Epidemiology

Does meeting recommendations for physical activity, screen time, and sleep increase the chance of better health perception in adolescents?

Samanta Barbosa Feitosa[1], Maria Clara de Andrade Braga[2], Karoline Barreto da Silva Rocha[1], Eylla Cristina Vieira Freitas[2], Maria Deisyelle Sibaldina da Silva Almeida[3], Ozeas de Lima Lins Filho[1], Rildo de Souza Wanderley Júnior[3], Mauro Virgílio Gomes de Barros[3], Carla Menêses Hardman[1], Daniel da Rocha Queiroz[1]

[1]Universidade Federal de Pernambuco, Programa de Pós-Graduação em Educação Física, Recife, PE, Brazil; [2]Universidade Federal de Pernambuco, Departamento de Educação Física, Recife, PE, Brazil; [3]Universidade de Pernambuco, Programa Associado de Pós-Graduação em Educação Física UPE/UFPB, Recife, PE, Brazil.

Associate Editor: Paulo Henrique Guerra, Universidade Estadual Paulista "Júlio de Mesquita Filho", Instituto de Biociências, Departamento de Educação Física, Rio Claro, SP, Brazil. E-mail: paulo.guerra@unesp.br.

Abstract - Aim: To analyze the possible associations of meeting isolated, combined, and integrated recommendations for moderate to vigorous physical activity, screen time, and sleep with health perception in adolescents. **Methods:** This is a cross-sectional, school-based epidemiological study with 576 adolescents (14-17 years old) enrolled in public schools in the Metropolitan Region of Recife, Pernambuco. Data were obtained through the Global School-Based Student Health Survey questionnaire. Binary logistic regressions were performed to analyze the association between meeting the recommendations and health perception. **Results:** Isolated meeting of recommendations were 29.7% for physical activity, 23.8% for screen time, and 27.3% for sleep. Combined meeting of recommendations was 8.5%, 6.1%, and 8% for "Moderate to Vigorous Physical Activity + Screen Time", "Screen Time + Sleep" and "Sleep + Moderate to Vigorous Physical Activity", respectively. Meeting two or more recommendations was associated with higher odds of having a "positive" health perception (OR = 2.03; 95% CI: 1.19;3.48). Meeting the physical activity recommendation (OR = 1.59; 95% CI: 1.01;2.50), the combined recommendation of screen time + sleep (OR = 2.42; 95% CI: 1.01;6.05) and meeting the combined recommendation of moderate to vigorous physical activity + sleep (OR = 3.35; 95% CI: 1.27;8.84) demonstrated an association with a positive health perception. **Conclusion:** Meeting two or more recommendations, only the physical activity recommendation, or the combination of "screen time and sleep" and "moderate to vigorous physical activity and sleep" increases the chances of positive self-perception of health in adolescents.

Keywords: physical activity, sedentary behavior, sleep, quality of life, adolescent.

Introduction

Health-related behaviors, such as regular physical activity, reduced sedentary behavior, and adequate sleep, coexist throughout the 24-h period[1-3]. Adherence to 24-h movement guidelines for children and adolescents is associated with positive health outcomes, including improved quality of life[3] and favorable indicators of cardiometabolic, emotional, and social health, as well as reduced risk of overweight/obesity and improved academic performance[2,4,5].

However, factors such as age, gender, self-image, social support, school environment, accessibility, among others, influence the adoption and maintenance of an active and healthy lifestyle by adolescents[6]. In addition, low adherence to healthy behaviors has been linked to the early onset of chronic noncommunicable diseases (NCDs), especially among young adults[7]. This problem is responsible for 25% of causes of death globally and 80% in the Americas[8], constituting a public health issue[9]. Projections indicate that between 2020 and 2030, approximately 524 billion dollars will be spent on treatments and hospitalizations related to NCDs, many of which have been appearing at an increasingly early age, impacting the health of adolescents and young people due to low levels of physical activity and inadequate eating habits[10].

It is possible to modify this scenario through behavioral changes during adolescence[7], since it is during this phase that physiological and psychological changes occur[11] that facilitate the adoption of behaviors related to the formation of lasting habits[7]. In this context, regular physical activity, limiting the time spent on sedentary

behavior, and getting an adequate amount of sleep at night are behaviors that can positively influence adolescents' perception of their health[12].

Self-perceived health is a widely used indicator to assess general health status, in which the individual classifies his or her health on a Likert scale ranging from "excellent" to "poor"[13]. Despite its general and subjective nature, such a question has demonstrated considerable usefulness as a public health indicator[14]. This indicator can be influenced by multiple personal, behavioral, psychological and socio-environmental factors[15], among which the most notable behavioral factors are physical activity, sedentary behavior, diet, alcohol and cigarette consumption[16].

Considering that adherence to physical activity recommendations, sedentary behavior, and sleep influence adolescents' health perception, it is crucial to investigate how these behaviors interact and affect this perception in an integrated manner[3]. However, most studies have analyzed these behaviors in isolation, without considering their interdependence, or have analyzed the association of physical activity and sedentary behavior without considering sleep. This fragmented approach limits the comprehensive understanding of how the combination of these behaviors influences adolescents' health perception, making it difficult to formulate integrated health promotion strategies.

Thus, the objective of the study was to analyze the possible associations of meeting isolated, combined, and integrated recommendations for moderate to vigorous physical activity, screen time and sleep with the perception of health in adolescents.

Methods

This is a cross-sectional, school-based epidemiological study conducted with adolescents aged 14 to 17, of both sexes, regularly enrolled in public schools in the Metropolitan Region of Recife, in the state of Pernambuco, covering data collected in 2023 by the research project entitled "Association between physical activity, sedentary behavior, motor competence, sleep quality and indicators of adiposity in adolescent high school students in the Metropolitan Region of Recife". The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[17] guidelines were followed to conduct this study.

The sample was selected by clusters in two stages: first, schools were randomly selected based on stratification by size (small: < 200 enrolled students; medium: 200-499 enrolled students; and large: > 500 enrolled students) and geographic region (Metropolitan North, Metropolitan South, Recife North, and Recife South). Then, classes were drawn using the "Research Randomizer" program (https://www.randomizer.org) considering the distribution by shift (daytime, nighttime) and grade (1st, 2nd, 3rd years of high school) in the selected schools.

To establish the geographic region, the division of the Regional Education Managements (GREs) was considered, and 20 schools were selected, 4 located in the Metropolitan North geographic region, 4 in the Metropolitan South, 6 in Recife North and 6 in Recife South. Regarding size, 1 small school, 15 medium-sized schools and 4 large schools were included.

To compensate for the effect of the multistage cluster sampling design, a correction of deff = 1.5 was applied. The sample size was calculated considering a 95% confidence interval, a maximum tolerable error of 2 p.p. and an estimated prevalence of 50% for the multiple behaviors analyzed. For the association analyses, the sample size needed to detect significant odds ratios of 1.2 or higher was estimated, with a 95% confidence interval and a statistical power of 80%.

The inclusion criteria adopted were adolescents aged 14 to 17 years, of both sexes, enrolled in the public high school system of the Metropolitan Region of Recife. And excluding those who: I) refused to participate in any stage of the study; II) did not have complete data regarding the assessment of moderate to vigorous physical activity, screen time, sleep and health perception; or III) obtained in the sum of the time of moderate to vigorous physical activity and screen time a value greater than the subtraction between the 24 hours of the day and the sleep time, considering the following mathematical expression "24 h - ST > MVPA + ST". Thus, to ensure that only valid data were used, the subtraction of sleep time (ST) was performed to identify whether the remaining time, referring to Moderate to Vigorous Physical Activity (MVPA) added to Screen Time (ST), exceeded the total time awake.

A translated and adapted version of the Global School-Based Student Health Survey (GSHS) was used for data collection. The instrument presented a reproducibility coefficient that ranged from 0.77 to 1.0 and the average time to complete the questionnaire was approximately 40 to 50 min. The questionnaire was administered via tablets (Samsung Galaxy A7 - Suwon, South Korea), using the SPHYNX® software (Sphynx Software Solutions Incorporation - Washington, United States). Automatic tabulation of the data was also performed using this program.

The independent variables of this study were moderate to vigorous physical activity, screen time and sleep, and the dependent variable was health perception. Health perception was measured through the question: "In general, do you consider your health to be?", with four response options: "Excellent", "Good", "Regular" and "Poor". The variable was subsequently operationalized in a dichotomous manner: "positive health perception" (Excellent/Good) or "negative health perception" (Regular/Poor).

Physical activity was measured through two questions that referred to the practice of moderate to vigorous physical activity in a typical week and in the last 7 days; the answers ranged from 0 to 7 days. In addition, the duration of the physical activity practice on the days in which it was performed, with an open-ended answer option. The average of the sum of the results of physical activity in a typical week and in the last 7 days was calculated. Therefore, adolescents were categorized as "meets" (≥ 420min/week) or "not meeting" (< 420 min/week) the moderate to vigorous physical activity recommendation[3].

Sedentary behavior was estimated through recreational screen time, that is, the time spent watching television, playing video games, using a computer and smartphone/tablet for purposes other than educational or occupational purposes, with an open-ended response option, in which adolescents responded in hours and minutes. From this, the weighted average of the total time spent on the four activities related to recreational screen time was calculated, during the week and weekends. The sample was categorized as "meets" (≤ 2 h/day) and "not meeting" (> 2 h/day) the screen time recommendation[3].

Sleep was assessed based on reports of the average number of hours spent sleeping during the week and on weekends, with response categories ranging from "less than 6 h" to "10 h or more" of sleep. The variable was represented in two categories: "meets" (8 to 10 h/day) or "not meeting" (< 8 h/day or > 10 h/day) the sleep recommendation[3].

In addition, the analyses also considered meeting of the recommendations in a combined and integrated manner. The pairs moderate to vigorous physical activity and screen time (MVPA+ST), screen time and sleep (ST +Sleep), and moderate to vigorous physical activity and sleep (MVPA+Sleep) were analyzed. And in an integrated manner, meeting of at least two of the three recommendations were analyzed.

Some variables were used as confounding factors in the relationship between meeting with moderate to vigorous physical activity recommendations, screen time, and sleep with health perception. Sex (female and male), age group (14 years, 15 years, 16 years, and 17 years), place of residence (urban and rural areas), race (white and non-white), and maternal education (< 8 years and ≥ 8 years) were considered.

Statistical analyses were performed using STATA software (https://www.stata.com) version 17.0 for Windows. Descriptive analysis included measures of central tendency, dispersion, absolute and relative values, and confidence intervals (95% CI). To analyze meeting of moderate to vigorous physical activity recommendations, screen time, and sleep, cutoff points were established for each behavior: moderate to vigorous physical activity (≥ 420 min/week), screen time (≤ 2 h/day of leisure-time screen time), and sleep (8 - 10 h).

In the bivariate analysis, the chi-square test was used to compare the prevalence of descriptive variables, meeting of recommendations and health perception between girls and boys. For association analysis, seven binary logistic regressions were performed, considering the cluster of recommendations in an integrated manner "meets 2 or more recommendations", the recommendations of "MVPA, ST and Sleep" in isolation and the combined recommendations "MVPA+ST", "ST+Sleep" and "MVPA +Sleep", always using health perception as the dependent variable.

The "Enter" input method was used for modeling, where all variables were included and remained in the regression model. The analyses were adjusted for sex, age, race, place of residence and mother's education, based on theoretical criteria. The quality of the adjustment of the logistic regression models was analyzed using the Hosmer-Lemeshow test. The magnitude of the associations was estimated from the odds ratios (OR = Odds Ratio) and confidence intervals (95% CI). Variables with a p-value < 0.05 were considered significantly associated.

The research was approved by the Human Research Ethics Committee of the Health Sciences Center of the Federal University of Pernambuco through opinion n. 5.921.335, meeting the guidelines established by resolution n. 466/2012 of the National Health Council. Participation in the research was permitted upon return of the Free and Informed Consent Form (FICF) and the Free and Informed Assent Form (FIAF), duly signed by the guardians and the adolescents, with the guarantee of confidentiality of the information and preservation of anonymity.

Results

In total, 1,036 adolescents participated in the study. However, after applying the eligibility criteria, the final sample consisted of 576 adolescents. Table 1 presents the descriptive characteristics of the sample and the prevalence of meeting of recommendations for moderate to vigorous physical activity, screen time and sleep, and health perception in adolescents. Most participants were between 16 (41.3%) and 17 years old (37.7%), female (54.7%), self-declared non-white (76.2%), with a mother's education of more than 8 years (58.5%) and living in urban areas (87.2%).

Health perception was considered "positive" by 67.9% of adolescents. When analyzing the differences by sex, 82.8% of male adolescents and 55.6% of female adolescents had a positive health perception ($p < 0.01$). Health perception was considered "negative" by 32.1% of the sample. When analyzing the differences by sex, girls (44.4%) had a greater negative health perception than boys (17.2%).

Table 1 - Descriptive variables of the sample and prevalence of meeting with recommendations in adolescents.

Variables	Total (n = 576)		Male (n = 261)		Female (n = 315)	
	n	%	n	%	n	%
Age group						
14 years	11	1.9	2	0.8	9	2.9
15 years	110	19.1	45	17.2	65	20.6
16 years	238	41.3	100	38.3	138	43.8
17 years	217	37.7	114	43.7	103	32.7
Race						
White	137	23.8	54	20.7	83	26.3
Non-white	439	76.2	207	79.3	232	73.7
Mother's education level						
< 8 years	239	41.5	104	39.8	135	42.9
≥ 8 years	337	58.5	157	60.2	180	57.1
Residence region						
Urban	502	87.2	225	86.2	277	87.9
Rural	74	12.8	36	13.8	38	12.1
Recommendation MVPA						
Yes	171	29.7	115	44.1	56	17.8
No	405	70.3	146	55.9	259	82.2
Recommendation ST						
Yes	137	23.8	68	26.0	69	21.9
No	439	76.2	193	74.0	246	78.1
Recommendation sleep						
Yes	157	27.3	68	26.0	89	28.2
No	419	72.7	193	74.0	226	71.8
MVPA+ST						
Yes	49	8.5	29	11.1	20	6.4
No	527	91.5	232	88.9	295	93.6
ST+SLEEP						
Yes	35	6.1	12	4.6	23	7.3
No	541	93.9	249	95.4	292	92.7
MVPA+SLEEP						
Yes	46	8.0	31	11.9	15	4.8
No	530	92	230	88.1	300	95.2
Meet 2*						
Yes	110	19.1	64	24.5	46	14.6
No	466	80.9	197	75.5	269	85.4
Health perception						
Positive	391	67.9	216	82.8	175	55.6
Negative	185	32.1	45	17.2	140	44.4

MVPA: Moderate to Vigorous Physical Activity; ST: Screen Time; *: 2 or more recommendations.

When analyzing the prevalence of recommendations, it was identified that 29.7% met the recommendation for moderate to vigorous physical activity, 23.8% met the recommendation for screen time, and 27.3% met the recommendation for sleep time. When analyzing the differences by sex, 44.1% of male adolescents and 17.8% of female adolescents met the recommendations for moderate to vigorous physical activity ($p < 0.01$). When analyzing screen time, 26.0% of males and 21.9% of females met the recommendation ($p = 0.24$). And, when analyzing sleep, 26.0% of males and 28.2% of females met the recommendation ($p = 0.55$).

Regarding the combined fulfillment of recommendations, it was found that 8.5% of adolescents met the recommendations for moderate to vigorous physical activity and screen time (MVPA+ST). When analyzing the differences between the sexes, 11.1% of male adolescents and 6.4% of female adolescents met this combination ($p = 0.04$). Regarding the combination of screen time and sleep (ST+Sleep), it was observed that 6.1% of the sample met this combination. For boys, meeting was 4.6% and for girls 7.3%. Regarding the combination of moderate to vigorous physical activity and sleep (MVPA+Sleep), meeting was 8%. When analyzing the difference between the sexes, it was observed that 11.9% of male adolescents and 4.8% of female adolescents met this combination ($p < 0.01$).

Furthermore, it was possible to observe that 19.1% of adolescents met two or more recommendations. Among male adolescents, 24.5% met two or more recommendations. Regarding females, approximately 14.6% met two or more recommendations ($p < 0.01$).

Table 2 presents the Odds Ratio (OR) values and confidence intervals (95% CI) for meeting the recommendations for moderate to vigorous physical activity, screen time and sleep and health perception in adolescents. Meeting two or more recommendations was statistically associated with greater chances of having a positive health perception (OR = 2.03; 95% CI: 1.19;3.48; $p < 0.01$).

Furthermore, meeting moderate to vigorous physical activity recommendation (OR = 1.59; 95% CI: 1.01;2.50; $p = 0.04$), meeting the combined recommendation of screen time + sleep (OR = 2.42; 95% CI: 1.01;6.05; $p = 0.04$), and meeting the combined recommendation of moderate to vigorous physical activity recommendation + sleep (OR = 3.35; 95% CI: 1.27;8.84; $p = 0.01$) were also associated with a positive health perception. The recommendations of screen time, sleep and the combined recommendation of moderate to vigorous physical activity recommendation + screen time did not show statistically significant associations with health perception.

Discussion

The aim of this study was to analyze the possible associations of meeting isolated, combined, and integrated recommendations for moderate to vigorous physical activity recommendation, screen time, and sleep with health perception in adolescents. The main finding of the study

Table 2 - Odds Ratio (OR) values and confidence intervals (95% CI) for meeting recommendations for moderate to vigorous physical activity recommendation, screen time and sleep and health perception in adolescents.

Variables	Crude model OR (95% CI)	p	Adjusted model OR (95% CI)	p
Recommendation MVPA	2.18 (1.43;3.32)	< **0.01**	1.59 (1.01;2.50)	**0.04**
Recommendation ST	1.51 (0.98;2.32)	0.06	1.45 (0.92;2.28)	0.10
Recommendation Sleep	1.35 (0.90;2.03)	0.13	1.45 (0.95;2.21)	0.08
PA+ST	2.22 (1.05;4.69)	**0.03**	1.98 (0.91;4.31)	0.08
ST+Sleep	1.96 (0.84;4.57)	0.11	2.42 (1.01;6.05)	**0.04**
MVPA+Sleep	4.21 (1.63;10.8)	< **0.01**	3.35 (1.27;8.84)	**0.01**
Meets 2 recommendations*	2.30 (1.37;3.84)	< **0.01**	2.03 (1.19;3.48)	< **0.01**

MVPA: Moderate to Vigorous Physical Activity; ST: Screen Time; * 2 or more recommendations.
Values in bold indicate statistical significance ($p < 0.05$).
Adjusted for sex, age, mother's education, place of residence and race.
Hosmer-Lemeshow test: MVPA ($\chi^2 = 87.6$; $p = 0.21$); ST ($\chi^2 = 69.9$; $p = 0.58$); Sleep ($\chi^2 = 81.6$; $p = 0.30$); MVPA+ST ($\chi^2 = 55.9$; $p = 0.69$); ST+Sleep ($\chi^2 = 75.4$; $p = 0.10$); MVPA+Sleep ($\chi^2 = 91.9$; $p < 0.01$); 2 recommendations ($\chi^2 = 87.3$; $p = 0.17$).

was that jointly complying with recommendations for screen time and sleep and moderate to vigorous physical activity recommendation and sleep increased the chances of positive self-perception of health in adolescents. Other secondary findings were that the prevalence of meeting the recommendations for moderate to vigorous physical activity recommendation and screen time was higher in male adolescents, while the prevalence of meeting the recommendations for sleep was more prevalent in female adolescents.

A systematic review and meta-analysis study showed that boys are more physically active and girls spend more time sleeping[18]. This may be attributed to the fact that, from childhood, boys are encouraged to participate in games that involve sports and physical activities, while girls are more encouraged to engage in typically sedentary activities, often limited to the home environment[19].

A study conducted with Australian adolescents found that girls spent more time on household chores, social activities and studying, compared to boys who were more physically active and spent more time on screen-based activities[20]. Studies in different countries indicate that girls sleep, on average, more than boys from childhood to adolescence, presenting less sleep fragmentation and greater efficiency, in addition to a greater need for sleep compensation on weekends during adolescence, suggesting a possible biological influence on these differences[21].

The results of the study by Tapia-Serrano et al.[22] indicate that adherence to just one of the 24-h movement guidelines alone may not be sufficient to significantly influence adolescent health. In the study, most adolescents met the sleep duration guidelines, but less than half met the physical activity and screen time guidelines. This suggests that adolescent health is influenced by a combination of multiple behaviors, rather than adherence to a single guideline alone. Therefore, it is important that adolescents be encouraged to adhere to all three 24-h movement guidelines to obtain maximum health benefits.

In the adjusted analysis, combined adherence to moderate to vigorous physical activity recommendations and screen time did not increase the chance of positive self-perception of health. However, reducing sedentary behavior and promoting physical activity among children and adolescents can contribute to improving overall health status[13]. It is believed that practicing physical activities during adolescence generates a positive effect on reducing symptoms of depression and anxiety and on self-image, and consequently, these effects together are capable of promoting a more positive perception of health[23]. In the study by Liang et al.[16] meeting the recommendations for physical activity and sedentary behavior was associated with ideal self-perception of health in both sexes. Furthermore, in the study by Marco et al.[24] low levels of physical activity combined with excessive screen time contributed to a negative perception of health in boys.

Combined adherence to recommendations for sedentary behavior and sleep increased the likelihood of positive self-perception of health. This is different from previous findings that analyzed these behaviors in isolation[13] or in young adults[25]. Our findings suggest that, in adolescents, adequate sleep can improve emotional regulation and energy levels, directly influencing the willingness to perform daily activities and the way health is perceived, and that reducing sedentary behavior can favor social interactions, mental well-being and a better balance between rest and physical activity, contributing to a more positive view of overall health. These findings highlight the importance of integrated approaches to health promotion in this population.

Additionally, the combined adherence to physical activity and sleep increased the likelihood of positive self-perception of health. This is in line with previous findings that analyzed the isolated association of physical activity[26] and sleep[27] with self-perception of health. These studies

observed that active adolescents perceived their health more positively, and sleeping at least 8 h per night was a predictor of positive health perception in adolescents. Although these studies analyzed behaviors in isolation, they are partially in agreement with the findings of the present study, suggesting that the combination of regular physical activity and adequate sleep may have synergistic effects on adolescents' health perception. Physical activity can improve sleep quality, and restorative sleep can increase the willingness to exercise, creating a cycle that positively impacts health perception.

Although meeting all three movement recommendations is ideal and offers greater health benefits, meeting two of the three recommendations provides significant improvements in self-rated health[12]. Combinations of screen time and sleep recommendations or screen time and moderate-to-vigorous physical activity were significantly associated with a higher overall Health-Related Quality of Life score.[28] In the study by Shi et al.[29] meeting all recommendations, only the moderate-to-vigorous physical activity recommendations, the combinations of moderate-to-vigorous physical activity and screen time, or moderate-to-vigorous physical activity and sleep were positively associated with self-rated health.

In the systematic review study by Zhang et al.[13], a positive association was observed between a higher level of physical activity and better self-rated health, and a negative association between sedentary behavior and self-rated health among children and adolescents. In the study by Sampasa-Kanyinga et al.[30], meeting a greater number of recommendations had a positive impact on the self-rated physical and mental health of adolescents. Furthermore, in the study carried out by Husu et al.[15], participants who perceived their health status as excellent showed less time in sedentary behavior and more moderate to vigorous physical activity.

Studies such as those by Khan et al.[28], Sampasa-Kanyinga et al.[31] and Kyan et al.[12] demonstrate that adherence to two recommendations, such as screen time and sleep, or screen time and physical activity, or sleep and physical activity, resulted in a positive health perception, when compared to non-adherence to these recommendations. Furthermore, in the study by Sun *et al*.[32], adherence to the combination of physical activity and screen time and physical activity and sleep were positively associated with good self-rated health. Thus, even if all three recommendations are not met, adherence to two of them is associated with a positive self-rated physical and mental health, which consequently reflects an improvement in the quality of life of individuals[30].

In addition, a study conducted by Rodriguez et al.[33] observed that practicing 60 min or more of physical activity daily significantly improves the general health of individuals, specifically psychological distress. Furthermore, physical activity can help promote healthy eating habits[34], greater emotional and stress control, and reduce the risk of developing diabetes, hypertension, and cardiovascular diseases[35]. In a study conducted by Tremblay et al.[3], total physical activity was favorably associated with indicators of physical, psychological, social, and cognitive health, which significantly reflects a better perception of health. Furthermore, higher intensity physical activity shows a more consistent relationship with health indicators when compared to lower intensity physical activity[36] .

In the present study, girls had a greater negative perception of health than boys. Corroborating our findings, a study that assessed the temporal trend of self-rated health in adolescents from 32 countries in Europe and North America showed that girls have a higher prevalence of negative health perception[37]. Similarly, in Brazil, two studies conducted with adolescents, one in the Amazon[24] and the other in Paraíba[38], observed a higher prevalence of negative self-rated health in girls. This is possibly due to girls undergoing routine exams and medical appointments more frequently, contributing to the early diagnosis of some health condition[39]. In addition, when assessing their health, women appear to consider a set of factors, such as lifestyle, risk of illness, among others[40].

This study has some limitations, including the use of self-reported data, which, although widely used in epidemiological studies, may affect accuracy or introduce some recall bias. Another limitation was the number of losses after the insertion of the eligibility criteria, however it is important to highlight that such criteria were adopted to ensure only the use of valid data. Despite the representative sample size, caution is necessary when generalizing the results of this study, since the sample comprises public state high schools from the Metropolitan Region of Recife and, consequently, does not encompass all the cultural and social differences present in other regions of Brazil or at a global level.

The potential of this study includes the performance of analyses focused on promoting the general health of adolescents and the use of a measurement instrument that has demonstrated adequate validity and reproducibility for epidemiological research. Furthermore, by investigating the association of isolated, combined and integrated meeting of recommendations for moderate to vigorous physical activity recommendation, screen time and sleep with the perception of health in adolescents in a context characterized by a scarcity of studies in the northeast region of Brazil, this study presents a valuable contribution to the field of knowledge.

Future studies should adopt a longitudinal approach, so that it is possible to analyze changes over time, enabling the identification of causal relationships between variables. The use of objective measures is recommended due to their greater precision and reliability, in addition to minimizing the risk of possible errors related to subjective measures.

Conclusions

This study revealed that meeting two or more recommendations, meeting only the moderate to vigorous physical activity recommendation, or the combination of "screen time and sleep" and "moderate to vigorous physical activity and sleep" increases the chances of positive self-perception of health in adolescents.

Understanding how adherence to recommendations and health perception are associated is fundamental for the formulation of public policies aimed at promoting an active and healthy lifestyle. Furthermore, it is important that parents/guardians, the school community, health professionals, and the adolescents themselves understand the importance of regular physical activity, reducing screen time, and maintaining good sleep quality, given that meeting these recommendations provides numerous health benefits.

Given this, it is essential that, at this stage of development, adolescents set aside some time each day for physical activity, including activities such as walking, dancing, cycling, playing sports or martial arts, participating in active games and play, etc. In addition, it is also important for adolescents to seek active forms of transportation, such as walking or cycling, avoid spending long periods in sedentary behavior, and ensure they get adequate sleep.

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Corresponding author

Daniel da Rocha Queiroz. Universidade Federal de Pernambuco, Programa de Pós-Graduação em Educação Física, Recife, PE, Brazil.
E-mail: daniel.rochaqueiroz@ufpe.br.

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