



Active Commuting and its Association With Mental Health and Lifestyle Among Spanish University Students

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Artistic swimmers performing a synchronized figure with technical precision and postural control.
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Abstract

Active commuting contributes to physical activity among young people, which is associated with numerous health benefits. The objective of this study was to analyze how students at a Spanish university commute to their place of study, examining the relationship between various sociodemographic variables, lifestyle habits, and mental health indicators. A cross-sectional study was conducted on a sample of 1,142 students (23.655 ± 7.84) from a university in northern Spain. The study assessed active commuting to the university, emotional and behavioral problems, emotional intelligence, self-esteem, life satisfaction, perceived stress, suicidal behavior, adherence to the Mediterranean diet, physical activity and sedentary behaviors, alcohol consumption, and compulsive internet use. 52.7% of the students were active commuters (on foot or by bicycle). This commuting mode was significantly associated with higher weekly physical activity ($p = .023$), lower perceived stress ($p = .006$) and higher life satisfaction ($p = .031$). Logistic regression analysis showed that younger age ($OR = 0.98$; $p = .030$), not being in paid employment ($OR = 0.64$; $p = .004$), lower levels of stress ($OR = 0.98$; $p = .048$) and higher life satisfaction ($OR = 1.04$; $p = .020$) were significantly associated with active commuting. The positive impact of active commuting on physical and psychosocial wellbeing suggests that governments should promote strategies to improve public health. These strategies should focus on groups where active commuting is less common, such as older students or those with higher incomes.

Keywords: college, healthy habits, physical activity, transportation, wellbeing

Introduction

Physical inactivity is recognized as one of the primary risk factors for non-communicable diseases, chronic conditions, and mental health problems (Katzmarzyk et al., 2022; Teno et al., 2024). Additionally, higher levels of total physical activity and reduced sedentary time are associated with a substantial reduction in the risk of premature mortality in adults (Ekelund et al., 2019). Moreover, globally, it has been estimated that physically inactive lifestyles generate high economic costs due to the direct medical expenses associated with diseases and problems related to physical inactivity (Santos et al., 2023).

Literature has confirmed that regular physical activity (PA) has beneficial effects on both present and future health, positioning it as one of the most influential modifiable factors in the well-being of the population (Warburton et al., 2006). However, a recent study conducted in 28 EU member countries revealed that 36.2% of adults aged 18 to 64 are physically inactive, with the highest rates observed in Southern European countries (Nikitará et al., 2021). Similarly, Guthold et al. (2018) found that globally, 27.5% of the adult population does not meet the recommended levels of PA, with these rates being significantly higher in high-income countries compared to low-income countries (36.8% vs. 16.2%).

Given this situation, a recommended strategy to increase PA levels is active commuting, which is defined as traveling by means that involve metabolic expenditure, such as walking, cycling, or skating (Nieuwenhuijsen et al., 2020). However, the percentage of university students who choose active commuting varies by context. Previous studies conducted in Spanish universities before the COVID-19 pandemic reported passive commuting rates ranging from 65% to 87.76% among students, with the car being the preferred means of transportation to university (Martín-López et al., 2024; Molina-García et al., 2014; Palma-Leal et al., 2022a).

On the other hand, active commuting not only contributes to increasing daily PA levels and meeting established recommendations (Fishman et al., 2015) but is also associated with an active lifestyle that benefits various dimensions of health and the environment (Henriques-Neto et al., 2020; Tainio et al., 2021). Additionally, PA has proven to be a potentially beneficial tool for influencing other health-related behaviors, such as preventing and reducing alcohol and drug use (Thompson et al., 2020).

In terms of its relationship with mental health, although various studies have linked subjective well-being and

mental health with different characteristics of active commuting, the literature does not show consistency in these findings (Liu et al., 2022). Conversely, experimental studies have demonstrated promising improvements in the mental health of individuals who use active commuting modes compared to those who use motorized vehicles (Scrivano et al., 2023). Additionally, active commuting to work or educational centers, when perceived as positive experiences, has been directly associated with greater life satisfaction (Fordham et al., 2018) and a reduced risk of mental disorders (Marques et al., 2020). In the case of schoolchildren, there is a noted relationship between active commuting and better academic performance, mediated by self-esteem and emotional and behavioral difficulties (Walker & Gamble, 2023). In this sense, the frequency of active commuting during university years is crucial for its maintenance into adulthood, underscoring the importance of this educational stage for the present and future health of students (Bopp et al., 2019).

However, the choice of transportation mode by university students depends on a range of psychosocial, personal, and environmental factors, such as perceived safety, personal motivation, physical effort required, distance to the educational center, weather conditions, and time investment, among others (Castillo-Paredes et al., 2021; Palma-Leal, 2023). Moreover, these commuting choices are also influenced by various sociodemographic factors, such as socioeconomic status, gender, type of university, age, and place of residence, which directly affect the likelihood of engaging in active commuting to the university (Palma-Leal, 2021).

This study was conducted at the University of La Rioja (UR), a public on-site institution in Logroño (La Rioja, Spain). The university promotes healthy lifestyles through various institutional initiatives, such as sports programs, health and well-being awareness activities, and the provision of sports facilities accessible to the entire university community. Likewise, the UR has a specific program called “Sustainable Mobility,” which aims to promote active and sustainable transport among students, teaching staff, and administrative and service personnel. Developed by the Sustainability Office, this initiative provides information on various active transport options, including maps and recommendations based on the chosen mode of transport. It can be accessed on the official website of the University of La Rioja. The main campus is in an urban area with good pedestrian access; however, the surrounding cycling network

remains limited. In addition, the geographical distribution of the student body and the distance between students' hometowns and the campus make active commuting less viable daily.

Determining the factors associated with active commuting is essential for establishing intervention strategies that promote an active lifestyle within educational contexts, through measures and initiatives implemented by universities and public management bodies. Therefore, the main objective of this study was to analyze the association between commuting mode among Spanish university students and various sociodemographic, lifestyle, and mental health variables. Specifically, the study aimed to identify which factors are significantly associated with active commuting (walking or cycling) compared to passive commuting (motorized transport). It was hypothesized that students who engage in active commuting would show healthier lifestyle habits, including higher physical activity levels and better adherence to the Mediterranean diet, as well as better psychological well-being, reflected in lower stress and higher life satisfaction, compared to those who commute passively.

Material and Methods

Participants

This study was conducted at the University of La Rioja (Spain), a public higher education institution located in northern Spain. During the 2020–2021 academic year, the university had a total of 4,408 enrolled students, distributed across five faculties and two higher education schools. Prior to sampling, students enrolled in distance education programs and those who did not understand Spanish (e.g., international exchange students) were excluded, resulting in a target population of 4,259 students.

A cross-sectional study was designed using a convenience sampling method. Participants were recruited from different faculties and academic years to ensure heterogeneity in the sample. Initially, 2,200 students voluntarily agreed to participate, representing approximately 52% of the eligible population. After excluding incomplete questionnaires and those with random, pseudo-random, or inconsistent responses, as well as students studying exclusively online, the final sample consisted of 1,142 students (742 women and 400 men), aged between 17 and 80 ($M = 23.0$, $SD = 7.84$). The

wide age range observed in the sample reflects the diversity of the university population, which includes both recently enrolled young students and older individuals pursuing second degrees or lifelong learning opportunities. This heterogeneity is characteristic of Spanish public universities and allows for a more comprehensive understanding of health and lifestyle profiles across different stages of adulthood.

Although a convenience sampling approach was used, which may introduce selection bias due to the voluntary nature of participation, several measures were taken to mitigate this limitation. Students from all faculties and academic years were invited to participate to ensure heterogeneity, and the final sample size ($N = 1,142$) represents a substantial proportion of the university population. These factors contribute to improving the generalizability of the findings, although the results should still be interpreted with caution regarding their external validity.

Ethical Considerations

Throughout the research process, the ethical principles of the Declaration of Helsinki were followed, and prior approval for the study was obtained from the Ethics Committee of the University of La Rioja. Verification URL: <https://sede.unirioja.es/csv/code/rVGMmMvkfVdA05wUtVEifww6IDkItSiy>.

Procedure

Participants were invited to participate in the survey via email, where they were provided with information about the study's purpose and asked to provide informed consent online before accessing the questionnaire. Participation in the research was voluntary and anonymous. The questionnaire was sent to all students via the university's institutional email, presenting the study and providing access to the survey through a SurveyMonkey link. Responses were collected between November 2020 and March 2021.

Instruments

In this study, a single instrument was developed, incorporating a total of eleven validated tests and questionnaires along with a series of sociodemographic questions (age, gender, nationality, education level, residence, employment status, income, and income satisfaction). The various questionnaires that comprise the instrument are described below.

The assessment of active commuting behavior to the university was conducted through the question, “How do you usually travel from your home to the university?”, using the ESVIAUN questionnaire (Bennasar, 2012). The response options were six: “I don’t commute to university (distance learning)”; “In a private vehicle shared with other students”; “In a private vehicle”; “By public transport”; “By bicycle”; and “Walking”. Subsequently, students who were studying online were excluded from the analysis, and two groups were created based on the commuting mode: the first comprised students who engaged in active commuting (by bicycle or walking), and the second comprised those who engaged in passive commuting (by public transport or motorized vehicle).

Physical activity and sedentary habits were assessed using the short Spanish version of the International Physical Activity Questionnaire (IPAQ-SF) (Craig et al., 2003). This questionnaire analyzes, over the seven days prior to administration, the intensity and type of PA performed, distinguishing between vigorous, moderate, and walking activities, as well as sitting time. For each type of activity, frequency and duration are recorded. Total scores are calculated by combining the duration (in minutes) and frequency (days) of walking, moderate, and vigorous PA, resulting in metabolic equivalent task (MET) minutes per week. The questionnaire also evaluates sitting time on weekdays and weekends. Additionally, sedentary behavior was measured through a single item assessing daily sitting time.

Adherence to the Mediterranean diet was measured using the KIDMED questionnaire (Serra-Majem et al., 2004). It consists of 16 dichotomous items (yes or no) that evaluate dietary patterns consistent with the Mediterranean diet. The final score ranges from -4 to 12, with higher values indicating greater adherence to the Mediterranean diet. The reliability of this instrument was established in a validation study with Spanish children and young people up to 24 years of age (Serra-Majem, 2001).

To identify harmful alcohol consumption patterns among students, the AUDIT scale was used, validated in its Spanish version for university students (García-Carretero et al., 2016). Developed by the World Health Organization (WHO), it consists of 10 questions about the quantity, frequency, and consequences of alcohol consumption, with scores ranging from 0 to 4 for each item. The total score is obtained by summing the individual item scores, with possible results ranging from 0 to 40. Higher scores indicate greater alcohol consumption.

Problematic internet use was assessed using the Spanish version of the Compulsive Internet Use Scale (CIUS) (Ortuño-Sierra et al., 2022). This scale consists of 14 Likert-type items with five response options (never, rarely, sometimes, often, very often), distributed across five dimensions: loss of control (items 1, 2, 5, and 9), preoccupation (items 4, 6, and 7), withdrawal symptoms (item 14), coping/mood alteration (items 12 and 13), and interpersonal and intrapersonal conflict (items 3, 8, 10, and 11). The total score is obtained by adding the individual item scores, with higher scores indicating more compulsive internet use.

Emotional and behavioral variables were measured using the Strengths and Difficulties Questionnaire (SDQ), validated in young Spanish populations by Ortuño-Sierra et al. (2016). This questionnaire evaluates emotional and behavioral difficulties through 25 items grouped into five subscales: emotional problems, conduct problems, peer problems, hyperactivity, and prosocial behavior. Each subscale consists of five items with responses on a three-point Likert scale (“0 = not true”, “1 = somewhat true”, “2 = certainly true”), resulting in subscale scores ranging from 0 to 10. The total difficulties score is calculated by summing the individual scores of all subscales except the prosocial subscale, which assesses social strengths and is analyzed independently. Total difficulty scores range from 0 to 40.

Emotional intelligence was assessed using the short Spanish version of the Trait Meta-Mood Scale (TMMs) by Fernández-Berrocal et al. (2004). It measures three cognitive components of emotional intelligence: attention to feelings, emotional clarity, and emotional repair. The original scale contains 48 items, but this study used the 24-item version. Responses are collected on a five-point Likert scale (from “strongly disagree” to “strongly agree”). Scores are calculated for each of the three emotional intelligence components individually, ranging from 8 to 40, as each component comprises eight items. Higher scores indicate greater emotional intelligence in each dimension.

Self-esteem was evaluated using the Rosenberg Self-Esteem Scale, validated in Spanish university students (Martín-Albo et al., 2007). This scale measures respondents’ general perceptions of their self-esteem and self-worth. It is unidimensional and consists of 10 Likert-type items with four response options, ranging from 1 (strongly disagree) to 4 (strongly agree). Final scores range from 10 to 40, with higher scores indicating higher self-esteem.

Overall life satisfaction was measured using the Satisfaction with Life Scale (SWLS) in its validated Spanish version by Atienza et al. (2000). This instrument assesses

global cognitive judgments of one's life satisfaction through 5 items, with responses on a five-point Likert scale ranging from "strongly disagree (1)" to "strongly agree (5)". Final scores range from 5 to 35, with higher scores indicating greater life satisfaction.

Perceived stress was measured using the Spanish version of the Perceived Stress Scale (PSS) (Remor, 2006), originally developed by Cohen et al. (1983). This instrument assesses feelings and thoughts experienced during the month prior to the scale administration. It consists of 14 items with five response options ranging from 0 (never) to 4 (very often), based on the frequency of these feelings. The total score is obtained by summing the individual item scores, with final scores ranging from 0 to 56. Higher scores indicate higher levels of perceived stress.

Suicidal behavior was evaluated using the SENTIA-Brief Scale (Díez-Gómez et al., 2021), consisting of five statements related to individuals' thoughts and feelings during the six months prior to administration. Response options are dichotomous (yes or no), with a value of 0 assigned to affirmative responses and 1 to negative responses. Thus,

total scores range from 0 to 5, with higher scores indicating greater severity or risk of suicide.

Finally, six pairs of questions from the Oviedo Infrequency Scale (INF-OV) were randomly interspersed among all questionnaire items. Fonseca-Pedrero et al. (2009) designed this scale to detect respondents who provide random, pseudo-random, or dishonest responses. It consists of 12 questions designed to have an obviously correct answer (yes or no), such as: "Have you ever seen a movie on TV?" and "Do you know people who wear glasses?". Students who provided two or more logically inconsistent answers on this scale were excluded from the subsequent analysis. Based on this, a total of 14 participants were excluded.

Statistical Analysis

Quantitative variables are represented according to their means and standard deviations, and qualitative variables according to their frequencies. The normality and homoscedasticity of the data for all variables were evaluated using the Kolmogorov-Smirnov test with Lilliefors correction and Levene's test.

Table 1
Synthesis of variables and the instruments used

DIMENSIONS	VARIABLES	INSTRUMENTS
Physical activity	Physical activity and sedentary behavior	International Physical Activity Questionnaire – Short Form (IPAQ-SF)
Lifestyle	Commuting mode	ESVIAUN questionnaire
	Adherence to the Mediterranean diet	KIDMED questionnaire
	Alcohol consumption	AUDIT Scale – Alcohol Use Disorders Identification Test
	Compulsive Internet use	Compulsive Internet Use Scale (CIUS)
Quality of life and mental health	Emotional intelligence	Trait Meta-Mood Scale – Short Version (TMMS-24)
	Emotional and behavioral difficulties	Strengths and Difficulties Questionnaire (SDQ) (Ortuño-Sierra et al., 2016)
	Self-esteem	Rosenberg Self-Esteem Scale
	Life satisfaction	Satisfaction With Life Scale (SWLS)
	Perceived stress	Perceived Stress Scale (PSS-14)
	Suicidal behavior	SENTIA-Brief Scale
Sociodemographic data	Age, gender, nationality, residence, employment status, income, income satisfaction	Ad hoc questionnaire
Control questions	Random or inconsistent responses	Oviedo Infrequency Scale (INF-OV)

Mean comparisons were performed using Student's *t* test for normally distributed variables and the Mann-Whitney *U* test for non-normally distributed variables. The association between qualitative variables was analyzed using the Pearson chi-square test.

To identify variables associated with active commuting, binary logistic regression analysis (backward elimination method) was conducted. The variables included were age, place of birth, gender, employment status, perceived stress, suicidal behavior, self-esteem, life satisfaction, emotional and behavioral difficulties, PA (MET), weekly sedentary time, adherence to the Mediterranean diet, alcohol consumption, and compulsive internet use. Statistical analysis was

performed using IBM-SPSS® (version 29) for Windows, with statistical significance set at $p < .05$.

Results

The most frequent nonactive commuting modes were private vehicles (25.2%) and public transport (20%). In contrast, the percentage of students who commuted actively was 48.4% on foot and 4.3% by bicycle. Table 2 shows the frequencies of active and nonactive commuting based on different sociodemographic factors. The frequency of use of both types of transport differed significantly based on type of residence, employment status, income level, and income satisfaction.

Table 2
Frequency of commuting mode based on various sociodemographic factors

		Nonactive commuting (<i>n</i> = 540)		Active commuting (<i>n</i> = 602)	<i>p</i> value
		<i>N</i>	%	%	
Age			23.18 ± 7.28	21.94 ± 5.83	.002
Nationality	Native-born	1002	47.7	52.3	.448
	Migrant	140	44.3	55.7	
Gender	Male	400	46.8	53.3	.790
	Female	742	47.6	52.4	
Education level	Bachelor's	980	46.3	53.7	.241
	Master's	103	51.5	48.5	
	Doctorate	59	55.9	44.1	
Residence	Alone or with partner	136	58.1	41.9	< .001
	With friends	279	10.4	89.6	
	With family	658	65.2	34.8	
	University residence	69	4.3	95.7	
Employment status	Yes	242	58.3	41.7	< .001
	No	900	44.3	55.7	
Income	0-499	726	45.7	54.3	< .001
	500-999	183	37.7	62.3	
	1,000-1,499	112	54.5	45.5	
	1,500 or more	121	64.5	35.5	
Income satisfaction	Totally insufficient	82	64.6	35.4	< .001
	Sufficient	739	48.2	51.8	
	Totally sufficient	321	40.8	59.2	

Additionally, the mean age of students using active commuting was significantly lower than that of those reporting other commuting alternatives (21.94 ± 5.83 vs. 23.18 ± 7.28 ; $p = .002$).

On the other hand, Table 3 shows the differences in lifestyle factors related to PA, sedentary behavior, and dietary habits among the participants based on their mode of commuting to the university. As can be seen, no associations were found between the variables, except for PA levels. Students who

commuted by walking or cycling demonstrated significantly higher weekly PA levels compared to their peers who commuted passively.

Similarly, Table 4 presents the differences in well-being, mental health, and emotional variables according to commuting mode. In this case, significant differences were observed in perceived stress and life satisfaction. Active commuting was associated with lower perceived stress levels and greater life satisfaction compared to nonactive commuting.

Table 3
Differences in lifestyles according to commuting modes

	Nonactive commuting (<i>n</i> = 540)		Active commuting (<i>n</i> = 602)		<i>p</i> value
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Physical activity (METS)	2554.76	2385.08	2792.61	2377.59	.023
Weekly sedentary time	384.69	222.64	379.85	210.46	.603
Mediterranean diet (KIDMED)	5.91	2.53	5.97	2.45	.932
Alcohol consumption (AUDIT)	3.36	3.37	3.90	3.96	.051
Compulsive internet use (CIUS)	16.97	11.14	17.10	10.33	.596

Table 4
Mental and emotional well-being values according to commuting modes

	Nonactive commuting (<i>n</i> = 540)		Active commuting (<i>n</i> = 602)		<i>p</i> value
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Perceived stress (PSS)	27.98	8.74	26.63	8.55	.006
Suicidal behavior (SENTIA)	0.46	1.06	0.51	1.11	.307
Self-esteem (Rosenberg)	31.40	6.11	30.95	6.04	.157
Life satisfaction (SWLS)	16.81	4.22	17.48	3.82	.031
Emotional and Behavioral difficulties (SDQ)	12.49	5.66	12.40	5.16	.932
Emotional problems	3.96	2.89	3.94	2.74	.925
Conduct problems	2.07	1.33	2.12	1.39	.572
Hyperactivity	3.95	2.16	3.88	2.14	.678
Peer problems	2.50	1.64	2.45	1.60	.588
Prosocial behavior	8.44	1.50	8.46	1.70	.216
Emotional intelligence (attention) (TMMS)	25.96	6.66	25.63	7.18	.317
Emotional intelligence (clarity) (TMMS)	24.71	6.60	24.15	6.88	.166
Emotional intelligence (repair) (TMMS)	25.39	6.55	24.76	6.37	.086

Table 5
Factors associated with active commuting to university

	<i>B</i>	Standard error	Wald	<i>p</i> value	OR	95% CI	<i>R</i> ² Nagelkerke
Age	-0.022	0.010	4.691	.030	0.978	0.959- 0.998	.030
Employment (YES)	-0.453	0.159	8.129	.004	0.636	0.466- 0.868	
Perceived stress	-0.016	0.008	3.905	.048	0.984	0.969-1.000	
Life satisfaction	0.041	0.018	5.440	.020	1.042	1.007-1.079	

Finally, Table 5 displays only the results that reached statistical significance in the binary logistic regression analysis of active commuting. Younger age, employment status, lower stress levels, and higher life satisfaction were associated with active commuting to the university. However, these factors together explained only about 5% of the variance.

Discussion

This study analyzed active commuting patterns among university students, as well as their relationship with various lifestyle habits and indicators of mental and emotional health. Overall, 52.7% of students reported actively commuting ($n = 602$), while 47.3% used nonactive commuting modes ($n = 540$). The most frequent passive commuting modes were private vehicles (25.2%) and public transport (20%), while walking was the predominant form of active commuting (48.4%). These results indicate a relatively balanced distribution between active and nonactive commuting, with a slightly higher prevalence of the former among students. Similar trends have been observed in previous studies, where the choice of commuting mode varies depending on factors such as distance, weather conditions, and sociodemographic characteristics (Palma-Leal et al., 2023). By way of comparison, a recent study conducted in neighboring Portugal reported that walking accounted for 28% of commutes, public transport for another 28% and car use for 42% (Ribeiro & Fonseca, 2022).

The moderate levels of active commuting can be explained, to a large extent, by the structural nature of the campus and the urban setting of the city of Logroño. Although the University of La Rioja promotes awareness initiatives such as Sustainable Mobility Week, the existing

cycling infrastructure does not guarantee continuous and fully integrated access from all student neighborhoods. The campus layout includes some sections of cycle lanes and indoor and outdoor bicycle parking facilities, although they do not yet form a comprehensive network that provides widespread active mobility. Simultaneously, Logroño City Council is driving forward municipal projects to improve cycling connections between the university and the city center, yet these initiatives are still in the development phase and may not yet have had a significant impact on students' commuting habits. The university also has various sports facilities (sports complex, courts, fitness studios, etc.), reflecting an institutional commitment to physical activity. However, the lack of changing rooms and showers specifically for cyclists or walkers, as well as the limited infrastructure to support active daily commuting, could restrict the choice of these modes of travel. Collectively, these structural and environmental factors, combined with the residential dispersion of the student body, provide a coherent explanatory framework for interpreting the observed balance between active and passive commuting in the sample analyzed (University of La Rioja, 2025).

Regarding sociodemographic variables, several factors have demonstrated a significant influence on active commuting. First, the type of residence stands out. Students living alone, with a partner, or with family members showed active commuting rates ranging from 34% to 42%, whereas those living with friends or in university residences had rates exceeding 89%. This disparity may be associated with proximity to the university, as student apartments and university residences are often located close to campus to facilitate daily activities. Conversely, students living with family or in other arrangements may have less proximity due to the location of the family home or other considerations, thus hindering accessibility.

A study by Teuber and Sudeck (2021) involving nearly a thousand university students in southwest Germany found that proximity to the university was a major factor influencing active commuting, with 78% of students living nearby commuting actively compared to only 22% of those living farther away. Similarly, studies such as Ross et al. (2020) have shown that distance to the educational institution is a significant barrier to active commuting among pre-university students, with fewer students opting for active modes as distance increases. However, in university populations, other factors appear to exert as much or even greater influence than distance. For instance, Rybarczyk (2018), in a study of university students in Michigan, found that distance is not a universal barrier to active commuting, highlighting the importance of personal, household, population density, and urban design factors. Along similar lines, Zannat et al. (2020) reported that, among French university students, urban design, intersection density, and the presence of safety measures and infrastructure supporting active commuting play critical roles in students' decisions to walk or bike.

Another crucial factor influencing students' mode of transportation is the compatibility of their studies with paid employment. Students who juggle both activities tend to engage less in active commuting. Research conducted in Toronto found that students working 20 hours or more per week were less likely to commute actively to campus (Allen & Farber, 2018), potentially due to limited leisure time. Similarly, a study by Castillo-Paredes et al. (2021) among Chilean university students found that time constraints were a significant barrier to active commuting for both genders.

Additionally, having paid employment is directly linked to socioeconomic status, another determinant examined in this study. Higher income levels and greater satisfaction with income were associated with lower rates of active commuting. Specifically, students earning less than one thousand euros had active commuting rates ranging from 45% to 62%, whereas those earning more had rates reduced to 35% to 45%. This inverse relationship between socioeconomic status and active commuting has been reported in various studies, including among children and adolescents (Rodríguez-Rodríguez et al., 2022), as well as among university students in Brazil (Henning et al., 2020) and Chile (Palma-Leal et al., 2021). Similarly, research conducted among more than 500 university students in Valencia, Spain, found that students with lower socioeconomic status expended significantly more energy on active commuting (Molina-García et al., 2014). These authors attribute this relationship to the greater likelihood of vehicle ownership among higher income

groups. This rationale may also explain why students who commute by vehicle tend to be significantly older than those who commute actively, as financial autonomy typically increases with age.

Regarding the relationship between lifestyle habits and modes of transportation, no associations were found between active commuting and internet use, alcohol consumption, sedentary time, or adherence to the Mediterranean diet. However, students who engaged in active commuting reported statistically higher levels of PA compared to their peers who commuted passively. Numerous previous studies have explored this relationship, and recent reviews have summarized key findings in this area. Bailey et al. (2023) highlighted that well-designed interventions promoting active commuting significantly increase PA levels among European children and adolescents. Similarly, a meta-analysis examining various systematic reviews concluded that active commuting to school or work contributes to increases in daily PA levels of 5 to 45 minutes among children, youth, and adults (Prince et al., 2021). In the case of university students, prior research has yielded similar results (Bopp et al., 2022; Palma-Leal et al., 2022b).

This finding is crucial, as engaging in active commuting not only helps individuals achieve recommended activity levels but also offers physical health benefits. For example, a systematic review by Dinu et al. (2018) found that individuals who engage in active commuting have a lower risk of all-cause mortality, as well as reduced incidence of cardiovascular disease and diabetes. Among university populations, Bopp et al. (2015) similarly found that students who actively commute to campus demonstrate better cardiovascular fitness, greater flexibility, and lower systolic blood pressure compared to motor vehicle commuters.

However, while the relationship between commuting modes and physical health has been extensively studied, there is less evidence regarding their psychosocial health effects. This study found that active commuting was significantly associated with lower perceived stress and higher life satisfaction, which were identified as factors significantly associated in the logistic regression model. Consistent with these findings, a seven-year longitudinal study in the United Kingdom involving more than 100,000 participants reported improved physical and mental health among individuals switching from passive to active commuting, with greater benefits observed among females (Jacob et al., 2020). Similarly, a Canadian study found that individuals who commuted actively were 35% less likely to be dissatisfied with their work-life balance, with female

commuters also reporting lower levels of life stress (Herman & Larouche, 2021). Singleton (2019) also demonstrated positive implications of active commuting for mental well-being, confidence, and enjoyment among adult populations in the United States.

According to these authors, the beneficial impact of active commuting on mental well-being may result from physiological effects such as increased adrenaline levels or endorphin release, as well as from the psychological enjoyment associated with walking or cycling compared to driving. Additionally, being aware of engaging in a healthy behavior can be reassuring. Finally, sociodemographic factors may also play a role, as there may be a discrepancy between preferences and actual options; individuals who opt for passive commuting may do so due to lack of alternatives, which could increase levels of dissatisfaction. While there is less evidence confirming these effects on mental health among university students specifically, it is reasonable to extrapolate from general population data, given higher rates of stress, anxiety and depression among university students compared to the general population (Ibrahim et al., 2013; Rotenstein et al., 2016), as well as the significant impact of PA on their mental health (Chen, 2023).

This study examines sociodemographic factors influencing active commuting and its impact on lifestyle and mental well-being in a large sample of university students. These findings provide valuable scientific evidence supporting strategies that promote active commuting as a key element for physical and psychosocial health. However, several limitations should be acknowledged. First, its cross-sectional design prevents the establishment of causal relationships among the variables studied, suggesting that future research should employ longitudinal approaches to clarify the directionality of these associations. In addition, the use of a convenience sample limits the generalizability of the results, and although participants were recruited from different faculties and academic years, data were obtained from a single public university. Therefore, caution is advised when extrapolating these findings to other academic or regional contexts. Second, all variables were assessed through self-report questionnaires, which are inherently subjective and may be affected by recall or social desirability bias. This limitation is particularly relevant for behavioral variables such as physical activity and commuting habits. Moreover, the study did not include objective measures of physical activity (e.g., accelerometry), which could have provided more accurate and complementary information. Nevertheless, all instruments employed were validated and

previously used in similar populations, and data quality was ensured through procedures designed to detect and exclude random or inconsistent responses. Finally, while this research focused on students from a single public university, the inclusion of participants from diverse disciplines increases its representativeness. Future studies should extend the sample to private universities and different regions to determine the generalizability of the observed trends.

Conclusion

The results of the present study demonstrate that engaging in active commuting among university students is associated with higher overall levels of weekly PA practice, as well as lower perceived stress and greater life satisfaction. Additionally, the findings highlight that commuting modes are influenced by several sociodemographic factors, such as age, the compatibility of studies with paid employment, income level, and income satisfaction. Given the positive associations that active commuting appears to have on both physical and psychosocial well-being, the evidence derived from this research should be taken into consideration by relevant authorities to promote strategies that contribute to better public health outcomes. Furthermore, these strategies should focus on demographic groups in which active commuting is less common, such as older students, those living farther from the university, those with higher incomes, and ultimately, those who are more likely to have access to alternative modes of transportation. Future interventions should focus on students with a higher socioeconomic status, those who combine their studies with part-time jobs, and those who live in suburban or rural areas far from campus. These groups tend to be more dependent on private or motorized transport and have lower levels of daily physical activity, making them priority targets for the design of both behavioral and structural interventions aimed at promoting active travel. Gender-sensitive approaches should also be incorporated so that both men and women perceive the university environment as a safe, accessible and inclusive space for walking or cycling. Furthermore, the number of secure bicycle parking facilities could be increased, and their use encouraged through recognition or reward programs, such as earning points on the university health card for active travel. At the institutional and governmental levels, these efforts could be complemented by the creation of an integrated network of bike lanes and safe pedestrian pathways connecting the university with different city neighborhoods, thereby promoting a more sustainable and health-conscious urban environment.

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