Original Article

Nutritional Contribution of Breakfasts Commercialized on Public Streets

Aporte nutricional de desayunos comercializados en la vía pública

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ABSTRACT

In this descriptive, quantitative, and cross-sectional study, the nutritional contribution and percentage of nutritional adequacy of energy, macronutrients, micronutrients, dietary fiber, added sugar, and energy density of the most frequently consumed preparations in street-vendor breakfasts were evaluated. These included quinoa beverage, oatmeal beverage, maca beverage, avocado sandwich, chicken sandwich, and bread with vegetable fritters, in an urban area of Lima. The breakfast most demanded by women (a beverage accompanied by a sandwich) covered 80.6% of energy nutritional goals, 77.1% of protein, 88.3% of total fat, 72.7% of total carbohydrates, 12.8% of calcium, 102.5% of iron, 7.6% of vitamin A, 29.5% of vitamin C, 272.3% of added sugar, 25.1% of saturated fat, and 33% of dietary fiber. Regarding the breakfast preferred by men (a beverage accompanied by two sandwiches), the nutritional goals met were 76.5% for energy, 59.8% for protein, 76.9% for total fat, 81.8% for total carbohydrates, 36.7% for calcium, 311.9% for iron, 49.8% for vitamin A, 59.4% for vitamin C, 184.3% for added sugar, 58% for saturated fat, and 56.9% for dietary fiber. The results revealed excesses of added sugars and deficiencies in energy, proteins, carbohydrates, dietary fiber, and micronutrients. Additionally, the three beverages and the avocado sandwich exhibited low energy density (0.4 kcal/g and 1.8 kcal/g, respectively), while chicken sandwich had the highest (3.6 kcal/g).

Keywords: Preparations, breakfasts, public streets, nutritional contribution.

RESUMEN

En este estudio descriptivo, cuantitativo y transversal se evaluó el aporte nutricional y % de adecuación nutricional de energía, macronutrientes, micronutrientes, fibra dietaria, azúcar añadido y densidad energética de las preparaciones consumidas con más frecuencia en los desayunos de venta callejera (bebida de quinua, bebida de avena, bebida de maca, pan con palta, pan con pollo y pan con torreja de verduras) en una urbanización en Lima.

El desayuno más demandado por las mujeres (una bebida acompañada de un sánguche) cubrió el 80,6 % de las metas nutricionales de energía, 77,1% de proteínas, 88,3 % de grasa total, 72,7 % de carbohidratos totales, 12,8 % de calcio, 102,5 % de hierro, 7,6 % de vitamina A, 29,5 % de vitamina C, 272,3 % de azúcar añadido, 25,1 % de grasa saturada y 33% de fibra dietaria. En cuanto al desayuno preferido por los hombres (una bebida acompañada de dos sándwiches), respecto a las metas nutricionales se alcanzó a cubrir 76,5 % de energía, 59,8 % de proteínas, 76,9 % de grasa total, 81,8 % de carbohidratos totales, 36,7 % de calcio, 311,9 % de hierro, 49,8 % de vitamina A, 59,4 % de vitamina C, 184,3 % de azúcar añadido, 58 % de grasa saturada y 56,9 % de fibra dietaria. Los resultados revelaron excesos de azúcares añadidos y deficiencias en energía, proteínas, carbohidratos, fibra dietaria y micronutrientes. Además, las tres bebidas y el pan con palta presentaron densidad energética baja (0,4 kcal/g y 1,8 kcal/g respectivamente), mientras el pan con pollo tuvo la más alta (3,6 kcal/g).

Palabras clave: Preparaciones, desayunos, vías públicas, contribución nutricional.

INTRODUCTION

Breakfast is the first meal of the day, breaking the overnight fast, and forms part of a balanced diet, providing greater adherence to nutritional recommendations and improved diet quality. It also contributes to better weight management and reduced cardio-metabolic risk indicators (Coronel, 2018). A breakfast that includes cereals, dairy products, fruits, and protein derivatives is considered complete and beneficial for physical and cognitive health (Navarro *et al.*, 2018). Breakfast consumption varies according to personal and family habits, particularly in terms of the time and place it is eaten. Many people opt to eat breakfast on the street when they are free, which in some cases does not meet their estimated nutritional requirements for this meal (Arriola *et al.*, 2018).

As noted by the World Health Organization (2020), overweight and obesity have increased globally, being risk factors for chronic non-communicable diseases. The primary cause is an energy imbalance due to increased consumption of high-calorie foods and decreased physical activity. Drewnowski (2017) stated that the consumption of energy-dense, low-cost, easily accessible, and excessively portioned foods can promote weight gain. According to the National Institute of Statistics and Informatics document, "Peru: Non-Communicable and Communicable Diseases, 2022," 63.1% of Peruvians aged 15 and older suffer from this condition, affecting two out of three individuals in urban areas and nearly one in two individuals in rural areas.

On the other hand, as Durán-Agüero *et al.* (2018) affirm, street food vending and consumption is a widespread phenomenon in all countries, accounting for nearly 30% of caloric intake and other nutrients. This addresses a demand for accessible and low-cost foods. In Peru, street food sales in public spaces have significantly increased (Durán, 2022). Currently, a portion of the urban population in the capital consumes their breakfast on public streets, often unaware of whether it meets their nutritional requirements.

An inadequate nutritional contribution—whether due to excess,

deficiency, or imbalance—could cause or worsen health problems. Finally, considering the importance of breakfast in public nutrition, this research determined and evaluated the nutritional contribution of energy, macronutrients, micronutrients, and energy density of breakfasts sold on public streets, identifying some risk situations. This will enable those involved in nutrition to propose measures to improve access to healthier meals for the users of this service.

MATERIALS AND METHODS

The population consisted of the six most commonly consumed preparations in breakfasts sold at street vending stalls in the public streets of the Maranga neighborhood, Lima, Peru. The analysis unit comprised three types of beverages and three types of sandwiches. The number of samples per preparation was 10, amounting to a total of 60 evaluated preparations. The samples were obtained from 10 conveniently selected vending stalls. Preparations with lower demand and sold outside this area were excluded.

To evaluate the variable of nutritional contribution of street-vendor breakfasts, a survey was applied to 50 breakfast consumers in the vicinity of a vending stall in this locality to identify the most popular breakfast preparations (considering the variables of breakfast type, beverages, and sandwiches most consumed) and simultaneously the socio-demographic profile of the consumer (considering variables such as gender, age range, and occupation). Based on the latter, their nutritional requirements were determined.

To approximate the nutritional contribution of typical street-vendor breakfast preparations, the net weight of the included ingredients was obtained. This was achieved through statements by each vendor using supporting materials (measuring cups, jars, and spoons). The data were provided as gross weight, cooked weight, and/or household measures, and auxiliary tables for dietary formulation and evaluation were used to convert them to net weight.

Additionally, the provided data were validated through content and consistency replicas of the preparations. Once the net weight values of each ingredient were determined, the nutritional contribution per 100 grams of each preparation was calculated. To obtain the nutritional contribution per usual portion, the average weight of three samples of each preparation was used.

The tool employed for these calculations was MS Excel, using Peruvian Food Composition Tables, as well as information from the Central American Food Composition Table and the Colombian Food Composition Table. Finally, the nutritional contribution of the most consumed combinations in street-vendor breakfasts was obtained and evaluated concerning its adequacy against established nutritional goals.

RESULTS AND DISCUSSION

Variability

High variability was observed in the average nutritional contribution of energy, macronutrients, micronutrients, and energy density. This heterogeneity in data is explained by the fact that the preparations were made by different individuals using varied ingredients and recipes.

Portion Size of Preparations

The average portion weights served at the sampled vending stalls were as follows: 266 grams for the quinoa, oatmeal, and maca beverages; 75 grams for the avocado sandwich (a value similar to that found by Arotinco *et al.* at a stall in downtown Lima); 80 grams for the bread with vegetable fritters; and 55 grams for chicken sandwich (a larger amount than that found by Arotinco *et al.* in 2020).

Sociodemographic Profile of Consumers of Street-Vendor Breakfasts

A survey conducted among 50 street-breakfast consumers to collect sociodemographic information revealed that 54% were men and 46% were women. Among both genders, the age group with the highest number of consumers was 30–59 years. In this population, men predominantly had non-light physical activity levels, while women primarily had light physical activity levels.

Although studies in Peru have previously analyzed the nutritional contribution of street-vendor foods, the sociodemographic profile of their consumers had not apparently been considered (Arotinco *et al.*, 2020), unlike in this study. Similar research has been conducted in other countries (Kovalskys *et al.*, 2022).

While the study by Kovalskys et al. included 8,714 adolescent and adult consumers from cities in eight Latin American countries, and Khusun et al. considered 1,333 individuals over 18 years from urban and rural areas in six provinces of Indonesia, this study focused on an urban area in Lima. It began with a survey of 50 individuals to identify the typical consumer profile of street-vendor breakfasts (gender, age group, and physical activity level) to determine their nutritional needs.

Main Types of Street-Vendor Breakfasts

Figure 1 shows the most consumed types of street-vendor breakfasts by gender. The majority of women consumed a beverage accompanied by one sandwich, while most men preferred a beverage with two sandwiches.

These results align with findings from a market research study on a protein drink by Cerón et al., which noted that young adults and adults often consumed a beverage paired with a solid food item.
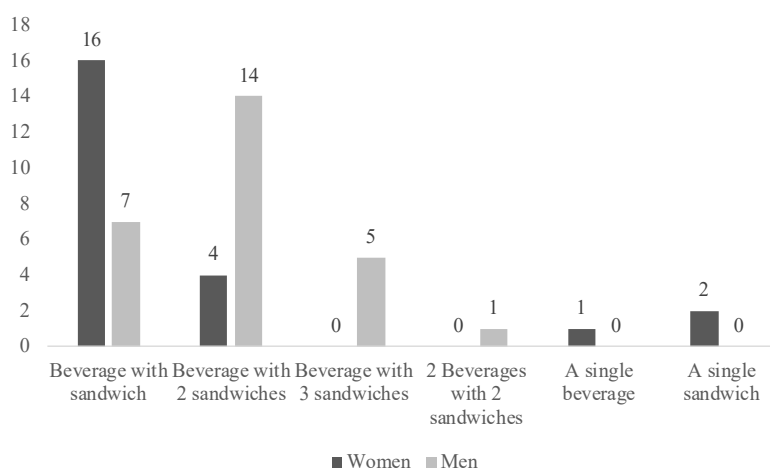

Figure 1. Main types of street-food breakfasts

Most Consumed Beverages in Street Food Breakfasts by Gender

As shown in Figure 2, the three beverages most consumed by men on the street were quinoa, maca and oatmeal, and by women were quinoa, oatmeal and emoliente, a traditional tea.

The findings of this study are similar to those of a project by Córdova *et al*. to establish a breakfast chain, which also identified quinoa, oatmeal, and emollient beverages as favorites among potential consumers. However, when comparing results with those of Cerón *et al.*, the overlap was only observed for the oatmeal beverage.

Most Consumed Sandwiches in Street Food Breakfasts by Gender

Figure 3 highlights that the three most popular sandwiches among men were avocado, vegetable fritters, and chicken. Similarly, women's preferences included chicken, avocado, and vegetable fritters sandwiches.

These results align with Córdova *et al.*'s market research, which also identified chicken and avocado sandwiches as frequently chosen by consumers.
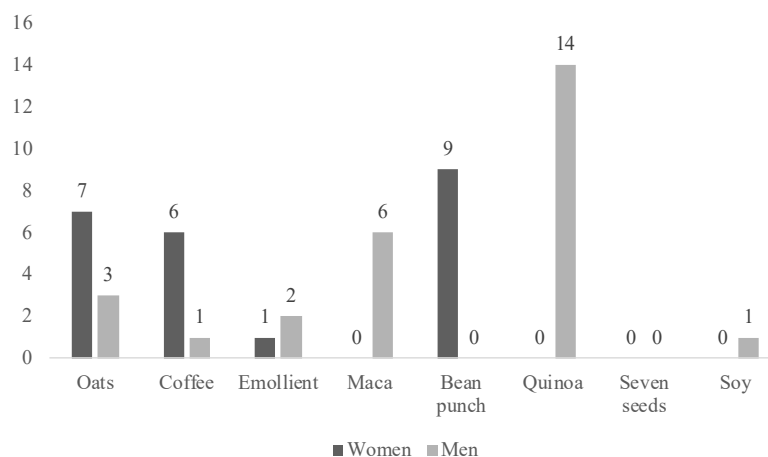

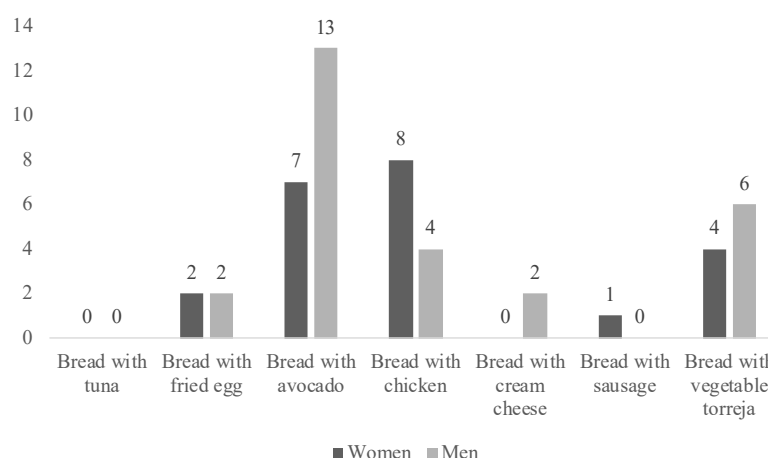**Figure 2.** Most consumed beverages in street food breakfasts by gender

Figure 3. Most consumed sandwiches in street food breakfasts by gender

Nutritional Contribution per 100 Grams of Preparations in Street Food Breakfasts

This study analyzed the average amounts of energy, macronutrients, micronutrients (critical in Peru), dietary fiber, added sugar, and energy density in 100 grams of the three most consumed beverages (Table 1) and sandwiches (Table 2).

According to the national regulations established by the Healthy Eating Promotion Law for Children and Adolescents approved by Law No. 30021, Supreme Decree N° 017-2017-SA that approves the Regulation of Law N° 30021 and Supreme Decree N° 012-2018-SA that approves the Advertising Warnings Manual, the average added sugar content in 100 grams of the beverages (quinoa, oatmeal, and maca) sold in Lima (Table 1) exceeded the technical parameters corresponding to Total Sugar in beverages (≥ 5 g/100 ml). However, since these are not processed foods, they are not subject to this legal framework. Nonetheless,

Table 1.

Nutritional energy (kcal), macronutrients (g), micronutrients (mg or µg) and energy density (kcal/g) in 100 grams of beverage marketed on the street

	Beverage Type		
	Quinoa	**Oatmeal**	**Maca**
	Avg. ± SD	Avg. ± SD	Avg. ± SD
Energy (kcal)	44.7 ± 9.4	42.4 ± 10.6	49.4 ± 11.8
Proteins (g)	0.4 ± 0.1	0.6 ± 0.3	0.6 ± 0.3
Total fat (g)	0.2 ± 0.1	0.2 ± 0.2	0.2 ± 0.1
Total carbohydrates (g)	11 ± 2.4	10.2 ± 2.3	12.2 ± 2.9
OF. (kcal/g)	0.4 ± 0.1	0.4 ± 0.1	0.4 ± 0.1
Calcium (mg)	6.2 ± 1.3	7.2 ± 6.3	10.4 ± 7.7
Phosphorus (mg)	5.7 ± 1.6	18.1 ± 8.2	13.2 ± 3.8
Zinc (mg)	0.1 ± 0	3.8 ± 11.3	0.1 ± 0
Iron (mg)	0.4 ± 0.3	0.3 ± 0.1	0.7 ± 0.4
Vitamins			
Vitamin A total equivalents (µg)	1.4 ± 2.4	0.4 ± 1.6	0 ± 0
Thiamine (mg)	0 ± 0	0 ± 0	0 ± 0
Riboflavin (mg)	0 ± 0	0 ± 0	0 ± 0
Niacin (mg)	0 ± 0	0 ± 0	0 ± 0
Vitamin C (mg)	1.4 ± 1.1	0 ± 0.1	0 ± 0.1
Added sugar (g)	7.2 ± 2.2	7.3 ± 2.4	8 ± 2.9
Saturated fat (g)	0 ± 0	0.1 ± 0.1	*
Dietary fiber (g)	0.4 ± 0.1	0.4 ± 0.1	0.3 ± 0.2

*Note: No data were found for some values

advertising warnings indicating "High in Sugar" and recommending avoidance of excessive consumption would be appropriate.

Regarding saturated fats, none of the beverages exceeded the legal limit (≥3 g/100 ml). The saturated fat content in the most popular beverages was very low and fell within permissible ranges, negating the need for warnings indicating "High in saturated fat - Avoid excessive consumption."

The quinoa, oatmeal, and maca beverages had energy density values of 0.4 ± 0.1 kcal/g. Compared to Drewnowski's references, these beverages were classified as low-energy-density foods (<1.51 kcal/g). However, studies cited by Drewnowski (2017) argue that sugary beverages, despite being low in energy density due to high water content, are significant sources of added sugar .

The sandwiches showed the following energy densities: bread with avocado, 1.8 ± 0.1 kcal/g; bread with chicken, 3.6 ± 0.2 kcal/g; and bread with vegetable fritters, 2.3 ± 0.2 kcal/g. These results correspond to medium (1.51–2.28 kcal/g) and high (>2.28 kcal/g) energy density categories.

The results of the added sugar content of the beverages in this study can confirm this statement, because the beverages analyzed, although they had a low energy density, characteristic of foods with a high water content, on the other hand, their added sugar content was high. The research conducted by Arotinco *et al.* analyzed the chemical nutritional content of quinoa, maca and soy beverages distributed in four breakfast outlets in the center of the capital city. When comparisons were made

on 100 grams of preparation, our results coincided with those of Arotinco *et al.* in the contents of total fat and total carbohydrates in the quinoa and maca drinks, but differed in the protein contents of these preparations (Arotinco *et al.* found values of 8.5 g in the quinoa drink and 1.45 g in the maca drink).

With regard to the saturated fat content in the most popular sandwiches from street food breakfasts analysed in this study (Table 2), and considering that the current legal framework (Healthy Eating Promotion Law for Children and Adolescents approved by DL No. 30021, Supreme Decree No. 017-2017-SA approving the Regulation of Law No. 30021, and Supreme Decree No. 012-2018-SA approving the Advertising Warnings Manual) does not apply to the culinary preparations evaluated, none of the sandwiches sold on the streets of Maranga exceeded the established saturated fat limit of ≥4 g/100 g in solid foods. The average contribution in avocado, chicken, and vegetable fritter sandwiches was 1.8 ± 1 g per 100 g, meaning they remained within the permissible range. Therefore, in these cases, it would not have been necessary to include a warning label stating "High in Saturated Fat – Avoid Excessive Consumption."

Regarding the Energy Density (E.D.) values of the sandwiches, the avocado sandwich had an average E.D. of 1.8 ± 0.1 kcal/g, the chicken sandwich 3.6 ± 0.2 kcal/g, and the vegetable fritter sandwich 2.3 ± 0.2 kcal/g. Comparing these results with references cited by Drewnowski (2017), the avocado sandwich was classified as medium E.D. (between 1.51 and 2.28 kcal/g), while both the chicken and vegetable fritter sandwiches fell into the high E.D. category (greater than 2.28 kcal/g). In contrast, the study

by Cuthbert *et al.* (2017) identified that the highest energy density foods regularly consumed by school-aged children were sweet biscuits containing refined sugar, which had an energy density above 4.5 kcal/g. Meanwhile, in the present study, the chicken sandwich had the highest energy density (3.6 kcal/g). Additionally, a study conducted by Arotinco *et al.* (2020) also examined the nutritional composition of chicken and avocado sandwiches, among other preparations sold at four street breakfast stalls in central Lima. When comparing the macronutrient content of these foods between our study and that of Arotinco *et al.*, there was consistency in the results for avocado sandwiches (average values of total carbohydrates 29.5 g, proteins 6.0 g, and total fat 7.2 g). However, there were greater differences in the macronutrient content of the chicken sandwich, with Arotinco *et al.* reporting average values of total carbohydrates 48 g, proteins 9.3 g, and total fat 1.2 g.

Table 2.

Nutritional energy (kcal), macronutrients (g), micronutrients (mg or µg) and energy density (kcal/g) in 100 grams of street sandwiches

	Sandwich type		
	Avocado	**Chicken**	**Vegetable Fritters**
	Avg. ± SD	Avg. ± SD	Avg. ± SD
Energy (kcal)	180.3 ± 11.7	355.1 ± 22	233.4 ± 20.4
Proteins (g)	4 ± 0.4	14.3 ± 1.7	7.7 ± 1.2
Total fat (g)	8.3 ± 1	18 ± 1.2	8.3 ± 1.8
Total carbohydrates (g)	25 ± 4.4	28.3 ± 1.4	33.2 ± 5.8
OF. (kcal/g)	1.8 ± 0.1	3.6 ± 0.2	2.3 ± 0.2
Minerals			
Calcium (mg)	31.7 ± 0.4	20.3 ± 2.4	41.3 ± 8.3
Phosphorus (mg)	78.4 ± 2.7	126.9 ± 12	90.9 ± 11.1
Zinc (mg)	0.7 ± 0	0.3 ± 0	0.8 ± 0.1
Iron (mg)	1.4 ± 0.2	1.8 ± 0	3.2 ± 0.4
Vitamins			
Vitamin A total equivalents (µg)	4.6 ± 0.6	12.9 ± 20.8	103.1 ± 36.1
Thiamine (mg)	0.1 ± 0	0.1 ± 0	0.2 ± 0
Riboflavin (mg)	0.2 ± 0	0.2 ± 0	0.2 ± 0
Niacin (mg)	2.3 ± 0.1	4.8 ± 0.6	1.9 ± 0.4
Vitamin C (mg)	4.8 ± 0.4	0.8 ± 0.4	3.9 ± 1.2
Saturated fat (g)	1.4 ± 0.2	1.2 ± 0.1	1.8 ± 1
Dietary fiber (g)	0.8 ± 0.2	1.1 ± 0.1	1.6 ± 0.2

Nutritional Contribution and Nutritional Adequacy Percentage of Energy, Macro, and Micronutrients per Serving According to the Type of Breakfast Preferred by Street Consumers

The results of nutritional contribution for energy, macronutrients, micronutrients (critical in Peru), dietary fibre, and added sugar per usual serving, classified by the type of street breakfast and consumer gender, are presented in Table 3 (male consumers) and Table 4 (female consumers). Additionally, the corresponding nutritional targets for this meal (20% of the Daily Requirement) and the percentage of nutritional adequacy are displayed.

Table 3.

Energy, macro and micronutrient intake and nutritional adequacy percentages per serving by type of breakfast preferred by male consumers in public places (quinoa beverage, avocado sandwich and vegetable fritter sandwich

Nutrient	Total	Nutritional Target for Breakfast		% Adequacy of Breakfast Recommendations	
Energy (kcal)	441	576.4		76.4	
Proteins (g)	10.3	14.4[a]	21.6[b]	71.8[c]	47.9[d]
Total Fat (g)	13.4	16[e]	19.2[f]	83.9[g]	69.9[h]
Total Carbohydrates (g)	74.8	79.3[i]	108.1[j]	94.3[k]	69.2[l]
Calcium (mg)	73.4	200		36.7	
Iron (mg)	5	1.6		311.9	
Vitamin A (µg)	89.6	180		49.8	
Vitamin C (mg)	10.7	18		59.4	
Added sugar (g)	17.7	7.2[m]	14.4[n]	245.7[ñ]	122.8[o]
Saturated fat (g)	2.6	4.4		58	
Dietary fiber (g)	3.1	5[p]	6[q]	62[r]	51.7[s]

(a) The nutritional target was obtained based on 10% of the Total Caloric Value. **(b)** The nutritional target was obtained based on 15% of the Total Caloric Value. **(c)** The % Adequacy was calculated considering 10% of the Total Caloric Value. **(d)** The % Adequacy was calculated considering 15% of the Total Caloric Value. **(e)** The nutritional target was obtained based on 25% of the Total Caloric Value. **(f)** The nutritional target was obtained based on 30% of the Total Caloric Value. **(g)** The % Adequacy was calculated considering 25% of the Total Caloric Value. **(h)** The % Adequacy was calculated considering 30% of the Total Caloric Value. **(i)** The nutritional target was obtained based on 55% of the Total Caloric Value. **(j)** The nutritional target was obtained based on 75% of the Total Caloric Value. **(k)** The % Adequacy was calculated considering 55% of the Total Caloric Value. **(l)** The % Adequacy was calculated considering 75% of the Total Caloric Value. **(m)** The nutritional target was obtained based on 5% of the Total Caloric Value. **(n)** The nutritional target was obtained based on 10% of the Total Caloric Value. **(o)** The % Adequacy was calculated considering 5% of the Total Caloric Value. **(p)** The % Adequacy was calculated considering 10% of the Total Caloric Value. **(q)** The nutritional target was obtained based on 25% of the Total Caloric Value.**(r)** The nutritional target was obtained based on 30% of the Total Caloric Value. **(s)** The % Adequacy was calculated considering 25% of the Total Caloric Value. **(t)** The % Adequacy was calculated considering 30% of the Total Caloric Value.

Table 4.

Energy, macro and micronutrient intake and nutritional adequacy percentages per serving by type of breakfast preferred by female consumers in public places (Quinoa beverage and chicken sandwich)

Nutrient	Total	Nutritional Target for Breakfast		% Adequacy of Breakfast Recommendations	
Energy (kcal)	314.2	390		80.6	
Proteins (g)	9	9.8[a]	14.6[b]	92.4c	61.7[d]
Total Fat (g)	10.4	10.8[e]	13[f]	96.3g	80.2[h]
Total Carbohydrates (g)	45	53.6[i]	73.1[j]	83.8k	61.4[l]
Calcium (mg)	27.8	200[m]	240[n]	13.9ñ	11.6[o]
Iron (mg)	2.3	3.6[m]	1.6[n]	63.1ñ	141.9[o]
Vitamin A (µg)	10.7	140		7.6	
Vitamin C (mg)	4.4	15		29.4	
Added sugar (g)	17.7	4.9[p]	9.8[q]	363.1r	181.4[s]
Saturated fat (g)	0.8	3		25.1	
Dietary fiber (g)	1.8	5[t]	6[u]	35.8v	29.8[w]

(a) The nutritional target was obtained based on 10% of the Total Caloric Value. **(b)** The nutritional target was obtained based on 15% of the Total Caloric Value. **(c)** The % Adequacy was calculated considering 10% of the Total Caloric Value. **(d)** The % Adequacy was calculated considering 15% of the Total Caloric Value. **(e)** The nutritional target was obtained based on 25% of the Total Caloric Value. **(f)** The nutritional target was obtained based on 30% of the Total Caloric Value. **(g)** The % Adequacy was calculated considering 25% of the Total Caloric Value. **(h)** The % Adequacy was calculated considering 30% of the Total Caloric Value. **(i)** The nutritional target was obtained based on 55% of the Total Caloric Value. **(j)** The nutritional target was obtained based on 75% of the Total Caloric Value. **(k)** The % Adequacy was calculated considering 55% of the Total Caloric Value. **(l)** The % Adequacy was calculated considering 75% of the Total Caloric Value. **(m)** The nutritional target was obtained based on 20% of the daily recommendation for women aged 30–50 years. **(n)** The nutritional target was obtained based on 20% of the daily recommendation for women aged 51–70 years. **(o)** The % Adequacy was calculated considering 20% of the daily recommendation for women aged 30–50 years. **(p)** The % Adequacy was calculated considering 20% of the daily recommendation for women aged 51–70 years. **(q)** The nutritional target was obtained based on 5% of the Total Caloric Value. **(r)** The nutritional target was obtained based on 10% of the Total Caloric Value. **(s)** The % Adequacy was calculated considering 5% of the Total Caloric Value. **(t)** The % Adequacy was calculated considering 10% of the Total Caloric Value. **(u)** The nutritional target was obtained based on 25% of the Total Caloric Value. **(v)** The nutritional target was obtained based on 30% of the Total Caloric Value. **(w)** The % Adequacy was calculated considering 25% of the Total Caloric Value. **(x)** The % Adequacy was calculated considering 30% of the Total Caloric Value.

To estimate the intake of macronutrients, dietary fiber, saturated fat, added sugars, and certain micronutrients considered critical for the Peruvian population (calcium, iron, vitamin A, and vitamin C), this study used reference values established by the National Center for Food and Nutrition (CENAN), the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the Institute of Medicine (IOM) of the United States. This differs from the study

by Kovalskys *et al.*,(2022) which used Daily Reference Values (DRV) based on the Dietary Reference Intakes (DRIs) from the Institute of Medicine (IOM) of the United States.

The energy intake from the most consumed breakfast by women in public streets in our study was 314 kcal, which is close to the 325 kcal reported by Kovalskys *et al.* (2022) for the same age group. For men, the breakfast analyzed in this research provided 441 kcal, similar to the 410 kcal reported for adolescents in Kovalskys *et al.*'s study. Additionally, in a study by Khusun *et al.* in Indonesia, the average energy intake from breakfast among adults was 396 kcal, representing 21–26% of daily energy intake and 16–26% of the Recommended Dietary Allowances (RDA).

Regarding macronutrient intake in breakfast, our research found protein intake ranged from 47.9–71.8% for male consumers and 61.7–92.5% for female consumers. Total fat intake ranged from 69.9–83.9% for male consumers and 80.2–96.3% for female consumers. Total carbohydrate intake ranged from 69.2–94.3% for male consumers and 61.5–83.8% for female consumers. In contrast, the study by Khusun *et al.* (2023) reported that 12.7% of breakfast energy came from proteins, 31.2% from total fats, and 55.2% from carbohydrates.

Saturated fat intake in this study covered 25% (women) and 58% (men) of the recommended daily limit for the first meal of the day. In comparison, Khusun *et al.* (2023) reported a 12.2% contribution from saturated fats. Added sugar intake in beverages ranged from 122.8% to 363% of the recommended daily limit for breakfast in male and female consumers, significantly exceeding the 1.5% reported in Khusun *et al.*'s study in Indonesia.

Regarding micronutrient intake, in a study by Maeshiro (2018) at an educational institution in Lima, calcium was found to cover the lowest percentage of the Estimated Average Requirement (EAR), which aligns with our findings. In our study, calcium intake in men only covered 36.7% of the recommended intake, while in women aged 30–50 years, it covered only 13.9%, and in women aged 51–70 years, just 11.6%. This deficiency can be explained by the fact that the most consumed breakfast preparations do not include a high-calcium food source.

Iron intake in our study covered 311.9% of the recommended intake for men, 63.1% for women aged 30–50 years and 141.9% for women aged 51–70 years. The predominant iron type was non-heme iron, which aligns with the study by Navarro *et al.* (2017) in Costa Rica, where the main sources of iron were also plant-based foods. On the other hand, the study by Huapaya, Salazar, and Vera (2011) on nutritional intake from street breakfasts in downtown Lima found that soy milk with avocado sandwich covered 45–60% of iron requirements and 55–65% of calcium needs among its main consumers. In addition, the combination of quinoa beverages with an omelette sandwich covered 15–35% of iron needs. Quinoa beverage with an egg sandwich provided 40–50% of calcium needs, also falling short of the required nutritional adequacy. Both our study and Navarro et al.'s (2017) research on school lunches in Costa Rica found low dietary fiber intake. The deficiency was greater in street breakfasts, covering only 7.2% and 12.4% of the daily fiber recommendation for women and men, respectively, compared to a 6% deficit in Costa Rican school meals.

Nutrient Adequacy Percentage Compared to Breakfast Targets (Male Consumers)

Figure 4 shows the percentage of adequacy for each nutrient (vertical bars) relative to the nutritional target (horizontal line) for the most consumed male breakfast. The adequacy percentages were taken from Table 3. For nutrients with adequacy percentages expressed as ranges, the mean value was used.
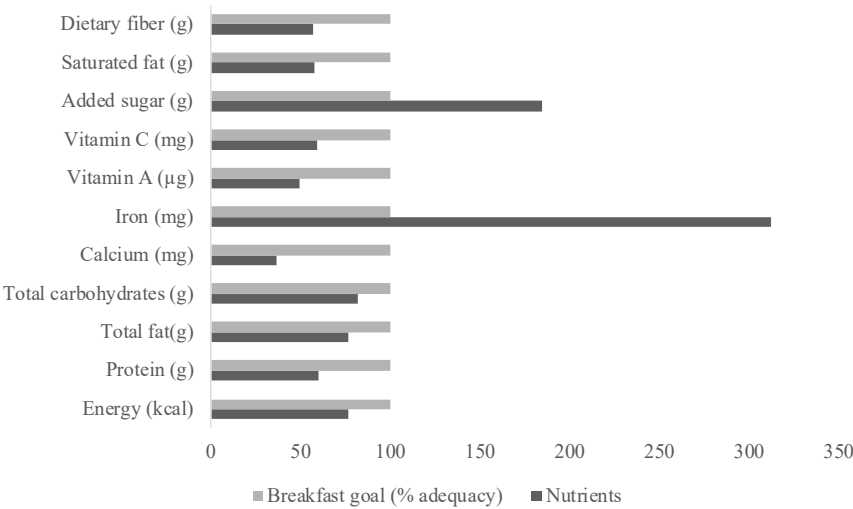
Nutrient Adequacy Percentage Compared to Breakfast Targets (Female Consumers)

Figure 5 illustrates the percentage of adequacy for each nutrient (vertical bars) relative to the nutritional target (horizontal line) for the most consumed female breakfast. The adequacy percentages were taken from Table 4. For nutrients with adequacy percentages expressed as ranges, the mean value was used.

Figure 4. Nutrient adequacy percentage compared to breakfast targets (male consumers)
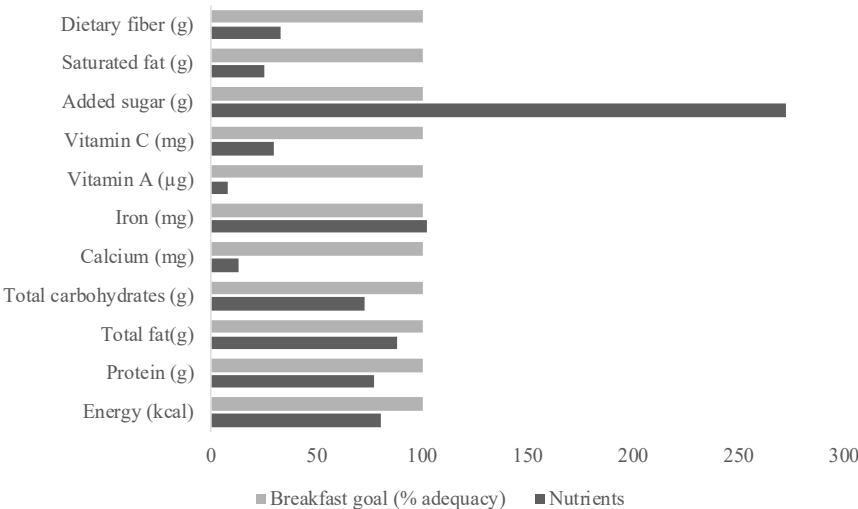

Figure 5. Nutrient adequacy percentage compared to breakfast targets (female consumers)

CONCLUSION

The consumption of street-vendor breakfasts is an increasingly common dietary practice among urban residents due to factors such as time constraints, convenience, affordability, taste, and perceived nutritional value. In this study, we not only identified the most commonly consumed street breakfasts and evaluated their nutritional contributions in terms of energy, macronutrients, micronutrients, and energy density, but also profiled the typical consumer and their nutritional requirements to assess whether street foods meet their dietary needs.

The results correspond to a low level of nutritional adequacy, with deficiencies in critical nutrients such as iron and calcium and dietary fiber and high amounts of added sugars. This information may contribute to improving the supply of food for mass consumption and to make nutritional recommendations according to the eating habits of the users of this service.

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