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Quality of the diet of families living in rural areas and situation of food insecurity

Qualidade da dieta de famílias residentes na zona rural e situação de insegurança alimentar

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Abstract

Introduction: Food and nutrition security is characterized by regular access to quality food in sufficient quantity. **Objective:** To verify the relationship between the diet quality of rural families and food insecurity (FI). **Method:** This is a cross-sectional study of families living in the rural area of a municipality in Zona da Mata Mineira. In the assessment of diet quality based on the Healthy Eating Index (HEI), portion sizes were adjusted according to age group recommendations outlined in Brazilian dietary guidelines. The mean score for each HEI component and the overall HEI score for all participants were calculated, with energy density standardized to 1,000 kcal. The FI of households was evaluated by the Brazilian Food Insecurity Scale (EBIA). Descriptive statistics, Spearman correlations, and Mann-Whitney test were calculated, considering the family's diet quality score and FI status. **Results:** No family reached the maximum score, indicative of quality, for total fruit, whole grain, milk, and derivatives. Higher scores were observed for total and whole fruits, meat, eggs, and legumes among food-secure families, while food-insecure families showed higher scores for total cereals. A negative correlation was identified between the EBIA score and total and whole fruits, meat, eggs, legumes, and sodium components, whereas a positive correlation was observed with total cereals. The total HEI score in households did not differ as to the security or FI situation. **Conclusion:** The diet of rural families needs improvement, especially those in FI. Methodologies for evaluating the quality of diet in groups, especially in families, should be strengthened.

Keywords: Food and nutrition security. Food consumption. Healthy eating index. Rural population.

Resumo

Introdução: Segurança alimentar e nutricional caracteriza-se pelo acesso regular a alimentos de qualidade e em quantidade suficiente. **Objetivo:** Verificar relação entre qualidade da dieta de famílias residentes na zona rural e a situação de insegurança alimentar (IA). **Método:** Trata-se de estudo transversal, com famílias residentes na zona rural de um município da Zona da Mata Mineira. Na análise da qualidade da dieta, pelo índice de alimentação

saudável (IAS), considerou-se porções específicas por faixa etária, segundo guias alimentares brasileiros. Calculou-se as médias da pontuação de cada componente do IAS e da pontuação final de todos os integrantes, mantendo o ajuste de densidade energética em 1.000 kcal. A IA das famílias foi avaliada pela Escala Brasileira de Insegurança Alimentar (EBIA). Calculou-se estatística descritiva, correlações de Spearman e teste de Mann-Whitney, considerando a pontuação da qualidade da dieta da família e a situação de IA. **Resultados:** Nenhuma família atingiu pontuação máxima, indicativa de qualidade, para fruta total, cereal integral e leite e derivados. Observou-se maiores pontuações dos componentes fruta total e inteira, e carne, ovos e leguminosas entre famílias seguras, e maior pontuação para cereais totais em famílias inseguras. Verificou-se correlação negativa entre a pontuação da EBIA e dos componentes fruta total e inteira, carne, ovos e leguminosas e sódio, e positiva com a de cereal total. A pontuação total do IAS nas famílias não diferiu quanto à situação de segurança ou IA. **Conclusão:** A dieta das famílias residentes na zona rural necessita de melhorias, especialmente daquelas em IA. Metodologias para avaliação da qualidade da dieta em grupos, principalmente na família, devem ser reforçadas.

Palavras-chave: Segurança alimentar e nutricional. Consumo alimentar. Índice de alimentação saudável. População rural.

INTRODUCTION

Food and Nutrition Security (FNS) is defined as regular and permanent access to quality food in adequate quantity, recognized as a fundamental right essential for the realization of other legally established human rights.¹ It is a multidimensional process that must be analyzed by different indicators that incorporate the dimensions of access, availability, biological use of food, and stability encompassing the nutritional and dietary dimensions of this situation.^{2,3} The dimensions of accessibility and availability pertain to the food aspect of food security; food utilization, due to its association with quality and health outcomes, aligns with the nutritional dimension; and stability encompasses all dimensions, bridging both the food and nutritional aspects of security.^{1,4}

The Brazilian Food Insecurity Scale (EBIA) is the sole direct indicator of household food insecurity (FI), including rural households, and addresses perception-based aspects related to the dimensions of food access and availability.^{2,4} However, it should be supplemented with additional indicators, as it does not encompass the nutritional dimension of food security.^{1,3,5}

It is important to highlight that the socioeconomic, nutritional, and perception-based indicators of FNS are interrelated and reflect the various dimensions of this concept. Food deprivation, characterized by limited quantity and variety of foods, is associated with insufficient or unstable income, rural residence, and other sociodemographic factors, which collectively hinder access to quality food. This lower access results in inadequate nutritional status, especially in more vulnerable groups such as rural families.^{3,5-8} It is noteworthy that rural families exhibit a higher prevalence of Food and Nutrition Insecurity (FNI), facing significant risks across the various dimensions of this condition. Consequently, they should be prioritized in the assessment and promotion of FNS.^{3,6-8}

The broad concept of FNS includes nutrient deficiencies and excesses as factors that can adversely affect individuals' nutritional status. Studies on food consumption often assess a single household member, extrapolating these findings to all residents. This approach generates consumption proxies that fail to accurately represent the family's overall consumption, providing only partial and indirect insights into FNI.^{3,8}

Families in FNI typically have a monotonous diet, primarily consisting of energy-dense foods that are low in micronutrients.⁸⁻¹¹ It is important to note that, like FNS, diet quality is a multifaceted phenomenon that should be analyzed holistically and stratified by food groups and specific nutrients.¹²⁻¹⁴ Examining diet quality in terms of food components, rather than isolated nutrients, enhances the assessment of food consumption in epidemiological studies, allowing for the identification of vulnerable groups.¹⁵

Diet quality has been analyzed using various methodologies and indexes that, although derived from the same instrument - the Healthy Eating Index (HEI) - have different names in Brazil. Some researchers refer to it as the Healthy Eating Index (Índice de Alimentação Saudável - IAS), while others call it the Diet Quality Index (Índice de Qualidade da Dieta - IQD).¹³⁻²²

Analyzing the quality of families' diets helps to understand intrafamilial patterns and identify households at risk for FNI.^{14,19,23} This assessment at the household level, however, is still little explored, especially in rural areas. Thus, the objective was to verify the relationship between the quality of the diet of families living in rural areas and the FI situation.

METHODS

A cross-sectional study was conducted with rural families from a municipality in the Mata Mineira Zone. The evaluated municipality had a population of 6,760 inhabitants, of which 3,014 (44.58%) reside in the rural area, which is further subdivided into four rural subareas.²⁴ The inclusion criterion encompassed all family members, including children over two years old, adolescents, adults, and the elderly. Data collection was conducted through home visits from July to October 2012, by two nutritionists involved in the study.

For the sample calculation, the prevalence of FI in Minas Gerais, available during the study period, was used.²⁵ The maximum error was estimated at 5%, with a significance level of 95%, resulting in a sample size of 547 individuals in the municipality, with 244 from the rural area (based on proportionality). As the EBIA is applied per household, the number of individuals living in rural areas was divided by four, which was the average value found per household in this municipality. As the EBIA is applied per household, the number of individuals living in rural areas was divided by four, which was the average number of individuals per household in this municipality. This resulted in an estimate of 61 households, which was then increased by 10% to account for potential losses and by 20% for control of confounding factors, leading to a final sample of 79 households.²⁶ The households were selected from the family farmers registry of the Company of Technical Assistance and Rural Extension of the State of Minas Gerais (EMATER) in the municipality, ensuring proportional representation of families from each rural subarea.

Families were evaluated based on their socioeconomic status, FI, and food consumption. The socioeconomic variables assessed included the number of residents, age, and household income per capita, measured in minimum wages (with the current value at the time of the survey being R\$ 622.00).

For the evaluation of FI, the EBIA was applied to the family food manager, and the scale was applied in its entirety in the presence of a household member under 18 years old. Households were classified as food secure (FS), or as having mild, moderate, or severe food insecurity, based on the number of affirmative responses.^{9,25}

To obtain information regarding food consumption, a usual intake recall was applied to each family member, and participants (or their guardians) were instructed to mention all foods typically consumed, along with their respective quantities in household measures, preparation methods, and details of the ingredients used.

Recall data were analyzed quantitatively, and energy, carbohydrates, proteins, total lipids, saturated fatty acids, and sodium were calculated.

The quality of the family diet was assessed using the HEI, which includes dietary components indicative of adequacy, and items such as saturated fat, sodium, and Gord_AA (saturated and trans fats, total and added sugars, and alcohol) related to diet moderation.²⁷ This index is based on the adequacy of nutritional recommendations for different age groups and can be applied to individuals or populations.^{20,28,29}

For the calculation of the HEI, data obtained from the usual intake recall applied by the nutritionist to all family members were used. The food consumed was portioned according to age-specific dietary guidelines. Children under two years of age were excluded, as the dietary guide used to calculate the HEI does not include this age group.^{27,29}

In the IAS analysis, preparations and industrialized foods were broken down, and their ingredients were computed in each corresponding group.

For the food and sodium components, an energy density adjustment was made per 1,000 kcal. The components of saturated fat and Gord_AA were calculated as a percentage of total calorie consumption, relative to the total energy intake.²⁷

Each component was scored to assign maximum values for compliance with intake recommendations and minimum values for the absence of consumption of food groups or the exceeding of upper limits (for moderation groups). For consumption between the minimum and recommended, the corresponding score was calculated.^{12,27,29}

To evaluate the HEI in the family, the average score of each of the 12 components, along with the final score for all members, was calculated.^{27,30}

This study was approved and adhered to the recommendations of the Ethics Committee in Research with Human Beings at the Federal University of Viçosa (registration 241.906/2013). Evaluations were conducted after all family members or their guardians (when under 18 years of age) signed the Informed Consent Form (TCLE). All families received nutritional guidance tailored to their specific situation.

The data were analyzed using SPSS version 20.0 software. Descriptive statistics were performed, considering socioeconomic variables, FI, and diet quality, through frequency and median calculations (minimum and maximum). Spearman correlations were calculated between the scores for the quality of the family diet (total score and per component) and the EBIA score. The scores of the HEI components were compared using the Mann-Whitney test, according to the FI situation.

RESULTS

Considering the household variables, 39.24% (n=31) of the families had a per capita income of less than half of the minimum wage at that time. The median number of residents in the household was 3 (range: 1-9), and 56.96% (n=45) of the households had up to four residents. The median number of children in the household was 0 (range: 0-4), and 34.18% (n=27) of the households included children among their residents. Among the households evaluated, 53.0% (n=42) had a resident under 18 years of age.

According to the EBIA, 49.4% (n=39) of the families were experiencing food insecurity (FI), with 87.2% (n=34) reporting mild food insecurity. Notably, 67.74% (n=21) of households with a per capita income of less than half of the minimum wage were in food insecurity; 62.22% (n=28) of households with up to four residents were food secure (FS); and 61.9% (n=26) of households with a resident under 18 years of age had some degree of food insecurity.

Regarding diet quality, it is noteworthy that no family achieved the maximum score for the HEI nor the components of total fruit, whole grains, and milk and dairy products. The components oil, meat, eggs and legumes, dark green vegetables, orange vegetables, and total vegetables received the maximum score in most families. Only 6.3% (n=5) of the families scored for the whole grain component (Table 1).

The components total and whole fruit, whole grains, and milk and dairy products had consumption medians that were significantly lower than the reference score. In contrast, the components total vegetables, dark green and orange vegetables, meat, eggs and legumes, and oil showed medians corresponding to the maximum score (Table 1).

Table 1. Score and percentage of adequacy of the components of the Healthy Eating Index in families living in rural areas of a municipality in the Zona da Mata region of Minas Gerais, 2014.

HEI Component	Reference Score	Median (min-máx.)	Minimum Score (%)	Maximum Score (%)
Total Fruit	0-5	0,61 (0,00-2,95)	20 (25,3)	0 (0,0)
Whole Fruit	0-5	0,95 (0,00-5,00)	25 (31,7)	1 (1,3)
Total Vegetable*	0-5	5,00 (1,94-5,00)	0 (0,0)	43 (54,4)
Dark Green and Orange Vegetables*	0-5	5,00 (0,30-5,00)	0 (0,0)	56 (70,9)
Total Cereal	0-5	4,14 (2,23-5,00)	0 (0,0)	5 (6,3)
Whole Grain Cereal	0-5	0,00 (0,00-1,67)	74 (93,7)	0 (0,0)
Milk and Dairy Products	0-10	2,15 (0,00-7,61)	6 (7,6)	0 (0,0)
Meat, Eggs and Legumes	0-10	10,00 (7,95-10,00)	0 (0,0)	71 (89,9)
Oil	0-10	10,00 (10,00-10,00)	0 (0,0)	79 (100,0)
Saturated Fat	0-10	6,67 (0,38-10,00)	0 (0,0)	8 (10,1)
Sodium	0-10	7,84 (2,58-10,00)	0 (0,0)	1 (1,3)
Gord_AA	0-20	18,97 (11,91-20,00)	0 (0,0)	27 (34,2)
Total Score	0-100	70,12 (55,49-85,61)	0 (0,0)	0 (0,0)

Gord_AA: calories from solid fats, sugar, and alcohol.

*Legumes are included in the total vegetable and dark green and orange vegetable components once they reach the maximum score in the meat, eggs, and legumes component.

The main foods consumed by at least one family member, according to each component of the HEI evaluated, were: banana (n=41; 51.9%), apple (n=17; 21.5%), and orange (n=16; 20.3%) in the fruit component; leafy greens (collard greens/tanni) stir-fried (n=52; 65.8%), lettuce (n=48; 60.8%), and tomato (n=23; 29.1%) in the total vegetable component. In the group of dark green and orange vegetables, only collard greens and tannia (n=64; 81.0%), carrot (n=9; 11.4%), and pumpkin (n=3; 3.8%) were included.

The most commonly consumed foods by at least one family member, in relation to the total cereal component, were: rice (n=79; 100%), French bread (n=65; 82.3%), cornmeal (angu) (n=57; 72.2%), unfilled sweet biscuits (n=22; 27.8%), simple cake (n=31; 39.2%), pasta (n=28; 35.4%), and potatoes (n=18; 22.8%). The only foods present in the whole grain cereal component were whole grain bread (n=3; 3.8%), granola (n=1; 1.3%), oats (n=1; 1.3%), and flaxseed (n=1; 1.3%).

The meat, eggs, and legumes component included the most consumed foods as follows: beans (n=79; 100%), chicken (n=55; 69.6%), pork (n=48; 60.8%), beef (ground or muscle) (n=34; 43.0%), and eggs (n=16; 20.3%). In the milk and dairy products component, the main foods consumed were whole milk (n=62; 78.5%) and cheeses (Minas or mozzarella type) (n=12; 15.2%).

The foods most commonly present in the oil and saturated fat components were: soybean oil (n=79; 100%), pork fat (n=52; 65.8%), margarine (n=42; 53.2%), and butter (n=13; 16.5%). In the sodium component, the most frequently consumed foods were cooking salt (n=79; 100%), bread (n=67; 84.8%), biscuits (n=45; 56.9%), and sausages (n=5; 6.3%). The Gord_AA component included the following main foods consumed by at least one family member: added sugar in coffee (n=79; 100%), milk and whole milk derivatives (n=63; 79.4%), pork fat (n=52; 65.8%), artificial juice (n=22; 27.8%), as well as sweets (n=18; 22.8%) and chocolate (n=14; 17.7%).

When analyzing the quality of the diet according to the FI situation, it was observed that families in FS presented higher scores for the components total fruits, whole fruits, meat, eggs, and legumes, while families in FI had higher scores for the total cereals component ($p < 0.05$). These differences were not maintained when stratifying by levels of food insecurity (FI). The total HEI score in families did not differ between groups based on food security status or food insecurity (FI), although a higher median score was observed in food-secure families (Table 2).

Table 2. Scores of the components of the Healthy Eating Index in families residing in rural areas of a municipality in the Zona da Mata region of Minas Gerais, according to food security or insecurity status. 2014.

HEI Components	Reference	Food Security (n=40)			Food Insecurity (n= 39)			p*
		Median (min-max)	Minimum Score (%)	Maximum Score (%)	Median (min-max)	Minimum Score (%)	Maximum Score (%)	
Total Fruit	0-5	0,82 (0,00-3,50)	8 (20,0)	0 (0,0)	0,40 (0,00-3,47)	12 (30,8)	0 (0,0)	0,032
Whole Fruit	0-5	1,40 (0,00-5,00)	9 (22,5)	1 (2,5)	0,60 (0,00-3,78)	16 (41,0)	0 (0,0)	0,030
Total Vegetable	0-5	5,00 (1,94-5,00)	0 (0,0)	23 (57,5)	5,00 (2,72-5,00)	0 (0,0)	20 (51,3)	0,790
DGO Vegetables	0-5	5,00 (1,93-5,00)	0 (0,0)	32 (80,0)	5,00 (0,30-5,00)	0 (0,0)	24 (61,5)	0,143
Total Cereal	0-5	3,87 (2,54-5,00)	0 (0,0)	2 (5,0)	4,26 (2,23-5,00)	0 (0,0)	3 (7,7)	0,027
Whole Cereal	0-5	0,00 (0,00-1,67)	37 (92,5)	0 (0,0)	0,00 (0,00-1,16)	37 (94,9)	0 (0,0)	0,634
Milk and Dairy products	0-10	1,75 (0,00-7,61)	4 (10,0)	0 (0,0)	2,64 (0,00-7,37)	2 (5,1)	0 (0,0)	0,308
Meat, Eggs and Legumes	0-10	10,00 (9,37-10,0)	0 (0,0)	39 (97,5)	10,00 (7,95-10,0)	0 (0,0)	32 (82,1)	0,021
Oil	0-10	10,00 (10,0-10,0)	0 (0,0)	40 (100,0)	10,00 (10,0-10,0)	0 (0,0)	39 (100,0)	-
Saturated Fat	0-10	7,67 (0,38-10,0)	0 (0,0)	5 (12,5)	6,33 (0,88-10,0)	0 (0,0)	3 (7,7)	0,530
Sodium	0-10	8,4 (3,93-9,86)	0 (0,0)	0 (0,0)	7,66 (2,58-10,0)	0 (0,0)	1 (2,6)	0,213
Gord_AA	0-20	19,4 (12,6-20,0)	0 (0,0)	18 (45,0)	18,74 (11,9-20,0)	0 (0,0)	9 (23,1)	0,293
Total Score	0-100	71,22 (55,5-85,6)	0 (0,0)	0 (0,0)	68,63 (60,4-78,4)	0 (0,0)	0 (0,0)	0,124

Gord_AA: calories from solid fats, sugar, and alcohol; DGO Vegetable: Dark Green and Orange Vegetables.

*Mann-Whitney test.

When evaluating the correlations between FI and diet quality, it was observed that the EBIA score correlated negatively with the total fruit ($r=-0.244$), whole fruit ($r=-0.258$), meat, eggs, and legumes ($r=-0.235$), sodium ($r=-0.262$) components; and positively with the total cereal ($r=0.223$) ($p<0.05$).

When considering the correlations between socioeconomic variables and HEI score, per capita income was positively correlated with dark green and orange vegetables ($r=0.237$), and negatively with total cereal ($r=-0.283$) and sodium ($r=-0.289$). The number of family members showed a positive correlation with milk and derivatives ($r=0.236$) and a negative correlation with sodium ($r=-0.227$). The number of children in the household was positively correlated with the components of total cereal ($r=0.307$) and milk and derivatives ($r=0.292$). The age of the reference resident showed a negative correlation with the total cereal component ($r=-0.277$) and a positive correlation with Gord_AA ($r=0.299$) ($p<0.05$).

DISCUSSION

The quality of the diet of rural families evaluated is related to the FI situation, with lower scores observed in the components total fruit, whole fruit, meat, eggs, and legumes, and a higher score in the total cereal component in food-insecure households.

In this study, FI showed a higher prevalence than that found in rural areas of Brazil and the Southeast, according to national research.^{25,31-36} Brazilian studies conducted at specific points in time using the EBIA revealed FI prevalences ranging from 40.9% to 88.5%, with higher prevalences in rural areas.^{6,7,10} Historically, rural populations have experienced a higher prevalence of FI compared to urban populations, despite being the primary contributors to food production in the country. Key factors contributing to this situation in rural areas include lower income and education levels, challenges related to food production, access, and distribution, instability in crop yields, and limited access to human rights and social programs, among others.^{7,8,35}

Additionally, studies indicate that rural diets are less diversified, with a higher proportion of cereals and lower proportions of fruits, leafy vegetables, and lean meats, which increases the vulnerability of these families.^{8,31-35}

Families in FI had lower scores for the components total and whole fruit, meat, eggs, and legumes, and higher scores for total cereal. It is worth noting that fruit consumption in Brazil is generally low, with even lower consumption observed in groups experiencing FI.^{5,10,11,15,19,21-22,35,37} A Mexican study conducted with children and adolescents also found lower scores of the fruit component in individuals in FI.²⁸ The lower consumption of meat among food-insecure groups reflects the cost of this food.^{3,8,9,31} The higher consumption of total cereals in these groups can be attributed to the increased intake of carbohydrates, primarily simple carbohydrates.^{5,9,31,32,35}

It is emphasized that the HEI score in families did not differ according to safety situation or FI; however, a higher final score was observed among families in FS, as well as in other studies.^{23,38,39} It is not recommended to classify the adequacy of a diet, as this may obscure which specific food components or nutrients require improvement.^{12,29}

The low consumption of fruits, vegetables, meat, and dairy products reflects the inadequate intake of micronutrients by families, which may characterize hidden hunger in food insecurity. This reduced food consumption, even in rural areas where there is typically production for self-consumption, can be explained by the fact that food consumption is influenced by cultural habits and socioeconomic factors.^{7-9,18} Income

restrictions, commonly present in families experiencing food insecurity, can lead to lower consumption of these foods, which are considered expensive and less satiating, as well as an increase in the intake of energy-dense foods, which are cheaper and provide greater satiety.⁹ It is important to note that food expenses constitute the largest portion of the budget for rural households.^{5,10,25,34,35}

Regarding the HEI component scores, all families achieved the maximum score for the oil component. However, this score is based on the consumption meeting the recommendation of 1/2 daily portion, adjusted to 1,000 kcal, without accounting for excessive consumption.²⁹ Ideally, this component of the index should adhere to the principle of moderation, similar to the components for saturated fat, sodium, and Gord_AA, to avoid considering excessive oil consumption as indicative of a healthy diet.

Studies on diet quality typically focus on specific age groups, with none addressing the family unit as a whole. Furthermore, these studies employ different methodologies, with adaptations made based on the sample unit and the research focus, even though all are grounded in the original or revised versions of the HEI.^{13,14-23,37-39}

In this study, the average scores of the family members were used to determine the overall quality of the family diet, while maintaining the adjustment for 1,000 kcal. This approach helps mitigate the impact of energy consumption, particularly in a population with heterogeneous dietary patterns due to varying age groups.^{29,30}

This study is innovative in that it addresses food insecurity (FI) and food consumption, taking into account all family members in rural areas. However, a limitation is the use of an index that includes beans in the "meat, eggs, and legumes" component, which may overestimate the score for this component. Beans were consumed regularly in all households, unlike meat and eggs, which could distort the results. It is believed that this bias was mitigated by adjusting the diet of all participants by caloric density since the relationship between FI and the lowest score of the component meat, eggs, and legumes was verified as expected. Another limitation is the non-inclusion of children under two years in the diet evaluation, due to the index not allowing evaluation of this age group.

Studies relating food consumption and FI are still rare and use different methodologies, some of these studies evaluate specific age groups or use the family food manager as a proxy for family consumption.^{5,8,31,33} When compared to the quality of diet according to FI or safety status, studies on this subject are even more limited. The evaluation of food consumption for the entire family, considering all its members, needs further exploration. Thus, this study contributes by assessing household food consumption based on the quality components of the diet, demonstrating the relationship between diet quality and the FI situation, and reinforcing the need for public policies in the areas of food and nutrition security (FNS), particularly in rural areas.

CONCLUSION

FI, as assessed by the EBIA, is associated with the poor diet quality of rural families, as evidenced by lower scores in components such as fruits, meat, eggs, and legumes. Methodologies for evaluating diet quality in groups, especially within families, should be further explored, as there are established techniques that remain underutilized. This study is innovative in its approach, assessing the diet quality of family units and linking it to their food security situation or FI. Exploring the family's food consumption in the context of FNS contributes to the diagnosis and monitoring of this situation in the country, and allows the development of public policies directed to the confrontation of FNI considering the existing specificities.

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Colaboradores

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