método:** Estudio seccional, con profesionales de la enfermería (enfermeras, técnicos y auxiliares de enfermería). Se aplicaron dos retiros de alimentos de 24 horas, totalizando 459 alimentos, que se redujeron a 24 grupos de alimentos. Los patrones de alimentación se identificaron con la técnica de Análisis de Componentes Principales, seguida de la rotación ortogonal varimax. El gráfico de sedimentación (Scree Plot) indicó tres factores a extraer y se adoptaron cargas  $> +0,30$  para definir los patrones de alimentación. **Resultados:** 309 profesionales participaron. La muestra comprendía el 85,8% de individuos femeninos. Las normas se denominaron “tradicionales”, que incluían arroz (0,747), frijoles (0,702) y carne (0,713); “saludables”: verduras (0,444), hortalizas (0,450), frutas (0,459), plátano y naranja (0,379), y “aperitivos”: azúcar (0,661), pan (0,471), pasteles y galletas (0,334), bebidas no alcohólicas (0,727). **Conclusión:** Los resultados resaltan el patrón “tradicional” de consumo de comida brasileña basado en la combinación de arroz, frijoles y carne. Es posible que en estudios futuros se investigue el efecto de las pautas de alimentación en los resultados de salud de los trabajadores de enfermería.

## DESCRIPTORES

Conducta Alimentaria; Grupo de Enfermería; Epidemiología Nutricional; Alimentación.

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