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Prevalence and factors associated with active commuting among university students in the state of Bahia

Prevalência e fatores associados ao deslocamento ativo em estudantes universitários do estado da Bahia

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Abstract - The objective was to estimate the prevalence, and the behavioral, sociodemographic, and environmental factors associated with active commuting (AC) to/from university in students from the state of Bahia. Methods: a cross-sectional study was conducted in 2019 with 1.506 students from federal universities (UFs) with campuses in the state of Bahia. The outcome of the study was the AC to/from the university. The independent variables were traffic violence, Human Development Index (HDI), sex, social class, work/internship, marital status and age group, university time, study shift, study workload, leisure-time physical activity (LPA), sitting time and sleep time. Association estimates were employed via Odds Ratio (OR), complemented by the 95% confidence interval (CI95%), through multilevel logistic regression for mixed effects. The prevalence of AC was 19.7%. University students of social class D/E were more likely to perform the AC (OR=1.992; CI: 1.273-3.116), on the other hand, university students who worked/interned (OR=0.732; CI: 0.598-0.895) and were inactive in leisure (OR=0.672; CI: 0.488-0.925) were less likely to perform the AC. The higher the HDI of the cities where the UFs are located, the lower the chances of AC (OR=0.669; CI: 0.505-0.886). Concluded that approximately twenty out of every one hundred students performed the AC to the university. It was observed that the socio-environmental context related to the HDI of the cities and individual aspects, such as social class, work/internship, and AFL, were associated with the AC.

Key words: Cross-sectional studies; Health; Physical activity; Students.

Resumo - *O objetivo foi estimar a prevalência e os fatores comportamentais, sociodemográficos e ambientais associados ao deslocamento ativo (DA) para ir/voltar à universidade em estudantes do estado da Bahia. Realizou-se um estudo transversal em 2019 com 1.506 estudantes das universidades federais (UFs) com campus no estado da Bahia. O desfecho do estudo foi o DA para ir/voltar à universidade. As variáveis independentes foram violência no trânsito, Índice de Desenvolvimento Humano (IDH), sexo, classe social, trabalho/estágio, situação conjugal e faixa etária, tempo de universidade, turno de estudo, carga horária de estudo, atividade física no lazer (AFL), tempo sentado e tempo de sono. Foram empregadas as estimativas de associação via Odds Ratio (OR), complementadas pelo intervalo de confiança a 95% (IC95%), por meio da regressão logística multinível para efeitos mistos. A prevalência de DA foi de 19,7%. Universitários da classe social D/E tiveram mais chances de realizar o DA (OR=1,992; IC: 1,273-3,116), por outro lado, universitários que trabalhavam/estagiavam (OR=0,732; IC: 0,598-0,895) e foram inativos no lazer (OR=0,672; IC: 0,488-0,925) tiveram menores chances de realizar o DA. Quanto maior o IDH das cidades de localização das UFs, menores foram as chances de DA (OR=0,669; IC: 0,505-0,886). Concluiu-se que aproximadamente 20 a cada 100 estudantes realizava o DA para a universidade. Observou-se que o contexto socioambiental relacionado ao IDH das cidades e os aspectos individuais, como a classe social, trabalho/estágio e AFL associaram-se com o DA.*

Palavras-chave: *Estudos transversais; Saúde; Atividade física; Estudantes.*

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INTRODUCTION

Higher levels of physical activity (PA) through commuting (active displacement: AD) contribute to reduced risk of all-cause mortality, incidence of cardiovascular diseases and diabetes[1,2]. However, despite the benefits caused by AD, PA levels in this context are decreasing, especially in everyday travel, while passive transport increased[3]. A lower frequency of using active transport, such as walking or cycling, is observed in university students (US), especially when going to the place of study[4].

In US, those male[4], of lower socioeconomic status[5] and that were physically active[6], were associated with AD. No studies are identified characterizing the influence of macro contextual indicators on the AD of US, however, it is possible to infer that environmental factor, such as lack of safety[5] and the greatest development of a city, as measured by the Human Development Index (HDI)[7,8], can negatively influence the attitude towards AD.

Thus, to better understand this theme in US is essential, due the adoption of unhealthy lifestyles[9], as well as the high number of US in Brazil[10]. These understanding can help in the elaboration of interventions and support to planning of institutional and urban policies, aiming to provide opportunities for AD to acquire health benefits for US[2-6]. This study conducted with US from the Federal Universities (FUs) of the state of Bahia, aimed to investigate the prevalence and sociodemographic, behavioral, and environmental factors associated with the AD.

METHODS

This cross-sectional study was carried out in 2019. The present study was approved by the research ethics committees of four higher education institutions (HEIs) in the state of Bahia (numbers: 2.767.041; 2.795.177; 2.915.077 and 3.033.773).

The population was US of courses of the FUs located in the state of Bahia: Federal University of Recôncavo da Bahia, Federal University of Bahia, Federal University of Western Bahia, University of International Integration of Afro-Brazilian Lusophony, Federal University of Vale do São Francisco and Federal University of Southern Bahia. As exclusion criteria: link with distance learning courses; under 18 years of age; and who did not inform the institution they belonged. This exclusion procedure was performed after the tabulation of the data.

To estimate the sample: prevalence of 50%, confidence level of 95%, and acceptable sampling error of three percentage points, and target population of 35805 US. The sample was increased in 40% for losses and 15% for association studies. The estimated sample was 1668 US. Due the convenience participation process, the sample was adjusted by sample weights[11], being considered the information from the census conducted in Brazilian FUs[12].

The data collection was carried out in the first academic semester of 2019 of all FUs. The research instrument was sent to the e-mail of the US, through electronic correspondence sent by the members of the student council or sectors that send electronic information. The US were also sought in the classrooms of the HEIs, for the purpose of inviting them to participate in the research.

The questionnaire was available on the Google Forms platform, and before self-filling the questionnaire, the US accessed the consent form on the first

electronic page and if they agreed to participate, they would have access to the questionnaire. If they reported not accepting to participate, they were directed to finalize the form.

The information was collected through a questionnaire with sixty-eight objective questions, composed of questions from previously validated instruments for US[13] and Brazilian adults[14,15]. Sociodemographic questions and those related to the student's tie to the University were also included.

The dependent variable of this study was elaborated for Section 2 (sociodemographic indicators) of the questionnaire of Indicators of Health and Quality of Life in Academics (ISAQ-A)[13], referring to the mode of travel to and/or return from the university, being the following questions: "What is the main means of transport you use to go to the University?" and "What is the main type of transport you use to get back from University? As answer options there were: bus, motorcycle, car, school transport, on foot, bicycle, and others. It was considered as AD, the report of going and/or returning on foot and/or by bicycle. The other response options were grouped into the passive category, as in previous studies[16,17]. The levels of reproducibility of these measures were not presented in the previous publication of the questionnaire[13], but it was asked to the authors for these results, which showed satisfactory agreement (kappa test, transport to go: 0.832, $p<0.001$; transport to return: 0.945, $p<0.001$).

The quality of these measures, obtained online, were analyzed in survey was carried out in 2023, in a subsample (39 US) not included in the main research. The levels of agreement between the questionnaire digital form (without supervision during application) and printed (applied under the supervision of evaluators) versions were satisfactory, with AD measurement via kappa test of 0.879 (transport to go) and 0.731 (transport to return).

The environmental variables (macro contextual) comprised the information on traffic violence, measured by the annual number of deaths in transport accidents in 2019[18], referring to each city that is located each campus of the universities (dichotomized in less than median [up to 154 deaths/year] and greater than and equal to median [155 deaths/year]), and the information on the HDI[19], it was used to determine the development of the cities where the campuses of the universities are located, dichotomized into less than median (up to 0.758) and greater than and equal to median (0.759 or more).

As individual characteristics (micro contextual) were considered the sociodemographic, link to the University, and health-related behaviors variables. The sociodemographic variables were: gender (male and female); age group in years (18 to 24 and 25 or more); marital status (with partner and without partner); social class (Classes A/B/C and Classes D/E)[20]; and work internship situation (no work/no internship and work/internship). The variables regarding the ties to the University were: time in the university, based on the year of entry into the institution, in up to two years (2019 and 2018) and three years or more (2017, 2016 and previous years); study period (day and night), and study hours in disciplines categorized in the median (up to 339 hours/class; 340 hours/class or more).

The behaviors variables were: leisure-time PA (LPA), referring the practice in relation to the places, therefore, US were considered as active, those who reported practicing PA in leisure, such as physical exercises (gymnastics, walking, running and bodybuilding), sports, dances or martial arts in the university facilities, trails, squares, clubs, streets, gyms, parks or beaches and were classified as inactive in leisure

US who said they did not perform LPA in these environments; sitting time[15], the weighted average was calculated by multiplying by 5 the time of the week, and multiplied by 2 the time of the weekend, with the result divided by 7 (excess time: ≥6 hours per/day; low to moderate time: <6 hours per/day)[21]; sleep time[13], the weighted average of the hours of sleep on a weekday multiplied by 5 and the hours of sleep on a weekend day multiplied by 2, then divided by 7 (appropriate sleep: 7 to 9 hours per/day; not appropriate: <7 hours per/day and >9 hours per/day)[22].

The analyzes carried out in Stata, version 17.0. Descriptive analyses of absolute and relative frequencies were performed. The collinearity of the independent variables was evaluated using the tetrachoric correlation (T) and the values of the correlations, significant ($p<0.05$), up to 0.70 were considered satisfactory. The crude analysis was performed by Odds Ratio (OR), complemented by the 95% confidence interval (95%CI), via binary logistic regression. The independent variables that presented values of $p<0.20$ in these analyses were followed for the multilevel logistic regression for mixed effects (MLRME) to estimate the OR and 95%CI.

In the MLRME, micro contextual (individual variables) variables were considered as Level 1 and macro contextual variables (environmental variables) were considered as Level 2. From the relationship between the variables of Level 1 and 2, the correlation coefficient of the residuals was presented, through the intraclass correlation coefficient (ICC), to estimate the magnitude of explanation of the variables of Level 2 in the total variance. The significance level adopted was 5%.

RESULTS

Participated 1.552 US, however, 21 were excluded for reporting age under 18 years (20 distance learning and a special registration), in addition, 4 US who did not report which institution they belonged to were also excluded. The sample reached was 1.506 US (response rate of 90.29%). The contextual micro and macro characteristics are presented in Table 1. The prevalence of AD among US was 19.7% (Figure 1).

Table 1. Description of the sociodemographic, study, behavioral and perceptual characteristics of university students from federal institutions. Bahia. 2019.

Variables	n	%
Gender		
Male	537	35.7
Female	968	64.3
Age group		
18-24	956	64.5
25 or more	550	35.5
Marital status		
No partner	1141	75.9
With partner	362	24.1
Social class		
Classes A/B/C	1133	84.8
Classes D/E	166	15.2
Work/internship		
Yes	640	40.7
No	862	59.3

%: Weighted proportion; LPA: leisure-time Physical Activity; HDI: Human Development Index.

Table 1. Continued...

Variables	n	%
Years in university		
Up to two years (2019 and 2018)	577	41.0
Three years or more (2017, 2016 and others	892	59.0
Study period		
Day	1054	68.5
Night	450	31.5
Study hours		
Up to 339	636	44.5
340 or more	734	55.5
LPA		
Active	891	61.2
Inactive	563	38.8
Sitting time		
Up to 5.9 hours	374	26.6
6 hours or more	1067	73.4
Sleep time		
Appropriate 7 to 9	622	42.7
Not appropriate <7 and >9	837	57.3
Traffic violence		
Less than the median	563	40.9
More than or equal to median	813	59.1
HDI		
Less than the median	563	40.9
More than or equal to median	813	59.1

%: Weighted proportion; LPA: leisure-time Physical Activity; HDI: Human Development Index.

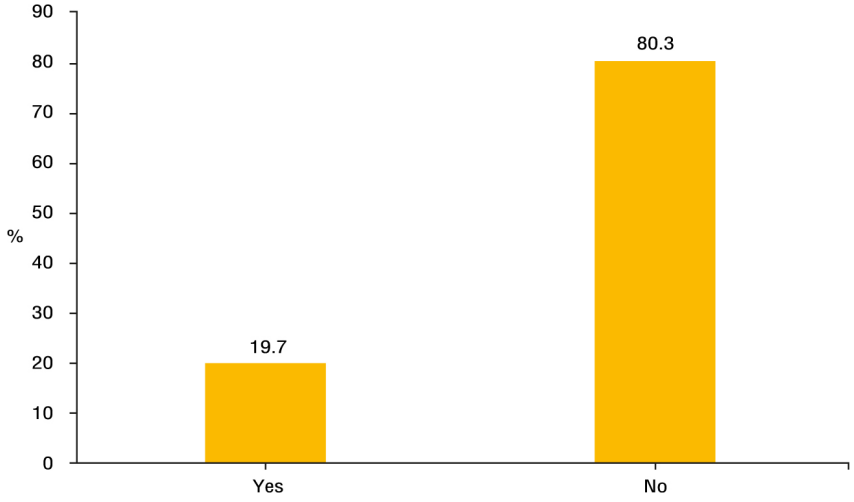

Figure 1. Prevalence of active commuting in university students. Bahia. 2019.

Table 2 shows the results of the T correlations. Higher values were observed between work/internship situation and age, work/internship situation and year of university entry, and study hours and year of university entry. The traffic violence variable showed a high correlation with the HDI variable. In view of the collinearity between the environmental variables (traffic violence and HDI), it was decided to perform separate analyses for each of them. Table 3 presents the crude analysis between exploratory characteristics and AD. It was observed that US aged 25 years or older had lower OR of AD. On the other hand, US from social classes D/E were more active in commuting.

Table 2. Tetrachoric correlations (T) and significance values (p) between sociodemographic, university-related, and behavioral variables. Bahia. 2019.

Variables	Gender T (p)	Age T (p)	Marital status T (p)	Years in university T (p)	Study period T (p)	Study hours T (p)	Work / internship T (p)	Social class T (p)	Sitting time T (p)	LPA T (p)	Sleep time T (p)	Traffic violence T (p)	HDI T (p)
Gender	1.000	-	-	-	-	-	-	-	-	-	-	-	-
Age	-0.100 (0.043)	1.000	-	-	-	-	-	-	-	-	-	-	-
Marital status	-0.019 (0.715)	0.330 (<0.001)	1.000	-	-	-	-	-	-	-	-	-	-
Years in university	0.122 (0.014)	0.346 (<0.001)	0.121 (0.025)	1.000	-	-	-	-	-	-	-	-	-
Study period	-0.179 (<0.001)	0.284 (<0.001)	0.113 (0.039)	-0.114 (0.026)	1.000	-	-	-	-	-	-	-	-
Study hours	0.027 (0.615)	-0.339 (<0.001)	-0.096 (0.067)	-0.145 (0.002)	-0.369 (<0.001)	1.000	-	-	-	-	-	-	-
Work or internship	-0.044 (0.374)	0.464 (<0.001)	0.299 (<0.001)	0.417 (<0.001)	0.247 (<0.001)	-0.235 (<0.001)	1.000	-	-	-	-	-	-
Social class	-0.030 (0.627)	-0.086 (0.206)	-0.165 (0.022)	-0.236 (<0.001)	0.198 (0.002)	-0.072 (0.262)	-0.283 (<0.001)	1.000	-	-	-	-	-
Sitting time	-0.051 (0.379)	-0.172 (0.001)	-0.138 (0.014)	-0.059 (0.280)	-0.088 (0.108)	0.161 (0.002)	-0.041 (0.435)	-0.172 (0.009)	1.000	-	-	-	-
LPA	0.226 (<0.001)	-0.069 (0.179)	-0.005 (0.943)	-0.089 (0.068)	-0.011 (0.841)	0.071 (0.140)	-0.116 (0.018)	0.013 (0.849)	0.119 (0.026)	1.000	-	-	-
Sleep time	-0.047 (0.342)	0.135 (0.006)	0.005 (0.943)	0.095 (0.053)	0.004 (0.947)	0.037 (0.465)	0.167 (0.001)	0.033 (0.638)	-0.034 (0.523)	-0.004 (0.951)	1.000	-	-
Traffic Violence	-0.013 (0.840)	0.096 (0.069)	-0.035 (0.545)	-0.087 (0.097)	-0.115 (0.027)	0.069 (0.174)	0.171 (<0.001)	-0.377 (<0.001)	0.094 (0.081)	0.075 (0.146)	0.016 (0.794)	1.000 (<0.001)	-
HDI	-0.013 (0.840)	0.096 (0.069)	-0.035 (0.545)	-0.087 (0.097)	-0.115 (0.027)	0.069 (0.174)	0.171 (<0.001)	-0.377 (<0.001)	0.094 (0.081)	0.075 (0.146)	0.016 (0.794)	1.000 (<0.001)	1.000

LPA: Leisure-time Physical Activity; HDI: Human Development Index.

Table 3. Association between environmental, sociodemographic, University ties and behavioral variables with AD. Bahia 2019. Estimates via binary logistic regression.

Variables	n	%	OR (95%CI)	p
Gender				0.074
Male	113	22.2	1	
Female	168	18.4	0.788 (0.607-1.023)	
Age group				0.005
18-24	195	21.8	1	
25 or more	86	15.8	0.671 (0.508-0.887)	
Marital status				0.773
No partner	211	19.9	1	
With partner	70	19.3	0.957 (0.709-1.291)	
Social class				<0.001
Classes A, B and C	189	17.5	1	
Classes D and E	59	34.7	2.495 (1.793-3.472)	
Work/internship				<0.001
No	190	22.9	1	
Yes	90	15.2	0.607 (0.463-0.796)	
Years in university				0.771
Up to two years (2019 and 2018)	103	19.4	1	
Three years or more (2017, 2016 and others	172	20.0	1.040 (0.800-1.351)	
Study period				0.050
Day	211	21.1	1	
Nigth	70	16.8	0.752 (0.566-0.999)	
Study hours				0.195
Up to 339	107	18.5	1	
340 or more	150	21.4	1.195 (0.913-1.566)	
LPA				0.010
Active	177	21.8	1	
Inactive	94	16.3	0.698 (0.530-0.919)	
Sitting time				0.567
Up to 5.9 hours	69	18.9	1	
6 hours or more	203	20.4	1.091 (0.810-1.468)	
Sleep time				0.989
Appropriate 7 to 9	117	19.6	1	
Not appropriate <7 and >9	153	19.6	0.998(0.768-1.297)	
Traffic violence				<0.001
Less than the median	168	32.7	1	
More than or equal to median	105	10.6	0.244 (0.183-0.324)	
HDI				<0.001
Less than the median	168	32.7	1	
More than or equal to median	105	10.6	0.244 (0.183-0.324)	

%: Weighted proportion; LPA: leisure-time Physical Activity; HDI: Human Development Index. OR: Odds Ratio; 95%CI: 95% confidence interval.

Table 4 shows the multilevel analyses. In the null model, there was a lower chance of the occurrence of AD among US in each institution (OR: 0.293; 95%CI: 0.147-0.581; p: <0.001). In the analysis, considering the traffic violence of each city in the multilevel model, there was higher chances of AD among US of social class D/E, in addition, US who worked or did an internship were less active in commuting, as well as those inactive in leisure. There was no association between traffic violence and AD.

In the analyses using the HDI in the multilevel model, the same patterns of association between exploratory characteristics were observed, when traffic violence was considered. On the other hand, it was noted that HDI was associated with AD, so the higher the HDI of the city, the lower the chances of AD. The HDI determined the occurrence of AD in 10.6%.

Table 4. Association between environmental, sociodemographic, university ties and behavioral variables with AD. Bahia 2019. Estimates via multilevel logistic regression for mixed effects.

Variables	Traffic violence			HDI		
Mixed model	**OR**	**CI 95%**	**p**	**OR**	**CI 95%**	**p**
Gender			0.476			0.475
Male	1.000			1.000		
Female	0.878	0.614 - 1.255		0.877	0.612- 1.126	
Age group			0.638			0.661
18-24	1.000			1.000		
25 or more	0.927	0.678-1.269		0.932	0.682-1.274	
Social class			0.003			0.003
Classes A, B and C	1.000			1.000		
Classes D and E	1.927	1.268-3.101		1.992	1.273-3.116	
Work/internship			0.003			0.002
No	1.000			1.000		
Yes	0.733	0.599-0.898		0.732	0.598-0.895	
Study period			0.081			0.081
Day	1.000			1.000		
Nigth	0.676	0.436-1.049		0.684	0.447-1.047	
Study hours			0.966			0.979
Up to 339	1.000			1.000		
340 or more	1.010	0.631-1.617		1.006	0.628-1.610	
LPA			0.016			0.015
Active	1.000			1.000		
Inactive	0.675	0.489-0.930		0.672	0.488-0.925	
Environmental variable			0.159			0.005
Less than the median	1.000			1.000		
More than and equal to median	0.572	0.989-1.001		0.669	0.505-0.886	
ICC (95% CI)		0.097 (0.037-0.234)			0.106 (0.041-0.248)	

LPA: Leisure-time Physical Activity; HDI: Human Development Index; OR: Odds Ratio; 95%CI: 95% confidence interval; ICC: intraclass correlation coefficient.

DISCUSSION

AD was prevalent among two out of every ten US in the FUs of Bahia. US of the campuses located in cities with high HDI showed less involvement with AD. On the individual aspects, US of lower social class presented higher chances of AD. US who worked or did an internship, and those who reported not performing LPA were less likely to perform the AD.

The prevalence of AD in US to go/return of the University in this study was 19.7%. This result was similar in Chilean US (17.8%)[23], however, Colombian US were more prone to AD (65.3%)[16], as were US from Coimbra, Portugal (55.1%)[24]. Potential differences may be related to the instruments for measuring commuting, especially due to the need to consider the environmental context around human mobility and the distances between the campuses in relation to the area of educational coverage, which involves not only the main city, but its surroundings. Thus, it is necessary to consider that a greater distance from home to university may decrease the prevalence of AD[4,24].

US living in cities with higher HDI were less active in commuting. In this context, the HDI determined the variation of AD, approximately, in 10%. Research conducted in different populations supports this result[7,8]. People living in localities with lower HDI may accumulate more PA in commuting when compared with the developed locations[7]. It should be noted that the HDI represents a measure that evaluates the human development of a region,

since it considers life expectancy, education, and per capita income. Places with lower HDI, may present expressiveness in terms of lower per capita income and thus favor AD, as it is the viable alternative, without the possibility to choose between vehicles or public transport[7]. Moreover, the cities with the highest HDI in this study have a higher built environment and demographic density, being more urbanized, which possibly increases the distance and time spent between home and university, thus favoring a decrease in the AD[4,5,24].

The findings of this study demonstrated that US in classes D/E were more likely to AD. This result corroborates with other studies with US[5,25]. It is noteworthy that access to PA in different domains is associated with the process of social inequality in Brazil, since people with lower income or worse professional qualifications are generally subject to higher PA traveling, and the social group with higher income and professional qualifications presents more opportunities in LPA[25]. It is possible that US with greater purchasing power may have more access to motorized vehicles and possibilities of paying various expenses[26], while for the lower income population, the AD is the only form of transport available.

It is interesting to note that US who worked or did an internship were less likely to perform the AD to university. One study noted that working condition has an influence on commuting to university, so workers, unlike students, move more often by motorized modes[27]. Also, female students and workers were more stressed and rushed when actively moving and demonstrated unfavorable attitudes towards walking and cycling, which was associated with lower choice of AD option[28]. Having less time can negatively influence the choice of AD[28,29].

The results showed a significant association between reporting the practice of LPA in different places away from home with AD. One study observed that young adults who performed five or more PA sessions per/week at leisure used active means of transportation to get to work and school[29] and the AD was significantly higher for students who met the PA recommendations[6]. In addition, students with lowers levels of PA are less active in commuting than those with medium or higher levels of PA[4]. AD may encourage more PA, thus, it seems interesting to adopt regular LPA practices, to favor the perception of self-efficacy for the choice of AD by US[30].

It is essential to consider some limitations, such as the use of self-reported measures, because memory bias, however, the instrument present a satisfactory level of agreement[19]. Considering the collection of data online, it is understood as a potential factor of restriction of participation, therefore we sought to minimize this problem with active search of participants and a larger number of invitations. In addition, the response of the instrument in digital format may favor filling errors, however, the analysis on a subsample showed satisfactory levels of agreement. As a strong point, it is highlighted the performance of this research with a representative sample of US from the federal universities of Bahia.

It was concluded that approximately twenty out of every one hundred US practiced AD to go/return of the University. Students with lower social classes, who practiced LPA, and those who did not work/did not an internship were more likely to perform AD. Cities with higher HDI contributed with lower chances of AD. New research are needed, which includes variables such as the distance between the residence and the University and other means of active transport.

Compliance with ethical standards

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Ethical approval

Ethical approval was obtained from the local Human Research Ethics Committees – Federal University of Recôncavo da Bahia (protocol no. 88803818.3.1001.0056), Federal University of Bahia (protocol no. 88803818.3.3001.5531), Federal University of Western Bahia (protocol no. 88803818.3.3004.8060), and University of International Integration of Afro-Brazilian Lusophony (protocol no. 88803818.3.3002.5576) and were written in accordance with the standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the experiments: ESS, TFS and SAF. Performed the experiments: ESS and TFS. Analyzed the data: ESS and TFS. Contributed reagents/materials/analysis tools: TFS and SAF. Wrote the paper: ESS and TFS.

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