



Urban environment and sociodemographic factors in physical activity among adults and older adults

Ambiente urbano e fatores sociodemográficos na prática de atividade física em adultos e idosos

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ABSTRACT

Introduction: Insufficient physical activity is a public health challenge as it may be associated with an increased risk of chronic noncommunicable conditions and reduced perception of quality of life. Although environmental and sociodemographic factors influence physical activity, studies in cities in the Brazilian countryside remain limited. **Objective:** To analyze the relationship between perceived urban environment, sociodemographic factors, and physical activity among adults and older adults living in the urban area of Santa Cruz, Rio Grande do Norte, Brazil. **Methods:** A cross-sectional observational study with a quantitative approach was conducted with 229 participants. Physical activity was assessed using the International Physical Activity Questionnaire, and environmental perception was evaluated using the Neighborhood Environment Walkability Scale. Descriptive analyses, correlations, the Student's t test, and multiple linear regression were performed ($p < 0.05$). **Results:** No correlations were observed between physical activity, age, and perceived urban environment, nor were differences in physical activity observed between adults and older adults ($p > 0.05$). In the multiple linear regression analysis, satisfaction with the environment ($\beta = -142.52$; 95% CI: -236.90 to -48.14; $p = 0.003$), age group ($\beta = -156.47$; 95% CI: -273.16 to -39.79; $p = 0.009$), and income ($\beta = -230.93$; 95% CI: -420.47 to -41.39; $p = 0.017$) remained associated with physical activity. **Conclusion:** Sociodemographic factors and perceived urban environment were associated with physical activity, suggesting the multifactorial nature of physically active behavior in urban contexts.

Keywords: Physical activity; Built environment; Aging; Active mobility; Health promotion.

RESUMO

Introdução: A prática insuficiente de atividade física constitui desafio de saúde pública, podendo estar associada ao aumento do risco de condições crônicas não transmissíveis e à redução da percepção da qualidade de vida. Embora fatores ambientais e sociodemográficos influenciem o comportamento ativo, estudos nessa temática em cidades do interior brasileiro ainda são limitados. **Objetivo:** Analisar a relação entre percepção do ambiente urbano, fatores sociodemográficos e atividade física em adultos e idosos residentes na zona urbana de Santa Cruz, Rio Grande do Norte, Brasil. **Métodos:** Estudo observacional transversal com abordagem quantitativa, realizado com 229 participantes. A atividade física foi avaliada pelo International Physical Activity Questionnaire, e a percepção ambiental pela Neighborhood Environment Walkability Scale. Foram realizadas análises descritivas, correlações, teste t e regressão linear múltipla ($p < 0,05$). **Resultados:** Não foram observadas correlações entre atividade física, idade e percepção do ambiente urbano, nem diferenças na atividade física entre adultos e idosos ($p > 0,05$). Na regressão linear múltipla, satisfação com o ambiente ($\beta = -142,52$; IC 95%: -236,90 a -48,14; $p = 0,003$), grupo etário ($\beta = -156,47$; IC 95%: -273,16 a -39,79; $p = 0,009$) e renda ($\beta = -230,93$; IC 95%: -420,47 a -41,39; $p = 0,017$) permaneceram associados à atividade física. **Conclusão:** Fatores sociodemográficos e percepção do ambiente urbano estiveram associados à atividade física, sugerindo o caráter multifatorial do comportamento ativo em contextos urbanos.

Palavras-chave: Atividade física; Ambiente construído; Envelhecimento; Mobilidade ativa; Promoção da saúde.

Introduction

Physical activity (PA) is conceptualized as a complex and dynamic behavior, present in different domains, including leisure, mobility, household chores, and work¹. Regular exercise is associated with promoting health and preventing chronic non-communicable diseases, including cardiovascular disease, type 2 diabetes, high

blood pressure, obesity, and various types of cancer²⁻⁴. Despite its benefits, levels of physical inactivity remain high worldwide. In Brazil, recent data indicate that 33.3% of adults in the capitals of Brazilian states and the Federal District have insufficient levels of PA⁵. This result is similar to global estimates, according to which 27% to 32% of adults do not meet the minimum PA

recommendations, with a higher prevalence in higher-income countries and in contexts marked by rapid urbanization^{6,7}.

This behavior results from the interaction of multiple determinants, which makes it difficult to explain based on a single dimension⁸. This view is consistent with ecological models of health behavior, which posit that PA emerges from a combination of individual, interpersonal/social, environmental, and political factors⁹. In this context, the urban environment has received attention due to its influence, with attributes such as street connectivity, accessibility to destinations, the presence of green spaces, and the quality of the infrastructure being associated with greater participation in PA^{10,11}.

Beyond the physical characteristics of the environment, the perception of the urban environment also influences active behavior. Factors such as safety, aesthetics, and environmental quality influence how urban spaces are used and, consequently, levels of PA^{12,13}. Additionally, the relationship between the urban environment and PA varies according to population groups, with different characteristics of the built environment having distinct effects on children, adults, and older adults¹⁴.

The relationship between the urban environment and PA varies throughout the life cycle, reflecting physiological, social, and behavioral changes associated with aging. Physical activity levels tend to decrease progressively with age, and this decline is influenced by factors such as reduced functional capacity, a higher prevalence of chronic diseases, and changes in daily routines¹⁵. A systematic review with meta-analysis indicates that, in older adults, the associations between the built environment and PA are inconsistent and depend on the activity domain analyzed, as well as the specific characteristics of the environment¹⁶. Furthermore, the practice of PA is not evenly distributed across the population, as it is influenced by individual, social, and contextual determinants, including gender, socioeconomic level, health status, and psychosocial factors, reflecting the multifactorial nature of this behavior^{17–20}.

Despite advances in research, much of the current evidence is concentrated in large urban centers and high-income countries. This limits the generalizability of the results to different contexts, such as smaller cities and developing regions, where urban, social, and economic characteristics may differ substantially^{21–23}. In the Brazilian context, studies point to the importance of deepening understanding of environmental factors associated with PA, as well as improving assessment

methods and instruments considering local specificities^{23–25}.

Considering that municipalities in the interior of Northeast Brazil present urban, social, and environmental characteristics distinct from large centers and remain little explored in the national literature, the objective of the current study was to analyze the associations between the perception of the urban environment, sociodemographic factors, and the practice of PA in adult and older adult residents in the urban area of a municipality in the interior of Northeast Brazil.

Methods

This is a cross-sectional observational study with a quantitative approach, conducted with adult and older adult residents in the urban area of the municipality of Santa Cruz, Rio Grande do Norte, Brazil. According to data from the Brazilian Institute of Geography and Statistics²⁶, the municipality has approximately 38,996 inhabitants, a territorial area of 624 km², and a population density of 59.76 inhabitants/km², which is substantially lower than that observed in the state capital, Natal (4,488.03 inhabitants/km²). Data collection took place between November 2025 and February 2026, covering neighborhoods in all regions of the municipality.

Ethical considerations

The study was conducted in accordance with the ethical principles established in Resolution No. 466/2012 of the National Health Council, which regulates research involving human beings in Brazil.

The project was approved by the Research Ethics Committee of the Federal Institute of Education, Science and Technology of Rio Grande do Norte (*Comitê de Ética em Pesquisa-CEP do Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Norte – IFRN*), through the Brazil Platform, under CAAE No. 91933225.9.0000.0225. All participants were informed about the objectives, procedures, risks, and benefits of the research, and were guaranteed confidentiality of information and the right to withdraw at any time. Participation occurred after signing the Informed Consent Form.

Sample

The sample consisted of 229 participants recruited using non-probability convenience sampling. Recruitment was conducted in homes, streets, and public spaces in different neighborhoods, seeking to broaden the

diversity of the sample. In total, 252 individuals were approached. Of these, 16 did not agree to participate, and 7 did not complete the data collection instruments due to understanding difficulties during the interview, resulting in a final sample of 229 participants (128 female and 101 male). As only fully completed questionnaires were included in the analyses, there were no missing data.

Eligibility criteria

Individuals aged 18 years or older, who had resided in the urban area of the municipality for at least six months, who voluntarily agreed to participate in the study by signing the Informed Consent Form, and who demonstrated the capacity to understand and respond to the data collection instruments were included.

Data collection

The interviews were conducted exclusively by the principal investigator, who had been previously trained in the standardized application of the instruments, through the in-person and individual administration of printed questionnaires, from Wednesday to Friday, during the morning and afternoon periods. After the participant had signed Informed Consent Form, all questions were read aloud by the researcher, who recorded the answers directly on the forms, maintaining the sequence of questions and the same application procedures for all participants, in order to ensure uniformity in data collection throughout the study period.

Instruments

PA was assessed using the short form of the International Physical Activity Questionnaire (IPAQ), validated for the Brazilian population. This instrument was developed by an international consortium with the aim of standardizing PA measurements across different countries and cultural contexts²⁷. In the Brazilian validation study, the version showed satisfactory results regarding validity and reproducibility²⁸. For the analyses, the total time spent on PA in minutes per week (min/week) was used, calculated by summing the weekly minutes of walking and moderate PA, plus twice the minutes of vigorous PA, and only considering episodes with a minimum duration of 10 continuous minutes.

The perception of the urban environment was assessed using the Neighborhood Environment Walkability Scale (NEWS), adapted for the Brazilian context, composed of 83 items. This instrument is used to

collect information about an individual's perceptions of urban environment characteristics related to mobility and PA²⁹. According to Malavasi et al.³⁰, the questionnaire presents an α value of 0.8042, indicating a good level of internal consistency, making it suitable for evaluating the relationship between environmental barriers and PA in Brazilian communities. The dimensions analyzed were residential density (neighborhood), access to destinations, street characteristics, places for walking or cycling, neighborhood aesthetics (surroundings), traffic safety, safety in relation to crime, and satisfaction with the environment. The scores were calculated by averaging the corresponding items, with negative items previously reversed, so that higher values represented a more favorable perception of the urban environment.

Sociodemographic data were collected using a questionnaire containing information on age, gender, marital status, income, and education. Marital status was categorized as single, married/cohabiting, divorced, and widowed. Income was categorized as <1 minimum wage, 1–2 minimum wages, 3–4 minimum wages, and ≥ 5 minimum wages, considering as a reference the national minimum wage of R\$ 1,518.00 in effect at the beginning of data collection. For statistical analysis, education level was grouped into four categories: no schooling, complete or incomplete primary education, complete or incomplete secondary education, and complete or incomplete higher education.

Statistical analysis

Statistical analysis was performed using JASP software (version 0.95.4; JASP Team, Amsterdam, Netherlands). Sample size was estimated using a priori power analysis in G*Power software, version 3.1³¹. A medium effect size ($f^2 = 0.15$) was considered, as proposed by Cohen³², adopting a statistical power of 80%, significance level of $\alpha = 0.05$, and 15 predictors, resulting in a minimum sample of 139 participants..

Initially, a descriptive analysis of the variables was performed. Continuous variables are presented as mean and standard deviation, accompanied by the median and minimum and maximum values to complement the description of the data distribution, and categorical variables as absolute and relative frequency. The normality of the data was assessed using the Shapiro-Wilk test, Q-Q plots, skewness, and kurtosis. Considering the high sensitivity of the Shapiro-Wilk test to sample size, the choice of how to present continuous variables and the statistical tests also took into account the visual

inspection of the distributions. Pearson or Spearman correlations were used, depending on the data distribution, and the t-test for independent samples was used to compare adults and older adults.

Multiple linear regression models using the Enter method were employed to investigate the associations between PA, sociodemographic variables, and perception of the urban environment. All independent variables were included simultaneously in the model. The adequacy of the model was assessed by inspecting the residuals, verifying the assumptions of independence, normality, and homoscedasticity. Multicollinearity among the independent variables was assessed using the Variance Inflation Factor ($VIF < 5$) and tolerance (> 0.20). The significance level adopted was $p < 0.05$.

Results

Sample characteristics

The sample ($n = 229$) was composed mostly of female participants (55.9%) and adults (60.3%). A predominance of participants had primary education (37.1%), an income between 1 and 2 minimum wages (59.8%), and were married (52.0%). The remaining characteristics are presented in Table 2.

Table 1 – Sociodemographic characteristics of the sample

Variable	n	%
Gender		
Female	128	55.9
Male	101	44.1
Age group		
Adult	138	60.3
Older adult	91	39.7
Schooling		
No schooling	6	2.6
Primary education	85	37.1
Secondary education	79	34.5
Higher education	59	25.8
Income		
< minimum wage	35	15.3
1 - 2 minimum wages	137	59.8
3 - 4 minimum wages	20	8.7
≥ 5 minimum wages	37	16.2
Marital status		
Married	119	52.0
Single	67	29.3
Widowed	23	10.0
Divorced	20	8.7

Values are expressed as absolute (n) and relative (%) frequency. Education levels include the categories complete and incomplete.

Reported PA averaged 528.52 min/week ($SD = 384.46$), with values ranging from 0 to 1890 min/week. The mean age was 50.01 years ($SD = 18.86$). Variables related to the perception of the urban environment showed moderate values, with higher means for satisfaction (3.49 ± 0.60) and safety in relation to crime (3.18 ± 0.56), while the availability of places to walk or cycle presented lower values (1.90 ± 0.41). The variables related to the perception of the urban environment indicated intermediate means for access (2.64 ± 0.42) and traffic safety (2.32 ± 0.38). Table 1 presents the complete findings.

Table 2 – Descriptive characteristics of the continuous variables in the study

Variable	Mean $\pm$ standard deviation	Median	Minimum-maximum
Physical activity (minutes/week)	528.52 $\pm$ 384.46	470.00	0 – 1890
Age (years)	50.01 $\pm$ 18.86	51.00	18 – 88
Neighborhood	2.04 $\pm$ 0.28	2.00	1.33 – 3.00
Streets	2.90 $\pm$ 0.51	3.00	1.00 – 4.00
Places to walk/cycle	1.90 $\pm$ 0.41	1.80	1.00 – 3.60
Surroundings	2.34 $\pm$ 0.47	2.33	1.00 – 3.67
Satisfaction	3.49 $\pm$ 0.60	3.56	1.06 – 4.94
Accessibility	2.64 $\pm$ 0.42	2.71	1.29 – 3.57
Traffic safety	2.32 $\pm$ 0.38	2.25	1.38 – 3.63
Crime safety	3.18 $\pm$ 0.56	3.17	1.50 – 4.00

Values are expressed as mean $\pm$ standard deviation, median, and minimum-maximum values.

Correlations between physical activity, age, and perception of the urban environment

The correlations between PA, age, and perception of the urban environment are presented in Table 3. No correlations were observed between PA and age or variables of perception of the urban environment ($p > 0.05$).

Regarding age, positive correlations were observed with neighborhood ($r = 0.154$; $p = 0.020$) and surroundings ($r = 0.173$; $p = 0.009$), in addition to a negative correlation with traffic safety ($\rho = -0.172$; $p = 0.009$). There were no correlations between age and streets, places to walk or cycle, satisfaction, access, and safety in relation to crime ($p > 0.05$).

No differences were observed between adults and older adults for PA (566.45 ± 406.87 vs. 470.99 ± 341.92 min/week; $p = 0.066$), nor for the variables of perception of the urban environment evaluated ($p > 0.05$) (Table 4).

When comparing genders, no differences were observed for PA ($p = 0.079$). Differences were observed

for the variables surroundings, traffic safety, and satisfaction. The female gender showed higher means for surroundings (2.41 ± 0.46 vs. 2.26 ± 0.47 ; $p = 0.017$), while the male gender showed higher means for traffic safety (2.40 ± 0.38 vs. 2.26 ± 0.36 ; $p = 0.005$) and satisfaction (3.64 ± 0.62 vs. 3.37 ± 0.56 ; $p < 0.001$). No differences were observed between genders for the other variables evaluated ($p > 0.05$).

Table 3 – Correlations between physical activity, age, and perception of the urban environment

Variable	Physical activity (minutes/week)	p	Age	p
Age	-0.118 ^a	0.076	—	—
Neighborhood	-0.016 ^a	0.808	0.154 ^b	0.020*
Streets	0.022 ^a	0.744	0.038 ^b	0.567
Places for walking/cycling	0.082 ^a	0.217	0.019 ^a	0.772
Surroundings	0.001 ^a	0.994	0.173 ^b	0.009**
Satisfaction	-0.127 ^a	0.055	-0.092 ^a	0.167
Access	-0.098 ^a	0.139	0.060 ^b	0.366
Traffic safety	-0.126 ^a	0.057	-0.172 ^a	0.009**
Crime safety	-0.074 ^a	0.262	0.122 ^a	0.066

a = Spearman correlation; b = Pearson correlation; * $p < 0.05$; ** $p < 0.01$.

Multiple linear regression: predictors of physical activity

Multiple linear regression analysis identified associations between satisfaction with the environment, age group, and income with PA (min/week), as shown in Table 5. Satisfaction with the environment was associated with PA (min/week), $\beta = -142.52$ (95% CI: -236.90; -48.14; $p = 0.003$), as was the older adult age group, $\beta = -156.47$ (95% CI: -273.16; -39.79; $p = 0.009$), and income between 3 and 4 minimum wages,

$\beta = -230.93$ (95% CI: -420.47; -41.39; $p = 0.017$). The other variables did not remain significantly associated with PA (min/week) after adjusting for the variables included in the model. The model presented $R^2 = 0.12$, adjusted $R^2 = 0.07$, and $p = 0.005$.

Table 5 – Multiple linear regression model for weekly physical activity time

Variable	β	95% CI	p
Satisfaction	-142.52	-236.90; -48.14	0.003
Age group (older adult)	-156.47	-273.16; -39.79	0.009
Income (3–4 minimum wages)	-230.93	-420.47; -41.39	0.017

β = unstandardized regression coefficient; 95% CI = 95% confidence interval; $R^2 = 0.12$; adjusted $R^2 = 0.07$; $F(15,213) = 2.47$; $p = 0.005$.

Discussion

The current investigation aimed to understand how the perception of urban spaces and sociodemographic factors relate to PA in adult and older adult residents in the urban area of a municipality in the interior of Northeast Brazil. The main findings indicated that PA was associated with satisfaction with the urban environment, age group, and income. In the comparisons between groups, no differences in PA were observed between adults and older adults or between genders, while gender-related differences were identified for some dimensions of environmental perception, especially surroundings, traffic safety, and satisfaction with the environment.

The results suggest associations between PA and sociodemographic factors, as well as with the perception of the urban environment, after adjusting for the variables included in the model. The association between age group and PA observed in the multiple regression follows a pattern frequently identified in the

Table 4 – Comparison of physical activity variables and environmental perception according to age group and gender

Variable	Adults Mean $\pm$ standard deviation	Older adults Mean $\pm$ standard deviation	p	Female Mean $\pm$ standard deviation	Male Mean $\pm$ standard deviation	p
Physical activity (minutes/week)	566.45 $\pm$ 406.87	470.99 $\pm$ 341.92	0.066	568.20 $\pm$ 390.11	478.22 $\pm$ 373.04	0.079
Neighborhood	2.01 $\pm$ 0.27	2.08 $\pm$ 0.30	0.055	2.07 $\pm$ 0.27	2.00 $\pm$ 0.30	0.058
Streets	2.90 $\pm$ 0.49	2.91 $\pm$ 0.55	0.895	2.87 $\pm$ 0.54	2.94 $\pm$ 0.48	0.315
Places for walking/cycling	1.89 $\pm$ 0.43	1.92 $\pm$ 0.37	0.553	1.93 $\pm$ 0.41	1.86 $\pm$ 0.40	0.185
Surroundings	2.31 $\pm$ 0.50	2.40 $\pm$ 0.41	0.125	2.41 $\pm$ 0.46	2.26 $\pm$ 0.47	0.017*
Satisfaction	3.54 $\pm$ 0.66	3.42 $\pm$ 0.51	0.150	3.37 $\pm$ 0.56	3.64 $\pm$ 0.62	<0.001*
Access	2.64 $\pm$ 0.43	2.65 $\pm$ 0.42	0.782	2.66 $\pm$ 0.43	2.62 $\pm$ 0.42	0.560
Traffic safety	2.35 $\pm$ 0.41	2.27 $\pm$ 0.33	0.149	2.26 $\pm$ 0.36	2.40 $\pm$ 0.38	0.005*
Crime safety	3.15 $\pm$ 0.58	3.23 $\pm$ 0.53	0.312	3.16 $\pm$ 0.56	3.21 $\pm$ 0.56	0.495

Independent samples t-test; * $p < 0.05$.

international literature. A systematic review involving older adults demonstrated a progressive reduction in PA levels with advancing age, with less participation in regular activities among older age groups¹⁵. Similarly, demographic and biological factors, including age and gender, have been consistently identified as important correlates of active behavior in different populations⁸. Evidence shows wide variation in PA levels among distinct population groups and geographic contexts, suggesting that active behavior is influenced by multiple individual and environmental factors^{6,17}.

Although no significant differences in PA were observed between adults and older adults, age group remained associated with PA in the adjusted model. Furthermore, the association between income and PA observed in this study reinforces the importance of socioeconomic factors in understanding this behavior. In a systematic review with meta-analysis stratified by socioeconomic level, only walking and cycling infrastructure showed a positive association with PA in older adults with lower socioeconomic status, while natural facilities and green spaces did not show consistent associations¹⁹. In another study, traffic safety, accessibility to destinations, urban aesthetics, and density of sports facilities were identified as attributes associated with PA in older adults³³. However, recent evidence indicates that the magnitude of these relationships varies according to the population, the urban context, and the specific domain of PA analyzed³⁴.

Regarding the perception of the urban environment, the observed correlations had a low magnitude and were not statistically significant. This pattern converges with evidence pointing to inconsistent results when environmental characteristics are evaluated in isolation. A meta-analysis including perceived environment identified reduced magnitudes and heterogeneity in the associations between different environmental characteristics and PA²¹. In European adults, the relationship between physical environment and PA also showed distinct behavior according to the domain analyzed, including leisure-time and transportation PA, and total PA³⁵. More recent results reinforce that multiple characteristics of the built environment may show mixed or no associations with PA when analyzed in different age groups¹⁴.

Although studies conducted in large urban centers have demonstrated positive associations between walkability, access to destinations, street connectivity, and levels of PA, these relationships may vary according to

the characteristics of the urban context analyzed¹⁰. Recent research indicates that urban environments more conducive to active mobility tend to be associated with higher levels of PA and better health-related indicators^{11,36}. In the Brazilian context, however, the high heterogeneity among cities regarding urban organization, accessibility, distribution of public spaces, and mobility patterns may be associated with differences in the relationship between the perception of the urban environment and PA^{12,25}.

The negative association observed between satisfaction with the urban environment and PA diverges from the pattern frequently described in the literature, in which more positive environmental perceptions are associated with active behaviors. However, the relationship between perception of the urban environment and PA appears to vary according to contextual, behavioral, and individual factors. In a Latin American urban population, associations in different directions were observed between perceived environmental characteristics and PA, including inverse associations between more favorable perceptions of certain environmental attributes and some domains of PA¹³. These findings suggest that more favorable perceptions of the environment do not necessarily correspond to greater PA in all contexts. In adults and older adults of lower socioeconomic status, attributes of the built environment, such as urban aesthetics and street connectivity, were associated with walking and moderate to vigorous PA, indicating that environmental influence may vary according to the PA domain analyzed³⁷. Previous studies also suggest that perceived environmental attributes are associated with how individuals experience the urban environment, but that this relationship is not always directly reflected in PA³⁸. Additionally, individual cognitive factors, including self-efficacy, perceived control, and behavioral habits, have been identified as possible factors associated with the relationship between the built environment and PA²⁰.

In the comparisons between genders, although no differences were observed for PA, differences were identified related to satisfaction with the environment, traffic safety, and surroundings. These results suggest differences between males and females in some dimensions of urban environment perception. In a systematic review conducted in Latin American countries, associations between perception of the urban environment and PA showed distinct behavior depending on the PA domain analyzed³⁹. Similarly, in a Chilean urban

population, certain perceived environmental characteristics showed distinct associations with PA between men and women¹³.

Studies conducted in the Brazilian context have also identified associations between the use of public spaces, accessibility to leisure areas, and levels of PA, although with heterogeneous results among different populations and regions of the country. Perceived characteristics of the built environment have been associated with different forms of PA in Brazilian adults¹². Accessibility to public spaces has been linked to the practice of PA in the Brazilian urban population²⁵, while patterns of use of open public spaces have been shown to be associated with levels of PA²⁴. National reviews indicate joint associations of individual, environmental, and social variables in the use of these spaces²².

The low magnitude of the associations and the reduced explanatory power of the model reinforce the multifactorial nature of PA. Ecological models in health suggest that PA results from the simultaneous interaction between individual, social, environmental, and behavioral factors, making it difficult to identify strong associations when environmental characteristics are analyzed in isolation⁹. Therefore, aspects related to the built environment should be interpreted as part of a complex network of determinants of PA, influenced by cognitive, cultural, socioeconomic, and contextual factors^{8,20,40}.

Several methodological aspects should be considered when interpreting the results. As this is a cross-sectional study, the findings allow for the verification of associations between the variables investigated, without establishing causal relationships. Among the study's limitations, the use of self-reported instruments stands out, as these can be subject to memory bias and social desirability biases. Convenience sampling also limits the generalizability of the results, which must be interpreted within the context of the investigation and not extrapolated to other populations or municipalities with distinct characteristics. Furthermore, the absence of variables related to health status and functional capacity may have influenced the observed associations. Despite this, the study contributes by simultaneously investigating sociodemographic factors and the perception of the urban environment in adult and older adult residents of a municipality in the interior of Northeast Brazil, a context that is still little explored in the national literature. Future studies could use longitudinal designs, incorporate objective measures of PA, such as accelerometry, and consider different domains

of PA and characteristics of the urban environment.

In conclusion, PA in adult and older adult residents in the investigated municipality was associated with sociodemographic factors and subjective aspects of the perception of the urban environment. Among the variables analyzed, age group, income, and satisfaction with the environment remained associated with PA, while the other environmental dimensions showed weak or inconsistent associations, suggesting the multifactorial nature of active behavior.

Although no differences in PA were observed between adults and older adults in the comparisons between groups, age group remained associated with PA in the regression model. The consistency of income and satisfaction with the environment in the model suggests associations between socioeconomic and perceptual factors and PA (min/week) in the investigated population. Furthermore, the inverse association between satisfaction with the urban environment and PA suggests that favorable environmental perceptions do not always correspond to higher PA.

The present study broadens the understanding of the relationship between the urban environment and PA in cities in the interior of Northeast Brazil, a context that has been little explored in the literature. The findings suggest that social and individual factors may be more relevant than traditional attributes of the built environment, highlighting the importance of considering territorial, socioeconomic, and cultural particularities in the investigation of active behavior.

Conflicts of interest

The authors declare no conflict of interest.

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Authors' contributions

Aloise A: Conceptualization; Methodology; Data analysis; Re-

search; Data curation; Project management; Original manuscript writing; Writing - revision and editing; Approval of the final manuscript version. Moreira H: Conceptualization; Methodology; Supervision; Writing - revision and editing; Approval of the final manuscript version.

Statement regarding the use of artificial intelligence tools in the article writing process.

For the preparation of this manuscript, the artificial intelligence tools ChatGPT and SciSpace were used to perform the following activities: assistance in linguistic revision, textual adaptation for Brazilian Portuguese, translation of the abstract, and text organization.

Availability of research data and other materials

After publication, the data will be available from the authors upon request.

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Reviewers' assessment

The authors and/or reviewers did not authorize the publication of either of the two reviews.