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Original article

Active mobility: a health strategy for children and adolescents – a pilot observational cohort study.

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Abstract

Introduction: Active mobility in commuting between home and school has been recognized as a relevant strategy for promoting health among children and adolescents, as it contributes to increasing daily physical activity levels and developing healthy habits from a young age. However, there are still gaps in literature regarding the impacts of this behavior on physical and psychological indicators in schoolchildren. **Objective:** the present pilot study aimed to investigate the association between the use of active modes of transportation between home and school and indicators of physical health, physical activity levels, and subjective well-being in adolescents. **Methods:** This is a prospective observational analytical study conducted with a convenience sample of 20 adolescents aged between 14 and 17 years. Participants were divided into two groups according to the mode of transportation used for commuting between home and school: Active Modes Group (AMG) and Non-Active Modes Group (NMG). Data were collected using an electronic questionnaire administered in a school setting. The variables investigated included active mobility characteristics, habitual physical activity level, and body composition. The distance between home and school was estimated by georeferencing using Google Maps. Subjective well-being indicators were also assessed. **Results:** The results indicated that the groups had similar characteristics in terms of age, BMI, body fat percentage, physical activity level, and distance between home and school. Although no statistically significant differences were observed in body composition variables, adolescents in the group that used active modes of transportation tended to have lower mean BMI and body fat percentage values when compared to the group that used passive transportation. Regarding psychological indicators, significant differences were observed between the groups. **Conclusion:** Adolescents who used active transportation had higher levels of positive effect and greater life satisfaction, as well as lower levels of negative affect. Consequently, overall subjective well-being was significantly higher in the active group compared to the non-active group. The findings of this pilot study suggest that active commuting between home and school may be associated with better indicators of psychological well-being and favorable trends in body composition in adolescents.

Keywords: Active mobility; Adolescents; Physical Activity; Psychological Well-being.

1. Introduction

The reduction in physical activity levels among children and adolescents has been recognized as an important public health problem on a global scale. It is estimated that more than 80% of adolescents worldwide do not meet the minimum physical activity recommendations proposed by the World Health Organization, which significantly increases the risk for the early development of chronic noncommunicable diseases, including obesity, type 2 diabetes, and cardiovascular diseases (Guthold et al., 2020; World Health Organization, 2020). This scenario has contributed to the increase in the prevalence of overweight and obesity among young people in different regions of the world, posing a major challenge for public health systems (Abarca-Gómez et al., 2017).

Among the strategies proposed to promote more active lifestyles among children and adolescents, active commuting stands out, defined as any form of non-motorized travel that requires energy expenditure through body movement, such as walking or cycling as a means of transportation (Andrade et al., 2016). In the school context, active commuting between home and school represents a relevant opportunity to increase the level of daily physical activity, contributing to the accumulation of minutes of moderate to vigorous physical activity throughout the day (Chillón et al., 2010; Peralta et al., 2020).

The adoption of active commuting has been associated with multiple health benefits, including higher daily energy expenditure, better cardiorespiratory fitness levels, and a lower risk of being overweight in children and adolescents when compared to those who use motorized means of transportation (Ikeda et al., 2021; Larouche et al., 2022). In addition, this form of mobility can contribute to reducing sedentary behavior and promote the development of healthy habits from childhood and adolescence (Peralta et al., 2020).

Several factors have been identified as determinants of physical activity and active transportation among young people. Individual, social, and environmental aspects, such as characteristics of the urban environment, road safety,

infrastructure for pedestrians and cyclists, family support, and socioeconomic conditions, can directly influence the choice of transportation mode used by students (Bauman et al., 2012; Loureiro et al., 2022; Wangzom et al., 2023). In Brazil, studies also indicate significant socioeconomic and regional inequalities in active transportation practices, highlighting the influence of structural and environmental factors on this behavior (Sá et al., 2016).

Among the factors associated with active commuting, the distance between home and school has been consistently described as one of the main predictors of active mobility. International studies show that the probability of active commuting decreases significantly when the distance exceeds approximately three kilometers, favoring the use of motorized means of transportation (Rodrigues et al., 2022; Sandretto et al., 2024). Therefore, understanding the characteristics of school mobility is essential for developing strategies that encourage more active lifestyles among adolescents.

In addition to the physiological benefits, recent evidence suggests that physical activity also plays an important role in promoting mental health and psychological well-being in young people. Studies indicate that higher levels of physical activity are associated with improved mood, higher self-esteem, and reduced symptoms of anxiety and depression among children and adolescents (Rodriguez-Ayllon et al., 2019; Biddle et al., 2019). In this context, active commuting can contribute to these positive effects by promoting greater contact with the external environment, social interaction, and a greater sense of autonomy during the home-school commute (Smith et al., 2021).

Despite the growing number of studies on active mobility, important gaps remain in scientific literature. Much of the research focuses primarily on physical indicators, such as total physical activity level, cardiorespiratory fitness, and body composition, while the relationship between active mobility and psychological health indicators, such as subjective well-being, remains less explored, particularly in adolescent populations and in Latin American contexts (Larouche et al., 2022; Smith et al., 2021). In addition, studies that simultaneously investigate factors related to mobility, physical activity, body composition, and psychological well-being in schoolchildren are still relatively scarce.

Given this scenario, it is necessary to expand scientific research by investigating the role of active mobility as a strategy for promoting comprehensive health among adolescents. Thus, the present study aimed to investigate the association between the use of active modes of transportation between home and school and indicators of physical health, physical activity level, and subjective well-being in adolescents.

2. Methods

This is a prospective observational analytical pilot study. The groups were classified as users (i.e., Active Modes Group - AMG) and non-users (i.e., Non-Active Modes Group - NAMG) on the home/school route.

2.1 Sample

For convenience, the sample consisted of 20 schoolchildren (50% girls), half of whom were AMG. As this was a pilot study, it was decided to balance the groups with 5 GMA girls and 5 GMnA girls, and the same occurred with the boys. Students from a single school in Anápolis-GO were included, all aged between 14 and 17 years, duly authorized by their parents and with individual consent, in accordance with Resolution 466/2012 of the National Health Council.

2.2 Procedures

The selected students completed an electronic questionnaire at school, covering indicators of active mobility and the level of habitual physical activity measured by the PAQ-A questionnaire (Guedes and Guedes 2015). Based on the travel data, the sample was stratified into two groups: Active Modes Group (GMA) and Non-Active Modes Group (GMnA). Subsequently, body composition was assessed using multifrequency electrical bioimpedance (TeraScience), a method that demonstrates high accuracy and strong correlation with the gold standard (DXA) in estimating fat-free mass in adolescents (CASTILLO-MARTÍNEZ et al., 2018).

2.3 Measurement of study variables

The study variables were active mobility, physical activity, and body composition. For logistical and feasibility reasons, we chose to use the mode of transport, travel time, and distance traveled for "active mobility"; for "physical activity level," we adopted the PAQ-A (Physical Activity Questionnaire for Adolescents); and for "body composition," we used bioimpedance (CASTILLO-MARTÍNEZ et al., 2018).

2.3.1 Active mobility

To assess this variable, participants used the questionnaire to indicate the mode of transport used for commuting between home and school, the average commute time, and the distance between home and school, providing their address and neighborhood so that the distance (m) could be confirmed. Google Maps was used to georeferenced the points (home/school) and measure the distances.

2.3.2 Level of physical activity

The Physical Activity Questionnaire for Adolescents (PAQ-A) (Bervoets et al., 2014) was used to identify the level of habitual physical activity.

This self-report instrument recalls activities performed in the last seven days, consisting of items that assess leisure activities, sports, physical education, and activities at different times of the day (morning, afternoon, evening, and weekend). Each item is scored on a scale from 1 (low level) to 5 (high level), and the final score is calculated by the arithmetic mean of the scored items, allowing individuals to be classified into levels of general physical activity. It is validated for the Brazilian population (Guedes & Guedes, 2015). Those with scores < 3 were considered Sedentary/Inactive, and those with scores ≥ 3 were considered Active (Guedes & Guedes, 2015).

2.3.3 Body Composition

To measure body composition, we chose to use bioelectrical impedance because it is a non-invasive, fast, practical, and painless method based on passing a low-intensity electrical current through the body. The impedance (Z), or opposition to the flow of current, is measured using a tetrapolar BIA analyzer, in which four electrodes are applied to the hand, the wrist, foot, and ankle, and then an electric current is applied to the source electrodes (distal), and the voltage drop due to impedance is detected by the proximal electrodes.

2.4 Statistical analysis

Statistical analysis was performed using SPSS statistical software, v 27.0, IBM, with descriptive statistics expressed as mean, standard deviation, frequency, and percentages. The Shapiro-Wilk test was used to verify the normality of the data.

The Mann-Whitney test (active modes/non-active modes) was applied to compare the groups (gender). The chi-square test verified the categorical association between all study variables. Multiple linear regression was performed between the scores for distance traveled and health parameters (WC), NAF, and type of modality (active or non-active), with data adjusted for age and overweight status, and logistic regression for dichotomous binary variables. The Chi-square test was also performed to compare frequencies. A correlation was also made using Spearman's coefficients (asymmetric distribution). The level of significance adopted was <0.05.

3. Results

Table 1: Comparison of groups

Variable	GMA Mean ± SD	Min–Max	GMnA Mean ± SD	Min–Max	p
Age (years)	15.80 ± 0.79	15–17	16.20 ± 0.79	15–17	0.272
BMI (kg/m²)	22.90 ± 2.71	19.53–26.78	23.85 ± 2.05	19.22 – 26.40	0.388
Body Fat (%)	22.10 ± 6.98	8	24.20 ± 7.48	14–35	0.525
PAQ-A	1.01 ± 0.20	0.78 – 1.17	1.05 ± 0.26	0.39 – 1.17	0.714
Distance (km)	2.04 ± 1.42	0.5 – 5.0	7.34 ± 9.27	1.5 – 33	0.106

Although not significant, bioimpedance data show a trend toward better average values in the group using active mode.

Table 2: Distribution of Modals and Average Distance

Modal	(n)	Distance (km)	Classification
On foot	10	2.04±1.41	GMA
By bus	6	9.94±11.54	GMnA
Car	4	3.42±2.40	GMnA

Table 3: Subjective well-being test results between groups.

Group	AP	AN	SV	BES
GMA	3.9 ± 0.5*	2.1 ± 0.6*	3.8 ± 0.6	3.53 ± 0.42
GMnA	3.3 ± 0.6	2.7 ± 0.7	3.2 ± 0.7	3.07 ± 0.48

PA: Positive Affect; NA: Negative Affect; LS: Life Satisfaction; SWB: Subjective Well-being

Adolescents who used active modes of transportation to get to school had higher levels of subjective well-being compared to those who used passive modes of transportation. The active group showed greater positive affect (3.9 ± 0.5 vs. 3.3 ± 0.6) and greater life satisfaction (3.8 ± 0.6 vs. 3.2 ± 0.7), as well as lower negative affect (2.1 ± 0.6 vs. 2.7 ± 0.7). Consequently, overall subjective well-being was significantly higher in the active group (3.53 ± 0.42) compared to the inactive group (3.07 ± 0.48) ($t = 2.37$; $p = 0.029$; $d = 0.84$).

These findings suggest that active commuting may contribute positively to the psychological well-being of adolescents.

4. Discussion

The present pilot study aimed to investigate the association between the use of active modes of transportation between home and school and indicators of physical health, physical activity level, and subjective well-being in adolescents. Overall, the results suggest that adolescents who use active modes of transportation tend to have better body composition indicators and greater subjective well-being, although statistically significant differences were observed mainly in psychological variables.

It should be noted that in the present sample of this pilot study, the groups had similar characteristics in terms of age, BMI, body fat percentage, level of physical activity, and distance traveled on the home-school route. This initial homogeneity is relevant, as it suggests that the differences observed later were not influenced by significant demographic or anthropometric discrepancies between the groups.

Although no statistically significant differences in body composition were observed, the group that used active modes of transportation had lower mean BMI and body fat percentage values when compared to the group that used passive transportation. Previous studies indicate that active commuting is associated with higher daily energy expenditure and a lower risk of being overweight in children and adolescents, especially when performed regularly throughout the week (Andersen et al., 2011).

In addition, active commuting represents a form of incidental physical activity, that is, activity incorporated into the daily routine, contributing to increased total energy expenditure and the development of more active habits from childhood and adolescence (Peralta et al., 2020).

Regarding the distances traveled, the analysis of the distribution of modes of transportation showed that participants in the GMA group traveled exclusively on foot, with an average distance of approximately 2 km, while the GMnA group predominantly used buses or cars, with longer average distances. This evidence is well established in the literature (Rodrigues et al., 2022; Wangzom et al., 2023; Sandretto et al., 2024), and reinforces that the distance between home and school is one of the main determinants of active mobility, being considered one of the main barriers to the adoption of walking or cycling as a means of school transportation (Loureiro et al., 2022; Sandretto et al., 2024). Studies conducted in different countries show that the probability of active travel decreases significantly when the distance exceeds approximately 3 km (Østergaard et al., 2013; Nunes Júnio et al., 2022).

Regarding the level of physical activity assessed by the PAQ-A, no significant differences were observed between the groups, although the scientific literature shows that adolescents who engage in active commuting are more likely to meet daily physical activity recommendations, contributing to higher levels of movement throughout the day (Peralta et al., 2020; Huang et al., 2021), in addition to contributing to the development of cardiorespiratory fitness and better physical conditioning, especially when performed frequently and at moderate intensity (Rodrigues et al., 2022; Ikeda et al., 2021).

The main finding of this study refers to subjective well-being, in which adolescents who used active modes of transportation had significantly higher levels of overall well-being compared to the group that used passive transportation. The observed effect size ($d = 0.84$) indicates a large effect, suggesting a relevant association between active mobility and psychological health, which is in line with several studies that have shown that physical activity is associated with improved mental health, higher self-esteem, and reduced symptoms of anxiety and depression in young people (Silva et al., 2018; Liu et al., 2025).

I emphasize that this pilot study naturally has some limitations, such as sample size and homogeneity, the use of self-reported instruments, which may be subject to memory or desirability biases, and the observational design.

Future studies with larger samples, longitudinal designs, and objective methods of measuring physical activity, such as accelerometry and GPS tracking, may deepen our understanding of the effects of active mobility on adolescent health. It will also be relevant to investigate environmental and social factors that influence active travel, such as route safety, family support, and urban infrastructure.

5. Conclusion

The results of this pilot study suggest that active commuting to school may be associated with better indicators of subjective well-being in adolescents. Although the differences in body composition and physical activity level were not statistically significant, a favorable trend was observed in the active group. These findings reinforce active mobility as a promising strategy for promoting physical and mental health among young people, highlighting the importance of interventions aimed at encouraging active forms of commuting in the school context.

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