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Sedentary behaviour and motor competence in adults: A correlational analysis with physical education university students

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Abstract

Sedentary behaviour is prevalent among adults and university students can spend more time in sedentary activities than general young adult population. While high amounts of sedentary behaviour have been associated with increased risks of chronic conditions and all case mortality in adults, it is unclear whether prolonged sitting can adversely affect motor competence. The purpose of this study was to examine the relationship between sedentary behavior and motor competence levels in adult university students. A cross-sectional study involving 30 physical education university students (16 women and 14 men, mean age = 22.2 ±4.4 years) was conducted. Sedentary behaviour was assessed using a self-administered questionnaire determining sitting time during weekdays and weekend days. Motor competence was determined through product-oriented assessment on balance, locomotor and objects control skills. The average sitting time among university students was 4.4 hours per day. When considering by sex, the average sitting time of men and women were, respectively, 3.5 and 5.2 hours per day. There were no significant differences in total sitting time between male and female university students. Correlation analysis revealed no significant associations between sedentary behaviour and motor competence. In addition, there were no significant differences in balance, locomotor or object control skills between individuals with different time spent in sedentary activities. Therefore, our results did not support the assumption that sedentary behavior affects motor competence in college adults, at least among physical education university students whose average sitting time was 4.4 hours per day. Regardless, we encourage limiting sitting time due to detrimental effects on several aspects of adult health and its link to all-cause mortality.

Introduction

Sedentary behavior refers to activities that do not increase energy expenditure substantially above the resting level (i.e., ≤1.5 metabolic equivalent [MET]), such as sitting and screen-based entertainment (Pate et al., 2008). Sedentary behavior is prevalent in children (Ferreira et al., 2016) and adults (Matthews et al., 2021) worldwide. In Brazil, the prevalence of excessive screen time (>2h/day) has been reported to be higher than 70% among children and adolescents (Schaan et al., 2019). In adults, the proportion of individuals who spend three or more hours per day using screen devices in their free time reaches 66% (Brenda et al., 2020). This high prevalence is a concern because the high time spent with sedentary activities can adversely affects numerous health aspects in all age ranges.

Particularly among adults, higher amounts of daily sedentary behavior are associated with increased risk of all-cause mortality (Rezende et al., 2016; Ku et al., 2018). In this regard, evidence has shown that sedentary time is associated with an increasead risk of metabolic syndrome (Wu et al., 2022), remarkably linked to obesity (Silveira et al., 2022), cardiovascular disease and diabetes type 2 (Rezende et al., 2014). In addition, high levels of sedentary behaviour are unfavourably associated with cognitive function, depression, function and disability, physical activity levels, and physical health-related quality of life in adults (Saunders et al., 2020).

The 'boom' of digital devices like smartphones and tablets in the last two decades caused an unprecedent problem in public health. The so called generation z, composed by indivuduals who borned between the

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years of 1997 and 2010 (Slepian et al., 2024), grew up in a digital era and nowadays several of them reached adult ages. In Brazil, there are 480 million of digital devices (computer, notebook, tablet and smartphone) in use, an average of 2.2 devices per inhabitant (Meirelles, 2024). While prior studies have reported that high levels of sedentary behavior are unfavourably associated with several aspects of health (Wu et al., 2022; Wu et al., 2023), less is known whether (and, if so, how) sedentary behavior can adversely impact aspects of human development.

One aspect of human development that can be afected by excessive time spent in sedentary activities is motor competence (Chagas et al., 2023). In fact, the higher time spent in sedentary activities may lower the time people have for opportunities to develop their motor competence. In addition, sedentary activities generally do not impose task constraints able to positively affect motor competence, at least in terms of gross motor skills (e.g., locomotor and object control skills).

Motor competence is a term which refers to the level of proficiency with which people perform a wide variety of movement skills, including those in active play, physical education classes and sport activities (Chagas & Marinho, 2021). There are several positive outcomes attributed to motor competence, making it important for all ages. For instance, motor competence is an important marker of human development (Gallahue et al., 2012) and an integral component of the health and performance of youth (Burton et al., 2023). It provides children with skills necessary to participate in sport and other physical activities (Barnett et al., 2019), whose behavioral pattern tends to track into adulthood (Malina, 1996).

Emerging evidence suggests sedentary behavior is negatively associated with motor competence in children (Adank et al., 2018; Dadson et al., 2020; Hardy et al., 2018; Lopes et al., 2012). However, less is known about whether sedentary behavior affects motor competence in adults. Overall, motor competence has been extensively examined in children and adolescents, but there is a paucity of investigations among adults (Salami et al., 2023). To our knowlegdment, there is no study examining the relationship between sedentary behavior and motor competence in adults.

Adult university students enrolled in physical education courses need a certain degree of motor competence for engagement and full participation in a wide variety of academic disciplines, such as gymnastics, aquatic and sport skills. In addition, the time that they spend in sedentary activities, including the use of smartphones, is high (Castro et al., 2020; Crespo et al., 2021). Therefore, besides the issues related to health and development, examining the link between motor competence and sedentary behavior in university students has also implications for academic activities.

The purpose of this study was to analyze the relationship between sedentary behavior and motor competence in adult university students. Considering that young adults grew up in a digital era with unprecedent access to digital devices; activity patterns can track from childhood and adolescence to young adulthood (Hayes et al., 2019); high time spent in sedentary activities may displace opportunities for practice, which are essential for motor development (Gallahue et al., 2012; Newell, 1986); we hypothesized that the time spent in sedentary behavior is negatively associated with motor competence.

Methods

Participants

This was a cross-sectional study conducted with 30 university students (14 men, 16 women). We recruited a convenient sample, aged between 18 and 34 years from a University at Rio de Janeiro City, Brazil. All students were enrolled in the Faculty of Physical Education. Inclusion criteria required individuals with no history of injury or known illness that could adversely affect performance on motor tasks. Participants with missing data were excluded of the analysis. We obtained written consent of all participants prior to engaging them in research. This study was performed in line with the ethical principles for research involving human participants, in accordance with the Declaration of Helsinki.

Procedures

Anthropometry

Data from the Brazilian National Health Survey (Instituto Brasileiro de Geografia e Estatística, 2013), involving 40,366 adults indicated that self-reported weight and height are measures with acceptable validity to determine weight status (Moreira et al., 2018). As such, in this study body weight and height were self-reported by participants, and then body mass index (kg/m^2) was calculated. These measures were obtained to provide anthropometric characteristics of the sample.

Sedentary behavior

Sedentary behavior was assessed using the two questions regarding 'sitting time' of the
International Physical Activity Questionnaire short form (IPAQ-SF), a valid and reliable self-administered instrument for cross-national monitoring of physical activity and inactivity (Craig et al., 2003), including among Brazilian adults (Matsudo et al., 2001). The questions asked were: (1) How much time do you usually spend sitting on a weekday? (2) How much time do you usually spend sitting on a weekend day? We delivered the questionnaire to participants in a digital format via Google forms.

We determined total sitting time combining both weekdays and weekend days. Then, using the median value, participants were splitted into two groups considering the total sitting time during week days: lower (below the median) and higher (above the median) sitting time.

Motor competence – balance, locomotor and object control skills

Motor competence was assessed using tasks requiring balance (walking backward), locomotor (two-legged sideways jumping) and object control (eye-hand coordination) skills. These three tests were derived from the KTK3+, a valid instrument to measure the motor competence of children, adolescents and young adults (Coppens et al., 2021). The first test consisted of walking backward on balance beams, with decreasing width, in which each beam was crossed three times where a maximum of eight steps per trial were allowed. The number of steps (a total of 72) was the item score. The second test required two-legged sideways jumping across a wooden slat, positioned in the middle of an area (60 cm × 100 cm), for 15s as quickly as possible, where participant should land inside area, with both feet simultaneously, without touching wooden slat while jumping. The number of successful landing was the item score. The third test consisted of eye-hand coordination, in wich the participant tries to control a tennis ball throwing and catching, alternately using right and left hands (indistincly through overhand and/or underhand skills), as many times as possible during 30s, against a square ($1m^2$) taped on the wall with the bottom side of the square 1m above the ground. Participants stand 1m from wall and performed this task twice, with the number of successful ball catches across both trials resulting in the test score.

Data Analyses

Descriptive statistics (mean, standard deviation and 95% confidence interval) were determined for all measurements. The Kolmogorov–Smirnov test did not confirm normality of the data distributions. Spearman correlation coefficients were determined to check the association between motor competence and sedentary behavior measurements. The Mann-Whitney test was used to investigate sex differences in sitting time and to compare motor competence levels (balance, locomotor and object control skills) between two groups of sedentary behavior (lower vs. higher time spent in sedentary activities). A significance level of 5% ($\alpha = 0.05$) was adopted in all statistical tests. Data analysis was executed using IBM SPSS software version 22.0.

Results

Descriptive statistics of age, body weight, height, BMI, motor competence and sedentary behavior levels from all participants are provided in Table 1. The average sitting time of the whole sample during entire week (7 days) was 4.4 hours per day. When considering by sex, the average sitting time time of men and women during entire week were, respectively, 3.5 and 5.2 hours per day. However, there were no significant differences in total sitting time (U=78.5, p= .162), as well as sitting time during weekdays (U=82.5, p= .206) and weekend days (U=87.5, p= .238) between male and female university students.

Spearman correlation analysis revealed that time spent in sedentary activities was not associated with locomotor (rho = -.223, p= .235), balance (rho= -.157, p= .407) and object control skills (rho= -.004, p= .952).

Participant's motor competence levels with lower and higher time spent in sedentary activities (sitting time) are displayed in Figure 1. Mann-Whitney test indicated that there were no significant differences between groups (lower vs. higher sedentary behavior) in balance (U=104.5, p = .740), locomotor (U=90.0, p= .349) and object control (U=98.5, p= .561) skills.

Table 1
Descriptive statistics (mean, standard deviation and 95% confidence interval) of all participants.

Variables	Whole sample (n=30)	Women (n=16)	Men (n=14)
Age (years)	22.2 (±4.4) CI: 20.6 – 23.9	22.6 (±4.0) CI: 20.5 – 24.8	21.8 (±5.0) CI:18.9 – 24.6
Body weight (kg)	67.9 (±14.4) CI: 62.6 – 73.3	62.2 (±15.0) CI: 54.3 – 70.2	74.4 (±10.9) CI: 68.2 – 80.7
Height (m)	1.69 (±0.1) CI: 1.66 – 1.73	1.64 (±0.1) CI: 1.61 – 1.68	1.75 (±0.1) CI: 1.72 – 1.79
BMI (kg/m^2)	23.5 (±3.9) CI: 22.0 – 25.0	22.9 (±4.4) CI: 22.2 – 26.1	24.1 (±3.4) CI: 22.2 – 26.1
Locomotor skill (raw scores)	74.8 (±12.3) CI: 70.2 – 79.4	74.9 (±11.6) CI:68.7 – 81.0	74.7 (±13.4) CI: 66.9 – 82.5
Balance skill (raw scores)	55.70 (±15.5) CI: 49.9 – 61.5	60.8 (±12.0) Ci: 54.4 – 67.2	49.9 (±17.4) CI: 39.8 – 59.9
OC Skill (raw scores)	32.5 (±13.9) CI: 27.4 – 37.7	26.8 (±14.4) CI: 19.1 – 34.5	39.1 (±14.4) CI: 33.3 – 44.9
SB weekdays (hours/day)	3.77 (±2.8) CI: 2.7 – 4.8	4.3 (±3.1) CI:2.6 – 6.0)	3.1 (±2.3) CI: 1.8 – 4.5
SB weekend (hours/day)	6.0 (±5.6) CI: 3.9 – 8.1	7.3 (±7.1) CI: 3.5 – 11.1	4.4 (±2.6) CI: 2.9 – 5.9

OC: Object control; SB: Sedentary behavior.

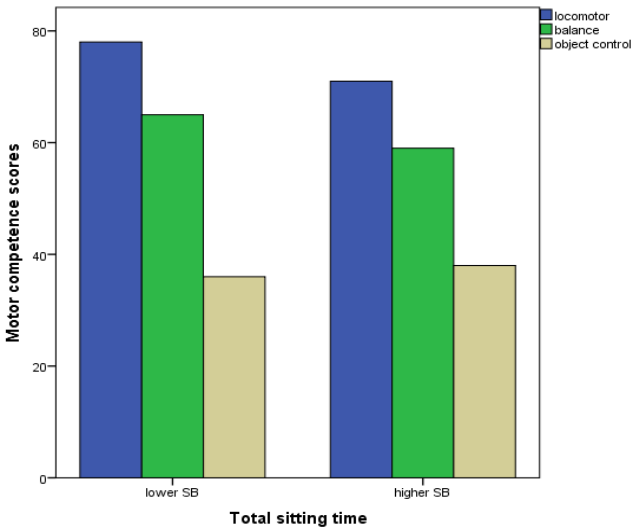

Figure 1. Motor competence scores (median values) in participants with lower and higher sedentary behavior (SB).

Discussion

The prevalence of adults who spend several hours per day in sedentary activities is high and, therefore, to study whether (and, if so, how) sedentary behavior can adversely impact aspects of health and development is needed. In this study, we analyzed the relationship between sedentry behavior and motor competence in adult university students. Our findings indicated no significant associations between sitting time and motor competence levels. In addition, there were no significant differences in motor competence levels between groups with different exposure time in sedentary activities. Therefore, our results did not support the assumption that sedentary behavior adversely affects motor competence in adults.

High time spent in sedentary activities is a concern because can negatively affect aspects of human health

and developement. In terms of human development, high time spent in sedentary activities may displace opportunities for practice, and then to hinder motor development. Yet sedentary behaviour is prevalent among adults (Matthews et al., 2021) and university students can spend more time in sedentary activities than general young adult population (Castro et al., 2020). In this study, the average sitting time during week was 4.4 hours per day. Our findings are in line with a population-based study (Sebastião et al., 2019) examining Brazilian adults using IPAQ, in which the mean sitting time in individuals aged 20 to 29 years ranged between 4.3 and 4.7 hours per day. On the other hand, a meta-analysis study (Castro et al., 2020) considering self-reported measures indicated that university students spent 7.29 hours per day being sedentary. However, our sample was composed by physical education university students, who are often engaged in sports and physical exercises during their academic activities. Such behavioral patterns is different from other university students, who spend higher sitting time during their academic activities.

Before determining a cut-off point of sitting time to estimate dose-response between exposure and outcomes, firstly it is needed to know if there is a link between variables. In this study was assessed the relationship between sitting time and motor competence levels in adult university students. Our findings indicated that the time spent in sedentary activities was not related to locomotor, balance and object control skills. In addition, there were no significant differences in motor competence levels between university students with different exposure time in sedentary activities.

Fundamental movement skills, that can be classified into distinct categories such as locomotor, balance and object control skills, are basic learnt movement patterns that do not occur naturally (Barnett et al., 2016). Therefore, besides the individual constraints, the development of competency in locomotor, balance and object control skills depends of tasks constraints and a sociocultural background (Newell, 1986) that provides opportunities for practice (Gallahue et al., 2012). Sedentary behavior integrates a sociocultural background that does not provide oportunities for practice. Given the high prevalence of sedentary behavior in adults, including university students who grew up in a digital era, as well as the preliminary findings showing a link between sedentary behavior and motor competence in schoolchildren (Santos et al., 2021), it seems plausible to consider an inverse relationship between sitting time and fundamental movement skills. However, our results did not corroborate an inverse relationship between sedentary behavior and motor competence in adults.

Our unexpected findings can be explained considering other aspects linked to motor competence. For instance, physical activity is independent of sedentary behavior and positively associated with motor competence across the lifespan (Hulteen et al., 2018). In addition, our sample, composed by physical education university students, can have experienced abundant and diviersified oportunities for practice throughout life, fostering motor competence, regardless time spent in sedentary activities. These aspects were not approached in this investigation and, therefore, are a limitation.

This study had other limitations. Although the motor competence assessment tool (KTK3+) has been validated to be used in young adults (Coppens et al., 2021), older university students were also recruited in this study. In addition, we examined a small sample size, which limits statistical power and generalizability. In terms of study design, our cross-sectional research did not allow for follow-up sedentary behavior and motor competence across time. Nevertheless, given the high prevalence of sedentary behavior in adults and the scarcity of investigations assessing motor competence in this population, this study can add to the literature expanding our knowledgement about motor competence and behavioral outcomes beyond the childhood and adolescence.

Considering these limitations, we recommend future studies with longitudinal designs, higher sample sizes and adjusted for potential confounders. Still, given the paucity of studies, even investigations with descriptive and correlational analysis examining sedentary behavior in young adults from different populations and geographic regions can add to literature.

Conclusion

Sedentary behavior was not associated with motor competence in adults, at least among physical education university students whose average sitting time was 4.4 hours per day. Regardless, we encourage to limit sitting time due to detrimental effects on several aspects of adult health and its link to all-cause mortality.

Authors' Contribution

Study Design: DC, JL; Data Collection: DC, JL; Statistical Analysis: DC; Manuscript Preparation: DC, JL, AL, DG.

Ethical Approval

The study was approved by the Departmental Council of Faculty (Institute of Physical Education and Sports, Rio de Janeiro State University (2025/02) and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

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Conflict of interest

The authors hereby declare that there was no conflict of interest in conducting this research.

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