SAÚDE E AMBIENTE
V.9 • N.3 • 2024 - Fluxo Contínuo

ISSN Digital: **2316-3798**
ISSN Impresso: **2316-3313**
DOI: **10.17564/2316-3798.2024v9n3p169-182**

INTER FACES CIENTÍFICAS

FACTORS ASSOCIATED WITH FOOD INTAKE AMONG PHYSICALLY ACTIVE ADULTS DURING COVID-19 PANDEMIC

FATORES ASSOCIADOS AO CONSUMO ALIMENTAR DE INDIVÍDUOS FISICAMENTE ATIVOS DURANTE A PANDEMIA DA COVID-19

FACTORES ASOCIADOS CON LA INGESTA DE ALIMENTOS ENTRE ADULTOS FÍSICAMENTE ACTIVOS DURANTE LA PANDEMIA DE COVID-19

Marcela Larissa Costa[1]
Matheus Bezerra Santos[2]
Maycon George Oliveira Costa[3]
Raquel Simões Mendes-Netto[4]

ABSTRACT

This study aimed to analyze the factors associated with food intake in a physically active population during the social isolation period imposed by the COVID-19 pandemic. Using a cross-sectional design, information was collected by electronic questionnaire among 246 physically active people between August and October 2020. Questions regarding the physical activity level and health habits were collected. Food consumption data were collected using a validated food frequency questionnaire. The level of physical activity was assessed using the International Physical Activity Questionnaire-short version. Logistic regression models were used to verify the association between variables. Binary logistic regression test pointed out associations between unhealthy diet and body dissatisfaction (OR=2.395; p<.001) and worse perceived sleep during the pandemic (OR=2.019; p=.011). The results indicate the need for healthy eating to maintain physical and mental health, even among physically active people. Thus, knowing that physically active individuals who have body dissatisfaction and poor sleep perception are more likely to have an unhealthy diet pattern during the pandemic, health professionals can work on improving eating patterns to help improve the overall health habits of individuals during this period.

KEYWORDS

Exercise; COVID-19; healthy eating

RESUMO

Este estudo teve como objetivo analisar os fatores associados ao consumo alimentar em uma população fisicamente ativa durante o período de isolamento social imposto pela pandemia de COVID-19. Usando um desenho transversal, as informações foram coletadas por questionário eletrônico entre 246 pessoas fisicamente ativas entre agosto e outubro de 2020. Foram coletadas perguntas sobre o nível de atividade física e hábitos de saúde. Os dados de consumo alimentar foram coletados por meio de um questionário de frequência alimentar validado. O nível de atividade física foi avaliado por meio do Questionário Internacional de Atividade Física. Modelos de regressão logística foram usados para avaliar a associação entre as variáveis. O teste de regressão logística binária apontou associações entre alimentação não saudável e insatisfação corporal (OR=2,395; p<0,001) e pior percepção do sono durante a pandemia (OR=2,019; p=0,011). Os resultados indicam a necessidade de uma alimentação saudável e manter a saúde física e mental, mesmo entre pessoas fisicamente ativas. Assim, sabendo que os indivíduos fisicamente ativos que têm insatisfação com o corpo e percepção ruim do sono têm maior probabilidade de ter um padrão de alimentação não saudável durante a pandemia, os profissionais de saúde podem trabalhar para melhorar os padrões de alimentação e ajudar a melhorar os hábitos gerais de saúde dos indivíduos durante esse período.

PALAVRAS-CHAVE

Exercício; COVID 19; Alimentação Saudável.

RESUMEN

Este estudio tuvo como objetivo analizar los factores asociados a la ingesta de alimentos en una población físicamente activa durante el periodo de aislamiento social impuesto por la pandemia de COVID-19. Utilizando un diseño transversal, se recogió información mediante cuestionario electrónico entre 246 personas físicamente activas entre agosto y octubre de 2020. Se recogieron preguntas sobre el nivel de actividad física y los hábitos de salud. Los datos sobre el consumo de alimentos se recogieron mediante un cuestionario validado de frecuencia de alimentos. El nivel de actividad física se evaluó mediante el Cuestionario Internacional de Actividad Física-versión corta. Se utilizaron modelos de regresión logística para verificar la asociación entre variables. La prueba de regresión logística binaria señaló asociaciones entre una dieta poco saludable y la insatisfacción corporal (OR=2,395; p<,001) y una peor percepción del sueño durante la pandemia (OR=2,019; p=,011). Los resultados indican la necesidad de una alimentación sana para mantener la salud física y mental, incluso entre personas físicamente activas. Por lo tanto, sabiendo que los individuos físicamente activos que tienen insatisfacción corporal y mala percepción del sueño son más propensos a tener un patrón alimentario poco saludable durante la

pandemia, los profesionales sanitarios pueden trabajar en la mejora de los patrones alimentarios para ayudar a mejorar los hábitos generales de salud de los individuos durante este periodo.

PALABRAS CLAVE

Ejercicio; COVID-19; Alimentación saludable

1 INTRODUCTION

The outbreak of severe acute respiratory syndrome caused by coronavirus 2 (SARS-CoV-2) emerged in China in December 2019 and with only 3 months of the epidemic underway, on March 11, 2020, the World Health Organization (WHO) declared a pandemic due to 118,000 confirmed cases and 4291 deaths across the globe (CDC, 2020; WHO, 2020a). The pandemic also led governments and health organizations to advise and adopt control measures to reduce the spread and contagion, among them the use of masks in public places and pandemic, a more restrictive measure of social distancing (Bavel *et al.*, 2020; WHO, 2020b).

However, these restrictive measures led to an increase in health risk behaviors, such as increased stress, anxiety, worse sleep perception, body dissatisfaction, and worse food intake (Malta *et al.*, 2020; Robertson *et al.*, 2021; Musse *et al.*, 2022). Physical inactivity was one of the most evident risk behaviors among them; due to the restrictions of access to places where physical exercises are practiced there was an increase in the incidence of sedentarism in this period (Ding *et al.*, 2021; Werneck *et al.*, 2021b).

Moreover, physical inactivity was previously associated during the pandemic with worse health habits such as stress, poorer sleep quality, and body dissatisfaction (Barroso *et al.*, 2021; Faro *et al.*, 2021). And, these risky habits have in turn been associated with worse food consumption (Oliveira *et al.*, 2020; Garcez *et al.*, 2021), and as a matter of fact, studies have found that pandemic negatively affected the individuals' eating habits and consumption (Malta *et al.*, 2020; Catucci *et al.*, 2021), the reasons for this negative change can be attributed to eating as a result of stress or a drop in motivation to eat healthily because of increased physical inactivity (Ammar *et al.*, 2020).

It is known that regular physical activity e is associated with better food intake (Zurita-Ortega *et al.*, 2018; Monteiro *et al.*, 2021). However, during the pandemic, studies focused on evaluating the level of physical activity and food intake of the population as a whole (Malta *et al.*, 2020; Werneck *et al.*, 2021a), without separately evaluating this intake among physically active individuals. It is important to understand how the food intake of these individuals was affected by the pandemic, and to elucidate whether the protective factor that physical activity generates on food intake was sufficient to protect individuals from unhealthy food consumption during this period of intense changes in routine.

Therefore, we hypothesize that physically active individuals will have their food intake associated with healthy lifestyle habits even during COVID-19 pandemic. Thus, this study aimed to analyze the factors associated with food intake in a physically active population during the pandemic.

2 METHODS

2.1 STUDY DESIGN, PARTICIPANTS AND DATA COLLECTION

This cross-sectional web-based online survey was carried out between Brazilian social isolation (August to October 2020). The survey was distributed through contacts in social media with gyms, functional training centers, and national sports nutrition researchers. The questionnaire consisted of 42 questions. For the purpose of this paper 28 questions were used, which are described in detail in section 2. 2. It required 15 minutes to complete all the answers.

The sample size was estimated with the G power software program for logistic regression with two tails, using an estimate odds ratio value of 3.5, p-value < 0.05, power = 0.95, and considering a binomial distribution which indicated that a minimum of 143 participants were required.

To be included in the study participants had to be Brazilian, physically active, and between 18 and 59 years old. Pregnant participants were excluded from the analysis. The initial sample was composed of 328 participants, but after the physical activity level assessment 82 participants were disregarded (sedentary or irregularly active), being considered eligible 246 individuals. The study was performed in compliance with the Helsinki Declaration Guidelines and approved under number: 4,380,553 in an Ethical Committee. Before filling out the questionnaire, all participants signed an informed consent form.

2.2 MEASURES

2.2.1 SOCIODEMOGRAPHIC

To assess the socioeconomic status, participants responded to questions regarding gender, age (used in a continuous form and categorized according to the median into ≥29 years and <29 years), education level, marital status (married, single or other), and state and city of Brazilian territory. State and city information were used to describe the sample: the states collected were categorized into Brazilian regions (northeast, southeast, or other); the cities were used to describe if the individual lived in the capital or other cities. For the purpose of analysis, the educational level was categorized into Higher education (post-graduate and graduate degree) and Lower education (high school and below).

Monthly household income was assessed according to the criteria of socioeconomic strata of Brazilian Association of Research Companies (ABEP, 2019): A: Up to USD$4,886.48 or more; B1: Up to USD $2,156.79; B2: Up to USD$1,078.79; C1: Up to USD$589.81; C2: Up to USD$334.36; D: Up to USD$137.64. The strata were divided into two categories for analysis: Higher income (strata A to B2) and Lower income (strata C1 to D). Work or study modality were also assessed: working or studying, or currently not working or studying, and how many hours of work or study per day: <4 h, 4–6 h, 6–8 h, >8 h/day were also assessed. The number of hours worked or studied was categorized into: Up to 8 h/day and more than 8 h/day.

Participants were also asked to self-report weight and height. These measurements were used to calculate the Body Mass Index (BMI) using the following formula: BMI = Weight (kg)/(height)^2 (m). BMI was used in the analyses as a continuous variable.

2.2.2 SOCIAL ISOLATION LEVEL DURING PANDEMIC

To assess the level of social isolation, the participants were questioned about the frequency of time away from home during social isolation from March to August 2020, where each month had a classification scale of social isolation in which the score ranged from 1 to 4, being 1 "not leaving home at all", 2 "leaving 1 to 2x/week", 3 "leaving ≥3x/week", and 4 "it was not possible to do any social isolation in my routine", with the value of each answer being equivalent to the number of the option chosen. A summation of the values for all the months evaluated was performed, where the final score ranged from 6 to 24. The score were divided into two categories for analysis: From 6-11 points "high level of social isolation", and from 12-24 points "low level of social isolation".

2.2.3 PHYSICAL ACTIVITY LEVEL DURING PANDEMIC

The level of physical activity was assessed using the International Physical Activity Questionnaire--short version (IPAQ) (Matsudo *et al.*, 2001). For the purpose of this study, participants who were categorized as "active" and "very active" by IPAQ were considered "active". Individuals who did not fit into either of the two aforementioned categories were disregarded in the analysis of this research.

In addition, participants answered questions about exercise before and during pandemic. The individuals were asked whether or not they practiced physical exercises before the pandemic and whether or not they noticed any changes in their exercise routine. To classify the practice of physical exercises before pandemic, and to classify the exercise routine, the participants answered two questions: "Did you practice any physical exercise before the pandemic?", with a "yes" and "no" answer option; and, "Have you noticed a difference in the amount of physical exercise in your routine?". With response option in likert scale form. The answers were dichotomized for statistical analysis.

2.2.4 FOOD CONSUMPTION DURING THE PANDEMIC

Food consumption was assessed by adapting the ISACAMP-Nutri food frequency questionnaire (UNICAMP, 2014). The participants answered about food consumption over the past 3 months. For the research objective, the consumption of foods considered "unhealthy" were analyzed, including: crackers/cookies; packaged snacks; artificial juice; sweets/desserts; embedded foods and ready-made/fast food. The consumption of foods considered "healthy" was also analyzed, namely: fruits and vegetables. For classification purposes, food consumption was categorized into: "healthy diet" those who reported eating fruits and vegetables ≥5x/week and unhealthy foods <5x/week; and "unhealthy diet" those who did not obtain the minimum score for fruits and vegetables or exceeded the maximum for unhealthy foods.

In addition, the participants were asked about their perception regarding the amount of food they were eating, based on a question: "Have you noticed a difference in the amount of food you are consuming?", with a 5-point Likert-type scale answer. The answers were dichotomized for statistical analysis.

2.2.5 PERCEPTIONS ON STRESS, SLEEP AND BODY SATISFACTION DURING THE PANDEMIC

To assess the perception of stress, sleep, and body satisfaction during social isolation, participants were asked, respectively, "Regarding your stress level, what is your perception during the pandemic?", "Regarding your sleep, what is your perception during the pandemic?", "How satisfied

do you feel with your body?", with response on a 4-point Likert-type scale. The answers were dichotomized for statistical analysis.

2.3 STATISTICAL ANALYSIS

The analyses were performed using the Statistical Package for Social Sciences (SPSS) software version 28.0. Continuous variables were subjected to the Kolmogorov-Smirnov test to verify the normality of the data. Descriptive analysis was performed based on the nature of the variable. Categorical variables are presented by percentage, while continuous variables are presented in the form of mean and standard deviation.

Next, a binary logistic regression analysis was performed to verify the association between food consumption with the independent variables: work/study modality, hours worked daily, level of social isolation, perceived amount of food consumed, perceived stress, sleep quality, body satisfaction, exercise practice before the pandemic, and change in exercise routine. Initially, univariate analysis was performed by calculating the odds ratio, 95% confidence interval and p value, all variables that showed a significance $p<0.2$ were entered into the multivariate adjusted analysis using the stepwise method. In the binary logistic regression model, the independent variables were considered significant by Wald's statistic and the models were considered significant by the Omnibus test. The analysis was controlled for gender, age, and income. The significance level adopted was 5%.

3 RESULTS

Table 1 shows the descriptive analysis of the sample. The sample had an average age of 31.72 (9.73) years and most of them were female (67.6%), from the northeast (89%), had a high level of education (74.4%), were married (60.1%) and had a higher income (64.6%). With regard to lifestyle habits during social isolation, most of the sample had low social isolation (53.7%), healthy food consumption (68.7%), reported an increase in the amount of food consumed (54.1%), increased stress (72.8%), worse sleep (57.3%) and were satisfied with their bodies (68.7%).

Table 1 – Cross-sectional descriptive analysis physically active adults from Brazil (n=246)

Variables		**Mean (SD)**
Age (years)		31.72 (9.73)
BMI (kg/m²)		24.47 (3.70)
Variables		**n(%)**
Sex	Male	79 (32.1)
	Female	167 (67.6)

Variables		Mean (SD)
Brazilian region	Northeast	219 (89.0)
	Southeast	22 (8.9)
	Others	5 (2.1)
Area	Capital	182 (73.9)
	Other cities	64 (26.1)
Education level	Lower education	63 (25.6)
	Higher education	183 (74.4)
Marital status	Single	76 (30.9)
	Married	170 (60.1)
Monthly household	Lower income	87 (35.4)
	Higher income	159 (64.6)
Employment or Study modality	Working/studying	217 (88.2)
	Not working or studying	29 (11.8)
Hours of work/day	Up to 8 h/day	174 (70.7)
	>8 h/day	72 (29.3)
Social isolation level	Low	132 (53.7)
	High	114 (46.3)
Physical activity level	Very active	106 (43.1)
	Active	140 (56.9)
Food consumption	Healthy diet	169 (68.7)
	Unhealthy diet	77 (31.3)
Amount of food consumption	Decreased food amount	133 (54.1)
	Increased food amount	113 (45.9)
Stress perception	Decreased stress	179 (72.8)
	Increased stress	67 (27.2)
Sleep perception	Better sleep	105 (42.7)
	Worse sleep	141 (57.3)

Variables		Mean (SD)
Body satisfaction	Satisfied	169 (68.7)
	Dissatisfied	77 (31.3)

SD: Standard deviation.
Source: Research data

In binary logistic regression analysis, associations in the adjusted model were found between unhealthy diet and body dissatisfaction (OR=2.39; p=0.006) and worse sleep during social isolation (OR=2.01; p=0.011). The model was controlled for age, sex, and income. No other significant associations were found among the other independent variables (Table 2).

Table 2 – Logistic regression analysis of the independent variables in relation to "unhealthy diet" in physically active individuals during quarantine in Brazil (n=246)

Dependent variable	Unhealthy diet			
Independent variables	Crude analysis		Adjusted analysis	
	OR	CI 95%	OR	CI 95%
Not working or studying	1.49	0.61; 3.67	-	-
Working or studying >8 h/day	0.87	0.48; 1.57	-	-
Lower social isolation	1.10	0.64; 2.00	-	-
Decreased food amount consumption	1.63	0.94; 2.83	-	-
Increased stress	0.75	0.41; 1.36	-	-
Worse sleep	2.01	1.16; 3.48	2.01	1.15; 3.53
Body dissatisfied	2.39	1.25; 4.56	2.53	1.30; 4.92

OR: Odds Ratio; CI 95%: 95% Confidence Interval. The model was controlled for sex, age and monthly income.
Source: Research data

4 DISCUSSION

Our results show that physically active individuals who presented body dissatisfaction and worse sleep perception during the pandemic were more likely to present unhealthy diet during this period.

A study conducted during the pandemic found that among physically active individuals, body dissatisfaction was associated with eating due to emotions, also associated with increased consumption of sweets and desserts (Costa *et al.*, 2021). In contrast, a study conducted before the pandemic identified a relationship between increased body satisfaction and better food consumption among

physically active individuals (Resende *et al.*, 2019). These findings suggest that pandemic may provisionally be a catalyst for poorer body image and body dissatisfaction (Robertson *et al.*, 2021), even in individuals who engage in physical activity, recognized as a protective factor for the occurrence of body dissatisfaction (Hausenblas; Fallon, 2006).

The intrinsic relationship between physical activity, sleep, and diet is well known. Studies suggest that these three dimensions are interrelated, and that individuals with insufficient sleep are usually physically inactive, have worse food choices, and vice versa (St-Onge *et al.*, 2016; Dolezal *et al.*, 2017). During the pandemic, a study between physically active and inactive individuals identified that only among physically inactive individuals the worst sleep perception was associated with eating due to emotions and increased consumption of unhealthy foods. The authors further suggest a protective role for physical activity in the emergence of negatively associated lifestyle factors such as diet and sleep perception (Costa *et al.*, 2021).

However, a longitudinal study conducted in Spain identified that social isolation affected the sleep quality and well-being of physically active individuals more than the sedentary individuals analyzed, the authors further discuss that the extreme and sudden reduction in physical activity imposed by social restrictions set a negative impact on both the sleep quality and well-being of the physically active population (Martínez-De-Quel *et al.*, 2021). Although this study did not analyze food consumption, other publications in the general population have identified worse food consumption in this period (Malta *et al.*, 2020; Pérez-Rodrigo *et al.*, 2021), making it possible to suggest with the results of the present study, that the food consumption of the physically active population was also negatively impaired and this may affected perceptions of sleep and body satisfaction.

Thus, we hypothesized that despite having protective factors against unhealthy diet, body dissatisfaction, and poor sleep quality, physically active individuals were negatively affected during the pandemic. The increased stress associated with COVID-19 may have led to negative associations and increases in health risk habits (i.e., body dissatisfaction, sleep, and unhealthy diet), which, as intrinsically related, may retroactively influence each other to increase the health impairment of these individuals during the pandemic.

As far as we know, this is the first study to identify factors associated with unhealthy diet in physically active individuals during the pandemic. Previous studies have focused on identifying factors associated with eating behaviors and dietary intake in the general population, not specifically targeting only physically active individuals. As a population that presents the protective factor against the appearance of inadequate diet, poor sleep, and body dissatisfaction, it can be assumed that the health habits of these individuals would be less negatively affected by the pandemic. However, as we have shown in this study, there is a significant portion of these individuals who presented unhealthy diet and negative associations with health habits.

This study also stands out for the use of validated tools to measure food consumption and physical activity during the social isolation period, giving greater reliability to the findings. Despite the important results found, we can cite some limitations. The cross-sectional characteristic of data collection does not allow a confirmation of causality found among the variables. The sampling method used, although relevant for the statistical analysis used, lacks generalization power to the entire popula-

tion, as most of the sample has a high level of education and internet access, and different contexts between individuals can generate different health outcomes.

We can also cite the use of questionnaires with self-reported approaches to weight, height and perceptions of health habits; however, it is worth noting that most surveys during the isolation period were conducted using online collection methods, which is considered a promising way to assess and monitor behaviors, health knowledge and lifestyle habits in infectious emergencies such as the current pandemic (Geldsetzer, 2020).

Since COVID-19 pandemic negatively affected the dietary consumption and health habits of the entire population of the globe, our findings suggest that the impact of social isolation also affected the individuals most protected against the onset of risky health habits, the physically active. Although other variables, aside from body dissatisfaction and sleep perception, were not significant in our results, further studies with new related variables may be relevant and bring new findings to the academic field. These findings may serve as precursors for possible new research, such as research with longitudinal and interventional methodologies, delving deeper into the topic and collaborating with the scientific community. In addition to strengthening the importance that a good diet and regular physical activity can bring positive influences on the physical, mental, and social spheres.

Thus, knowing that physically active individuals who have body dissatisfaction and poor sleep perception are more likely to have a unhealthy diet pattern during the pandemic, health professionals, such as nutritionists and nutrition counselors, can work on improving eating patterns to help improve the overall health habits of individuals during this period. Thus, it is relevant to create strategies to combat pandemic related disorders so that side effects related to COVID-19 do not extend longitudinally (Aguilar, 2021).

5 CONCLUSION

Our results suggest that among physically active individuals who had unhealthy diet were more at odds of having body dissatisfaction and worse perceived sleep during the COVID-19 pandemic, regardless of sex, age, and monthly income. These results may suggest that physical activity isolated is not a guarantee of healthy eating and lifestyle habits, reinforcing the complementary nature of nutrition for the maintenance of good health habits. It is essential to continue studies on the subject in order to also approach non-active individuals and with other variables, such as mental health dimensions, to identify possible new associations.

ACKNOWLEDGEMENTS

The authors would like to thank the members of Laboratory of Studies in Nutrition and Exercise (LENEx) for their assistance in the pre-test phase of the questionnaire. This study was financed in part by the Foundation for the Support of Research and Technological Innovation of the State of Sergipe (FAPITEC/SE: PROMOB - 88881 157882/2017-01; and PROEF - 88887.157406/2017-00), and to the Coordination for the Improvement of Higher Education Personnel (CAPES - Finance Code 001). The

content of this manuscript is solely the responsibility of the authors and does not necessarily represent the official views of the funding agency.

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Recebido em: 21 de Setembro de 2023
Avaliado em: 18 de Janeiro de 2024
Aceito em: 2 de Abril de 2024

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1 Nutritionist. Master in Nutrition Sciences. Postgraduate Program in Nutrition Sciences. Federal University of Sergipe, São Cristóvão, Sergipe. Brazil. ORCID: https://orcid.org/0000-0002-2350-0193

2 Nutritionist. Federal University of Sergipe, Nutrition and Exercise Studies Laboratory, São Cristóvão, Sergipe. Brazil. ORCID: https://orcid.org/0009-0002-8217-7952

3 Postgraduate Program in Nutrition Sciences. Federal University of Sergipe, São Cristóvão, Sergipe. Brazil. ORCID: https://orcid.org/0000-0001-7913-9301

4 Nutritionist. PhD in Food Science. Associate Professor. PhD. Postgraduate Program in Nutrition Sciences. Federal University of Sergipe, São Cristóvão, Sergipe. Brazil. ORCID: https://orcid.org/0000-0001-8238-8958

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