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Sport Types and Time Spent Playing Sport Are Associated with Eating Pattern Among Young Brazilian Athletes

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Abstract

Background: Nutritional studies on athletes have focused on the intake of nutrients and nutritional supplements. The lack of sufficient evidence on eating pattern is challenging for those advising athletes on their daily dietary patterns during training and competitions.
Objectives: To identify the eating pattern of high school athletes and its association with sport characteristics.
Methods: This cross-sectional study enrolled 248 Brazilian athletes (170 boys; age range, 14 - 20 years). We assessed the frequency of meals, unhealthy and healthy food items, and sports variables. Poisson regression model and the effect measure [prevalence ratio, PR] was analyzed.
Results: The athletes exhibited low breakfast consumption and lunch or dinner with parents, as well as a low consumption of healthy food items. More than one-third of all athletes ate vegetables and fruits on $\leq$ 2 days per week. We found a positive association between the time spent practicing the sport type and the regular consumption of raw salad and fruits. Soccer athletes had the worst eating pattern, including high soft drink (PR, 1.32; 1.10 - 1.60) consumption and the lowest bean (PR, 1.13; 1.01 - 1.26), raw salad (PR, 1.19; 1.04 - 1.37), and vegetable (PR, 1.10; 1.01 - 1.22) consumption, whereas the volleyball players exhibited the most adequate eating pattern.
Conclusions: Sports types and the time spent practicing these sports are associated with eating pattern. This information may be crucial for improving performance and promoting healthy habits that could benefit athletes even after their sports career.

Keywords: Sports, Food Groups, Dietary Habits, Eating Behavior, Health Food

1. Background

In addition to ensuring optimal performance in sports, adequate nutrition is essential for optimal growth, development, and maturation in young athletes (1). Firstly, with regard to performance, the main focus of athletes is adequate energy and nutrient intake and the avoidance of conditions related to nutritional deficiencies, including muscle mass loss, body mass and/or hormonal imbalances, and injuries (2). Secondly, with regard to health, developing a good eating pattern (such as having breakfast, adequate choice and frequency of healthy foods) that is continued in adulthood may reduce the risk of disordered eating and chronic diseases (3). Furthermore, unhealthy eating pattern is associated with poor mental health (4) and academic performance (5).

Most of the studies on nutrition in athletes focus on the intake of nutrients (6), nutrient and water intake (7), nutritional supplement consumption (8), and eating disorders (9). This approach evaluates the intake adequacy by comparing individual nutrients with current recommendations. The lack of evidence on eating pattern is challenging for those advising athletes on their daily dietary patterns during training and competitions (10), and for those developing public policies for education and health promotion (11).

However, recent studies have increasingly been assessing the food consumption frequency and quality in adolescents and adults (12, 13), and whether the foods are unprocessed, processed, or ultra-processed (14). This evidence is crucial, as nutrition-specific education programs should address both food choices and meals, and not just the required nutrients (10). However, to our knowledge, only a few studies have evaluated the eating pattern from young athletes as well its association with characteristics of sport participation in developed countries (15), and there is a lack of studies that have been conducted in emerging countries (10).

Many adolescents do not live under ideal educational, health and training circumstances (16). A recent survey showed that only 16.3% of adolescents who participated in

sports have a coach or receive any instructions for practice (17), thus emphasizing the precarious training conditions those adolescents were exposed to. These conditions reinforce the need to understand eating pattern, and to identify the factors associated with unhealthy habits.

2. Objectives

Here, we aimed to identify the eating pattern in high school athletes, and its association with characteristics of sport participation.

3. Methods

The analyses in the present cross-sectional study were based on data from the "Brazilian High School Athlete Study: Health-related Outcomes", which is a study performed during the state phase of the 2015 Federal Institutes Games (FIGs) in Brazil (18). The FIGs are organized annually and the top-ranked athletes are selected and follow the regional and national phases. The athletes were from high school classes at federal institutes representing 12 cities of the state of Goiás in the Brazilian Midwest.

All regular athletes enrolled at FIG were invited to participate in the present study (n = 361). A total of 320 athletes were included by the following inclusion criteria: age of 14 - 20 years who had no previous history of musculoskeletal surgery and were participating in one the following sport types: soccer, handball, volleyball, and basketball. Of these, 42 declined to participate and 27 were injured. Therefore, 251 athletes were evaluated in our study.

Prior to participation, the athletes and their parents or guardians, in the case of minors, voluntarily signed an informed consent form approved specifically for this study. The present study was performed in accordance with the Helsinki Declaration, and was approved by the Ethics Committee for Human Research of the Instituto Federal Goiano (number 1.630.480).

3.1. Data Collection Procedure

To measure body weight and height, a digital scale with maximum capacity of 150 kg and accuracy of 100 g (Plenna-MEA-03140, São Paulo, Brazil) and stadiometer accurate to 0.1 mm were used, respectively. Thereafter, the body mass index (BMI) was calculated by dividing the mass by the square of the height (kg/m^2); these values were then classified according to the standard deviation (SD) of the BMI Z-scores, based on the World Health Organization's Growth Reference data (19), as follows: normal weight (-2 SD $<$ BMI Z-score $<$ 1 SD), overweight (1 SD $\leq$ BMI Z-score $<$ 2 SD), or obese (BMI Z-score $\geq$ 2 SD). Students wore light clothes at the evaluations and were instructed to remain standing upright, with shoulders relaxed and the face directed forward.

The athletes reported on their weekly frequency of physical exercise (1, 2, 3, 4, and $\geq$ 5 days per week), annual competition frequency (1 per year, or $\geq$ 2 per year), sports type (volleyball, basketball, handball, or soccer), and time spent practicing this sport (months). We used a validated and reproducible questionnaire from The Brazilian National School-Based Health Survey (PeNSE) (16, 20) to assess the eating pattern. Food consumption was assessed based on the frequency of consumption of the 5 following healthy food items in the previous 7 days: bean, raw salad (cucumber, lettuce, tomato, carrot, and onion), vegetables (cabbage, chayote, broccoli, spinach, and pumpkin), fruits, and milk; as well as the 5 following unhealthy food items in the previous 7 days: deep-fried salty snacks, processed meat (hamburger, sausage, and ham), bagged salty snacks, sweets, and soft drinks. All survey questions had the following associated response options: 0, 1, 2, 3, 4, 5, and 6 times a week, and daily. Food consumption was categorized as regularly consumed (at least 5 days in the previous 7 days) or not regularly consumed for data analysis (12).

The questionnaire also evaluated healthy behaviors, such as how often the athlete usually "had breakfast", and "lunch and dinner with parents", as well as unhealthy behavior, such as "eating in front of the TV". The responses to these questions were also categorized as regular practice (at least 5 days in the previous 7 days) or not regular practice (21). All athletes are regularly enrolled in school and study in the mornings, so we consider breakfast between 6 and 8:59 am (22). At the weekend it was considered the same timing of breakfast.

At the outset of the study, the researcher explained to the subjects in a group meeting how the questionnaire should be answered. The subjects then answered the questionnaires individually. The PeNSE reliability was tested on 34 high school students by the 7-day test-retest protocol. All the questions indicated good and very good values (Kappa range, 0.701 - 0.841).

Handgrip strength was evaluated using a manual force dynamometer (EMG System, model TRF_MAN200, São José dos Campos, Brazil; nominal capacity, 200 kg; sensitivity, 2 mV/V $\pm$ 10%; error $<$ 0.03%; input resistance, 405 Ω; output resistance, 350 Ω). The equipment was adjusted according to each athlete's size and was calibrated prior to data collection. The data were collected using a signal conditioner, with 16 channels, and an A/D converter with 16-bit resolution and 100$\times$ amplification. Data reliability was tested with the same protocol as aforementioned and a high intra-class correlation coefficient (ICC = 0.974, 0.969 - 0.981) was observed.

For the collection of handgrip strength data, the athlete sat with the elbow flexed at 90°, shoulders adducted and neutrally rotated, forearm in the neutral position, and the wrist with a 10° extension. The participants executed two valid isometric trials of 5 s for right handgrip strength,

and the largest value was computed. Athletes were motivated to perform maximum handgrip strength. A resting period of 60 s between each trial was allowed. Strength were normalized by body weight (BW). Athletes were categorized according to tertiles: 1° tertile (lowest), 2° tertile, and 3° tertile (highest).

3.2. Statistical Analysis

The analyses were performed by the Statistical Package for the Social Sciences (SPSS 20.0). Data were analyzed using descriptive statistics and the Wald chi-Square test of association (bivariate analysis) for all eating pattern outcomes. The sports variables (weekly frequency, competition, sport type, time spent practicing this sport, and handgrip strength) were considered as independent variables. The independent variables with a level of significance of $P < 0.20$ in the bivariate analysis were included in a multivariable analysis according to the Poisson regression model with robust variance. The effect measure was the prevalence ratio (PRs) with its respective 95% confidence intervals (CIs) (23). The reference category to calculate the PR for each variable was considered the lower prevalence. The multivariable analyses were adjusted for sociodemographic (gender and age) and anthropometric (body mass index) variables, and the threshold $\alpha = 0.05$ was used to indicate statistical significance.

4. Results

Of the enrolled students, 248 (98.8%) completed the protocol, including 170 male and 78 female athletes. The mean age, weight, height, and BMI of the athletes were 16.4 ± 1.4 years, 65.2 ± 12.1 kg, 1.71 ± 0.09 m, and 22.33 ± 3.15 kg/m^2, respectively; 73.5% of the athletes exhibited normal BMI. The athletes exhibited low regular breakfast consumption (54.4%) and few had lunch or dinner with parents (35.5%). Moreover, we found a low consumption of healthy items, such as vegetables, fruits, and milk. In fact, more than one-third of all the athletes ate vegetables and fruits $\leq$ 2 days per week. With regard to unhealthy food items, the majority of athletes consumed deep-fried salty snacks, processed meats, and bagged salty snacks $\leq$ 2 days per week (Table 1).

Bivariate analysis indicated an association between sports variables and meal consumption, healthy food items, and unhealthy food items (Tables 2 - 4). After these variables were inserted in the multivariable analysis, the following associations remained: (a) inadequate fruit and soft drink consumption with playing basketball; (b) inadequate consumption of beans, raw salad, vegetable, and soft drinks with playing soccer; (c) irregular breakfast consumption with playing basketball and soccer; (d) irregular having lunch and dinner with parents with playing handball and basketball; and (e) irregular consumption of raw salad and fruits with time spent practicing the sport type (Table 5).

Table 1. Healthy and Unhealthy Eating Pattern of High School Athletes.

Eating Pattern (N = 248)	Total, No. (%)
Healthy Eating Pattern	
Have breakfast, days per week	
0 - 2	86 (34.7)
3 - 4	27 (10.9)
5 - 7	135 (54.4)
Lunch/dinner with parents, days per week	
0 - 2	145 (58.5)
3 - 4	15 (6.0)
5 - 7	88 (35.5)
Bean consumption, days per week	
0 - 2	17 (7.0)
3 - 4	27 (11.0)
5 - 7	200 (82.0)
Raw salad consumption, days per week	
0 - 2	57 (23.2)
3 - 4	59 (24.0)
5 - 7	130 (52.8)
Vegetable consumption, days per week	
0 - 2	140 (56.9)
3 - 4	60 (24.4)
5 - 7	46 (18.7)
Fruit consumption, days per week	
0 - 2	95 (38.8)
3 - 4	82 (33.5)
5 - 7	68 (27.7)
Milk consumption, days per week	
0 - 2	107 (43.5)
3 - 4	48 (19.5)
5 - 7	91 (37.0)
Unhealthy Eating Pattern	
Eating in front of the TV, days per week	
0 - 2	166 (66.9)
3 - 4	21 (8.5)
5 - 7	66 (24.6)
Deep-fried salty snack consumption, days per week	
0 - 2	157 (64.1)
3 - 4	63 (25.7)
5 - 7	25 (10.2)
Processed meat consumption, days per week	
0 - 2	185 (76.1)
3 - 4	44 (18.1)
5 - 7	14 (5.8)
Bagged salty snack consumption, days per week	
0 - 2	189 (77.2)
3 - 4	38 (15.5)
5 - 7	18 (7.3)
Sweets consumption, days per week	
0 - 2	107 (43.7)
3 - 4	65 (26.5)
5 - 7	73 (29.8)
Soft drink consumption, days per week	
0 - 2	100 (40.8)
3 - 4	75 (30.6)
5 - 7	70 (28.6)

Table 2. Association (χ^2) and Prevalence Ratio Between Meal Consumption and Independent Variables

Variables	Total, %	Have Breakfast[a]		Lunch/Dinner with Parents[a]		Eating in Front of the TV[b]	
		%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)
Weekly frequency, d			P = 0.705		P = 0.008[c]		P = 0.489
1 - 2	48.8	47.5	1.04 (0.95 - 1.14)	60.2	1	22.9	1.09 (0.71 - 1.67)
3 - 4	40.5	41.8	1	63.3	1.02 (0.94 - 1.10)	28.6	1.23 (0.81 - 1.90)
≥ 5	10.7	46.2	1.03 (0.89 - 1.19)	84.6	1.15 (1.05 - 1.26)	19.2	1
Competition, per year			P = 0.590		P = 0.156		P = 0.623
Only 1	48.5	46.6	1.02 (0.94 - 1.12)	60.3	1	23.3	1
≥ 2	51.5	43.1	1	69.1	1.05 (0.98 - 1.13)	26	1.06 (0.83 - 1.36)
Sport type			P = 0.033[c]		P = 0.045[c]		P = 0.576
Basketball	14.1	62.5	1.22 (1.06 - 1.40)	78.1	1.14 (1.03 - 1.26)	21.9	1.13 (0.70 - 1.82)
Handball	15.4	40	1.05 (0.91 - 1.27)	74.3	1.12 (1.01 - 1.24)	17.1	1
Volleyball	26.4	33.3	1	66.7	1.07 (0.97 - 1.17)	28.3	1.30 (0.86 - 1.96)
Soccer	44.1	48	1.11 (0.99 - 1.24)	56	1	27	1.26 (0.86 - 1.86)
Practice, y			P = 0.715		P = 0.214		P = 0.986
0 -1	27.7	47.5	1.04 (0.93 - 1.16)	72.1	1.10 (0.99 - 1.22)	24.6	1.03 (0.58 - 1.86)
> 1 - 5	39.1	41.9	1	62.8	1.04 (0.94 - 1.15)	26.7	1.08 (0.61 - 1.91)
> 5 - 10	27.3	50	1.06 (0.94 - 1.18)	56.7	1	25	1.04 (0.58 - 1.87)
> 10	5.9	53.8	1.08 (0.89 - 1.31)	76.9	1.13 (0.97 - 1.31)	23.1	1
Handgrip strength			P = 0.775		P = 0.652		P = 0.604
1° Tertile	33.5	42.7	1	64.6	1.02 (0.93 - 1.12)	25.6	1.12 (0.83 - 1.51)
2° Tertile	33.5	46.3	1.03 (0.92 - 1.14)	61	1	20.7	1
3° Tertile	33	48.1	1.04 (0.95 - 1.15)	67.9	1.04 (0.95 - 1.14)	27.2	1.16 (0.86 - 1.56)

Abbreviations: PR, prevalence ratio; 95% CI, 95% confidence interval.
[a] Irregular practice (< 5 days in the previous 7 days).
[b] Regular practice (at least 5 days in the previous 7 days).
[c] Data reflect statistical significance (P < 0.05).

5. Discussion

The main results show that sports types and the time spent practicing these sports are associated with eating pattern variables. Soccer athletes had the worst eating pattern, since they had high soft drink consumption and the lowest bean, raw salad, and vegetable consumption. We found a positive association between the time spent practicing sports and the regular consumption of healthy food items. In contrast with the nutrient intake data, this is the first study to assess the eating pattern of high school athletes from Latin America (10), and it provides a detailed view of the food consumption in athletes and offers important information for instituting appropriate interventions and planning public policies that could benefit athletes even after their sports career.

We found some differences in the meal consumption characteristics and food items between sport types. Although they had higher lunch or dinner with parents, soccer athletes had the worst eating pattern. A recent review (24) presented an unanimous agreement on the inadequate nutrient intake of soccer players, even though they only found a few studies evaluating the eating pattern. A study (25) of British professional soccer players described several important aspects of the soccer culture that impact the nutritional consumption of athletes, such as the traditional ideas that are prevalent in the sport; the power possessed by the managers, who were generally former players and practiced the nutrition knowledge they acquired through their own professional careers; the fact that many clubs infrequently work with sports nutritionists (25). These findings highlight the need for interventions, particularly in countries such as Brazil, where soccer is the most popular sport among young individuals (17). Although volleyball players exhibited better healthy habits, eating patterns between different sport types cannot be appropriately compared due to the lack of studies.

High soft drink consumption is associated with soccer

Table 3. Association (χ^2) and Prevalence Ratio Between Irregular Consumption of Healthy Food Items and Independent Variables

Variable	Total, %	Bean Consumption[a]		Raw salad Consumption[a]		Vegetable Consumption[a]		Fruit Consumption[a]		Milk Consumption[a]	
		%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)
Weekly frequency, d			P = 0.686		P = 0.875		P = 0.881		P = 0.814		P = 0.399
1 - 2	48.8	16.2	1	47.9	1.04 (0.89 - 1.20)	81.2	1.02 (0.93 - 1.13)	70.1	1	64.1	1.09 (0.95 - 1.26)
3 - 4	40.5	20.8	1.04 (0.95 - 1.14)	47.4	1.03 (0.89 - 1.20)	81.4	1.03 (0.93 - 1.14)	74	1.02 (0.95 - 1.10)	64.9	1.10 (0.96 - 1.27)
≥ 5	10.7	19.2	1.03 (0.89 - 1.18)	42.3	1	76.9	1	73.1	1.02 (0.91 - 1.14)	50	1
Competition, per year			P = 0.298		P = 0.159		P = 0.774		P = 0.138		P = 0.123
Only 1	48.5	20	1.04 (0.96 - 1.13)	42.1	1	79.8	1	67.5	1	67.8	1.06 (0.98 - 1.14)
≥ 2	51.5	14.9	1	51.2	1.06 (0.98 - 1.16)	81.3	1.01 (0.95 - 1.07)	76.2	1.05 (0.98 - 1.13)	58.2	1
Sport type			P = 0.057		P = 0.004		P = 0.046		P = 0.119		P = 0.839
Basketball	14.1	6.2	1	46.9	1.12 (0.95 - 1.32)	71.9	1	81.2	1.13 (1.02 - 1.25)	62.5	1.02 (0.90 - 1.15)
Handball	15.4	14.3	1.08 (0.95 - 1.22)	31.4	1	74.3	1.01 (0.89 - 1.15)	64.7	1.02 (0.90 - 1.16)	65.7	1.04 (0.93 - 1.16)
Volleyball	26.4	18.3	1.11 (0.99 - 1.25)	38.3	1.05 (0.91 - 1.22)	76.7	1.03 (0.92 - 1.15)	61	1	66.1	1.04 (0.95 - 1.14)
Soccer	44.1	22.4	1.15 (1.04 - 1.30)	60.6	1.22 (1.07 - 1.39)	88.9	1.10 (1.00 - 1.21)	74.7	1.08 (0.99 - 1.20)	59.6	1
Practice, y			P = 0.422		P = 0.001		P = 0.242		P = 0.022		P = 0.318
0 - 1	27.7	11.7	1	44.3	1.34 (1.14 - 1.57)	86.9	1.16 (0.97 - 1.37)	78.3	1.36 (1.12 - 1.67)	65.6	1.20 (0.98 - 1.47)
> 1 - 5	39.1	15.1	1.03 (0.93 - 1.14)	51.1	1.41 (1.21 - 1.64)	81.2	1.12 (0.95 - 1.33)	74.1	1.33 (1.09 - 1.62)	60	1.16 (0.94 - 1.41)
> 5 -10	27.3	22	1.09 (0.98 - 1.22)	52.5	1.42 (1.21 - 1.66)	88.1	1.17 (0.98 - 1.38)	69.5	1.30 (1.06 - 1.60)	66.1	1.20 (0.98 - 1.47)
> 10	5.9	23.1	1.10 (0.90 - 1.35)	7.7	1	61.5	1	30.8	1	38.5	1
Handgrip strength			P = 0.802		P = 0.902		P = 0.473		P = 0.131		P = 0.457
1° Tertile	33.5	16	1	44.4	1	76.5	1	67.9	1	59.8	1
2° Tertile	33.5	20	1.03 (0.94 - 1.14)	47.6	1.02 (0.92 - 1.13)	82.9	1.04 (0.97 - 1.11)	68.3	1.01 (0.92 - 1.09)	61	1.01 (0.92 - 1.11)
3° Tertile	33	18.5	1.02 (0.92 - 1.13)	47.5	1.02 (0.92 - 1.13)	83.8	1.04 (0.97 - 1.12)	79.7	1.07 (0.99 - 1.16)	68.4	1.05 (0.96 - 1.15)

Abbreviations: PR, prevalence ratio; 95% CI, 95% confidence interval
[a] Irregular consumption (< 5 days in the previous 7 days).

Table 4. Association (χ^2) and Prevalence Ratio Between Regular Consumption of Unhealthy Food Items and Independent Variables

Variables	Total, %	Deep-Fried Salty Snack Consumption[a]		Processed Meat Consumption[a]		Bagged Salty Snack Consumption[a]		Sweets Consumption[a]		Soft Drink Consumption[a]	
		%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)	%	PR (95% CI)
Weekly frequency, d			P = 0.166		P = 0.562		P = 0.815		P = 0.776		P = 0.783
1 - 2	48.8	12.7	1.16 (0.98 - 1.38)	5.2	1	6	1	26.7	1	26.7	1
3 - 4	40.5	7.4	1.06 (0.90 - 1.26)	5.2	1.00 (0.90 - 1.12)	8.2	1.04 (0.92 - 1.17)	30.9	1.05 (0.90 - 1.23)	30.9	1.05 (0.90 - 1.28)
≥ 5	10.7	3.8	1	12	1.12 (0.90 - 1.40)	7.7	1.03 (0.85 - 1.25)	30.8	1.05 (0.82 - 1.34)	26.9	1.00 (0.78 - 1.28)
Competition, per year			P = 0.681		P = 0.899		P = 0.511		P = 0.848		P = 0.112
Only 1	48.5	9.6	1.03 (0.91 - 1.16)	5.4	1	7.9	1.04 (0.93 - 1.16)	29.8	1.01 (0.88 - 1.17)	22.8	1
≥ 2	51.5	8.1	1	5.7	1.01 (0.91 - 1.12)	5.7	1	28.7	1	32	1.13 (0.97 - 1.30)
Sport type			P = 0.656		P = 0.194		P = 0.645		P = 0.647		P = 0.006
Basketball	14.1	12.5	1.12 (0.89 - 1.41)	16.1	1.24 (1.00 - 1.53)	12.5	1.13 (0.92 - 1.40)	25	1	40.6	1.35 (1.07 - 1.71)
Handball	15.4	5.7	1	8.6	1.09 (0.92 - 1.31)	5.7	1.01 (0.85 - 1.20)	34.3	1.12 (0.85 - 1.48)	20	1.04 (0.82 - 1.33)
Volleyball	26.4	11.9	1.11 (0.92 - 1.30)	3.3	1	5.1	1	35.6	1.14 (0.89 - 1.46)	16.9	1
Soccer	44.1	11.1	1.09 (0.79 - 1.21)	4.1	1.01 (0.91 - 1.13)	8.1	1.05 (0.92 - 1.21)	28.3	1.04 (0.83 - 1.31)	37.8	1.31 (1.09 - 1.57)
Practice, y			P = 0.506		P = 0.349		P = 0.328		P = 0.788		P = 0.266
0 - 1	27.7	5.0	1	5.1	1	3.3	1	26.7	1.05 (0.74 - 1.48)	19.7	1
> 1 - 5	39.1	10.6	1.10 (0.95 - 1.27)	5.9	1.01 (0.88 - 1.16)	10.6	1.13 (0.98 - 1.30)	29.4	1.09 (0.77 - 1.52)	30.6	1.16 (0.96 - 1.39)
> 5 -10	27.3	8.5	1.06 (0.91 - 1.24)	5.1	1.00 (0.86 - 1.15)	5.1	1.03 (0.90 - 1.18)	33.9	1.15 (0.81 - 1.62)	32.8	1.19 (0.97 - 1.46)
> 10	5.9	15.2	1.19 (0.86 - 1.63)	23.1	1.32 (0.95 - 1.84)	7.7	1.08 (0.83 - 1.41)	23.1	1	38.5	1.27 (0.91 - 1.77)
Handgrip strength			P = 0.549		P = 0.603		P = 0.230		P = 0.495		P = 0.931
1° Tertile	33.5	7.5	1	3.8	1	3.7	1	29.3	1.05 (0.87 - 1.25)	29.3	1.03 (0.86 - 1.23)
2° Tertile	33.5	12.2	1.08 (0.93 - 1.26)	7.3	1.07 (0.94 - 1.21)	9.8	1.11 (0.97 - 1.27)	34.1	1.11 (0.93 - 1.33)	29.3	1.03 (0.86 - 1.23)
3° Tertile	33	11.2	1.06 (0.92 - 1.24)	5.1	1.03 (0.91 - 1.15)	7.7	1.07 (0.95 - 1.22)	25.6	1	26.9	1

Abbreviations: PR, prevalence ratio; 95% CI, 95% confidence interval
[a] Regular consumption (at least 5 days in the previous 7 days).

and basketball. Considering the high glycemic index of sugary drinks and the risk of insulin resistance and obesity over time (26), it is vital to reduce the consumption of these beverages in order to improve health, along with the consumption of ultra-processed foods that are energy dense; high in free sugars, unhealthy fats, and salt; and low in dietary fiber (14). Recent studies (27-29) and the Brazilian Dietary Guidelines have recommended a new approach that extends beyond simple supply and intake of nutrients, and considers the choice of foods and meals, and the level of

processing to which the food was submitted, and also advocates for the restriction of foods and beverages with low nutritional value.

Our results show that athletes who practiced sports for more than ten years had a higher regular consumption of raw salad (92.3%) and fruits (69.2%). This regular consumption prevalence is much higher than Brazilian adolescents. Azeredo et al. (30), who evaluated the eating pattern with the same questionnaire, showed that fewer than one third present a regular consumption of raw salad and fruit. Our findings suggest that sports have a positive effect on eating pattern. Similar results were found by Dortch et al. (31) who indicated that participation in sports is associated with higher consumption of vegetables and fruits. Consumption of a diet rich in fruits and vegetables is associated with lower risks of numerous chronic diseases, including cancer, diabetes, obesity, and cardiovascular diseases (32).

Although the most experienced athletes had a higher consumption of healthy food items, our results are concerning. Only few of all athletes regularly consumed vegetables (18.7%), fruits (27.8%), and milk (37%). Coutinho et al. (2), who evaluated Brazilian modern pentathletes, also found that the consumption of fruits (~20%) and vegetables (~15%) was insufficient, whereas the consumption of baked goods (~45%) and sugared soft drinks (~30%) was frequent. These data reflect the actual settings in Brazil, as other studies have also demonstrated low consumption of vegetables and fruits in the country, among adolescents, adults, and elderly people. According to the Brazilian Dietary Guidelines, these consumption levels of healthy food are much lower than those recommended for children and adolescents, and indicate the need for a re-evaluation of current national policies and nutritional regulations in schools and sports organizations.

In the present study, 54.4% of cases regularly had breakfast. This prevalence is much lower once compared with Egyptian adolescent athletes (78.5%) (33). Eating breakfast regularly is relevant, as it reduces the consumption of unhealthy snack foods during the day and may improve consumption of fiber-rich products and lead to a more even distribution of energy and nutrient intake throughout the day, that may improve glucose and insulin metabolism, appetite regulation (hunger and satiety); thus reducing risk of becoming overweight (5). Moreover, breakfast consumption may improve cognitive function and school performance (5). Thus, our findings are concerning due to the lower prevalence of regular breakfast consumption in athletes, as compared to young students from Brazil (34), who reported a frequency higher than 75%.

Although there is a consensus on literature from the importance of implementing intervention programs for athletes, there is still a lack of knowledge about the eating patterns of young athletes and its association between these eating patterns and with characteristics of sport participation (24). Once this relationship is thoroughly understood, efficient nutritional programs conducted by nutritionists can then be performed improving performance and health from athletes. In emerging countries, such information is crucial for improving the performance in the athletes and for promoting healthy habits that will benefit athletes throughout their life. Hence, nutrition and health promotion programs should not only focus on the specific nutrients, but also on food intake and eating practices (11, 24). Overall, we believe that our findings may help researchers, coaches, and health professionals to conduct more specific interventions. Future research about eating patterns should evaluate these variables by longitudinal design to improve cause and effect results.

In conclusion, sports types and the time spent practicing these sports are associated with eating pattern. Athletes who practice sports for many years have a more regular, healthy food consumption. Moreover, we found certain differences in the meal consumption characteristics and unhealthy food items among sport types, wherein soccer athletes had the worst eating pattern.

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Footnotes

Conflict of Interests: The authors declare no potential conflicts of interest.

Ethical Approval: Prior to participation, the athletes and their parents or guardians, in the case of minors, voluntarily signed an informed consent form approved specifically for this study. The present study was performed in accordance with the Helsinki Declaration, and was approved by the Ethics Committee for Human Research of the Instituto Federal Goiano (number 1.630.480).

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Table 5. Adjusted Prevalence Ratio for Sports Variables and Meal Consumption Characteristics, Healthy Food Items, and Unhealthy Food Consumption[a]

Variable	Irregular Meal Consumption[b]		Irregular Healthy Food Items[b]					Regular Unhealthy Food Items[c]		
	Have Breakfast	Lunch/Dinner with Parents	Bean Consumption	Raw Salad Consumption	Vegetable Consumption	Fruit Consumption	Milk Consumption	Deep-Fried Salty Snack Consumption	Processed Meat Consumption	Soft Drink Consumption
Sport type										
Basketball	1.26 (1.09 - 1.46)[d]	1.13 (1.01 - 1.26)[d]	1	1.09 (0.92 - 1.30)	1	1.14 (1.01 - 1.22)[d]			1.20 (0.97 - 1.50)	1.34 (1.03 - 1.74)[d]
Handball	1.05 (0.90 - 1.21)	1.14 (1.03 - 1.25)[d]	1.02 (0.89-1.17)	1	1.04 (0.91 - 1.18)	1.02 (0.90-1.16)			1.11 (0.93 - 1.32)	1.05 (0.82 - 1.33)
Volleyball	1	1.09 (0.99 - 1.20)	1.07 (0.94 - 1.22)	1.05 (0.91 - 1.22)	1.06 (0.94 - 1.18)	1			1	1
Soccer	1.13 (1.01 - 1.27)[d]	1	1.13 (1.01 - 1.26)[d]	1.19 (1.04 - 1.37)[d]	1.10 (1.01 - 1.22)[d]	1.10 (0.99 - 1.22)			1.02 (0.90 - 1.15)	1.32 (1.10 - 1.60)[d]
Practice, y										
0 - 1				1.34 (1.14 - 1.58)[d]		1.43 (1.17 - 1.73)[d]				
> 1 - 5				1.42 (1.21 - 1.67)[d]		1.36 (1.23 - 1.65)[d]				
> 5 - 10				1.43 (1.22 - 1.69)[d]		1.28 (1.05 - 1.57)[d]				
> 10				1		1				
Weekly frequency, d										
1 - 2		1						1.13 (0.96 - 1.34)		
3 - 4		1.00 (0.92 - 1.10)						1.06 (0.89 - 1.26)		
≥ 5		1.10 (0.98 - 1.23)						1		
Competition, per year										
Only 1		1		1		1	1.06 (0.99 - 1.15)			1
≥ 2		1.03 (0.94 - 1.12)		1.07 (0.97 - 1.17)		1.05 (0.98 - 1.13)	1			1.14 (0.97 - 1.33)
Handgrip strength										
1° Tertile						1				
2° Tertile						1.02 (0.92 - 1.12)				
3° Tertile						1.06 (0.97 - 1.16)				

[a] Multivariable analysis according to the Poisson regression model with robust variance. Prevalence ratio (PR) is the effect measure, with its respective 95% confidence intervals (CIs). The model was adjusted for gender, age, and body mass index. Values are expressed as adjusted PR (95% CI).
[b] Irregular practice or consumption (< 5 days in the previous 7 days).
[c] Regular consumption (at least 5 days in the previous 7 days).
[d] Data reflect statistical significance (P < 0.05).