



Physical activity and daily behaviors among adolescents in the Kepulauan Seribu

Actividad física y comportamiento cotidiano entre adolescentes de las Islas Seribu

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Received: 09-09-25
Accepted: 14-01-26

How to cite in APA

Resmana, D., Samsudin, S., Ganeswara, R., Ginanjar, S., Rihatno, T., Nuraini, S., Setiawan, A., & Mohammad Anugrah, S. (2026). Physical activity and daily behaviors among adolescents in the Kepulauan Seribu. *Retos*, 77, 306-314. <https://doi.org/10.47197/retos.v77.117568>

Abstract

Introduction: Physical activity and daily behavior during adolescence are crucial, especially in island regions, which have distinct geographic and social characteristics compared to mainland regions.

Objective: This study aims to describe the anthropometric characteristics, physical activity levels, and daily behaviors and compare them by gender among adolescent in the Kepulauan Seribu Island.

Methodology: A total 320 adolescent students (aged 12-16) participated. Data were collected through a mobile-based online questionnaire regarding age, weight, height, body mass index, and duration of sitting, sleeping, studying at home, and walking.

Results: Males had higher weight and height, while females had higher body mass index. The physical activity levels showed that males in the high category and females in the moderate category. Female spent more time sitting and studying at home, male spent more time walking, and sleep duration did not differ significantly.

Discussion: These findings suggest that males are more likely to be in the high physical activity category due to a combination of social and environmental factors. Different daily behavior patterns are caused by different social support, daily activity preferences and school activities.

Conclusions: Adolescent in the Kepulauan Seribu engage in varied physical activities. Male were more frequently observed in the high intensity category, while female in moderate category. Analyses of daily activity time revealed significant sex differences. Female spent more time sitting and studying at home, whereas male accumulated more walking time, and, in supplementary analyses, sleep duration did not differ meaningfully.

Keywords

Adolescent; children; healthy; physical activity; sedentary.

Resumen

Introducción: La actividad física y el comportamiento diario durante la adolescencia son cruciales, especialmente en las regiones insulares, que presentan características geográficas y sociales distintas a las de las regiones continentales.

Objetivo: Este estudio busca describir las características antropométricas, los niveles de actividad física y los comportamientos diarios, y compararlos por género en adolescentes de las Islas Seribu.

Metodología: Participaron 320 estudiantes adolescentes (de 12 a 16 años). Los datos se recopilaron mediante un cuestionario en línea para dispositivos móviles sobre edad, peso, altura, índice de masa corporal y duración de los periodos de sedentarismo, sueño, estudio en casa y caminata.

Resultados: Los hombres presentaron mayor peso y altura, mientras que las mujeres presentaron un índice de masa corporal mayor. Los niveles de actividad física mostraron que los hombres se encontraban en la categoría alta y las mujeres en la categoría moderada. Las mujeres pasaban más tiempo sentadas y estudiando en casa, los hombres más tiempo caminando, y la duración del sueño no mostró diferencias significativas.

Discusión: Estos hallazgos sugieren que los hombres tienen mayor probabilidad de estar en la categoría alta de actividad física debido a una combinación de factores sociales y ambientales. Los diferentes patrones de comportamiento diario se deben a diferentes niveles de apoyo social, preferencias de actividades diarias y actividades escolares.

Conclusiones: Los adolescentes de las Islas Seribu realizan diversas actividades físicas. Los hombres se observaron con mayor frecuencia en la categoría de alta intensidad, mientras que las mujeres en la categoría moderada. El análisis del tiempo de actividad diaria reveló diferencias significativas entre sexos. Las mujeres pasaban más tiempo sentadas estudiando en casa, mientras que los hombres acumulaban más tiempo caminando. En análisis complementarios, la duración del sueño no mostró diferencias significativas.

Palabras clave

Adolescente; niños; saludable; actividad física; sedentario.

Introduction

Adolescence is a critical development period in which regular physical activity and healthy daily behaviours supports neurocognitive development and strengthens academic competencies (Mao et al., 2024). Evidence shows that higher physical activity in youth is associated with more favourable cardiometabolic profiles, healthier body composition, better fitness, and improved cognitive and psychosocial outcomes, whereas insufficient activity and excessive sedentary behavior are linked with increased risk for obesity, metabolic disturbances, and poorer mental health (Guthold et al., 2020; Haapala et al., 2025; Mao et al., 2024). Consequently, promoting active lifestyles and balanced movement patterns during adolescence is a central priority for public health.

The World Health Organization (WHO) recommends that children and adolescents accumulate at least an average of 60 minutes per day of moderate to vigorous physical activity, including vigorous, muscle-, and bone-strengthening activities on at least three days weekly (Bull et al., 2020). However, previous study shows that most school-aged adolescents worldwide do not meet these recommendations, with physical inactivity particularly common among girls and in many low- and middle-income countries. (Brazo-Sayavera et al., 2021; Guthold et al., 2020). These global patterns highlight a substantial gap between current adolescent behaviour and international guidelines and underscore the need for specific data to inform tailored interventions (Guthold et al., 2020). Beyond physical activity alone, contemporary frameworks emphasize the integration of physical activity, sedentary behaviour, and sleep across the whole day (Nusurupia et al., 2024). Prolonged sedentary time has been associated with unfavourable physical and psychosocial outcomes in adolescents (L. da Costa et al., 2022; Greier et al., 2023), while inadequate or irregular sleep is linked with poorer academic performance, mental health, and overall well-being (Hosker et al., 2019; Schlieber & Han, 2021). Understanding how these behaviours coexist in different populations is therefore crucial for designing effective interventions

Adolescent Physical activity behaviours are shaped by a combination of individual, social, and environmental factors, including sex, age, socioeconomic status, family environment, school policies, and neighbourhood characteristics (Easterbrook et al., 2023; Larrinaga-Undabarrena et al., 2023). Recent evidence from Indonesian junior high school students shows that parents' income is associated with both physical activity and sedentary behaviour levels, suggesting that family economic resources can shape adolescents' movement profiles (Rusdiawan et al., 2024). These findings underscore the importance of considering socioeconomic determinants when interpreting physical activity and daily behavior data in adolescent groups.

The school setting plays a central role in shaping adolescents' daily physical activity and sedentary behaviour through physical education, recess, classroom practices, and school-related active transport (Wachira et al., 2022). Evidence from, Portugal, shows that physical education classes of different durations make distinct contributions to daily MVPA and to the likelihood of meeting recommended activity thresholds, highlighting the importance of both the frequency and duration of PE lessons for adolescents' total physical activity (M. Costa et al., 2024). In addition, educational proposals implemented within physical education classes have been successfully used to promote active commuting behaviours, such as walking to school, in adolescents, demonstrating that physical education curricula can directly influence daily movement patterns beyond the classroom (Saucedo-Araujo et al., 2025).

Physical activity levels vary geographically, with wide cross-national and regional differences in adolescent inactivity (Gouveia et al., 2021; Marcen et al., 2022). Indonesian evidence points to context effects, with studies comparing urban and rural settings reporting mixed but meaningful contrasts in meeting movement guidelines (Nusurupia et al., 2024). Broader national analyses also suggest rural communities can be more active than urban counterparts, highlighting environmental and lifestyle influences (Haru Pradani et al., 2025). Island regions introduce further complexities distance, marine transport reliance, and environmental exposures that may shape daily movement opportunities and constraints (Setiawati et al., 2023).

The Kepulauan Seribu is Jakarta's sole administrative regency, an offshore archipelago of small islands whose livelihoods center on fisheries and tourism, with inter-island mobility primarily by boats (Mira et al., 2019).. These geographic creates socio-cultural dynamics that tend to resemble rural areas, so this configuration can limit adolescent physical activity through limited sports facilities and access to struc-



tured physical activity programs. At the same time, ready access to natural spaces provides opportunities to utilize the environment as a space for activities. However, literature on adolescent physical activity in the Seribu Islands is still scarce.

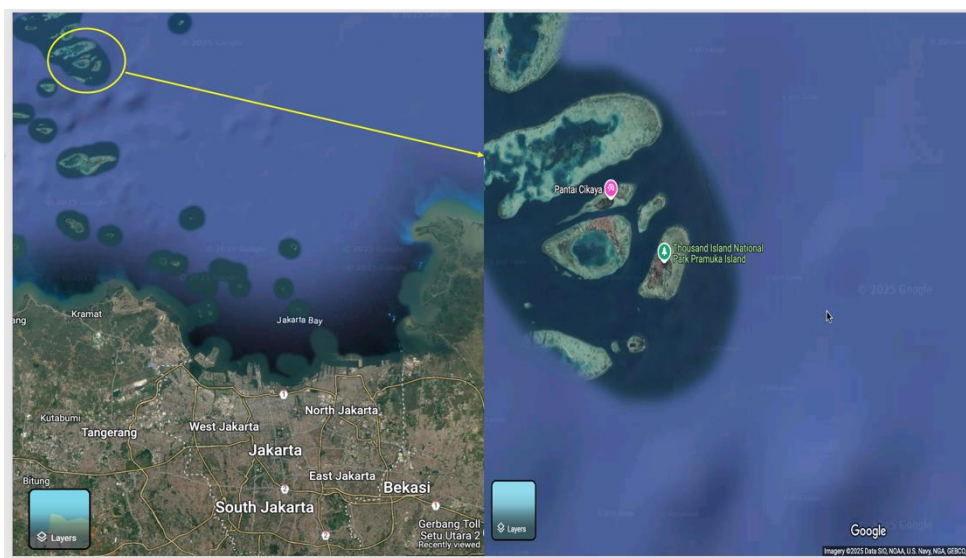
Therefore, this study aimed to describe anthropometric characteristics, physical activity levels, and daily behaviours among adolescents living in the Kepulauan Seribu regency and to examine sex differences in these parameters. By focusing on a geographically delimited island and integrating physical activity with multiple daily behaviours, this study seeks to provide specific evidence that can inform school- and community-based interventions and contribute to filling the current gap in the literature on adolescent movement behaviours in small-island settings.

Method

Participants

The sample comprised of 320 adolescent students, 158 males and 162 females, aged 12-16 years were recruited from several public junior high schools across the Kepulauan Seribu. Drawing participants from multiple schools within the archipelago enhances external validity for public-school populations in this study. The inclusion criteria were current enrollment in grades 7–9 at a participating public school, age 12–16 years at assessment, residence in the regency for at least the previous one year to ensure environmental exposure. While the exclusion criteria were physician-diagnosed conditions contraindicating habitual physical activity, acute musculoskeletal injury, cognitive limitations precluding valid self-report. All evaluations were conducted by the same researcher in collaboration with the physical education teacher, who received instructions on the specific conditions for each measurement. The study was approved by Ethics Committee of the State University of Jakarta.

Figure 1. Location of the Kepulauan Seribu Island (from Google Maps©; data from ©2025; accessed on August 20, 2025).



Procedure

The physical activity level was assessed using the International Physical Activity Questionnaire–Short Form (IPAQ-SF), a widely used standardized self-report instrument for measuring current activity levels (López-Gil et al., 2020). The IPAQ-SF has been applied to child and adolescent samples and has demonstrated acceptable validity across European and Asian populations (McCrorie et al., 2020; Sturm et al., 2021). Each participant was asked about their moderate to vigorous activity in the past 7 days, which is the minimum physical activity recommendation set by the WHO. The physical activity levels were classified as low (<600 MET-min/week), moderate (600-3000 MET-min/week), or high (>3000 MET-min/week). In this study, the main parameters of interest were: (a) physical activity level, categorized

as low, moderate, or high according to the established IPAQ scoring protocol; (b) daily sitting time (hours/day); (c) daily sleep duration (hours/night); (d) daily time spent studying at home (hours/day); and (e) daily walking time (hours/day). Additionally, the questionnaire was administered in a supervised classroom environment with standardized instructions, all behavioral data were still based on self-reports completed on mobile phones. Therefore, the information on physical activity and daily behaviors may be influenced by recall errors and social desirability, with some adolescents potentially over-reporting or under-reporting behaviors rather than perfectly reflecting their actual daily routines.

Anthropometric assessments were conducted using calibrated instruments. Standing height was assessed with a portable stadiometer that was calibrated before each session according to manufacturer guidance. Body mass was measured using a Xiaomi Mi 2 Pro digital scale placed on a firm, level surface and zeroed before each use, providing readings to the nearest 0.1 kg. Body mass index (BMI) was subsequently computed as weight in kilograms divided by height in meters squared (kg/m^2). To reduce measurement error attributable to human factors, authors operated under harmonized standard operating procedures that specified step-by-step protocols for participant positioning, device handling, calibration checks, and data recording

Data analysis

Descriptive statistics were reported as mean \pm standard deviation for continuous variables and frequency (percentage) to describe the data, and independent t-tests to compare the physical activity of males and females. Chi-square was used to compare physical activity levels between groups. Significance was set at the 0.05 α level.

Results

A total of 320 adolescent students (158 males and 162 females) from several public junior high schools across the Kepulauan Seribu provided complete self-reported behavioural data and anthropometric measurements. The mean age was 13.8 ± 2.1 years for males and 13.3 ± 1.9 years for females, and this difference was not statistically significant ($p = 0.112$). Males were significantly heavier and taller than females (weight: 45.9 ± 3.6 kg vs. 44.3 ± 4.2 kg, $p = 0.001$; height: 155.9 ± 12.1 cm vs. 149.8 ± 7.1 cm, $p = 0.001$), whereas females had a higher BMI than males (21.4 ± 3.1 vs. 19.2 ± 3.6 kg/m^2 , $p = 0.001$) (Table 1).

Table 1. Independent t-test Comparison of Age, Weight, Height, and BMI of Male and Female

	Experimental Group (n=320)		t	p
	Male (n=158)	Female (n=162)		
	Average DT	Average DT		
Age (years)	13.8 ± 2.1	13.3 ± 1.9	1.963	0.112
Weight (kg)	45.9 ± 3.6	44.3 ± 4.2	3.226	0.001
Height (cm)	155.9 ± 12.1	149.8 ± 7.1	4.812	0.001
BMI (kg/m^2)	19.2 ± 3.6	21.4 ± 3.1	-5.146	0.001

Note: \bar{x} = Mean; SD = Standard Deviation; * = Significance at 0.05 α -level

According to the self-reported IPAQ-SF data, most adolescents were classified in the high physical activity category, although the distribution of categories differed significantly by sex (Table 2). Among males, 72.15% (114/158) were classified as having high physical activity, 20.03% (32/158) as moderate, and 7.81% (12/158) as low. Among females, 50.61% (82/162) were in the high category, 38.27% (62/162) in the moderate category, and 11.11% (18/162) in the low category ($\chi^2 = 15.953$, $p = 0.001$). These proportions represent adolescents' self-perception of their habitual activity during the previous week rather than objectively measured physical activity.

Table 2. Comparison of Physical Activity Levels of Male and Female using Chi Square

Age Group	Physical Activity Levels						X ²	P
	LOW		MOD		HIGH			
	n	%	n	%	n	%		
Male	12	7.81	32	20.03	114	72.15	15.953	0.001
Female	18	11.11	62	38.27	82	50.61		

Note: All physical activity data are based on self-reported responses to the IPAQ-SF. LOW = Low Physical Activity; MOD = Moderate Physical Activity; HIGH = High Physical Activity; n = Number of participants; % = Percentage; * = Significance at 0.05 α -level

Self-reported daily behaviours also showed significant differences between sexes (Table 3). Females reported spending more time sitting per day than males (148 ± 42 vs. 133 ± 26 minutes, $p = 0.001$) and more time studying at home (72 ± 29 vs. 62 ± 20 minutes, $p = 0.001$). In contrast, males reported longer daily walking time than females (58 ± 19 vs. 50 ± 21 minutes, $p = 0.001$). Self-reported sleep duration did not differ significantly between sexes (535 ± 123 vs. 515 ± 110 minutes per night, $p = 0.127$). As with physical activity, these behavioural indicators are based solely on self-reported averages for the previous week and should be interpreted as approximate estimates of adolescents' daily routines.

Table 3. Independent t-test Comparison of Sitting, Sleep, Study at home, Walking of Male and Female

	Experimental Group (n=320)		t	p
	Male (n=158)	Female (n=162)		
	Average DT	Average DT		
Sitting (minutes)	133 ± 26	148 ± 42	-3.852	0.001
Sleep (minutes)	535 ± 123	515 ± 110	1.532	0.127
Study at home (minutes)	62 ± 20	72 ± 29	-3.598	0.001
Walking (minutes)	58 ± 19	50 ± 21	3.575	0.001

Note: All behavioural variables (sitting, sleep, study at home, walking) are based on self-reported questionnaire data referring to the previous week; \bar{x} = Mean; SD = Standard deviation; * = Significance at 0.05 α -level

Discussion

This study aimed to analyze anthropometric characteristics, physical activity level, and daily activity among adolescents living in the Kepulauan Seribu, a small island regency with distinctive geographic and environmental conditions (Setiawati et al., 2023). Overall, males were taller and heavier than females and had a lower BMI, while females showed a higher BMI despite similar age, a pattern that broadly reflects sex-related differences in adolescent growth and body composition reported in previous research (Lacroix et al., 2023). Most adolescents in our study reported moderate to high levels of physical activity, with boys more often classified as very active and girls more often in the moderate category, reflecting international evidence that boys accumulate more moderate to vigorous physical activity than girls (Brazo-Sayavera et al., 2021; Gracia et al., 2022; Kretschmer et al., 2023). In daily behavior, females reported more time sitting and studying at home, whereas males reported more time walking and sleep duration did not differ significantly between genders, which is in accordance with previous studies that mentioned higher sitting time in females and small or inconsistent gender differences in adolescent sleep (Brazo-Sayavera et al., 2021; Grasaas et al., 2024)

Our study found that male had a higher mean body weight than female, consistent with previous research showing male tend to have a higher mean body weight than female (Lacroix et al., 2023). This difference was attributed to specific dietary patterns (del-Cuerpo et al., 2023). In addition, male higher physical activity, which lead to increase muscle mass and overall body weight (Vari et al., 2016). Male also showed a greater mean body height than female. Our findings align with earlier studies indicating that males experience a later and more pronounced pubertal growth spurt, whereas females accumulate relatively more body fat during mid-adolescence, which may contribute to higher BMI despite comparable age (del-Cuerpo et al., 2023). Previous studies have confirmed that higher BMI among girls underscores the importance of monitoring weight status and related behaviors in adolescent girls in remote areas, where prevention and counseling opportunities may be more limited (Shao & Zhou, 2023; Zhao et al., 2025).

The distribution of self-reported physical activity levels differed significantly by gender, with a higher proportion of high levels in males and moderate levels in females, while low levels were relatively small in both. This finding aligns with previous and narrative reviews documenting that adolescent male tend



to accumulate more moderate to vigorous physical activity and engage in organized sports more frequently than adolescent female (Kretschmer et al., 2023). In addition, a recent study in Norway and Belgium reported that adolescent female was consistently less active than male at moderate to vigorous physical activity levels, particularly during school hours (García et al., 2025). However, other studies have shown different results than ours. A study of adolescents on Santa Maria Island reported no differences in PA levels between genders, despite higher aerobic fitness and strength in males (Gouveia et al., 2021). In addition, studies conducted African countries reported no significant differences in physical activity between males and females adolescent (Wachira et al., 2022). These variations in findings suggest that cultural factors, perceptions of safety, availability of student-friendly programs, and social support may shift the proportion of women from High to Moderate despite the island environment being relatively supportive of activity (Duffey et al., 2021; Martins et al., 2021).

In this study, we found that females sat longer per day and spent more time studying at home, while males accumulated more walking minutes, while sleep duration did not differ significantly between genders. This behavioural profile was similar with previous evidence that adolescent females spent more sedentary time and less moderate to vigorous physical activity than male, partly reflecting differences in self-efficacy and social norms (Brazo-Sayavera et al., 2021). Longer study at home time among female was consistent with educational surveillance showing that girls generally spend study at home or more time on homework than male (Easterbrook et al., 2023; Gracia et al., 2022). Greater homework time contributes to sedentary accumulation and may displace higher-intensity activities, reinforcing the gender gap in vigorous participation reported internationally (Brazo-Sayavera et al., 2021).

The greater walking durations observed among males are consistent with prior evidence indicating that males are more likely to walk to and from school compared to females, although these differences are typically modest and dependent on contextual circumstances (Brindley et al., 2023; Swain et al., 2024). Active school commuting was a strong correlate of total daily physical activity among adolescents, supporting the interpretation that increased walking contributed substantially to the overall activity levels of male (Kek et al., 2019). The absence of a sleep difference between sexes in our data is compatible with studies reporting no gender difference in adolescent sleep duration, even though other cohorts have found small sex disparities (Grasaas et al., 2024)

Our study did not directly compare with urban adolescents. However, the higher physical activity pattern aligns with evidence that adolescents in island area often exhibit higher physical activity than their urban peers (Wattelez et al., 2021). These differences were attributable to greater access to outdoor spaces, shorter and more walkable distances that promote active transport, and lower motorized traffic density which facilitate daily movement (Drenowatz et al., 2020; Wattelez et al., 2021). Conversely, urban environments often restrict movement through limited green space, safety concerns, and high screen exposure associated with sedentary behavior (Christiana et al., 2021; Sallis et al., 2016).

This study has several limitations that should be considered when interpreting the findings. First, the indicator of physical activity and daily behaviours were derived from self-reported data collected via a mobile-phone questionnaire, and self-report measures of movement behaviours are known to be vulnerable to recall bias, misinterpretation, and social desirability. These processes can lead adolescents to over- or underestimate their true levels of activity and sedentary time, particularly for socially valued behaviours. Second, we did not include objective device-based measures such as accelerometers, which would have strengthened the precision of the exposure assessment and allowed direct comparison with device-based surveillance data. Third, our sample consisted of adolescents attending public junior high schools in a single island regency and did not include an urban or mainland comparison group. Future research should combine self-report with device-based monitoring and include comparison groups from urban, rural, and other non-island settings to better characterise differences in adolescent physical activity and movement behaviours.

Conclusions

This study shows that adolescents in the Kepulauan Seribu have diverse physical activity patterns. Males are more likely to engage in high levels of physical activity, while females are more likely to engage in moderate levels of physical activity. Daily activity time shows significant differences, with boys spending



more time playing games, while girls spend more time doing homework. These findings can be used by schools and local governments to design and monitor gender-responsive programs that utilize the islands' walkability and open spaces. Further research using comparisons with urban cohorts and piloting school- and community-based strategies are also needed to translate these results into measurable practice.

Acknowledgements

We would like to thank the Faculty of Sports and Health Sciences, Jakarta State University, for their financial support, which made this research possible. We also thank the adolescents in the Kepulauan Seribu who agreed to participate in this research.

Financing

This study was supported by the Faculty of Sport and Health Sciences, Jakarta State University (365/UN39.5.FIKK/III/2025).

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