Physical Activity Epidemiology

Is there an association between physical activity and fear of COVID-19 among teachers?

Nayra Suze Souza e Silva[1], Luana Lemos Leão[2], Renato Sobral Monteiro-Junior[1], Rose Elizabeth Cabral Barbosa[1], Marise Fagundes Silveira[1], Rosângela Ramos Veloso Silva[1], Desirée Sant'Ana Haikal[1]

[1]*Universidade Estadual de Montes Claros, Montes Claros, MG, Brazil;* [2]*University of Ottawa, Faculty of Health Sciences, School of Nutrition Sciences, Ottawa, Ontario, Canada.*

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Abstract - Aim To identify the association between physical activity during the pandemic and fear of COVID-19 among teachers in the state of Minas Gerais, Brazil. **Methods:** This is an epidemiological, cross-sectional, and analytical web survey conducted with teachers. Data collection occurred between August and September 2020 through a digital form. The fear of COVID-19 served as the dependent variable, measured using the COVID-19 Fear Scale validated for Brazil, and linked to independent variables related to physical activity. Poisson regression with robust variance was employed, with severe fear of COVID-19 considered the reference category. **Results:** A total of 15,641 teachers participated in the study. Among them, 43.7% reported severe fear of COVID-19, and 47.9% were not engaging in physical activity. Teachers categorized as insufficiently active (PR = 0.98) and physically active (PR = 0.96) were found to be less likely to experience severe fear of COVID-19. A lower prevalence of severe fear of COVID-19 was observed among those engaging in physical activity on weekdays, with a decreasing prevalence as the frequency of weekly physical activity and the duration of exercise per day increased. Furthermore, those who practiced weightlifting/Crossfit also showed an inverse association with intense fear of COVID-19. **Conclusion:** The findings indicate that engaging in physical activity during the pandemic was inversely associated with severe fear of COVID-19. Additionally, a longer duration of physical activity correlated with a reduced prevalence of severe fear of COVID-19.

Keywords: coronavirus, fear, exercise, public health, epidemiological survey.

Introduction

The COVID-19 pandemic has increased mental health concerns[1]. This recent scenario resulted in increased psychiatric problems, such as stress, fear, anxiety, depressive symptoms, insomnia, denial, anger, fear and, in the worst case, suicide[2]. Within this complex landscape, fear has emerged as a focal point, characterized by emotional responses to specific stimuli and a heightened perception of threat or danger[3]. Notably, during the pandemic, fear has become closely associated with the virus's transmission dynamics, particularly through close contact, which further escalated public anxiety[4]. By the time of this research, Minas Gerais had reported a total of 542,909 confirmed COVID-19 cases and 11,902 deaths, intensifying concerns about morbidity and mortality[5]. This pervasive fear, combined with these grim statistics, has often clouded clear and rational thinking in individuals' responses[6].

It is crucial to consider how different segments of the population may experience and cope with these psychological challenges disparately[7]. The intricate relationship between fear and demographic and lifestyle factors, such as sex, age, socioeconomic status, adds complexity to the psychological impact of the pandemic[6]. This interplay between fear and other psychiatric problems reinforces the urgency of exploring effective coping mechanisms[6,9].

In this context, physical activity (PA) emerges as a promising avenue, identified as a beneficial and effective method for alleviating mental health problems[10]. Studies have shown that regular PA can reduce symptoms of anxiety and depression, which are often exacerbated by excessive fear[11,12]. Before the pandemic, teachers in Minas Gerais, Brazil, were relatively active, with many reporting regular engagement in some form of exercise[13,14]. However, the level of PA observed during the pandemic has varied widely, influenced by factors such as lockdown measures, fear of infection, and access to safe environments for exercise[15]. For example, barriers to engaging in PA during the pandemic included restrictions on movement, closure of gyms and recreational spaces, and increased workloads due to remote work[16].

It was already well known that teaching was a highly stressful occupation accompanied by several challenges even before the pandemic[17]. When the pandemic began, the main impact on the teacher classes was the shift from face-to-face to remote teaching[18]. This change significantly impacted the teachers' professional and personal lives. Consequently, teachers' demands for resilience and creativity led to an accumulation of psychological symptoms[19].

As excessive fear can be associated with mental disorders, it is relevant to investigate whether teachers experienced severe fear as a result of the pandemic[20], and whether PA can help mitigate these feelings. Thus, this study aimed to identify the association between PA during the pandemic and fear of COVID-19 among teachers in the state of Minas Gerais, Brazil.

Methods

Study design, settings, context and ethical aspects

This is an epidemiological, cross-sectional, and analytical study of the websurvey type, which followed the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)[21] and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[22].

The study involved public basic education teachers (early childhood education, elementary school, and/or high school) from the state of Minas Gerais, Brazil. The state is composed of approximately 90,000 basic education teachers (data provided by the Minas Gerais State Secretariat for Education (SEE/MG), working in 3,441 schools in 2020[23].

This project was approved by the research ethics committee of the State University of Montes Claros (4,200,389/2020) and adhered to Resolution 466/12 of the National Health Council/Ministry of Health.

Participants

The study included teachers actively teaching in 2020 within the public education system of the state of Minas Gerais, Brazil. Participants worked in early childhood education, elementary school, and/or high school, and voluntarily agreed to take part in the study. Retired teachers, those who declined participation, and individuals employed in roles other than teaching (including directors and coordinators) were excluded from the survey. There were no restrictions on participation for those on sick leave.

Sample size

For determining the sample size, a formula considering infinite populations was utilized. A prevalence of 50% was assumed to yield the maximum sample size and inferential power. The chosen tolerable error was 3%. The sample was then doubled (design effect deff = 2), and an additional 20% increase in the sample size was incorporated to account for potential losses. Consequently, a minimum sample of 2,564 teachers was calculated. The data collection could not be ended according to the sample size previously calculated due to the time during which the collection form was active/available to receive responses.

From an administrative standpoint, the State Secretariat for Education of Minas Gerais (SEE-MG) divides the state into six centers, each further subdivided into Regional Teaching Superintendencies (RTS), totaling 45 RTSs. Access to the number of teachers affiliated with each RTS was provided by SEE-MG. As a result, the sample was estimated to ensure the proportionality of teachers across RTSs, determining the minimum number of teachers to be studied in each of them.

Data source and measurement

To test and refine the instrument, a pilot study involving 20 teachers from five cities was conducted prior to the actual data collection. The instrument did not undergo any significant changes after the pilot study, so pilot participants were included in the final sample.

Upon completion of the pilot project, the research initiative was promoted through SEE-MG's social media platforms to inform and encourage teachers to participate. Data collection occurred through an online digital form, utilizing Google Forms®, from August 20 to September 11, 2020.

The link to the form was sent by SEE-MG to teachers' institutional email addresses, with a specified deadline for data collection. To prevent automated system responses, a reCAPTCHA was implemented. The questionnaire, developed by the project's research team, consisted of 144 questions organized into four sections: sociodemographic characteristics, working conditions, health, and lifestyle. It drew inspiration from other instruments published in the literature during the pandemic period, particularly the “ConVid - Behavior Survey” by the Oswaldo Cruz Foundation[24], and incorporated the validated Brazilian instrument, the COVID-19 Fear Scale. All questions were mandatory to minimize the loss of information. The study ensured the anonymity of participants.

Variables

Dependent variable

This study focused on fear of COVID-19 as the dependent variable, measured using the COVID-19 Fear Scale, an instrument[6] validated for the Brazilian population[25]. The scale, consisting of seven Likert-type items, assesses individuals' fear levels related to COVID-19. The total score is derived from the sum of the items, with categorization as follows: seven to 19 points as “mild fear”, 20 to 26 points as “moderate fear”, and 27 to 35

points as “severe fear”. For this study, “mild fear” and “moderate fear” were combined into a single category. This categorization aimed to distinguish individuals without severe fear from those exhibiting severe fear of COVID-19, with the latter being the focal category for analysis.

Independent variables

The independent variables focused on PA during the pandemic and included the following: PA levels, number of days engaging in PA per week, daily time devoted to PA, and the type of PA performed.

The independent variable “physical activity levels” followed the recommendations of the World Health Organization[26]. Teachers were classified as physically inactive (no regular weekly PA), insufficiently active (engaging in less than 150 min of PA per week), or physically active (participating in 150 min or more of PA per week)[26].

Outdoor PA activities encompassed walking, running, cycling, while other types of PA included dance, wrestling, hydro gymnastics, Pilates, yoga, swimming, and team sports.

Adjustment variable

In order to adjust the model, variables associated with mental health problems were used: sex[9], age[27], self-reported ethnicity[28], family income[29], living with a spouse[29], weekly workload[17], adherence to social distance[9], presence of comorbidity[9], anxiety and/or depression diagnosed by a physician during the pandemic[9], quality of sleep was affected during the pandemic[30], self-medication during the pandemic[31], food intake[30] and Body Mass Index (BMI)[32].

The eating habits variable was formulated based on responses to nine questions related to the consumption of vegetables, fruits, beans, whole foods, ham, frozen food, packaged snacks, chocolate, and soda. Cluster analysis was employed to discern distinct behavioral patterns, ultimately revealing two clusters: one characterized by a healthier eating pattern and the other by a less favorable eating pattern. Body Mass Index (BMI) was computed using self-reported weight and height and subsequently classified according to the World Health Organization's guidelines[33].

Statistical analysis

Data were organized, inspected, and analyzed using the Statistical Package for Social Sciences (SPSS®) version 22.0. The frequency and prevalence of the outcome, independent variables, and adjustments were presented. Bivariate analyzes were performed using Poisson Regression, showing the Prevalence Ratio (PR), 95% Confidence Interval (95%CI), and p-value of the independent variables being severe fear of COVID-19 the reference category. We constructed several multiple models to examine the independent effects of different variables related to PA on the outcome. In each model, the adjustment variables were consistently retained for every PA variable. The strength of associations was quantified through the adjusted PR, 95% CI, and a significance level of 5% ($\alpha \leq 0.05$).

Results

The form was accessed by 16,210 teachers, of which 15,641 agreed to participate in the survey. Teachers from 795 cities in Minas Gerais (93.2%) participated, with the smallest representation in the *Vale do Aço* region (12.1%) and the largest in the *Centro* region (22.8%) (Figure 1).

Demographically, the participating teachers exhibited diverse characteristics: 81.9% were female, 36.7% fell within the age bracket of 40 to 49 years, 25.4% had an income of less than or equal to 2 minimum wages, and 35.8% reported having at least one type of comorbidity. Additionally, 25.9% disclosed a medical diagnosis of depression and/or anxiety during the pandemic. Dietary habits revealed that 50.5% had a less favorable eating pattern. Health-wise, 23.9% were classified as overweight, and 47.9% were physically inactive. A notable 43.7% of the participants reported experiencing severe fear of COVID-19 (Table 1).

Table 2 displays both crude and adjusted analyses of severe fear of COVID-19 concerning variables associated with PA. The adjusted analysis incorporated the following variables: sex, age, self-reported ethnicity, family income, cohabitation with a partner, weekly workload, adherence to social distance, presence of comorbidity, anxiety and/or depression diagnosed by a physician during the pandemic, sleep quality, self-medication, food intake, and BMI.

Insufficiently active teachers (PR = 0.98; CI95% = 0.97;0.99) and physically active teachers (PR = 0.97; CI95% = 0.96;0.99) exhibit a lower likelihood

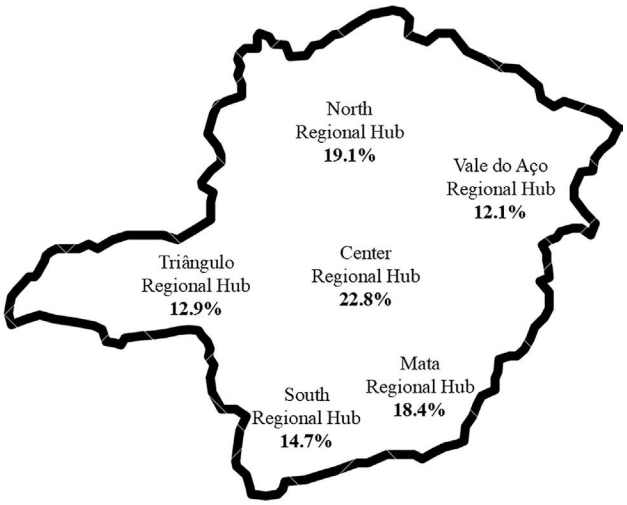

Figure 1 - Distribution of teachers by regions in the state of Minas Gerais, Brazil (n = 15,641).

Table 1 - Descriptive analysis of the study participants (n = 15,641).

Variables	n (%)
Sex	
Female	12,817 (81.9)
Male	2,824 (18.1)
Age	
20 to 29 years old	1,163 (7.4)
30 to 39 years old	4,685 (30.0)
40 to 49 years old	5,740 (36.7)
50 to 59 years old	3,507 (22.4)
≥ 60 years old	546 (3.5)
Skin color/ethnicity	
White/Asian	8,001 (51.2)
Black/Brown/Indigenous	7,640 (48.8)
Family income (minimum wage)[§]	
1-2	3,969 (25.4)
3-5	9,301 (59.5)
6-9	1,945 (12.4)
≥10	426 (2.7)
Living with the partner	
No	5,188 (33.2)
Yes	10,453 (66.8)
Weekly workload[+]	
≤ 40 h	13,167 (84.2)
≥ 40 h	2,472 (15.8)
Adherence to social distance	
Totally	12,486 (79.8)
Partially	3,096 (19.8)
Did not adhere	59 (0.4)
Comorbidities	
No	10,047 (64.2)
Yes	5,594 (35.8)
Formal diagnosis of anxiety and/or depression DP	
No	11,597 (74.1)
Yes	4,044 (25.9)
Quality of sleep affected DP	
No	8,648 (55.3)
Yes	6,993 (44.7)
Self-medication DP	
No	8,844 (56.5)
Yes	6,797 (43.5)
Eating habits DP	
Good eating pattern	7,737 (49.5)
Bad eating pattern	7,904 (50.5)
BMI[+,#]	
Normal weight	7,326 (47.6)
Overweight	4,380 (28.5)
Obese	3,679 (23.9)
Physical activity level DP	
Physically inactive	7,497 (47.9)
Insufficiently active	4,931 (31.6)
Physically active	3,213 (20.5)
Number of days spent doing physical activity per week DP	
Not doing physical activity	7,497 (47.9)
≤ 2 days	3,610 (23.1)
3-4 days	2,981 (19.1)
≥ 5 days	1,553 (9.9)
Daily time spent doing physical activity DP	
Not doing physical activity	7,497 (47.9)
≤ 60 min	5,867 (37.5)
≥ 60 min	2,277 (14.6)
Type of physical activity DP	
Not doing physical activity	7,497 (47.9)
Weight training/Crossfit	667 (4.3)
Outdoor physical activity	4,770 (30.5)
Physical activity at home	2,115 (13.5)
Another type of physical activity	592 (3.8)
Severe fear of COVID-19	
No	8,810 (56.3)
Yes	6,831 (43.7)

DP, During the Pandemic; BMI, Body Mass Index.
[+]Variation in n due to loss of information.
[#]Pregnant women were excluded (n = 246).
[§]Quantity of minimum wages received by the family. Brazilian national minimum wage = $212.6/ month.

of experiencing severe fear of COVID-19 compared to physically inactive teachers, indicating that physical inactivity is associated with an increased fear of COVID-19. This could imply that maintaining PA reduces the fear of COVID-19 or that teachers who did not experience fear of COVID-19 felt more inclined/active to engage in PA during the pandemic. Among the teachers who engaged in PA during the week, there was a lower prevalence of severe fear of COVID-19 compared to those who were not engaging in PA with the prevalence of severe fear decreasing as the number of days dedicated to PA increased. Similarly, a lower prevalence of fear was observed among those who dedicated 60 min (PR = 0.98; CI95% = 0.97;0.99) or more (PR = 0.98; CI95% = 0.97;0.99) to PA per day, when compared to inactive teachers.

Concerning the type of physical activity, only individuals engaging in PA within domestic environments did not exhibit significant results regarding fear of COVID-19.

Table 2 - Crude and adjusted prevalence ratio of independent variables according to severe fear of COVID-19 in public basic education teachers. Minas Gerais, 2020 (n = 15,641).

Variables	PR_{crude} ($CI_{95\%}$)	p-value[+]	$PR_{adjusted}$ ($CI_{95\%}$)[#]	p-value[+]
Physical activity level DP		< 0.001		0.006
Physically inactive	1.00		1.00	
Insufficiently active	0.95 (0.94;0.96)		0.98 (0.97;0.99)	
Physically active	0.90 (0.89;0.92)		0.97 (0.96;0.99)	
Number of days spent doing Physical activity per week DP		< 0.001		0.014
Not doing physical activity	1.00		1.00	
≤ 2 days	0.95 (0.94;0.97)		0.98 (0.97;0.99)	
3-4 days	0.94 (0.93;0.95)		0.98 (0.97;0.99)	
≥ 5 days	0.90 (0.89;0.92)		0.97 (0.95;0.99)	
Daily time spent doing physical activity DP		< 0.001		0.009
Not doing physical activity	1.00		1.00	
< 60 min	0.95 (0.94;0.96)		0.98 (0.97;0.99)	
≥ 60 min	0.93 (0.91;0.94)		0.98 (0.97;0.99)	
Type of physical activity DP		< 0.001		< 0.001
Not doing physical activity	1.00		1.00	
Weight training/Crossfit	0.89 (0.86;0.91)		0.94 (0.92;0.97)	
Outdoor physical activity	0.95 (0.94;0.96)		0.98 (0.97;0.99)	
Physical activity at home	0.96 (0.94;0.98)		0.99 (0.98;1.01)	
Another type of physical activity	0.92 (0.90;0.95)		0.94 (0.92;0.97)	

DP, During the Pandemic; PR, Prevalence Ratio; CI95%, 95% Confidence Interval.
[+]Wald Test.
[#]The analysis was adjusted for: sex, age, self-reported skin color, family income, living with partner, weekly workload, adherence to social distance, presence of comorbidity, formal diagnosis of anxiety and/or depression DP, sleep quality was affected DP, self-medication DP, eating habits DP and BMI.

However, other categories such as weight training/Crossfit (PR = 0.94; CI95% = 0.92;0.97), outdoor PA (PR = 0.98; CI95% = 0.97;0.99), and other types of PA (PR = 0.94; CI95% = 0.92;0.97) were inversely associated with severe fear of COVID-19 (Table 2).

Discussion

Given current circumstances, and the emergence of depressive and anxiety symptoms directly related to COVID-19, along with the well-established relationship PA, sedentary behavior and depressive and anxiety symptoms[34,35], it is essential to understand the impact of PA within the pandemic context. In this sense, our study identified that more than 43% of teachers reported experiencing severe fear of COVID-19 and approximately 50% were not engaging in PA during the pandemic. Notably, the findings demonstrated an inverse association with experiencing severe fear of COVID-19 and engaging in PA during the pandemic. As well as the severity of fear of COVID-19 is associated with the amount of time dedicated to daily PA.

Fear is intricately linked to health risk behaviors and can have profound effects on individuals, particularly at more severe levels[6]. Mental health challenges during pandemics often surpass the impact of the disease itself[36]. A meta-analysis showed high stress and anxiety as features of the negative mental impact of COVID-19 in the general population[9]. Following this trend, study conducted in Peru reported that over half of the participants (59.24%) exhibited a high level of fear of COVID-19[37]. The study which validated the fear of COVID-19 scale for Brazil showed that 29.4% of the adult population presented severe fear of COVID-19[25]. However, in the present study, performed with teachers, 43.7% of the participants showed severe fear of COVID-19. When comparing these data, we observed a higher prevalence of severe fear among teachers than the general Brazilian population. It is hypothesized that disruptions in routine and uncertainties related to returning to the classroom may have stirred anxiety among educators regarding the disease. Considering the timeframe of data collection in this study, when information about COVID-19 was still uncertain, it is plausible that such uncertainties contributed to a heightened prevalence of fear among teachers.

Our study showed that only 14.6% of the teachers engaged in more than 60 min of daily physical activity. This number is concerning, particularly given the physical activity Guidelines for the Brazilian Population. These guidelines recommend that adults engage in at least

150 min per week of moderate-intensity PA, or 75 min per week of vigorous-intensity PA, or a combination of both[38]. Our study also revealed a notable prevalence of physical inactivity among teachers, with 47.9% reported as physically inactive. In comparison, another study conducted with the adult Brazilian population during the COVID-19 pandemic indicated a 26% increase in the percentage of physical inactivity[39]. These findings deviate from the recommendation of the American College of Sports Medicine, which endorsed continuing PA during the pandemic, given the many positive effects, including the alleviation of symptoms related to anxiety and perceived stress[40]. The engagement in regular PA is directly related to the individual's emotional behavior, promoting well-being and pleasure, highlighting its importance[41]. Prior to the COVID-19 pandemic, a review emphasized that systematic and monitored exercises acted as a non-pharmacological treatment for depressive symptoms[42].

This study identified an inverse association with severe fear of COVID-19 among teachers who engaged PA during the pandemic. A lower prevalence of severe fear was observed as the frequency and the duration of PA per day increased. Regarding the type of PA, weight training/Crossfit, outdoor exercise, and other types of exercise, all of them presented an inverse association with severe fear of COVID-19. These findings align with previous studies that reported a decline in mental health conditions among individuals whose PA decreased during the pandemic, while those who maintained their PA levels exhibited lower levels of anxiety[43,44]. The potential of PA to improve mental health is likely attributed to a combination of synergistic influences from both neurobiological and behavioral learning mechanisms. Randomized controlled trials have demonstrated that PA enhances connectivity in clinically significant neurocircuits[45-47]. However, the underlying mechanisms responsible for these beneficial effects remain poorly understood.

From a clinical perspective, PA is not a standard part of the treatment of mental health disorders. However, based on our results and evidence from previous studies, it appears likely that individuals dealing with anxiety and depression could derive benefits from engaging in PA. PA is an inexpensive and accessible possibility for managing mental health problems arising from social distancing[48]. Nevertheless, the results of our study did not show a significant association between fear of COVID-19 and the PA performed at home. According to Moreira-Neto et al.[49], the benefits for mental health depend on how the PA is being performed. Thus, it is believed that PA performed in domestic settings may lack the same degree of control and systematization compared to other practices in specific environments, such as gyms and sports facilities.

Although our study results contribute to understanding alternatives for reducing fear of COVID-19, it is important to consider certain limitations. For this type of discussion, the central limitation is causality, as cross-sectional studies do not allow the establishment of cause-and-effect relationships. At this point, it is not possible to assert that those who engaged in PA during the pandemic had a lower fear of COVID-19 or that teachers who experienced less fear of COVID-19 were more inclined to engage in PA.

Another limitation of this study is the non-use of validated instruments in data collection. This decision was made due to the observation that lengthy questionnaires resulted in lower completion rates compared to shorter versions. Thus, employing validated inventories would have led to a larger instrument, directly impacting the completion rate of the survey. Web surveys may introduce selection bias due to their reliance on internet access for participation, and responses are based on self-reporting. However, we also identified advantages in employing online methods for research, including remote data collection, particularly beneficial during the pandemic when maintaining social distance is imperative.

Despite these limitations, our study boasts methodological rigor and a robust sample, with participants evenly distributed across the state. We achieved representation from 93.2% of cities in Minas Gerais and coverage of 13.3% of teachers working in rural areas. Furthermore, as this is a relatively recent situation, there is a paucity of literature. To our knowledge, this study is the first to analyze this association within this specific population in Brazil.

Conclusions

The PA during the pandemic showed a significant inverse association with the fear of COVID-19 in this study. Additionally, there was a lower prevalence of severe fear of COVID-19 as the number of PA days per week and the duration of PA minutes per day increased. Therefore, the data presented in this study may highlight the essential role of PA in managing mental health issues, emphasizing the importance of regular PA during the pandemic.

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Corresponding author

Nayra Suze Souza e Silva. Universidade Estadual de Montes Claros, Campus Darcy Ribeiro, Montes Claros, MG, Brazil.
E-mail: nayra.silva@unimontes.br.

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