Original Manuscript

Perceptual and Motor Skills
2025, Vol. 0(0) 1–22

DOI: 10.1177/00315125251344404
journals.sagepub.com/home/pms
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Relationship Between Quality of Life, Level of Physical Activity, Physical Fitness, and Body Composition on the Academic Performance of High School Students in an Integrated Educational System

Jeann C. Gazolla[1], João B. Ferreira-Júnior[2], Samuel Encarnação[3,4,5,6], André C. Schneider[3,6], António M. Monteiro[3,6], José E. Teixeira[3,6,7,8,9], Pedro Forte[3,5,6], João P. Verbena e Oliveira[2], Diego A. Borba[10], Carlos M. A. Costa[2], and Carlos A. Vieira[1]

[1]College of Physical Education and Dance, Universidade Federal de Goiás, Goiânia, Brazil
[2]Department of Education, Instituto Federal do Sudeste de Minas Gerais- Campus Rio Pomba, Rio Pomba, Brazil
[3]Department of Sports Sciences, Instituto Politécnico de Bragança, Bragança, Portugal
[4]Department of Physical Education, Sport and Human Movement, Ciudad Universitaria de Cantoblanco, Universidad Autónoma de Madrid (UAM), Madrid, Spain
[5]CI-ISCE, Instituto Superior de Ciências Educativas do Douro (ISCE Douro), Penafiel, Portugal
[6]Research Centre for Active Living and Wellbeing (Livewell), Instituto Politécnico de Bragança, Bragança, Portugal
[7]Department of Sports Sciences, Polytechnic Institute of Guarda, Guarda, Portugal
[8]SPRINT—Sport Physical Activity and Health Research & Inovation Center, Guarda, Portugal
[9]Research Center in Sports Sciences, Health Sciences & Human Development (CIDESD), Vila Real, Portugal
[10]Universidade Estadual de Minas Gerais, Unidade de Divinópolis, Brazil

Corresponding Author:
João B. Ferreira-Júnior, Instituto Federal do Sudeste de Minas Gerais- Campus Rio Pomba, Rio Pomba, Brazil.
Av. Dr. José Sebastião da Paixão - Lindo Vale, Rio Pomba – Minas Gerais, CEP: 36180-000.
Email: jbfjunior@gmail.com

Abstract

Background: Adolescence is a critical period for the development of physical and cognitive health. Understanding how lifestyle and physical health parameters relate to academic performance and quality of life may inform school-based interventions. **Purpose:** This study aimed to evaluate the relationship between physical activity level (PAL), quality of life (QoL), physical fitness (PF), strength, speed and agility, body composition, and academic performance (AP) in high school students. **Research Design:** A cross-sectional, correlational study using multiple linear regression models to assess predictive relationships. **Study Sample:** 365 students (aged 16.93 ± 0.94 years) participated in the study. **Data Collection and Analysis:** Evaluations included Body Mass Index (BMI); PAL; QoL; PF (handgrip strength, countermovement vertical jump, and agility); and AP. A multiple linear regression was conducted using AP as the dependent variable, with BMI, jump performance, agility, handgrip strength, and PAL scores as predictors. Five additional multiple linear regressions were performed, each with a QoL domain as the dependent variable, and the same set of predictors as in the AP model. Participants' age and sex were included as covariates in all models. **Results:** Significant predictive capacity was observed for AP (F = 2.22, p = .028, R = 0.31, R^2 = 0.093) and two QoL domains: physical health (F = 2.32, p = .021, R = 0.28, R^2 = 0.079) and psychological health (F = 2.32 and p = .021, R = 0.28, R^2 = 0.079); however, with weak correlation coefficients (0.2 ≤ R <0.4). Only jump performance and age significantly affected the AP model (β = 0.038, p = .014) and the psychological health domain model (β = 0.48, p = .018). **Conclusions:** The predictors explained 9.3% of the variance in AP and 7.9% of the variance in physical health and psychological health in QoL domains, suggesting that additional factors (e.g., socioeconomic status, dietary habits) may play a role. The findings highlight the importance of multifactorial approaches in future research.

Keywords

quality of life, educational test performance, physical fitness, cognition, adolescent behavior

Introduction

There is significant scientific interest in evaluating the factors that influence an individual's physical and mental health. Quality of life (QoL), physical activity level (PAL), and physical fitness (PF) are highlighted as key contributors to overall health (Juškienė, 2016), which encompasses a wide range of dimensions, linking both positive and negative aspects of life, and offers various methods for assessment (Saylor, 2004). This variation causes individuals with the same illness to show different levels of physical and emotional health and wellness. Taking these factors into account and recognizing the multi-faceted aspect of QoL, health-related factors are now essential in its assessment (Okely et al., 2019). Thus, the relationship of PAL and PF with QoL has been evaluated, particularly in adolescents, as adolescence is a critical period for establishing health-related behaviors that impact long-term QoL (Gu et al., 2016).

For instance, feeling physically fit can promote autonomy and psychological well-being, thereby positively influencing QoL scores (Riiser et al., 2014). Higher levels of PF are positively associated with improved physical functioning, mental health, and vitality scores in men with an average age of 25 years (Marquez et al., 2020). Regarding PAL, a previous study showed that performing two weekly sessions of moderate- to high-intensity physical activity, lasting 60 min, over 12 months lead to improvements in QoL among women over 20 years old (Silva et al., 2018). Similarly, the weekly hours students aged 14 to 17 spent on sports-related activities were positively associated with QoL scores (Jalali-Farahani et al., 2016). Another study found a weak direct relationship between PAL and QoL ($r = 0.14$) in students (19.5 ± 1.2 years) (Çiçek, 2018). Regarding sedentary behaviors, the intensive cell phone use for entertainment can directly impacts PAL, which may indirectly contribute to lower QoL (Kliesener et al., 2022). However, it has been noted that no relationship could be established between physical activity during leisure time and the QoL of college students (Nowak et al., 2019). Therefore, further studies are needed to assess whether the practice of physical activity is indeed related to students' QoL (Abrantes et al., 2022). Moreover, it is essential to better understand how and to what extent PF and PAL are related to QoL in adolescents.

Similar to QoL, these variables (i.e., PF and PAL) can also affect academic performance (AP) (Cadenas-Sanchez et al., 2020; Solis-Urra et al., 2021), which refers to a student's success in school activities, including test grades, attendance, assignments, and participation in extracurricular activities. AP has been associated with lower stress, a positive self-concept, higher self-efficacy, healthy behaviors, and increased subjective well-being (Buecker et al., 2018). Regarding PF levels, certain variables are expected to positively influence AP, such as speed, muscle strength, and cardiorespiratory fitness. A previous study showed that students aged 10–12 years who performed better in speed, agility, and cardiorespiratory fitness tests exhibited higher levels of selective attention and concentration (Páez-Maldonado et al., 2020), which, according to the authors, could positively influence AP. Consistent with these findings, another study reported that muscle strength and speed/agility were positively related to AP in children under the age of 13 years (Cadenas-Sanchez et al., 2020). Cardiorespiratory fitness was also considered the best predictor of PF and was positively associated with AP in students aged 10–12 years (Páez-Maldonado et al., 2020). However, other studies have not identified a relationship between muscle strength, speed, or agility and AP in students (Barrigas et al., 2018; Chumlhak et al., 2020). Therefore, further research is needed to determine the extent to which muscle strength and speed/agility influence AP.

Regarding PAL, students with higher PAL may have higher QoL (Chumlhak et al., 2020). Booth et al. (2014) suggested that moderated physical activity performed over the long term may positively impact the AP of students up to 16 years old. However, two recent studies found no relationship between PAL and AP in students aged

16 ± 2.76 years (Cadenas-Sanchez et al., 2020; Fernandes, 2019). Another factor that can influence the AP is QoL. Qi et al. (2020) observed a positive association between QoL and AP in elementary and high school students. Additionally, students up to 12 years old diagnosed with learning difficulties were found to have lower QoL (Rezende et al., 2017).

Overweight and obesity are other factors that can negatively affect both QoL and AP (Lopez-Agudo & Marcenaro-Gutierrez, 2021; Çam & Ustuner Top, 2021). A previous study revealed a negative relationship between QoL and obesity in students aged 9–11 years (Wafa et al., 2016). An ideal Body Mass Index (BMI) range of 18.6–24.9 kg/m^2 seems to be associated with fewer symptoms of depression (Badillo et al., n.d), while a decrease in BMI may contribute to improved QoL in individuals under the age of 20 years (Jørgensen et al., 2022). Furthermore, studies involving high school students have shown that those with higher BMI tend to achieve lower AP scores in mathematics and reading skills (Anderson & Good, 2017; Mendoza-Castejón & Clemente-Suárez, 2020). This negative association between BMI and AP may be attributed to the increased likelihood of students with higher BMI experiencing weight-related stigma, which can result in distress caused by teasing or bullying (Feeg et al., 2014; Martin et al., 2017; Pearl et al., 2021). One potential explanation for the divergence among studies examining the associations between PF, PAL, QoL, and AP lies in methodological differences, as these variables have been measured by the aforementioned studies using varied instruments or methods. Additionally, PF has often been inferred by assessing specific components, such as muscle strength, agility, muscular endurance, cardiorespiratory endurance, or flexibility, typically in isolation. Thus, further research is needed to clarify whether relationships exist between strength, speed, agility, PAL, QoL, and body composition with AP, as well as to determine the extent to which these variables influence AP in adolescents. Additionally, as previously noted, it is crucial to investigate how strength, speed, agility, PAL, and body composition impact QoL.

Addressing these issues can assist full-time public-school administrators in designing health programs aimed at enhancing students' QoL and AP. Accordingly, this study seeks to explore the relationships among QoL, PAL, muscular strength, speed, agility, body composition, and AP in high school students within an integrated education system. Specifically, it focuses on two linear regression models. The first model examines the relationships between muscular strength, speed, agility, body composition, and PAL with QoL to determine how these factors influence QoL. The second model investigates the relationships among muscular strength, speed, agility, body composition, PAL, QoL, and AP to evaluate their influence on AP. The hypothesis posits that both models, with their respective sets of independent variables, would significantly predict adolescents' QoL and AP (Esmailzadeh et al., 2018; Fraile-Martinez et al., 2024; Gu et al., 2016; Joseph et al., 2014; Trott et al., 2024; Zayed et al., 2024).

Materials and Methods

Study Design

The study was exploratory (Oliveira et al., 2017) and comprised three stages. In the first stage, information on physical activity level and QoL was collected using the WHOQOL brief, previously validated for the Brazilian population (Fleck, 2006), and the IPAQ short version (Lee et al., 2011), also validated in Portuguese (Matsudo et al., 2001). In the second stage, anthropometric measurements (body weight and height) were obtained to calculate body composition via BMI (body weight/body height^2) (Wu et al., 2024). In addition, PF was assessed through hand grip strength (Muñoz & Millán, 2019), performance in the countermovement vertical jump, an agility test (Kotaro & Hideaki, 2011), and a 10-m sprint test (Altmann et al., 2019). Finally, the third stage involved recording the students' AP. The first two stages were conducted on the same day and lasted approximately 2 h, during which the physical tests were performed with the volunteers wearing light and appropriate clothing for physical activity. These stages took place in October 2022. The third stage involved calculating the AP based on grades provided by the school's education department after the conclusion of the second trimester of 2022, covering the months of July to October.

Participants

A total of 365 high school students from the full-time education system of the Federal Institute of Education, Science, and Technology of Southeast Minas Gerais, Rio Pomba Campus (IF Sudeste MG), Brazil, participated in the study. Volunteers were invited to participate in person and through posters displayed around the campus. The statistical power was calculated using G*Power (Version 3.1.2) (Faul et al., 2007, 2009). Since two regressive models were implemented in this study, the power analysis was set as follows: for model 1 (multiple linear regression predicting QoL): effect size = 0.19, 95% confidence interval for statistical significance ($p < .05$), and number of predictors = 5 (BMI, jump, agility, hand grip strength, and PAL); and for model 2 (multiple linear regression predicting AP): effect size = 0.19, 95% confidence interval for statistical significance ($p < .05$), and number of predictors = 6 (BMI, jump, agility, grip strength, QoL, and IPAC). Both models demonstrated high statistical power, with Model 1 achieving 1.0 and Model 2 achieving 0.99. Students of both genders, aged between 15 and 21 years, enrolled in the technical courses integrated with high school at the institution, were recruited. After being informed about the study, adult volunteers read and signed the Informed Consent Form, while minor volunteers signed the Assent Form, and their legal guardians signed the Informed Consent Form. The present study was approved by the institutional research review board.

Evaluation of Physical Activity Level

The usual PAL was assessed using the short version of the International Physical Activity Questionnaire (IPAQ). The model used in the present study was the official Brazilian Portuguese translation of the short version, previously validated for the Brazilian population (Hallal et al., 2003). The questionnaire considers the duration and frequency of physical activities performed in a week, including only sessions of over 10 continuous minutes and categorizing the intensity of physical activities performed (i.e., light, moderate, and vigorous). The time spent on physical activity, measured in minutes, was used for statistical analysis. The questionnaire has been shown to provide valid and precise results, as reported in the systematic review by Sember et al. (2020).

Evaluation of Quality of Life (QoL)

QoL was assessed using the WHOQOL-brief questionnaire (Lopez-Agudo & Marcenaro-Gutierrez, 2021), consisting of 26 questions in Portuguese, which has been used to assess QoL in adolescents (Çiçek, 2018). Responses are scored on a Likert scale from 1 to 5, where higher scores indicate better QoL. The questionnaire is divided into four domains: (i) physical health, comprising questions 3, 4, 10, 15, 16, 17, and 18; (ii) psychological health, consisting of questions 5, 6, 7, 11, 19, and 26; (iii) social relationships, covered by questions 20, 21, and 22; and (iv) environment, encompassing questions 8, 9, 12, 13, 14, 23, 24, and 25 (Lopez-Agudo & Marcenaro-Gutierrez, 2021). Overall QoL was calculated as the sum of the 26 questions.

Evaluation of Body Composition

Anthropometric evaluation included measurements of body mass and height. Body mass was measured with a digital scale (Lider, model P150 M, Araçatuba, Brazil) with a resolution of 50 g, and height was measured using a stadiometer (Sanny, model ES2020, São Bernardo, Brazil). Body composition was then estimated using the BMI, calculated as the ratio of body mass (in kilograms) to the square of the individual's height (in meters) (Nuttall, n.d.).

Evaluation of Physical Fitness

Health-related PF was evaluated through tests for hand grip strength, countermovement jump, agility, and a 10-m sprint. Muscular strength was measured using a hand dynamometer with a precision of 0.1 *N* (SH1001, Saehan, South Korea). Volunteers were seated with both feet flat on the ground and the elbow flexed at 90°. They performed three attempts, with a 30-s rest between attempts, and they received verbal encouragement from the examiners. The attempt with the highest performance was recorded for analysis.

Vertical jump performance was assessed using two countermovement jumps, with a 1-min rest between jumps. Volunteers were instructed to jump high and as fast as possible with a self-determined range of motion (Cloak et al., 2014). Jump height was measured using a contact mat (Multi Sprint, Hidrofit®, Belo Horizonte, Brazil), and the best performance was recorded for statistical analysis.

Agility was assessed through two attempts at an agility test (Cloak et al., 2014), with a 1-min interval between attempts. Volunteers ran 15-m in a straight line with two reference points: the first at 10-m and the second at 15-m from the starting line. Upon reaching the 15-m point, volunteers returned as quickly as possible to the 10-m point. The time taken to cover the distance was recorded using a photocell system (Multi Sprint, Hidrofit®, Belo Horizonte, Brazil) positioned at the starting line. The fastest time was used for analysis (Cloak et al., 2014). In addition, speed was evaluated through a 10-m sprint, with another photocell positioned at the 10-m point to record the time. The test started with volunteers in a standing position, with one foot immediately just behind the starting line, and they were instructed to complete the test in the shortest time. Verbal encouragement was provided throughout the test.

The PF evaluation was conducted on a single day at the same location for all volunteers, utilizing the schedule time for Physical Education classes. Volunteers were instructed to wear appropriate clothing, including a shirt or T-shirt, shorts or leggings, sneakers, or remain barefoot for the assessments.

Academic Performance

The participants' AP was obtained through the weighted average of their grades in the following subjects: mathematics, Portuguese, chemistry, biology, physics, sociology, philosophy, history, geography, English, and physical education. Grades were recorded on a scale of 0 to 10 and were provided by the Teaching Department of IF Sudeste MG - Campus Rio Pomba, Brazil, after the conclusion of the second academic trimester of 2022.

Statistical Analysis

The data is presented as mean ± standard deviation for variables with a normal distribution and as median and interquartile range [25^{th}-75^{th}] for variables without a normal distribution. The normality of the data was tested using the Kolmogorov-Smirnov test. A multiple linear regression was performed using AP as the dependent variable, with BMI, jump, agility, grip strength, overall QoL, and IPAC as predictors. Five additional multiple linear regressions were performed, each with a QoL domain as the dependent variable, and the same set of predictors as in the AP model. Participants' age and sex were included as covariates in all models. Participants' age and sex were included as covariates in all models (Cleophas et al., 2006). During the regression analysis, multicollinearity among predictors was tested, and variables with a value of Variance Inflation Factor (VIF) < 5 were considered no-multicollinear and thus, not redundant for the model (Kim, 2019). Normality and predictors' autocorrelation were also tested using the Shapiro-Wilk and Durbin-Watson tests, respectively. The F-statistic value was outputted to determine the overall significance level of the models. The correlation coefficient (R) was classified as very weak ($0 < R < 0.2$), weak ($0.2 \leq R < 0.4$), moderate ($0.4 \leq R < 0.7$), strong ($0.7 \leq R < 0.9$), and very strong ($R \geq 0.9$) (Papageorgiou, 2022). The coefficient of determination (R^2) was calculated to assess the percentage of variance explained by the models (Cohen, 2013). All analyses were performed using Jamovi version 2.3.24.0, considering a significance level of $p \leq .05$.

Results

Table 1 presents the descriptive results for age, body composition, and physical fitness tests. Table 2 provides the descriptive results for QoL, PAL, and AP.

The regression analysis met the assumptions of multicollinearity (VIF <5), normality ($p > .05$), and autocorrelation ($p > .05$) for the AP and QoL models (i.e., overall QoL, physical health, psychological health, social relationships, and environment). Statistically significant results were found for the AP model (F = 2.22 and $p = .028$) and two QoL domains: physical health (F = 2.32 and $p = .021$) and psychological health (F = 2.32 and $p = .021$), indicating that the analyzed variables can predict AP as well as the physical health and psychological health domains of QoL (Table 3). However, the correlation coefficients were weak (Table 3). No significant effects were observed for overall QoL (F = 1.26 an $p = .28$) or for the other QoL domain models: social relationships (F = 1.36 an $p = .22$), and environment (F = 0.97 an $p = .45$).

Regarding the predictors' effect, only jump performance and age significantly affected the AP model ($\beta = 0.038$, $p = .014$) and the psychological health domain model ($\beta = 0.48$, $p = .018$); respectively. The other variables did not show significant effects on AP or the psychological health domain ($p > .05$). Additionally, no significant effects were observed for any variable in the physical health domain model ($p > .05$). Therefore, the multiple linear regression equations were defined as follow:

(1) AP model:

y = 8.56035 – 0.10576 Age + 0.43363 Sex* – 0.42537 BMI + 0.03788 Jump +.2867 Agility – 0.0033 Grip Strength – 0.00772 QoL – 0.000377 IPAQ;

(2) Physical health domain model:

y = 10.9373 + 0.0288Age – 0.4316 Sex* + 0.000191 BMI +0.0199 Jump +.5539 Agility + 0.0357 Grip Strength + 0.000458 IPAQ; and

Table 1. Descriptive Results for Age, Body Composition, and Physical Fitness Tests (n = 395).

Age (years)	BMI (kg.m^{-2})	Jump (cm)	Agility (s) (95% CI)	Hand grip strength (kgf)
17.3 ± 1.0	22.2 ± 4.0	27.8 ± 7.8	3.18 [2.97–3.39]	38.7 ± 10.9

Kg.m^{-2}: Kilograms per meter squared, cm: centimeters, s: seconds, kgf: Kilogram-force.

Table 2. Descriptive Results for Quality of Life, Physical Activity Level, and Academic Performance (n = 395).

Quality of life						
Physical health (a.u.)	Psychological health (a.u.)	Social relationships (a.u.)	Environment (a.u.)	Overall QoL (a.u.) (95% CI)	IPAQ (min)	AP (a.u.)
15.0 ± 2.3	14.4 ± 2.7	14.8 ± 3.0	14.2 ± 2.3	58.8 [53.5−63.9]	197 ± 169	7.45 ± 0.93

a.u; arbitrary unit.

Table 3. Simple Linear Regression Matrix for the Academic Performance (AP) and Overall Quality of Life (QoL) Models.

Variables	R	R^2	F	*p*
AP	0.31	0.093	2.22	0.028
Overall QoL	0.20	0.041	1.26	0.28
Physical health	0.28	0.079	2.13	0.042
Psychological health	0.28	0.079	2.16	0.040
Social relationships	0.23	0.052	1.36	0.22
Environment	0.19	0.037	0.97	0.45

(3) Psychological health domain:

$$y = 5.336 + 0.4828\ \text{Age} - 0.4169\ \text{Sex}^* - 0.0107\ \text{BMI} + 0.0187\ \text{Jump} - 0.0393\ \text{Agility} + 0.017\ \text{Grip Strength} + 0.000819\ \text{IPAQ}.$$

(*) Men = 0 and Women = 1.

Discussion

This study investigated the relationships between PF, body composition, PAL, QoL, and AP in adolescents. It was hypothesized that the predictors analyzed in this study could explain a meaningful proportion of variance in both QoL and AP. The findings revealed significant associations between jump performance, agility, grip strength, BMI, PAL, and QoL with AP ($p < .05$). Similarly, significant associations were observed between jump performance, agility, grip strength, BMI, and PAL with two QoL domains: physical health and psychological health ($p < .05$). However, the predictors in the analyzed models demonstrated a weak ability to explain variance in AP, and physical health and psychological health QoL domains, as indicated by the low coefficients of determination (R^2 ranging from 0.079 to 0.093).

This study investigated the relationships between physical fitness (PF), body composition, physical activity levels (PAL), quality of life (QoL), and academic performance (AP) in adolescents. It was hypothesized that the predictors analyzed in this study could explain a meaningful proportion of variance in both QoL and AP. The findings revealed statistically significant associations between jump performance and AP, as well as between age and the psychological health domain of QoL. However, the regression models showed weak explanatory power, as indicated by low coefficients of determination (R^2 ranging from 0.037 to 0.093). These results suggest that other unexamined factors may play a more substantial role in influencing these outcomes.

Previous studies have identified an association between lower body physical performance and AP. Cadenas-Sanchez et al. (Cadenas-Sanchez et al., 2020) highlighted positive relationship between lower limb strength and AP in students aged between 8 and 11 years. Similarly, another study involving students aged 8.60 ± 0.61 years reported a significant positive correlation between jump performance and AP (Batez et al., 2021). Regarding speed and agility, Páez-Maldonado et al. (2020) showed that students who achieved the best results in speed and agility tests exhibited greater selective attention, concentration, and better AP among adolescents aged 10–12 years. Ruiz-Ariza et al. (2017) also identified speed and agility as predictors of cognitive functioning and AP in adolescents. Overall, these findings align with the results of the current study, strengthening the evidence supporting the positive influence of good physical fitness on AP.

However, previous studies have failed to identify significant associations between AP and lower body physical performance. For instance, the strength of the lower limbs was not linked to focus or cognitive control, factors that may influence AP, in students aged 14.5 ± 1.2 years (Cadenas-Sanchez et al., 2017). Similarly, Kao et al. (2017) reported no significant association between lower limb strength and AP in students aged 9–11 years. Consistent with these findings, Shigeta et al. (2021) observed no relationship between jump performance and AP in students aged 16.5 ± 0.4 years, and Haverkamp et al. (2021) found no association between speed/agility and AP in students up to 16 years old. Likewise, Chumlhak et al. (2020) did not identify a relationship between speed/agility and AP in students up to 13 years old. Regarding QoL, Henning et al. (2015) reported no relationship between QoL and AP in students aged 22.8 ± 2.2 years. Earlier studies also failed to find an association between body composition, PAL, and QoL with AP. For BMI, Martin et al. (2017) highlighted that the relationship between BMI and AP remains inconclusive and warrants further investigations. As for PAL, Lindner (2002) evaluated 1447 students aged between 13 and 17 years and found no association between PAL and AP. Aadland et al. (2017) evaluated 697 students up to 10 years old from 57 schools and found no relationship between moderate to vigorous physical activity and AP. Similarly, Cadenas-Sanchez et al. (2020) did not observe significant associations between PAL and AP in students aged 14.5 ± 1.2 years.

In contrast to the findings of the present study, some previous research has identified associations between body composition, PAL, and QoL with AP. For instance, higher levels of obesity have been linked to lower AP in students up to 12 years old (Muntaner-Mas et al., 2018). In accordance with these findings, a previous study observed that higher BMI was associated with reduced working memory in students aged 10–13 years (Wu et al., 2017). Regarding PAL, longitudinal studies have shown significant associations between PAL and AP (Booth et al., 2014; Kamijo et al., 2012). Booth et al. (2014) suggest that moderate physical activity performed over the long-term positive impacts the AP of students up to 16 years old. In agreement, Lima et al. (2019) observed that higher PAL levels are associated with better AP in students aged 7–12 years. Moreover, a recent study by Qi et al. (2020) reported an association between QoL and AP in elementary and high school students.

The predictors analyzed in the present study (i.e., jump performance, agility, grip strength, BMI, PAL, and QoL) explained approximately 9.3 of the variances in AP. The low coefficient of determination observed can be attributed to the fact that only jump performance showed significant influence on AP ($p < .05$), while the other variables did not ($p > .05$). This finding indicates that contextual and psychosocial factors may play a significant role in these relationships. Factors such as family support, school attendance, mental well-being, perseverance in overcoming barriers, socioeconomic status, and aerobic capacity may play a significant role in determining AP (Butler et al., 2022; Kliesener et al., 2022). A study conducted by Cosgrove et al. (2018) showed that students with consistent school attendance performed better academically than those with frequent absences. Furthermore, previous research suggests that favorable socioeconomic contexts not only provide access to educational and sports resources, but also promote environments that provide emotional stability and healthy behaviors, which, in turn, facilitate improved academic performance (Subramaniam et al., 2022).

Regarding socioeconomic conditions, a study conducted by De Greeff et al. (2014) with students aged 7–10 years indicates that those with socioeconomic disadvantages had lower AP. Conversely, students aged between 11 and 14 years from environments with greater advantages were more likely to have AP classified as very good or excellent (Fernandes, 2019).

A greater cardiorespiratory fitness has been positively associated with better attention capacity and, consequently, improved AP (Cadenas-Sanchez et al., 2017). In agreement, Aadland et al. (2017) reported a positive association between cardiorespiratory fitness, executive functions, and AP. Therefore, including these variables in future research could help clarify the gaps observed in current models.

Regarding QOL, the predictors analyzed (i.e., jump performance, agility, palmar grip strength, BMI, and PAL) accounted for approximately 7.9% of the variance in the physical health and psychological health domains. The low coefficient of determination can be attributed to the fact that none of the predictors significantly affected physical health, and only age was associated with psychological health domain ($p = .018$). This suggests as adolescents grow older, their psychological resilience and capacity to manage stressors may improve, contributing to better psychological health. The other predictors did not demonstrate a significant influence on the psychological health domain. Additionally, the models for social relationships, environment, and overall QoL domains did not demonstrate statistical significance ($p > .05$), indicating that other factors might be more relevant for these aspects of QoL. The current study appears to be the first to examine the relationship between PF, body composition, PAL and different QoL domains (i.e., physical health, psychological health, environment and social relationship) in adolescents, which limits direct comparisons between the present results and those of previous studies.

Other studies failed to establish robust associations between body composition, PAL, and PF with QoL in adolescents (Buttitta et al., 2014; Nowak et al., 2019; Panzini et al., 2007; Wafa et al., 2016). Panzini et al. (2007) did not identify a relationship between QoL scores and BMI in children and adolescents aged 8–18 years. A literature review by Buttitta et al. (2014) also indicated that three studies reported no association between QoL and BMI in individuals up to 18 years old. Regarding the PAL, Wafa et al. (2016) found no relationship between PAL and QoL in children aged 9–11 years. In agreement, Nowak et al. (2019) concluded no significant relationship could be established between PAL and QoL in students aged 18–30 years.

However, previous research has also identified contrasting results, with some studies showing that higher levels of PAL and lower BMI positively influence physical health in adolescents (Aadland et al., 2017; Elavsky et al., 2005; Henning et al., 2015; Jalali-Farahani et al., 2016; Malebo et al., 2007; Riazi et al., 2010; Tasmektepligil et al., 2013; Wafa et al., 2016; Williams et al., 2005). Spending more time engaging in sports activities has been associated with improved QoL scores in students aged 14–17 years (Jalali-Farahani et al., 2016). PAL contributes to better mental and physical health, which, in turn, enhances QoL scores (Tasmektepligil et al., 2013). Regarding body composition, children aged 8–18 years classified as obese have lower QoL compared to children with normal weight (Riazi et al., 2010; Williams et al., 2005). The total QoL scores of obese children aged 9–11 years were significantly lower when compared to children with normal BMI. Furthermore, the higher the severity of obesity, the worse the QoL (Wafa et al., 2016).

Previous studies have also identified associations between jumping performance, speed, and agility tests with QoL. Morales et al. (2013) observed a positive relationship between lower limb strength and QoL in students aged 8–11 years. Similarly, Andersen et al. (2017) reported that greater explosive in the lower-body strength positively affected QoL in children up to 10 years old.

Possible explanations for the divergences among studies assessing the relationship between PF (speed/agility, and grip strength), PAL, QoL, and body composition with AP and QoL include differences in how these variables were evaluated and the methodologies used. For instance, muscle strength has been measured through various tests, such as hand grip strength (Solis-Urra et al., 2021), vertical and horizontal jumps (Oliveira et al., 2017), and push-up and sit-up tests (Barrigas et al., 2018). Agility has been assessed using square tests (Cadenas-Sanchez et al., 2017), Shuttle Run, and T505 tests (Cadenas-Sanchez et al., 2020). APL has been evaluated both objectively - using equipment such as the accelerometer (Cadenas-Sanchez et al., 2020), and subjectively - through validated questionnaires like IPAQ (Fernandes, 2019) and QAPACE (Jalali-Farahani et al., 2016). QoL has been assessed using different questionnaires, such as the WHOQOL-Brief (Çiçek, 2018), PedsQLTM (Jalali-Farahani et al., 2016), Kidscreen-27 (Kliesener et al., 2022), and ComQol-A5 (Nowak et al., 2019). Future studies could enhance the model used in the current study to determine the AP and QoL by including variables such as school absenteeism, perseverance in overcoming barriers, socioeconomic status, and aerobic capacity.

Practical Application, Future Perspectives, and Limitations

The present study is not free from limitations. One of them is the exclusion of cardiovascular capacity from the data collection procedures. It has been recognized as a primary component of PF that can affect AP and QoL in students aged 14–21 years and should be considered in feature regression models (Páez-Maldonado et al., 2020). Another important factor not evaluated in this study is dietary habits, which have been suggested to positively impact both AP and QoL (Peña-Jorquera et al., 2021). Additionally, psychological and sociodemographic factors, which may contribute to improved AP and QoL scores in adolescents aged between 10 and 15 years, were not included in the analysis (Franco-Paredes et al., 2019). Furthermore, the fact that the study's participants were very similar in QoL scores could also harm the regressive equations' capability to capture the significative effects of the independent variables in the adolescents' QoL. A comprehensive, multifactorial exploration of the determinants of QoL and AP in more varied populations in terms of age, sociodemographic backgrounds, and presenting heterogeneous scores of QoL and AP is needed in future research to identify new connections between QoL, PAL, and physical fitness, body composition in the teenagers' AP. Moreover, approaches enrolling the employment of artificial intelligence-based models could provide deeper insights into the influence of physical fitness on adolescents' AP performance and QoL.

Conclusions

The results of the present study suggest that the predictors analyzed (i.e., jump performance, agility, grip strength, BMI, PAL, and QoL) account for approximately 9.3% of the variance in AP and 7.9% of the variance in physical health and psychological health in QoL domains. However, the low coefficients of determination indicate that other unexamined variables (e.g., time spent on academic activities, school attendance, dietary habits, and socioeconomic context) likely play substantial roles in determining these outcomes. In addition, only age significant predict and psychological health domain of QoL; and only jump performance tests showed a significant relationship with AP, suggesting that higher levels of performance in this parameter are and practical interventions to support the academic and overall development of adolescents.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The Goiás State Research Support (Fundação de Amparo à Pesquisa do Estado de Goiás).

ORCID iDs

João B. Ferreira-Júnior https://orcid.org/0000-0002-7541-8212
Samuel Encarnação https://orcid.org/0000-0003-2965-2777

References

Aadland, K. N., Moe, V. F., Aadland, E., Anderssen, S. A., Resaland, G. K., & Ommundsen, Y. (2017). Relationships between physical activity, sedentary time, aerobic fitness, motor skills and executive function and academic performance in children. *Mental Health and Physical Activity*, *12*(12), 10–18. https://doi.org/10.1016/j.mhpa.2017.01.001

Abrantes, L. C. S., de Souza de Morais, N., Gonçalves, V. S. S., Ribeiro, S. A. V., de Oliveira Sediyama, C. M. N., do Carmo Castro Franceschini, S., dos Santos Amorim, P. R., & Priore, S. E. (2022). Physical activity and quality of life among college students without co-morbidities for cardiometabolic diseases: Systematic review and meta-analysis. *Quality of Life Research*, *31*(7), 1933–1962. https://doi.org/10.1007/s11136-021-03035-5

Altmann, S., Ringhof, S., Neumann, R., Woll, A., & Rumpf, M. C. (2019). Validity and reliability of speed tests used in soccer: A systematic review. *PLoS One*, *14*(8), Article e0220982. https://doi.org/10.1371/journal.pone.0220982

Andersen, J. R., Natvig, G. K., Aadland, E., Moe, V. F., Kolotkin, R. L., Anderssen, S. A., & Resaland, G. K. (2017). Associations between health-related quality of life, cardiorespiratory fitness, muscle strength, physical activity and waist circumference in 10-year-old children: The ASK study. *Quality of Life Research*, *26*(12), 3421–3428. https://doi.org/10.1007/s11136-017-1634-1

Anderson, A. S., & Good, D. J. (2017). Increased body weight affects academic performance in university students. *Preventive Medicine Reports*, *5*(5), 220–223. https://doi.org/10.1016/j.pmedr.2016.12.020

Badillo, N., Khatib, M., Kahar, P., & Khanna, D. (n.d.). Correlation between body mass index and depression/depression-like symptoms among different genders and races. *Cureus*, *14*(2), Article e21841. https://doi.org/10.7759/cureus.21841

Barrigas, C., Figueiredo, N., Aurélio, H., & Rebolo, A. (2018). Educação física, aptidão física e desempenho académico. *Boletim Sociedade Portuguesa de Educação Física*, *41*, 67–82.

Batez, M., Milošević, Ž., Mikulić, I., Sporiš, G., Mačak, D., & Trajković, N. (2021). Relationship between motor competence, physical fitness, and academic achievement in young school-aged children. *BioMed Research International*, Article, 6631365. https://doi.org/10.1155/2021/6631365

Booth, J. N., Leary, S. D., Joinson, C., Ness, A. R., Tomporowski, P. D., Boyle, J. M., & Reilly, J. J. (2014). Associations between objectively measured physical activity and academic attainment in adolescents from a UK cohort. *British Journal of Sports Medicine*, *48*(3), 265–270. https://doi.org/10.1136/bjsports-2013-092334

Buecker, S., Nuraydin, S., Simonsmeier, B., Schneider, M., & Luhmann, M. (2018). Subjective well-being and academic achievement: A meta-analysis. *Journal of Research in Personality*, *74*(5), 7. https://doi.org/10.1016/j.jrp.2018.02.007

Butler, N., Quigg, Z., Bates, R., Jones, L., Ashworth, E., Gowland, S., & Jones, M. (2022). The contributing role of family, school, and peer supportive relationships in protecting the mental wellbeing of children and adolescents. *School Mental Health*, *14*(3), 776–788. https://doi.org/10.1007/s12310-022-09502-9

Buttitta, M., Iliescu, C., Rousseau, A., & Guerrien, A. (2014). Quality of life in overweight and obese children and adolescents: A literature review. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, *23*(4), 1117–1139. https://doi.org/10.1007/s11136-013-0568-5

Cadenas-Sanchez, C., Migueles, J. H., Esteban-Cornejo, I., Mora-Gonzalez, J., Henriksson, P., Rodriguez-Ayllon, M., Molina-García, P., Löf, M., Labayen, I., Hillman, C. H., Catena, A., & Ortega, F. B. (2020). Fitness, physical activity and academic achievement in overweight/obese children. *Journal of Sports Sciences*, *38*(7), 731–740. https://doi.org/10.1080/02640414.2020.1729516

Cadenas-Sanchez, C., Vanhelst, J., Ruiz, J. R., Castillo-Gualda, R., Libuda, L., Labayen, I., De Miguel-Etayo, P., Marcos, A., Molnár, E., Catena, A., Moreno, L. A., Sjöström, M., Gottrand, F., Widhalm, K., Ortega, F. B., & HELENA project group. (2017). Fitness and fatness in relation with attention capacity in European adolescents: The HELENA study. *Journal of Science and Medicine in Sport*, *20*(4), 373–379. https://doi.org/10.1016/j.jsams.2016.08.003

Çam, H. H., & Ustuner Top, F. (2021). Prevalence of hypertension and its association with body mass index and waist circumference among adolescents in Turkey: A cross-sectional study. *Journal of Pediatric Nursing*, *57*, e29–e33. https://doi.org/10.1016/j.pedn.2020.09.017

Chumlhak, Z., Oliveira, V., Brasil, M., Mattes, V., Menegaldo, P., & Silva, S. R. d. (2020). Nível de aptidão física, imagem corporal e desempenho escolar em escolares de séries iniciais do ensino fundamental, *Research Society and Development*, *9*(7), Article e178973558. https://doi.org/10.33448/rsd-v9i7.3558

Çiçek, G. (2018). Quality of life and physical activity among university students. *Universal Journal of Educational Research*, *6*(6), 1141–1148. https://doi.org/10.13189/ujer.2018.060602

Cleophas, T., Zwinderman, A., & Cleophas, T. (2006). Subgroup analysis using multiple linear regression: Confounding, interaction, synergism. In: *Statistics Applied to Clinical Trials*. Springer. https://doi.org/10.1007/978-1-4020-4650-6_12

Cloak, R., Nevill, A., Smith, J., & Wyon, M. (2014). The acute effects of vibration stimulus following FIFA 11+ on agility and reactive strength in collegiate soccer players. *Journal of Sport and Health Science*, *3*(4), 293–298. https://doi.org/10.1016/j.jshs.2014.03.014

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge. https://doi.org/10.4324/9780203771587

Cosgrove, J. M., Chen, Y. T., & Castelli, D. M. (2018). Physical fitness, grit, school attendance, and academic performance among adolescents. *BioMed Research International*, 2018, Article 9801258. https://doi.org/10.1155/2018/9801258

de Greeff, J. W., Hartman, E., Mullender-Wijnsma, M. J., Bosker, R. J., Doolaard, S., & Visscher, C. (2014). Physical fitness and academic performance in primary school children with and without a social disadvantage. *Health Education Research*, *29*(5), 853–860. https://doi.org/10.1093/her/cyu043

Elavsky, S., McAuley, E., Motl, R. W., Konopack, J. F., Marquez, D. X., Hu, L., Jerome, G. J., & Diener, E. (2005). Physical activity enhances long-term quality of life in older adults: Efficacy, esteem, and affective influences. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, *30*(2), 138–145. https://doi.org/10.1207/s15324796abm3002_6

Esmailzadeh, S., Hartman, E., Farzizadeh, R., Azevedo, L. B., Kalantari, H.-A., Dziembowska, I., Kostencka, A., Narimani, M., & Abravesh, A. (2018). Association between physical fitness and cognitive performance in 19-24 year old males. *Biology of Sport*, *35*(4), 355–362. https://doi.org/10.5114/biolsport.2018.78056

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/bf03193146

Feeg, V. D., Candelaria, L. M., Krenitsky-Korn, S., & Vessey, J. A. (2014). The relationship of obesity and weight gain to childhood teasing. *Journal of Pediatric Nursing*, *29*(6), 511–520. https://doi.org/10.1016/j.pedn.2014.08.011

Fernandes, G. N. A. (2019). Qualidade de vida, autopercepção de saúde, motivação para aprender e desempenho escolar de adolescentes. https://repositorio.ufmg.br/handle/1843/33425

Fleck, M. P. (2006). Development and validation of the Portuguese version of the WHOQOL-OLD module. *Rev Saude Publica*, *40*(5), 785–791. https://doi.org/10.1590/s0034-89102006000600007

Fraile-Martinez, O., García-Montero, C., Fraile-Martinez, M., Pekarek, L., Barrena-Blázquez, S., López-González, L., Álvarez-Mon, M. Á., Pekarek, T., Casanova, C., Álvarez-Mon, M., Diaz, R., Saez, M. A., & Ortega, M. A. (2024). A comprehensive study of the academic benefits and practical recommendations to include resistance training programs in institutional education. *Frontiers in Psychology*, *15*, 1387162. https://doi.org/10.3389/fpsyg.2024.1387162

Franco-Paredes, K., Díaz-Reséndiz, F. J., Hidalgo-Rasmussen, C. A., & Bosques-Brugada, L. E. (2019). Health-related quality-of-life model in adolescents with different body composition. *Eating and Weight Disorders: EWD*, *24*(1), 143–150. https://doi.org/10.1007/s40519-018-0501-6

Gu, X., Chang, M., & Solmon, M. (2016). Physical activity, physical fitness, and health-related quality of life in school-aged children. *Journal of Teaching in Physical Education*, *35*(2), 117–126. https://doi.org/10.1123/jtpe.2015-0110

Hallal, P. C., Victora, C. G., Wells, J. C. K., & Lima, R. C. (2003). Physical inactivity: Prevalence and associated variables in Brazilian adults. *Medicine & Science in Sports & Exercise*, *35*(11), 1894–1900. https://doi.org/10.1249/01.MSS.0000093615.33774.0E

Haverkamp, B. F., Oosterlaan, J., Königs, M., & Hartman, E. (2021). Physical fitness, cognitive functioning and academic achievement in healthy adolescents. *Psychology of Sport and Exercise*, *57*, Article 102060. https://doi.org/10.1016/j.psychsport.2021.102060

Henning, M. A., Krägeloh, C., Thompson, A., Sisley, R., Doherty, I., & Hawken, S. J. (2015). Religious affiliation, quality of life and academic performance: New Zealand medical students. *Journal of Religion and Health*, *54*(1), 3–19. https://doi.org/10.1007/s10943-013-9769-z

Jalali-Farahani, S., Amiri, P., & Chin, Y. S. (2016). Are physical activity, sedentary behaviors and sleep duration associated with body mass index-for-age and health-related quality of life among high school boys and girls? *Health and Quality of Life Outcomes*, *14*, 30. https://doi.org/10.1186/s12955-016-0434-6

Jørgensen, R. M., Vestergaard, E. T., Kremke, B., Bahnsen, R. F., Nielsen, B. W., & Bruun, J. M. (2022). The association between weight loss and long term development in quality-of-life among children living with obesity: A pragmatic descriptive intervention study. *Italian Journal of Pediatrics*, *48*(1), 135. https://doi.org/10.1186/s13052-022-01326-2

Joseph, R. P., Royse, K. E., Benitez, T. J., & Pekmezi, D. W. (2014). Physical activity and quality of life among university students: Exploring self-efficacy, self-esteem, and affect as potential mediators. *Quality of Life Research*, *23*(2), 659–667. https://doi.org/10.1007/s11136-013-0492-8

Juškienė, V. (2016). Spiritual health as an integral component of human wellbeing. *Applied Research In Health And Social Sciences: Interface And Interaction*, *13*(1), 3–13. https://doi.org/10.1515/arhss-2016-0002

Kamijo, K., Khan, N. A., Pontifex, M. B., Scudder, M. R., Drollette, E. S., Raine, L. B., Evans, E. M., Castelli, D. M., & Hillman, C. H. (2012). The relation of adiposity to cognitive control and scholastic achievement in preadolescent children. *Obesity*, *20*(12), 2406–2411. https://doi.org/10.1038/oby.2012.112

Kao, S.-C., Westfall, D. R., Parks, A. C., Pontifex, M. B., & Hillman, C. H. (2017). Muscular and aerobic fitness, working memory, and academic achievement in children. *Medicine & Science in Sports & Exercise*, *49*(3), 500–508. https://doi.org/10.1249/MSS.0000000000001132

Kim, J. H. (2019). Multicollinearity and misleading statistical results. *Korean Journal of Anesthesiology*, *72*(6), 558–569. https://doi.org/10.4097/kja.19087

Kliesener, T., Meigen, C., Kiess, W., & Poulain, T. (2022). Associations between problematic smartphone use and behavioural difficulties, quality of life, and school performance among children and adolescents. *BMC Psychiatry*, *22*(1), 195. https://doi.org/10.1186/s12888-022-03815-4

Kotaro, M., & Hideaki, S. (2011). Development of a field test for evaluating aerobic fitness in middle-aged adults: Validity of a 15-m Incremental Shuttle Walk and Run Test. *Journal of Sports Science and Medicine*, *10*(4), 712–717.

Lee, P. H., Macfarlane, D. J., Lam, T., & Stewart, S. M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 115. https://doi.org/10.1186/1479-5868-8-115

Lima, R. A., Pfeiffer, K. A., Møller, N. C., Andersen, L. B., & Bugge, A. (2019). Physical activity and sedentary time are positively associated with academic performance: A 3-year longitudinal study. *Journal of Physical Activity and Health*, *16*(3), 177–183. https://doi.org/10.1123/jpah.2017-0587

Lindner, K. (2002). The physical activity participation–academic performance relationship revisited: Perceived and actual performance and the effect of banding (academic tracking). *Pediatric Exercise Science*, *14*(2), 155–169. https://doi.org/10.1123/pes.14.2.155

Lopez-Agudo, L. A., & Marcenaro-Gutierrez, O. D. (2021). The relationship between overweight and academic performance, life satisfaction and school life. *Food Policy*, *101*, Article 102077. https://doi.org/10.1016/j.foodpol.2021.102077

Malebo, A., Van Eeden, C., & Wissing, M. (2007). Sport participation, psychological well-being, and psychosocial development in a group of young black adults. *South African Journal of Psychology*, *37*(1), 188–206. https://doi.org/10.1177/008124630703700113

Marquez, D. X., Aguiñaga, S., Vásquez, P. M., Conroy, D. E., Erickson, K. I., Hillman, C., Stillman, C. M., Ballard, R. M., Sheppard, B. B., Petruzzello, S. J., King, A. C., & Powell, K. E. (2020). A systematic review of physical activity and quality of life and well-being. *Translational Behavioral Medicine*, *10*(5), 1098–1109. https://doi.org/10.1093/tbm/ibz198

Martin, A., Booth, J. N., McGeown, S., Niven, A., Sproule, J., Saunders, D. H., & Reilly, J. J. (2017). Longitudinal associations between childhood obesity and academic achievement: Systematic review with focus group data. *Current Obesity Reports*, *6*(3), 297–313. https://doi.org/10.1007/s13679-017-0272-9

Matsudo, S., Araújo, T., Matsudo, V., Andrade, D., Andrade, E., Oliveira, L. C., & Braggion, G. (2001). Questionário internacional de atividade física (IPAQ): Estudo de validade E reprodutibilidade no brasil. *Revista Brasileira de Atividade Física & Saúde*, *6*(2). Article 2. https://doi.org/10.12820/rbafs.v.6n2p5-18

Mendoza-Castejón, D., & Clemente-Suárez, V. J. (2020). Autonomic profile, physical activity, body mass index and academic performance of school students. *Sustainability*, *12*(17). Article 17. https://doi.org/10.3390/su12176718

Morales, P. F., Sánchez-López, M., Moya-Martínez, P., García-Prieto, J. C., Martínez-Andrés, M., García, N. L., & Martínez-Vizcaíno, V. (2013). Health-related quality of life, obesity, and fitness in schoolchildren: The Cuenca study. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, *22*(7), 1515–1523. https://doi.org/10.1007/s11136-012-0282-8

Muñoz, G., & Millán, S. (2019). Comparing the Camry dynamometer to the Jamar dynamometer for use in healthy Colombian adults. *Revista Salud Bosque*, *9*(2), 21–29. https://doi.org/10.18270/rsb.v9i2.2794

Muntaner-Mas, A., Palou, P., Vidal-Conti, J., & Esteban-Cornejo, I. (2018). A mediation analysis on the relationship of physical fitness components, obesity, and academic performance in children. *The Journal of Pediatrics*, *198*(e4), 90–97. https://doi.org/10.1016/j.jpeds.2018.02.068

Nowak, P., Bożek, A., & Blukacz, M. (2019). Physical activity, sedentary behavior, and quality of life among university students. *BioMed Research International*, *2019*(2), Article 9791281. https://doi.org/10.1155/2019/9791281

Nuttall, F. (n.d.). Body mass index: Obesity, BMI, and health: A critical review—PubMed. Retrieved November 21, 2024, from. https://pubmed.ncbi.nlm.nih.gov/27340299/

Okely, J. A., Čukić, I., Shaw, R. J., Chastin, S. F., Dall, P. M., Deary, I. J., Der, G., Dontje, M. L., Skelton, D. A., Gale, C. R., Chastin, S., Cox, S., Coulter, E., Čukić, I., Dall, P., Deary, I., Der, G., Dontje, M., & Seniors USP Team. (2019). Positive and negative well-being and objectively measured sedentary behaviour in older adults: Evidence from three cohorts. *BMC Geriatrics*, *19*(1), 28. https://doi.org/10.1186/s12877-019-1026-1

Oliveira, V. M. de, Brasil, M. R., Chumlhak, Z., Cordel, P. T., Czuy, G. H. B., & Silva, S. R. da (2017). Nível de aptidão física em escolares: influência do índice de massa corporal, sexo e quantidade de sono. *Saúde e meio ambiente: revista interdisciplinar*, *6*(1), 4–17. https://doi.org/10.24302/sma.v6i1.1382

Páez-Maldonado, J. A., Reigal, R. E., Morillo-Baro, J. P., Carrasco-Beltrán, H., Hernández-Mendo, A., & Morales-Sánchez, V. (2020). Physical fitness, selective attention and academic performance in a pre-adolescent sample. *International Journal of Environmental Research and Public Health*, *17*(17), 6216. https://doi.org/10.3390/ijerph17176216

Panzini, R. G., Rocha, N. S. da, Bandeira, D. R., & Fleck, M. P. d. A. (2007). Qualidade de vida e espiritualidade. *Archives of Clinical Psychiatry (São Paulo)*, *34*(1), 105–115. https://doi.org/10.1590/S0101-60832007000700014

Papageorgiou, S. N. (2022). On correlation coefficients and their interpretation. *Journal of Orthodontics*, *49*(3), 359–361. https://doi.org/10.1177/14653125221076142

Pearl, R. L., Wadden, T. A., & Jakicic, J. M. (2021). Is weight stigma associated with physical activity? A systematic review. *Obesity*, *29*(12), 1994–2012. https://doi.org/10.1002/oby.23274

Peña-Jorquera, H., Campos-Núñez, V., Sadarangani, K. P., Ferrari, G., Jorquera-Aguilera, C., & Cristi-Montero, C. (2021). Breakfast: A crucial meal for adolescents' cognitive performance according to their nutritional status. The cogni-action project. *Nutrients*, *13*(4), 1320. https://doi.org/10.3390/nu13041320

Qi, S., Qin, Z., Wang, N., Tse, L. A., Qiao, H., & Xu, F. (2020). Association of academic performance, general health with health-related quality of life in primary and high school students in China. *Health and Quality of Life Outcomes*, *18*(1), 339. https://doi.org/10.1186/s12955-020-01590-y

Rezende, B. A., Lemos, S. M. A., & Medeiros, A. M. de. (2017). Qualidade de vida E autopercepção de saúde de crianças com mau desempenho escolar. *Revista Paulista de Pediatria*, *35*(4), 415–421. https://doi.org/10.1590/1984-0462/;2017;35;4;00009

Riazi, A., Shakoor, S., Dundas, I., Eiser, C., & McKenzie, S. A. (2010). Health-related quality of life in a clinical sample of obese children and adolescents. *Health and Quality of Life Outcomes*, *8*(134), 1–6. https://doi.org/10.1186/1477-7525-8-134

Riiser, K., Ommundsen, Y., Småstuen, M. C., Løndal, K., Misvær, N., & Helseth, S. (2014). The relationship between fitness and health-related quality of life and the mediating role of self-determined motivation in overweight adolescents. *Scandinavian Journal of Public Health*, *42*(8), 766–772. https://doi.org/10.1177/1403494814550517

Ruiz-Ariza, A., Grao-Cruces, A., De Loureiro, N. E. M., & Martínez-López, E. J. (2017). Influence of physical fitness on cognitive and academic performance in adolescents: A systematic review from 2005–2015. *International Review of Sport and Exercise Psychology*, *10*(1), 108–133. https://doi.org/10.1080/1750984X.2016.1184699

Saylor, C. (2004). The circle of health: A health definition model. *Journal of Holistic Nursing: Official Journal of the American Holistic Nurses' Association*, *22*(2), 97–115. https://doi.org/10.1177/0898010104264775

Sember, V., Meh, K., Sorić, M., Starc, G., Rocha, P., & Jurak, G. (2020). Validity and reliability of international physical activity questionnaires for adults across EU countries: Systematic review and meta analysis. *International Journal of Environmental Research and Public Health*, *17*(19), 7161. https://doi.org/10.3390/ijerph17197161

Shigeta, T. T., Leahy, A. A., Smith, J. J., Eather, N., Lubans, D. R., & Hillman, C. H. (2021). Cardiorespiratory and muscular fitness associations with older adolescent cognitive control. *Journal of Sport and Health Science*, *10*(1), 82–90. https://doi.org/10.1016/j.jshs.2020.05.004

Silva, D. B. da, Papini, C. B., Nakamura, P. M., Gomes, G. A. d. O., & Kokubun, E. (2018). Efetividade de duas intervenções com diferentes volumes de exercícios físicos na qualidade de vida em mulheres usuárias da Atenção Básica de Saúde. *Revista Brasileira de Atividade Física & Saúde*, *23*(e0059), 1–9. https://doi.org/10.12820/rbafs.23e0059

Solis-Urra, P., Sanchez-Martinez, J., Olivares-Arancibia, J., Castro Piñero, J., Sadarangani, K. P., Ferrari, G., Rodríguez-Rodríguez, F., Gaya, A., Fochesatto, C. F., & Cristi-Montero, C. (2021). Physical fitness and its association with cognitive performance in Chilean schoolchildren: The Cogni-Action Project. *Scandinavian Journal of Medicine & Science in Sports*, *31*(6), 1352–1362. https://doi.org/10.1111/sms.13945

Subramaniam, M., Devi, F., AshaRani, P. V., Zhang, Y., Wang, P., Jeyagurunathan, A., Roystonn, K., Vaingankar, J. A., & Chong, S. A. (2022). Barriers and facilitators for adopting a healthy lifestyle in a multi-ethnic population: A qualitative study. *PLoS One*, *17*(11), Article e0277106. https://doi.org/10.1371/journal.pone.0277106

Tasmektepligil, M., Ağaoğlu, S., Atan, T., & Cicek, G. (2013). The contrastive study of physical activity levels of phsical education students and the other department students. *International Journal of Academic Research*, *5*(6), 90–95. https://doi.org/10.7813/2075-4124.2013/5-6/A.12

Trott, M., Kentzer, N., Horne, J., Langdown, B., & Smith, L. (2024). Associations between total physical activity levels and academic performance in adults: A systematic review and meta-analysis. *Journal of Education and Health Promotion*, *13*(273), 1–13. https://doi.org/10.4103/jehp.jehp_1618_23

Wafa, S. W. W. B. S. S. T., Shahril, M. R. B., Ahmad, A. B., Zainuddin, L. R. B., Ismail, K. F. B., Aung, M. M. T., & Mohd Yusoff, N. A. B. (2016). Association between physical activity and health-related quality of life in children: A cross-sectional study. *Health and Quality of Life Outcomes*, *14*(71), 2–6. https://doi.org/10.1186/s12955-016-0474-y

Williams, J., Wake, M., Hesketh, K., Maher, E., & Waters, E. (2005). Health-related quality of life of overweight and obese children. *JAMA*, *293*(1), 70–76. https://doi.org/10.1001/jama.293.1.70

Wu, N., Chen, Y., Yang, J., & Li, F. (2017). Childhood obesity and academic performance: The role of working memory. *Frontiers in Psychology*, *8*(611), 1–7. https://doi.org/10.3389/fpsyg.2017.00611

Wu, Y., Li, D., & Vermund, S. H. (2024). Advantages and limitations of the body mass index (BMI) to assess adult obesity. *International Journal of Environmental Research and Public Health*, *21*(6), 757. https://doi.org/10.3390/ijerph21060757

Zayed, M. A., Moustafa, M. A., Elrayah, M., & Elshaer, I. A. (2024). Optimizing quality of life of vulnerable students: The impact of physical fitness, self-esteem, and academic performance: A case study of Saudi arabia universities. *Sustainability*, *16*(11), 4646. https://doi.org/10.3390/su16114646

Author Biographies

Jeann C. Gazolla, Degree in Physical Education in 2019 at IF Sudeste MG- Rio Pomba Campus. Participated in the International Mobility Program with an internship at the Polytechnic Institute of Bragança, Portugal (2018). Completed a Master's degree in Physical Education, Sport, and Health in 2023 (UGF).

João B. Ferreira-Júnior, Holds a degree in Physical Education in 2006 (UFMG), a Master's degree in Sports Training (Exercise Physiology) in 2009 (UFMG), and a PhD in Health Sciences in 2014 (UnB). Completed a doctoral exchange program (sandwich PhD) at The University of Oklahoma, USA. Completed a postdoctoral fellowship in 2021 (UFJF). Currently a professor in the Physical Education program at the Instituto Federal of Sudeste of Minas Gerais – Rio Pomba Campus. Faculty member of the Professional Graduate Program in Physical Education (ProEF).

Samuel Encarnação, Holds his degree in Physical Education (IF Sudeste MG-Campus Rio Pomba), and a Master's degree in Physical Education (UFV). He is currently a PhD student in Physical Activity and Sports Sciences at the Universidad Autónoma de Madrid (UAM), Spain. His research focuses on physical exercise, health, and ageing, with an emphasis on risk prevention and rehabilitation in special populations.

André C. Schneider, Holds his degree in Physiotherapy from Universidade Tuiuti do Paraná (UTP-PR), and holds a postgraduate degree in Physiotherapy to Sports and Physical Activity from Faculdade Vanguarda in São José dos Campos (SP). Currently, he is a Master's student in Exercise and Health at the Polytechnic Institute of Bragança (IPB) and a researcher at the Research Center for Active Living and Wellbeing.

António M. Monteiro, Completed his Ph.D. in Physical Activity and Health in 2012 at the University of Porto, Master's degree in Master's in Developmental Biokinetics in 2006 at the University of Coimbra, and Bachelor's degree in Physical Education and Sports in 1998 at UTAD. He is an Adjunct Professor at the Instituto Politécnico de

Bragança, Vice-Director at CI-ISCE, and researcher at the Research Center for Active Living and Wellbeing.

José E. Teixeira, Completed his degree in Cardiopneumology from the Polytechnic Institute of Castelo Branco in 2013 and in Sports from the Polytechnic Institute of Bragança in 2017, a Master in Exercise and Health by the Polytechnic Institute of Bragança in 2022 and a PhD in Sports Sciences by the University of Trás-os-Montes in 2022. Currently, he teaches at the Polytechnic Institute of Guarda and Polytechnic Institute of Cávado e Ave. He is also an integrated researcher at the SPRINT—Sport Physical Activity and Health Research & Inovation Center.

Pedro Forte, Completed his Ph.D. in Sports Sciences in 2018 at the University of Beira Interior, Master's degree in Exercise and Health in 2014 at the Polytechnic Institute of Bragança, and Bachelor's degree in Sports in 2012 at the Polytechnic Institute of Bragança. He is Coordinator Professor at the Higher Institute of Educational Sciences of Douro, Invited Adjunct Professor at the Instituto Politécnico de Bragança, Vice-Director at CI-ISCE and researcher at the Research Center for Active Living and Wellbeing.

João P. Verbena e Oliveira, Holds a degree in Event Management from Centro Universitário das Faculdades Metropolitanas Unidas (2017). Currently an undergraduate student in Physical Education at the Instituto Federal of Sudeste of Minas Gerais – Rio Pomba Campus.

Diego A. Borba, Hold his degree in Physical Education from Centro Universitário de Formiga. Specialist in Sports Training (UFMG). Master's degree in Sports Training (UFMG). PhD in Sports Sciences (UFMG). Currently a tenured professor in the Physical Education program at the State University of Minas Gerais, Divinópolis Campus.

Carlos M. A. Costa, Graduated in Physical Education (UFJF), Specialist in Sports Training (UFRJ), Master's in Physical Education (UFV), PhD in Sport Sciences (UFMG). Professor of Basic, Technical, and Technological Education at the Instituto Federal of Sudeste of Minas Gerais – Rio Pomba Campus. Faculty member of the Professional Graduate Program in Physical Education (ProEF). Conducts research on thermography, sports training, sleep, and school physical education.

Carlos A. Vieira, Graduated in Physical Education, Master's in Public Health (USP), PhD in Health Sciences (UnB). Part of the PhD was conducted at the University of North Carolina, Chapel Hill, USA (CAPES scholarship holder). Associate Professor at the Faculty of Physical Education and Dance at the Federal University of Goiás (FEFD/UFG). Faculty member of the graduate program in Physical Education (PPGEF) at FEFD/UFG and the graduate program in Health Sciences (PPGCS) at the UFG School of Medicine. Vice Director of FEFD/UFG; Coordinator of the Strength Training specialization course at FEFD. Develops research on exercise, health, and special populations.