



Factors associated with types of perceived barriers to leisure-time physical activity among Brazilian university students

Fatores associados aos tipos de barreiras percebidas à atividade física no tempo livre entre estudantes universitários brasileiros

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Abstract

Introduction: University students face several difficulties that limit their engagement in leisure-time physical activity, but the characteristics that determine the types of perceived barriers are still insufficiently understood in scientific literature.

Objective: To analyze the factors associated with the types of perceived barriers to leisure-time physical activity among Brazilian university students.

Methodology: The barriers assessed were fatigue, unfavorable weather, excessive workload, lack of motivation, academic obligations, family responsibilities, commute time to the practice location, lack of motor skills, lack of physical fitness, lack of facilities, lack of money and lack of safety conditions. Each barrier was evaluated according to its perceived importance. Independent variables included sex, age, time in university, body mass index, work/internship status, and level of physical activity. Path analysis was conducted using AMOS software.

Results: 1,300 university students participated. Being female was associated with seven of the 12 barriers, especially lack of safety conditions and fatigue. Older students tended to perceive all barriers as less important. Students who worked or interned perceived excessive workload as a more important barrier and academic obligations as less important. Higher physical activity levels reduced the perception of seven barriers, while higher body mass index increased the perception of lack of physical fitness as an important barrier.

Discussion: The findings are consistent with previous studies, reinforcing the influence of individual and contextual factors on how barriers are perceived.

Conclusions: Biological, behavioral, and sociodemographic factors play a determining role in the perception of barriers to physical activity during leisure time among university students. This indicates that promotional actions should be specifically planned, considering these factors.

Keywords

Difficulty; students; Brazil; physical exercise.

Resumo

Introdução: Estudantes universitários enfrentam dificuldades que limitam sua participação em atividades físicas de lazer, e os fatores que determinam os tipos de barreiras percebidas ainda são pouco compreendidos na literatura.

Objetivo: Analisar os fatores associados às barreiras percebidas para a prática de atividade física de lazer entre universitários brasileiros.

Metodologia: Foram avaliadas as seguintes barreiras: fadiga, clima desfavorável, sobrecarga de trabalho, falta de motivação, obrigações acadêmicas, responsabilidades familiares, distância até o local de prática, falta de habilidades motoras, falta de condicionamento físico, falta de instalações, falta de recursos financeiros e falta de segurança. Cada barreira foi analisada quanto à importância percebida. As variáveis independentes incluíram sexo, idade, tempo na universidade, índice de massa corporal, situação de trabalho/estágio e nível de atividade física. A análise de caminhos foi conduzida no software AMOS.

Resultados: Participaram 1.300 estudantes. O sexo feminino associou-se a sete das 12 barreiras, especialmente falta de segurança. Aqueles que trabalhavam ou estagiavam atribuíram maior importância à sobrecarga de trabalho e menor às obrigações acadêmicas. Níveis mais altos de atividade física reduziram a percepção de sete barreiras, enquanto índice de massa corporal elevado aumentou a percepção da falta de condicionamento físico como barreira.

Discussão: Os achados reforçam evidências anteriores, indicando que fatores individuais e contextuais influenciam a forma como as barreiras são percebidas.

Conclusões: Fatores biológicos, comportamentais e sociodemográficos exercem papel determinante sobre a percepção de barreiras à prática de atividade física no lazer dos universitários. Indicando que ações de promoção devem ser planejadas de maneira específica, considerando tais fatores.

Palavra-chave

Dificuldade; estudantes; Brasil; exercício físico.

Introduction

Barriers to physical activity refer to conditions and circumstances that negatively influence adherence to, continuation of, or resumption of this behavior and are often identified through self-reporting by individuals (Hirayama, 2006). It is important to emphasize the inherently subjective nature of this construct, as such barriers are formulated based on individual perception, reflecting personal experiences, conditions, and contexts. In this sense, similar objective conditions can be perceived differently by individuals. Therefore, circumstances that represent significant obstacles for some may not be perceived in the same way by others. This demonstrates that the perception of barriers is deeply linked to individual interpretation and experience (Rosenstock, 1974).

According to evidence from a systematic review involving studies from various countries (Ferreira et al., 2022), approximately 81.8% of university students reported that barriers to physical activity are related to lack of time, lack of motivation, and the absence of accessible places. These barriers are largely associated with physical activity itself (Pinto et al., 2017), sociodemographic factors (Moreno; Domingo; Ferro, 2025), and time-related aspects of the university context (Duarte et al., 2022). Women, physically inactive individuals, those of older age, and those with longer time enrolled in university tend to perceive such barriers more frequently (Blanco et al., 2019; Duarte et al., 2022).

In contrast, when it comes to investigating the determinants associated with the types of perceived barriers to leisure-time physical activity (LTPA), there remains a significant gap in the scientific literature, particularly regarding approaches grounded in more sophisticated theoretical and methodological models capable of simultaneously analyzing the multiple factors influencing this behavior (Burton; Barber; Khan, 2021). This scarcity reinforces the urgency of conducting research aimed at deepening the understanding of the elements underlying the perception of multiple barriers to LTPA among university students, considering that a large proportion of existing studies have been limited to the analysis of direct associations between variables using conventional statistical models, which restricts the apprehension of the more complex relationships that may exist among individual, social, and behavioral determinants.

In this sense, the use of path analysis represents a relevant methodological advancement, as it allows the simultaneous examination of direct and indirect relationships among multiple factors, enabling a more comprehensive view of the mechanisms through which different determinants interrelate in the formation of perceived barriers to LTPA. Thus, this approach contributes to deepening the understanding of the underlying elements associated with the perception of multiple barriers to LTPA among university students (Maroco, 2014).

Among the domains of physical activity, those practiced during leisure time have been widely recognized as the most significant in reducing mortality risk (Cheng et al., 2018), especially among university students, as the population enrolled in higher education in Brazil comprises approximately 9.9 million individuals. Given the above, the present study aimed to analyze the factors associated with the types of perceived barriers to LTPA among Brazilian university students.

Method

Study characteristics

This study is a cross-sectional epidemiological investigation conducted with university students in the state of Bahia, Brazil, where approximately 490,000 university students reside (Secretaria De Modalidades Especializadas De Educação - SEMESP, 2021). The human development index (HDI) of the state of Bahia is 0.691 (Instituto Brasileiro de Geografia e Estatística - IBGE, 2021). The information analyzed in this study comes from an investigation conducted in 2019, which received approval from four Research Ethics Committees (approval numbers: 2.767.041, 2.795.177, 2.915.077, 3.033.773).

Participants



The target population consisted of undergraduate students enrolled in on-campus programs at public universities affiliated with the Brazilian Ministry of Education (federal level). A total of six federal universities are located in the state of Bahia: the Federal University of Recôncavo da Bahia (UFRB), the Federal University of Vale do São Francisco (UNIVASF), the Federal University of Bahia (UFBA), the Federal University of Southern Bahia (UFSB), the Federal University of Western Bahia (UFOB), and the University of International Integration of Afro-Brazilian Lusophony (UNILAB).

Inclusion and Exclusion Criteria

University students with active enrollment met the inclusion criteria. Students were excluded from the study sample, after data tabulation, if they were enrolled in distance education programs, held a higher education degree, were enrolled only in individual undergraduate courses, were enrolled in technical programs, or were under 18 years of age. All exclusion criteria were stated in the Informed Consent Form (ICF).

Sample

The study sample was estimated according to Luiz and Magnanini (2000), considering a prevalence of 50%, a 95% confidence level, and a sampling error of three percentage points for a target population of 35,805 university students (the total number enrolled in federal universities in the state of Bahia). An additional 40% was added to account for possible losses, and 15% was added for association studies. The final calculated sample consisted of 1,668 university students. The sampling process followed a convenience sampling method.

Data Collection

Data collection was conducted with the assistance of university students who did not participate in the study and graduate students from postgraduate programs. The research instrument was sent to the individual email addresses of the university students via electronic correspondence forwarded by course coordinators or departments responsible for electronic communications in the form of individualized messages. Additionally, students were approached in classrooms before or after class sessions on different days of the week to invite them to participate in the study. The questionnaire was developed and made available in an online electronic format, accessible through various internet-connected electronic devices.

The data collection schedule, which took place during the first academic semester of 2019, was adapted to the specific academic calendars of each university, as the beginning of classes varied across institutions. Data collection occurred between February 4, 2019, and September 4, 2019.

Dependent and Independent Variables and Theoretical Investigation Model

Data were obtained through a questionnaire consisting of 68 multiple-choice questions. The dependent variable in this study was the barriers to engaging in LTPA, assessed through 12 response options: fatigue, unfavorable weather, excessive workload, lack of motivation, academic obligations, family responsibilities, distance to the place of practice, lack of motor skills, low physical fitness, lack of facilities, lack of financial resources to pay for tuition or professional services, and lack of safety conditions. An additional option, "I did not perceive any difficulties", was also provided. This measure was based on the following question: "Considering a typical week, what are the main difficulties you perceive in engaging in physical activity during your leisure time?" (Sousa et al., 2013).

Participants were asked to select and rank up to three barriers in order of importance, with the first representing the most important, without repeating the same barrier across different ranks. To address this ranking analytically, a weighting system based on the order of importance assigned by the participants was adopted, following a procedure previously used and validated in studies with Brazilian university students (Sousa; Fonseca, 2017). Reporting "I did not perceive any difficulties" or not indicating any barrier in the 2nd and/or 3rd options was assigned a value of 0; the barrier indicated as the most important received a weight of 3, the second most important received a weight of 2, and the third most important received a weight of 1. At each importance level, barriers not reported by the participant as 1st, 2nd, and 3rd options received weights lower than 1, with an interval of 0.09 between each barrier, ranging from 0.99 to 0.09; the order of assigning these weights followed the proportions observed for the barriers in this study at each importance level, from the most prevalent (weight 0.99) to the least



prevalent (weight 0.09). Finally, the values for each barrier at the three important levels were summed, resulting in continuous values, with higher values indicating the barrier as more important. Cases in which no barrier was indicated at any of the three important levels were considered missing data. The reproducibility levels for each ranked barrier were: first option, kappa = 0.51; second option, kappa = 0.27; and third option, kappa = 0.32 (Sousa et al., 2013).

The independent variables were selected based on a previous systematic review (Ferreira et al., 2022) and additional non-systematic searches in various databases (Google Scholar, LILACS, SciELO, and PubMed). The independent variables in this study included sex (male and female, categorized as 0 and 1, respectively); age, measured in full years; time in university, assessed using the year of enrollment, analyzed quantitatively; body mass index (BMI), calculated using self-reported weight and height, which have demonstrated satisfactory validity for use in studies involving Brazilian university students (Sousa; Barbosa, 2016), and computed using the standard formula (weight divided by height squared), expressed in kilograms per square meter (kg/m^2), and analyzed as a continuous variable; work/internship status (does not work/does not intern and works/has an internship, categorized as 0 and 1, respectively); and moderate-to-vigorous physical activity, measured using the short version of the International Physical Activity Questionnaire (IPAQ), analyzed as a continuous variable in minutes per week, with vigorous activity time weighted by a factor of two (Ferreira et al., 2025).

Data analysis

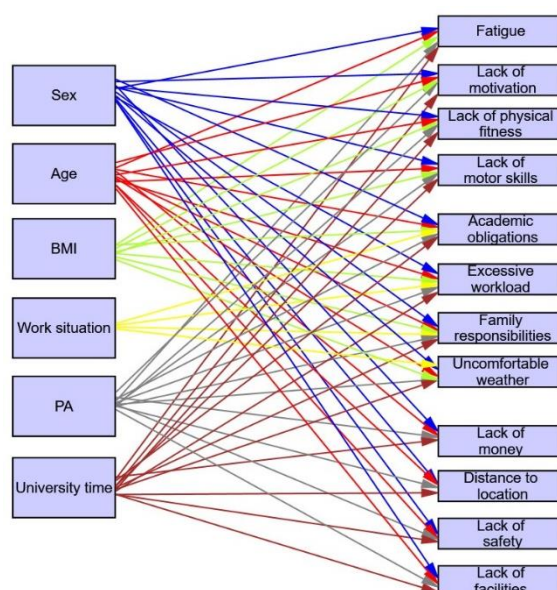
Responses were tabulated using Microsoft Excel (version 2007) and subsequently transferred to statistical software for analysis. Descriptive analyses, including mean (with standard deviation – SD), absolute and relative frequencies, were performed using SPSS software, version 25.0.

Path analysis was conducted using AMOS software (version 25.0). The relationships in the theoretical model (Figure 1) were informed by a prior systematic review and additional studies identified through non-systematic database searches. For this analysis, listwise deletion was first applied to the dependent variable. Subsequently, univariate normality was assessed using acceptable values for skewness and kurtosis (between -2 and 2), and multivariate normality was considered satisfactory with values up to 4. As multivariate normality was not met (value = 152.9), the asymptotically distribution-free (ADF) estimator was employed. Nonsignificant path coefficients (β) were sequentially removed, leaving only statistically significant paths ($p < 0.05$) in the final model. To test the robustness of the results, the model was re-estimated using the Maximum Likelihood (ML) estimator to assess sensitivity and potential bias associated with the choice of estimator.

The variable *time at university* was initially included in the theoretical path analysis model based on its conceptual plausibility and previous literature suggesting an association with barriers to LTPA. However, during structural model estimation, it did not show a statistically significant association with any of the barriers investigated ($p > 0.05$). Following the model specification procedure adopted in this study, in which nonsignificant path coefficients were sequentially removed in order to obtain a more parsimonious and statistically stable model, the variable *time at university* was excluded from the final model, as its inclusion did not improve the explanation of the structural relationships under study.

Model fit quality was assessed using the following goodness-of-fit indices: Chi-square (χ^2) p-value, considered satisfactory when not significant; chi-square to degrees of freedom ratio (χ^2/df), with values ≤ 2 considered acceptable (Joreskog; Sorbom, 1989; Bentler; Bonett, 1980); Comparative Fit Index (CFI) and Normalized Fit Index (NFI), with values > 0.90 considered acceptable (Ulmann, 2001); Root Mean Square Error of Approximation (RMSEA) with a 90% confidence interval, and values ≤ 0.06 deemed satisfactory (Hu; Bentler, 1999); Standardized Root Mean Square Residual (SRMR), with values < 0.08 considered acceptable (Hu; Bentler, 1999).

Figure 1. Theoretical model for estimating the association between exploratory variables and barriers to physical activity practice among university students. Bahia. 2019. BMI: Body mass index; PA: Physical activity.



Results

Characteristics of university students

The study initially included 1,552 university students. Twenty-one students were excluded due to institutional affiliation (20 were enrolled in distance education programs and 1 was a special student). An additional 21 participants were excluded based on age (17 were under 18 years old and 4 did not report their age), along with 4 participants who did not specify their university. This resulted in a final eligible sample of 1,506 participants. After applying listwise deletion, the analytical sample comprised 1,300 students.

Sociodemographic characteristics, university affiliated, biological data, and physical activity is presented in Table 1. The sample included a higher proportion of female students and students without employment ties, who were neither working nor engaged in an internship. The mean age was 25.25 years, the mean BMI was 23.73 kg/m², the mean weekly physical activity was 392.13 minutes, and the average time enrolled in university was 3.54 years.

Table 1. Description of the sample of university students from federal universities in the state of Bahia, according to sociodemographic, biological, behavioral, and university affiliation variables. Brazil. 2019.

Variables		
Sex, n (%)		
Male	464	(36.0)
Female	836	(64.0)
Age n; Me (DP)	1,300; 25.25	(7.94)
Work/internship status, n (%)		
Does not work/does not intern	741	(58.7)
Works/has an internship	599	(41.3)
University Time (years), n; Me (SD)	1,300; 3.54	(2.17)
BMI (kg/m ²), n; Me (SD)	1,300; 23.73	(4.88)
Physical activity (min./week), n; Mean (SD)	1,300; 392.13	(8.20)

BMI: Body Mass Index; n: sample, %: proportion, Me: mean, SD: standard deviation, Kg/m²: kilogram per square meter, min./week: minutes per week.

Source: Author's own work.

The results presented in the following table (Table 2) indicated that tiredness, academic obligations, and lack of financial resources to pay for tuition or professional services were the most prominent bar-

riers reported by university students, considering their relatively high means. The barriers of low physical fitness and distance to the place of practice also emerged as significant, although there was some variation in the student's responses. The barriers of tiredness, work overload, academic obligations, lack of financial resources to pay for tuition or professional services, and lack of motivation exhibited univariate normality, as observed through skewness and kurtosis (-0.33 to -0.27; 0.16 to 0.52; -0.37 to -0.34; 0.05 to 0.77; 0.15 to 1.72, respectively).

Table 2. Description of the types of barriers perceived for the practice of physical activity during leisure-time in university students from federal institutions in the state of Bahia. Brazil. 2019.

Barriers	Mean	SD	Minimum	Maximum	Median	IQR	Skewness	Kurtosis
Fatigue	3.07	1.19	0.00	4.89	2.89	4.89	-0.33	-0.27
Excessive workload	2.62	0.06	0.00	4.89	2.52	4.89	0.16	0.52
Academic obligations	3.08	1.20	0.00	4.98	2.89	4.98	-0.37	-0.34
Distance to the practice location	2.33	0.76	0.00	4.89	2.43	4.89	-0.32	2.92
Low physical fitness	2.25	0.70	0.00	4.89	2.43	4.89	-0.59	3.22
Lack of financial resources to pay for tuition or professional services	2.63	0.99	0.00	4.98	2.61	4.98	0.05	0.77
Lack of safety conditions	2.26	0.64	0.00	4.89	2.34	4.89	-0.69	3.25
Unfavorable weather	2.20	0.64	0.00	4.62	2.34	4.62	-1.22	3.07
Lack of motivation	2.52	0.90	0.00	4.89	2.52	4.89	0.15	1.72
Family responsibilities	2.27	0.06	0.00	4.98	2.43	4.98	-0.25	3.38
Lack of motor skills	2.14	0.63	0.00	4.62	2.34	4.62	-1.41	2.98
Lack of facilities	2.20	0.64	0.00	4.80	2.34	4.80	-1.15	3.38

SD: Standard deviation; IQR: Interquartile range

Source: Author's own work.

The β coefficients corresponding to each path of the associations in the general model are presented in Table 3. It was observed that, except for the length of time at university, all other variables were significantly associated with the perception of at least one barrier. Notably, sex, age, and physical activity were associated with a greater number of perceived barriers to engaging in during LTPA.

Table 3. Analysis of factors associated with the types of perceived barriers to leisure-time physical activity in the general model among university students from federal institutions in the state of Bahia. Brazil. 2019.

Barriers	Variables	β	p
Fatigue	Sex	0.127	<0.001
Lack of motivation	Sex	0.014	0.625
Low physical fitness	Sex	0.081	0.004
Lack of motor skills	Sex	0.097	<0.001
Academic obligations	Sex	0.045	0.100
Excessive workload	Sex	0.023	0.400
Family responsibilities	Sex	0.078	0.005
Unfavorable Weather	Sex	0.054	0.062
Lack of financial resources to pay for tuition or professional services	Sex	0.096	<0.001
Distance to the practice location	Sex	0.099	<0.001
Lack of safety conditions	Sex	0.135	<0.001
Lack of facilities	Sex	0.032	0.266
Fatigue	Age	-0.142	<0.001
Lack of motivation	Age	-0.090	0.003
Low physical fitness	Age	-0.099	0.002
Lack of motor skills	Age	-0.110	<0.001
Academic obligations	Age	-0.124	<0.001
Excessive workload	Age	-0.013	0.707
Family responsibilities	Age	0.067	0.066
Unfavorable Weather	Age	-0.107	<0.001
Lack of financial resources to pay for tuition or professional services	Age	-0.048	0.107
Distance to the practice location	Age	-0.111	<0.001
Lack of safety conditions	Age	-0.097	<0.001
Lack of facilities	Age	-0.115	<0.001
Fatigue	BMI	0.032	0.165
Lack of motivation	BMI	-0.016	0.521
Low of physical fitness	BMI	0.049	0.078
Lack of motor skills	BMI	-0.018	0.141
Academic obligations	BMI	-0.044	0.026
Excessive workload	BMI	-0.010	0.608
Family responsibilities	BMI	0.016	0.488

Unfavorable Weather	BMI	0.004	0.836
Academic obligations	Work situation	-0.097	<0.001
Excessive workload	Work situation	0.253	<0.001
Family responsibilities	Work situation	0.006	0.771
Unfavorable Weather	Work situation	-0.024	0.215
Fatigue	University time	0.001	0.976
Lack of motivation	University time	0.029	0.298
Low of physical fitness	University time	0.014	0.614
Lack of motor skills	University time	0.008	0.765
Academic obligations	University time	0.010	0.712
Excessive workload	University time	0.029	0.368
Family responsibilities	University time	0.001	0.963
Unfavorable Weather	University time	0.011	0.708
Lack of financial resources to pay for tuition or professional services	University time	-0.029	0.328
Distance to the practice location	University time	0.003	0.922
Lack of safety conditions	University time	0.008	0.773
Lack of facilities	University time	-0.006	0.834
Lack of facilities	PA	-0.059	0.041
Lack of safety conditions	PA	-0.058	0.038
Distance to the practice location	PA	-0.056	0.058
Lack of financial resources to pay for tuition or professional services	PA	-0.106	<0.001
Unfavorable Weather	PA	-0.018	0.528
Family responsibilities	PA	-0.044	0.130
Excessive workload	PA	-0.030	0.275
Academic obligations	PA	0.012	0.656
Lack of motor skills	PA	-0.075	0.010
Low physical fitness	PA	-0.077	0.009
Lack of motivation	PA	-0.149	<0.001
Fatigue	PA	-0.010	0.723

β: standardized angular coefficient; PA: physical activity; BMI: body mass index.
Source: Author's own work.

Figure 2 presents the final model depicting the associations with perceived barriers to engaging in LTPA. The variable time at university was excluded from the model due to its nonsignificant association with any barrier. The exploratory characteristics investigated accounted for the barriers with coefficients ranging from 1% to 7%.

Figure 2. Final model of the factors associated with the types of perceived barriers to engaging in physical activity during leisure-time among university students from federal institutions in the state of Bahia, Brazil. 2019.

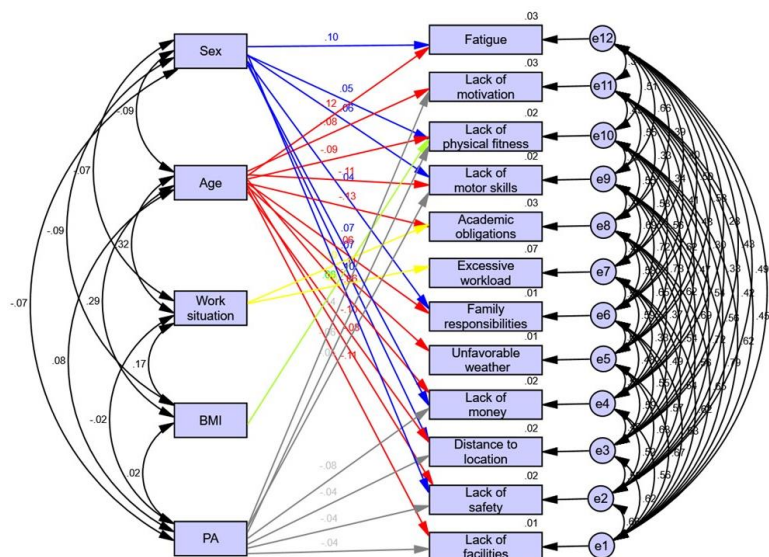


Table 4 details the values corresponding to the associations depicted in figure 2. It was possible to observe sociodemographic characteristics with a higher frequency of paths to various barriers. Being female was associated with seven out of the twelve perceived barriers and with the highest occurrences of perceiving lack of safety conditions and fatigue as important barriers (β: 0.099; β: 0.096, respectively).



In contrast, age showed an inversely proportional relationship, as increasing age corresponded to a lower perception of all types of barriers as important.

Regarding work/internship status, students in this condition perceived work overload as a more important barrier (β : 0.026), while reporting a lower perception of academic obligations as a significant barrier (β : -0.098).

As for physical activity, it was found to be a determinant in the report of seven out of the twelve perceived barriers. An increase in physical activity reduced the perception of these barriers as important, with β values ranging from -0.044 to -0.136. Meanwhile, an increase in BMI led to a higher perception of lack of physical fitness as an important barrier, with a β of 0.062.

Table 4. Analysis of factors associated with the types of perceived barriers to the practice leisure-time physical activity in the final model among university students from federal institutions in the state of Bahia. Brazil. 2019.

Barriers	Variáveis	β	p
Fatigue	Sex	0.096	<0.001
Low physical fitness	Sex	0.049	0.016
Lack of motor skills	Sex	0.059	<0.001
Family responsibilities	Sex	0.041	0.038
Lack of financial resources to pay for tuition or professional services	Sex	0.073	<0.001
Distance to the practice location	Sex	0.066	<0.001
Lack of safety conditions	Sex	0.099	<0.001
Fatigue	Age	-0.125	<0.001
Lack of motivation	Age	-0.076	0.004
Low physical fitness	Age	-0.090	<0.001
Lack of motor skills	Age	-0.106	<0.001
Academic obligations	Age	-0.127	<0.001
Family responsibilities	Age	0.063	0.048
Uncomfortable weather	Age	-0.109	<0.001
Lack of financial resources to pay for tuition or professional services	Age	-0.055	0.036
Distance to the practice location	Age	-0.103	<0.001
Lack of safety conditions	Age	-0.084	<0.001
Lack of facilities	Age	-0.110	<0.001
Low physical fitness	BMI	0.062	0.018
Academic obligations	Work situation	-0.098	<0.001
Excessive workload	Work situation	0.261	<0.001
Lack of facilities	PA	-0.044	0.007
Lack of safety conditions	PA	-0.041	0.024
Distance to the practice location	PA	-0.044	0.043
Lack of financial resources to pay for tuition or professional services	PA	-0.084	<0.001
Lack of motor skills	PA	-0.055	<0.001
Low physical fitness	PA	-0.065	0.003
Lack of motivation	PA	-0.136	<0.001

β : standardized coefficient of determination; PA: physical activity; BMI: body mass index.

Source: Author's own work.

Table 5 presents the fit indices of the final association model. The parameter related to the p-value of the χ^2 test indicated a poor fit. The ratio between the χ^2 value and the degrees of freedom was approximately 2, and both the CFI and NFI were above 0.90. The RMSEA and SRMR values were considered satisfactory. As a robustness check, the structural model was re-estimated using the ML estimator. The model demonstrated excellent fit indices ($\chi^2/df = 2.07$; CFI = 0.997; NFI = 0.994; RMSEA = 0.029, 90% CI: 0.019–0.038), which were consistent with those obtained using the ADF estimator. These findings indicate that the structural relationships identified in the model are robust to different estimation methods.

Table 5. Adequacy/adjustment indices of the final model of factors associated with the types of barriers to the practice of leisure-time physical activity in university students from federal universities in Bahia. Brazil. 2019.

Index	Values obtained	Evaluation
p-value of the χ^2	<0.001	Inadequate
χ^2/df	2.21	Adequate
CFI	0.994	Adequate
NFI	0.989	Adequate
RMSEA (90% CI)	0.031 (0.022-0.040)	Adequate
SRMR	0.195	Adequate

χ^2 : chi-square; χ^2/df : Ratio between the value of χ^2 and the degrees of freedom; CFI: Comparative Fit Index; NFI: Normalized Fit Index; RMSEA: Root Mean Square Error of Approximation; IC90%: 90% Confidence Interval; SRMR: Standardized Root Mean-Square Residual.



Source: Author's own work.

Discussion

This study found that sociodemographic variables were determining factors in the perception of several barriers as being more important. Being female accounted for 1% to 3% of the barriers related to fatigue, low physical fitness, lack of motor skills, family responsibilities, lack of financial resources to pay for tuition or professional services, distance to the practice location, and lack of safety conditions. The perception of lack of safety conditions and fatigue stood out as the most prominent barrier.

These perceptions may be associated with structural and social factors inherent to the current societal model. The literature indicates that women, due to their greater vulnerability to violence and harassment, often perceive a lack of safety in certain environments (Nasser; Hassan, 2022), which in turn affects their decision to engage in physical activity during leisure. This sense of insecurity is widely documented in studies on gender inequality and urban violence (Rede de Observatórios de Segurança, 2019; Nasser; Hassan, 2022).

In 2023, at least eight women were victims of violence every 24 hours in Brazil. Among the states monitored, Bahia recorded the highest number of female homicides (Rede de Observatórios de Segurança, 2019). Additionally, according to Instituto Patrícia Galvão e Locomotiva (2019), 70% of women in this state have experienced some form of violence or harassment during their commutes, either on public transportation or on foot. These data highlight the severity of the problem in public spaces, including potential areas for physical activity. This context of vulnerability directly impacts women's perception of safety, which likely explains why female university students in this study perceived lack of safety as a significant barrier to physical activity in leisure time.

Regarding the predominance of the perception of fatigue as a barrier, it is understood that although women have increasingly gained space in the labor market and educational environments, the unequal division of domestic responsibilities still prevails in many contexts. Studies suggest that women continue to bear most household chores and family responsibilities, even when employed (Mussida; Patimo, 2021). This is also true for female university students (Cruz; Santos, 2023).

In line with this, the present study found that the perception of family responsibilities as a barrier was associated only with female students and increased with age. Therefore, this overlap of multiple social and professional roles (Cruz; Santos, 2023) may heighten the perception of demands related to family tasks among women, especially older women, emerging as a significant barrier to physical activity during leisure time.

On the other hand, age showed an inversely proportional relationship, as increased age was associated with a decreased perception of 11 out of the 12 barriers. In contrast, other studies, such as those by Ramirez-Velez (2015), found that increased age was associated with perceived barriers such as fear of injury and lack of skill. However, a recent systematic review identified a negative association between increasing age and participation in physical activity (Chaabane et al., 2021), as also demonstrated in the national, regional, and global trend study on insufficient physical activity, which included 5.7 million participants (Strain et al., 2024). Therefore, it is evident that perceived barriers are multifaceted and can be influenced not only by age but also by social and environmental contexts that change over time. One possible explanation for the inverse association observed in the present study is that older university students may show greater adaptation to the academic environment and to the routines of university life, which may reduce the perceived impact of barriers related to time management, academic demands, or access to resources for engaging in physical activity. In addition, older students may develop different expectations and coping strategies regarding everyday demands, resulting in a lower perception of obstacles to engaging in LTPA.

Regarding work/internship status, it accounted for the perception of work overload as a barrier in 7% of cases. Conversely, students in this condition reported a lower perception of academic obligations as a significant barrier. This finding suggests that when balancing work and study, university students tend

to reorganize their priorities, favoring one activity over the other. Thus, the overload generated by combining work and academic responsibilities appears to directly influence the perception of barriers to physical activity in leisure time, as observed in other studies (Vieira; Silva, 2019).

In the context of physical activity, it was found to be a determining factor in reducing the perception of seven out of the twelve most significant perceived barriers, with determination indices ranging from 1% to 3%. Specifically, increased physical activity was associated with a reduced perception of the following barriers: lack of facilities, lack of safety conditions, distance to the practice location, lack of financial resources to pay for tuition or professional services, lack of motor skills, low physical fitness, and lack of motivation. The literature supports this, suggesting that low levels of physical activity during leisure are associated with increased perception of barriers across different domains (Sousa; Fonseca, & Barbosa, 2013; Chaabane et al., 2021). This suggests that physical inactivity may amplify the perception of barriers, creating a context in which lack of practice reinforces the perception that the activity is difficult or inaccessible. Thus, encouraging physical activity, especially during leisure time, even gradually, can not only improve health and quality of life of university students (Ketzner et al., 2024) but also help to minimize perceived barriers.

Conversely, an increase in BMI accounted for the perception of low physical fitness as an important barrier by 2%. A recent study that examined the association between barriers to physical activity practice and adiposity markers in university students found that those with higher adiposity indicators more frequently reported barriers such as lack of skills and fear of injury (Duarte et al., 2022). Consequently, overweight students are less likely to be physically active compared to those of normal weight (Alkhaldeh et al., 2024). It is therefore estimated that these students tend to have lower fitness levels due to reduced physical activity levels, which contributes to the perception of this barrier. This phenomenon, however, reveals an apparent contradiction, since regular physical activity is precisely an essential factor for improving fitness and reducing excess weight (Lopez et al., 2022). Furthermore, the perception of lack of physical fitness as a barrier can generate a cycle in which physical inactivity exacerbates fitness issues, making it even harder to overcome the barrier.

According to the theoretical model investigated in this study, although the parameter related to the p-value of the χ^2 indicated a poor fit, it is common in structural model analysis for the χ^2 test to be significant, especially with large samples, and therefore it is not necessarily indicative of poor model fit. The ratio between the χ^2 value and the degrees of freedom was approximately 2, which is considered satisfactory, as values between 1 and 3 are acceptable and indicate good absolute model fit. The CFI and NFI values above 0.90 suggest an excellent fit, thus characterizing the model as adequate in relative comparison to a baseline model. The RMSEA and SRMR values also showed satisfactory fit, as these indicators respectively reflect population-level model quality and the adequacy of residuals between predicted and observed values in the sample. Therefore, it was concluded that the present model demonstrates satisfactory quality in determining the perceived barriers among the university students in this study. In other words, the results indicate that the model is robust and not sensitive to the estimation method used.

A limitation of this study concerns the use of a questionnaire and the online data collection format. However, the questionnaire used demonstrated validity and reproducibility, and the barriers showed satisfactory structural validity (Sousa; Fonseca, 2017). Regarding the online format, frequent invitations were sent throughout the data collection period to minimize low participation. Additionally, a separate study was conducted to assess agreement in reporting LTPA barriers among university students not involved in the current research, using both online and in-person formats. This study indicated that the online method provided a satisfactory level of data quality (data not shown).

On the other hand, by exploring the types of perceived barriers, this study offers a multidimensional analysis that can reveal important nuances in understanding the challenges faced by university students, allowing for more effective targeting of interventions. Estimating the factors associated with each type of barrier and considering their potential interrelations enables a broader understanding of the phenomenon investigated. This contributes to the robustness of the findings, offering a detailed view of how different factors determine the variables investigated.

Therefore, this study enriches the existing literature by addressing the perception of barriers to LTPA among Brazilian university students, contributing to future research in the field and enabling comparisons with other regional and even international contexts. The findings of the present study also have relevant implications for the development of institutional policies aimed at promoting physical activity in the university context. Identifying the different types of perceived barriers and the factors associated with each of them can assist managers and educational policymakers in developing strategies more closely aligned with students' needs. In this context, higher education institutions can implement structural and programmatic actions, such as expanding the availability of physical activity programs on campus and providing adequate and safe spaces for practice, as well as incorporating health promotion initiatives into institutional university policies.

Conclusions

Based on the results of this study, it can be concluded that being female was associated with seven out of the twelve perceived barriers. In contrast, increasing age was associated with a reduced perception of all types of barriers as important. Work/internship status was a determining factor in the perception of work overload as the most important barrier. An increase in physical activity was associated with a decreased perception of seven out of the twelve barriers as important, while a higher BMI was associated with the perception of low physical fitness as an important barrier.

It is recommended that future research explore personalized interventions to overcome barriers to engaging in LTPA, as well as strategies to create enabling environments within educational institutions. It is also suggested to expand the sample to include students from different states and regions of Brazil, allowing for a broader understanding of the barriers to LTPA among university students from diverse cultural and socioeconomic contexts.

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