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Comparison of physical activity time, sedentary behavior and anxiety symptoms of residents of coastal cities and non-coastal cities: a cross-sectional study

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ABSTRACT

OBJECTIVE

The objective of this study was to examine the duration of physical activity, sedentary behavior, and anxiety symptoms among inhabitants in coastal cities and non-coastal cities.

METHOD

This cross-sectional study, included residents in the city of São Sebastião (coastal city) and São Paulo (non-coastal city). The research participants completed questionnaires assessing anxiety symptoms using the Beck Anxiety Inventory and their physical activity time and sedentary behavior using the International Physical Activity Questionnaire. The surveys were sent using the Google Forms Platform, with participants selected based on convenience.

RESULTS

A total of 308 participants were included in the present study, with 154 participants from the coastal city and 154 participants from the non-coastal city. Significant differences ($p<0.001$) were verified for the variables: walking [(coastal city = 80 (30 – 210 minutes per week); non-coastal city = 100 (30 – 195 minutes per week)], moderate intensity physical activity [coastal city = 120 (0 – 285 minutes per week); non-coastal city= 75 (0 – 203 minutes per week)], moderate and vigorous physical activity [costal city = 150 (0 – 360 minutes per week); non-coastal city = 122 (0 – 300 minutes per week)], and for the variables weekday sedentary behavior [coastal city= 4.0 (3.0 – 8.0 hours); non-coastal city = 6.0 (5.0 – 9.0 hours)], and daily sedentary behavior [coastal city= 4.8 (2.9 – 7.0 hours); non-coastal city = 6.6 (4.9 – 9.1 hours)].

CONCLUSION

Residents in coastal cities exhibit increased walking duration, moderate, moderate and vigorous physical activity, and reduced sedentary behavior during weekday, as well as sedentary behavior daily. However, they do not experience diferences in symptoms of anxiety.

KEYWORDS

Exercise; Public health practice; City.

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INTRODUCTION

Studies have shown that living in coastal cities (CC) may have an impact on physical activity (PA) and sedentary behavior (SB), primarily due to the increased accessibility of flat coastline streets. These accessibility enable individuals to engage in leisure or transportation activities such as walking or biking. This issue has emerged as a significant topic of discussion, with evidence either supporting or refuting this idea.[1,2] Even a non-consensus about it can be considered; those residing in an environment characterized by a higher presence of green spaces exhibit a greater propensity to meet the recommended quantity of PA.

Moreover, residing in regions with greater proximity to vegetation such as CC, correlates with diminished physiological and psychological stress.[5,6] increased physical and mental well-being , and improved mental health.[3-8] The study conducted by White et al.[2] utilizing a British sample revealed that individuals residing near the coastal area exhibited superior mental health indicators compared to those living at a greater distance from the shoreline. In conjunction with White et al. the findings of Liu et al.[9], also with British sample, indicate that green space, blue space, and the natural environment significantly reduce the risk of psychiatric disorders in middle-aged and older adults . Finally, A study involving an Australian sample demonstrated that nature-relatedness orientation, characterized by individuals deriving pleasure from spending time in natural environments, shows significant potential as a protective factor against elevated levels of depression.[8]

It is crucial to emphasize that the majority of research investigating the relationship between mental health, PA and SB among individuals in CC compared to non-coastal cities (NCC) has primarily been conducted in high-income countries. Unfortunately, there is a paucity of information regarding this subject in low- and middle-income nations, including Brazil.

Thus, the objective of this study is to investigate the potential difference between living in a CC (São Sebastião, São Paulo, Brazil) and the duration of PA and SB as well as mental health outcomes, such as anxiety symptoms, in comparison to those residing in a NCC (São Paulo, São Paulo, Brazil). The current investigation proposes that individuals residing in CC will exhibit higher PA time and decreased time of SB and levels of anxiety.

METHODS

Study design

This was a study with a cross-sectional design, met the precepts of the Declaration of Helsinki, was approved by the local Ethics and Research Committee with protocol number 5.707.995, and all participants agreed to the free and informed consent form.

Participants

People who had medical and/or clinical conditions that prevented the practice of PA were not considered for this research.

The investigation subjects consisted of adult residents living in the CC of São Sebastião, located in the state of São Paulo, Brazil. This group of people was recruited at the XV Jornada da Saúde event, organized by students from the Medicine program at Universidade Santo Amaro. The city of São Sebastião is inhabited by around 91,637 persons. The locality has a human development index of 0.77, indicating a relatively high level of development. In terms of population density, São Sebastião has an average of 185.00 residents per square kilometer. Furthermore, reports indicate that 98% of individuals between the ages of 6 and 14 attend school.

The other group, consisting of adults living in the NCC (São Paulo, São Paulo, Brazil), was recruited in actions at the PA, Sport and Mental Health Laboratory (LAFESAM) at Universidade Santo Amaro. The city of São Paulo has an estimated population of 12,396,372 people, and the municipal human development index is 0.80. The demographic density of the city is at 7,398.26 residents per square kilometer, and the schooling rate from 6 to 14 years of age is 96%.

Sample characterization

The participants answer a brief interview to determine the characteristics of the sample, including gender, age, presence of comorbidities, tobacco usage, and alcohol consumption. Furthermore, the researchers utilized the Beck Anxiety Inventory (BAI) questionnaire to evaluate symptoms of anxiety, as well as the International PA Questionnaire (IPAQ) to measure the quantity of time spent engaging in PA. These instruments are described in additional detail for better comprehension.

Beck anxiety inventory (BAI)

The Beck anxiety inventory (BAI) is a simple evaluation instrument of 21 items that encompass cognitive, emotional and physical dimensions of anxiety.[10-12] Each item is measured using a 4-point scale ranging from “strongly disagree (0)” as no symptoms to “strongly agree” (3) as a severely affected by the symptoms. The count varies from 0 to 63 points. The BAI shows good reliability (Cronbach's alpha coefficient = 0.95) and test-retest reliability (Pearson's r = 0.73 to 0.96), and presents high correlations with other anxiety measures (State-Trait Anxiety Inventory = 0.58; Daily Anxiety = 0.54). The cutoff point adopted to identify low and high anxiety symptoms accompanied that shown in a previous study <13 points (low anxiety symptoms) and ≥13 points (high anxiety symptoms).

International Physical Activity Questionnaire (IPAQ)

The IPAQ is a questionnaire developed with the objective of estimating the level of habitual practice of PA for a population.[13] There is two versions available, one in the long format and the other in the short format. For the present study, the short version of the IPAQ was used and it is composed of 8 questions related to the time spent in the last week in physical activities in its different domains: walking, moderate intensity PA (MPA) and vigorous intensity PA (VPA). Time spent in moderate and vigorous activity (MVPA) was calculated as the number of days multiplied by the number of hours reported. The IPAQ has good reliability (Spearman correlation coefficient = 0.80) and presents high correlations with other measures of PA (accelerometer = 0.70 to 0.80).

Statistical analysis

For continuous variables, data are presented as mean (standard deviation) or median and interquartile range (IQR). Categorical variables are displayed as absolute and frequency (percentage) values. Using the Kolmogorov-Smirnov test and Levene's test, normality and equality of variances were assessed. Median and interquartile range are displayed for non-parametric data (IQR: 25 – 75).

The Mann-Whitney test was used to compare the two groups (CC and NCC). The results of the logistic regression models were presented as odds ratios (ORs). Using the Spearman Correlation Test, the presence of relationships between numerical variables (MVPA, SB, symptoms of anxiety and depression) was investigated. Using IBM SPSS Statistics version 22, data were analyzed (SPSS Inc., Chicago, IL, USA). The significance level was set at P 0.05.

RESULTS

A total of 308 participants were included in the present study, with 154 participants from the CC and 154 participants from the NCC. Table 1 presents information regarding sample characteristics, which did not differ between the groups. The groups were around 45 years old, predominantly composed of women (more than 70%), with part of the sample using tobacco (approximately 10%) and alcohol (approximately 30%). In relation to carrying out the World Health Organization (WHO) MVPA recommendation (≥ 150 minutes per week), a higher percentage was found among participants from the CC (52%) compared to the NCC (17%).

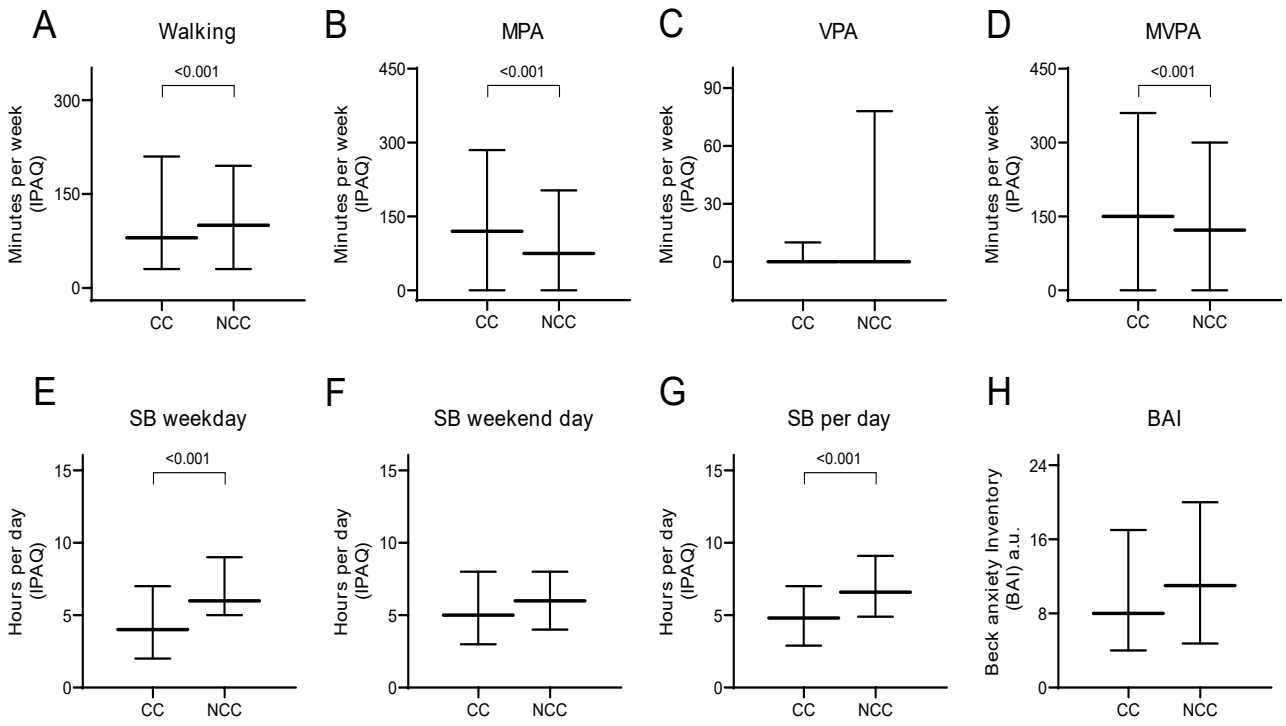
Table 1 - Sample characterization

Variable	Coastal city (n= 154)	Non-coastal city (n=154)	P
Age	45.3 ± 13.7	43.1 ± 7.0	0.076
Women (%)	75	71	0.524
Smoking (%)	10	8	0.450
Alcohol use (%)	38	27	0.0109
≥ 150 minutes per week of MVPA (%)	52	17	<0.001
≤ 6 hours of SB per day (%)	28	38	0.132
≥ 13 points anxiety symptoms (%)	34	43	0.103

Legend: MVPA = modarate and vigorous physical activity; SB = sedentary behavior.

Figure 1 presents comparisons regarding measures of PA (Panels A-D), SB (Panels E-G), and anxiety symptoms (Panel H). In summary, significant differences (p<0.001) were verified for the variables: walking [(CC = 80 (30-210 minutes per week); NCC = 100 (30-195 minutes per week)], AFM [CC = 120 (0-285 minutes per week); NCC = 75 (0-203 minutes per week)], and MVPA [CC = 150 (0-360 minutes per week); NCC = 122 (0-300 minutes per week)], and for the variables weekday SB [CC = 4.0 (3.0-8.0 hours); NCC = 6.0 (5.0-9.0 hours)], and daily SB [CC = 4.8 (2.9-7.0 hours); NCC = 6.6 (4.9-9.1 hours)]. No difference were observed for VPA variables, as SB weekend day, and BAI.

Figure 1 - Comparison of participants from a coastal city (São Sebastião) and a non-coastal city (São Paulo) regarding the walking variables (Panel A), Moderate physical activity (Panel B), Vigorous physical activity (Panel C), Moderate physical activity and vigorous activity (Panel D), Sedentary behavior on weekdays (Panel E), Sedentary behavior on weekend days (Panel F), Sedentary behavior per day (Panel G), Anxiety symptoms (Panel H). CC = coastal city; NCC = non-coastal city; MPA = Moderate physical activity; VPA = vigorous physical activity; MVPA = moderate/vigorous physical activity;SB = sedentary behavior; BAI = Beck anxiety inventory.



Source: Authors (2025)

DISCUSSION

The current study examined whether individuals residing in a CC exhibit increased duration of PA and reduced symptoms of anxiety in comparison to individuals residing in a NCC. In summary, our study revealed that individuals residing in a CC exhibit significantly improved metrics in terms of PA (walking, MPA, MVPA) and SB (weekdays and on a daily basis).

Prior studies[1, 7] have shown that residents of CC have longer PA time, shorter SB, and fewer anxiety symptoms compared to those in NCC. Our research partially supports these findings, as we did not find any statistical differences in anxiety symptoms.[1, 7] Fuller and colleagues[6] found that individuals living in urban areas with green spaces still have some exposure to biodiversity. They discovered a positive relationship between urban green spaces and the well-being of visitors to these areas. This suggests that in cities without coastal areas, constructed green spaces can enhance overall well-being.

The greatest duration of walking time recorded in the NCC may be attributed to the significant usage of public transportation, such as subways and buses, which often necessitates walking between subway stations and from residences to bus stops. In addition, utilizing bicycles for commuting in the CC might affect the duration of walking, reducing it, and increasing the time spent on MVPA. The research stated indicates that persons from CC engage in higher outdoor MVPA, particularly through seaside activities.

Regarding the presence of blue spaces in CC, these areas may offer convenient opportunities for engaging in water activities. However, Pasanen and their colleagues[3] demonstrated that few individuals living in these areas practice them, and, therefore, they

do not represent positive health associations for the population. Thus, the health benefits of CC living appear at least in part due to participation in outdoor land-based activities. The results of our study indicate that residents of a CC, which has more access to green areas, engage in more PA and spend less time in SB compared to earlier research conducted in the United Kingdom and the Netherlands.[14,15] More research is needed to explore the mechanisms behind the relationship between living in a CC, spending more time on PA and less time on SB, and having better mental health outcomes.

The mentioned findings indicate that while there is insufficient statistical evidence to establish a direct correlation between CC and reduced anxiety symptoms, it is evident that significant factors such as increased PA and decreased SB are more common in CC compared to NCC. Aditionally, the observed lack of difference concerning the BAI (Beck Anxiety Inventory), a self-report measure of anxiety symptoms, has been noted. Future research may incorporate a psychiatric interview to reveal potential disparities in mental health indicators among participants of CC and NCC for mental health outcome.

Our study is not free of limitations. Due to the cross-sectional nature of this study, we cannot conclude the relationship between changes in PA, SB, and mental health markers. In addition, we acknowledge that our assessment of PA and SB lacked an objective measure, which may have provided more comprehensive information about the frequency and duration of these activities. Nevertheless, while individuals may overestimate their PA or SB time when assessing PA and SB by questionnaire, it remains unclear why being in a CC would have any discernible impact on this bias.

CONCLUSION

Residents in CC exhibit increased walking duration, MPA, MVPA, and reduced SB during weekdays, as well as SB daily. However, they do not experience differences in symptoms of anxiety.

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