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Original Scientific Article

Healthy Lifestyle Program to Improve Physical Literacy and Physical Fitness of Junior High School Students: A Quasi-Experimental Approach

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Abstract

Objectives. This quasi-experimental study aimed to evaluate the effectiveness of the Healthy Lifestyle Program (HLP), integrated into regular physical education classes, in enhancing physical literacy and physical fitness among junior high school students aged 13–14, while addressing sedentary behaviors associated with high screen time and limited outdoor play.

Materials and Methods. Seventy-two eligible students (mean age = 13.6 ± 0.4 years; 19 males and 17 females per group) were allocated to an experimental group (EXP; n = 36) or a control group (CON; n = 36) using a non-random assignment based on intact classes, consistent with a quasi-experimental design. The EXP group participated in the HLP, which consisted of weekly 80-minute sessions incorporating warm-up activities, motor skill activation, fitness circuits, small-sided games, classroom active breaks, and home-based physical activity assignments at a target intensity of Borg RPE 12–14, complemented by weekly healthy lifestyle education. The CON group followed the standard physical education curriculum. Physical literacy was assessed using the Indonesian-adapted Adolescent Physical Literacy Questionnaire (APLQ; Cronbach's α = 0.951), and physical fitness was measured using the Indonesian Physical Fitness Test (TKJI; validity = 0.720; reliability = 0.920). Inter-rater reliability was high (APLQ ICC = 0.82; TKJI ICC = 0.88). Program content validity was confirmed using Aiken's V (0.94). Data were analyzed using descriptive statistics, Shapiro–Wilk tests for normality, Levene's tests for homogeneity, and MANOVA with partial η^2 effect sizes.

Results. Baseline scores were comparable between groups. The EXP group demonstrated substantial improvements in physical literacy (gain = 24.75 ± 14.52) and physical fitness (gain = 6.94 ± 2.51), whereas the CON group showed minimal change (physical literacy gain = −0.44 ± 2.18; physical fitness gain = 0.08 ± 0.60). MANOVA revealed a significant multivariate effect (Wilks' $\Lambda = 0.180$, $p < 0.001$), with large effect sizes for both physical literacy ($\eta^2 = 0.602$) and physical fitness ($\eta^2 = 0.785$). All statistical assumptions were met.

Conclusions. The Healthy Lifestyle Program significantly improved physical literacy and physical fitness among early adolescents. These findings support the integration of educationally grounded, multicomponent lifestyle programs into school curricula, such as Kurikulum Merdeka, to address sedentariness using accessible and contextually appropriate resources. Future research should examine longer intervention durations and more diverse socioeconomic contexts.

Keywords: healthy lifestyle program, physical literacy, physical fitness, junior high school.

Introduction

In Contemporary life, sedentary lifestyles among adolescents have become increasingly prevalent, marked by prolonged screen time through television viewing, gaming, computer use, and extended sitting during school hours or commuting, all of which contribute to decreased physical activity and lower fitness levels (Mehtälä et al., 2020). Within the domain of Physical Education, the central issue extends beyond the goal of merely "getting students to move";

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schools must build personal capacities that enable students to be willing, capable, and consistent in engaging in physical activity outside formal Physical Education lessons (Fierro-Suero et al., 2022; Estevan et al., 2023). The concept of physical literacy comprising motivation, confidence, competence, and understanding emerges as an essential educational construct linking knowledge acquisition and behavioral engagement (Yli-Piipari et al., 2021). When physical literacy is low, adolescents' motivation and confidence to participate in physical activity tend to decline, resulting in limited engagement beyond school hours (Caldwell et al., 2020; Castillo et al., 2020). Thus, physical literacy should be conceptualized not merely as an attribute but as an educational outcome that mediates behavioral transformation through structured learning experiences.

Physical literacy serves as the pedagogical foundation that connects the affective and cognitive learning domains with behavioral and physical outcomes. This integration aligns with the Self-Determination Theory (SDT), which explains how intrinsic motivation and perceived competence drive sustained participation in physical activity (Nguyen et al., 2025), and with Experiential Learning Theory (ELT), which emphasizes learning through active engagement and reflection (Lima et al., 2024; Ockerman & Bagui, 2024). The theoretical framework underpinning the integration of physical literacy and physical fitness is grounded in these theories, where physical literacy functions not just as a psychological construct but as a bridge between motivation, behavior, and fitness development.Within this framework, physical literacy operates as both a process and an outcome of learning where physical competence develops alongside self-regulation, autonomy, and reflective understanding of one's body and movements (Rudd et al., 2020; Bernhart et al., 2022; Chen et al., 2020; Lev-Arey et al., 2024).

Accordingly, the Healthy Lifestyle Program (HLP) proposed in this study is not a simple fitness regimen; it functions as an educational intervention designed to enhance learning processes that lead to behavioral transfer from the school environment to home and community contexts (Nguyen et al., 2025; Lee et al., 2025). This is an essential shift in thinking, framing the program not merely as a fitness initiative but as a pedagogical model that advances existing learning theories by integrating physical literacy as a foundational component of broader educational goals.

Moreover, this study advances educational theory by framing the Healthy Lifestyle Program (HLP) as a structured learning design that intentionally converts "in-lesson participation" into transferable self-regulation and lifestyle practices. Grounded in Self-Determination Theory, the HLP is designed to cultivate autonomy, competence, and relatedness through meaningful task design and supportive social contexts, as these psychological needs are consistently linked to self-determined forms of motivation and sustained physical activity (Nguyen et al., 2025; Mendoza et al., 2017). At the same time, drawing on the CSPAP conceptualization of schools as social-ecological systems (Rudd et al., 2020; Bernhart et al., 2022; Chen et al., 2020), the HLP treats behavioral transfer (school-to-home/community) not as an individual responsibility but as an outcome of aligned learning opportunities across settings, thereby extending PE from a lesson-based curriculum into an ecosystemic pedagogy.

To operationalize this concept, the HLP draws upon the Comprehensive School Physical Activity Program (CSPAP) model, which frames schools as dynamic ecosystems integrating multiple learning contexts: structured lessons, physical activity during and beyond school hours, teacher reinforcement, and family-community support (Pardo et al., 2013; Kumala et al., 2019; Hadyansah et al., 2023).

Through this framework, the integration of physical literacy and fitness training serves as a pedagogical innovation that bridges the often-separated domains of physical competence and motivational learning. The approach enriches educational theory by offering a model that unites behavioral learning (habit formation), cognitive learning (knowledge and understanding), and affective learning (motivation and confidence), thereby expanding existing models of holistic education through the lens of embodied learning and self-regulated practice.

Empirical data from junior high schools in Tasikmalaya Regency, West Java, Indonesia, reveal that despite regular PE instruction, most students exhibit limited motivation for physical activity beyond school hours, coupled with sedentary habits such as gaming and consumption of high-sugar snacks. This situation not only reflects low physical literacy but also signals early patterns of lifestyle-related health risks, including obesity and metabolic disorders (Utami et al., 2018; Tejerina et al., 2018; Rocka et al., 2022). Global studies corroborate these findings, showing that over 80% of adolescents fail to meet the World Health Organization's physical activity recommendations (Chaput et al., 2020). Meanwhile, digital and school-based interventions focusing solely on fitness improvement often yield transient results, lacking the motivational and cognitive dimensions needed for sustainability (Weber et al., 2025; Fajrin et al., 2024).

The present study responds to this unresolved theoretical and methodological gap. Prior interventions frequently address physical literacy or fitness in isolation, neglecting their reciprocal and reinforcing relationship. Few have examined school-based models that simultaneously nurture cognitive-motivational engagement and measurable physical improvement within real-world learning constraints. This research introduces and tests the Healthy Lifestyle Program (HLP), a 12-week quasi-experimental intervention that integrates physical literacy instruction into PE lessons and extends it through school-home reinforcement strategies. Conceptually, this study advances contemporary educational theory by demonstrating how embodied and situated learning frameworks can strengthen behavioral transfer, thereby establishing a pedagogically grounded path toward sustainable adolescent health literacy and fitness development beyond traditional PE boundaries.

Materials and Methods

Participants

This study was conducted in several junior high schools in Tasikmalaya City, West Java, Indonesia. The community is predominantly of middle-to-upper socioeconomic status. Most parents work as civil servants, professionals, or entrepreneurs. They have high digital access, including smartphones and reliable internet. As a result, children spend

substantial screen time gaming and consuming digital media. Opportunities for outdoor play are limited due to dense academic schedules and tutoring.

Seventy-two Grade 7 students (N = 72; 19 males and 17 females per group), aged 13–14 years (mean = 13.6, SD = 0.4), met eligibility and consented to participate. Participants were allocated to the experimental or control group based on pre-existing intact classes to maintain normal school scheduling and instructional continuity. Although group equivalence was assessed at baseline, individual randomization was not performed; therefore, the study was classified as quasi-experimental rather than a randomized controlled trial.

Inclusion criteria: (1) age 13–14, (2) enrolled in junior high during the study, (3) parental/guardian consent, and (4) child's verbal assent. Exclusion criteria: (1) pre-existing physical or mental health conditions affecting participation, (2) involvement in a similar intervention in the past six months, (3) inability to provide informed assent or consent.

Research Design and Organization

This research employs a quasi-experimental design with pre- and post-tests to evaluate the impact of the Healthy Lifestyle Program on adolescents' physical literacy and fitness. The design allows for the comparison between an experimental group that participates in the intervention and a control group that does not, with both groups assessed at the beginning and end of the study. This approach provides a robust evaluation of the intervention's effectiveness while accounting for potential confounding variables.

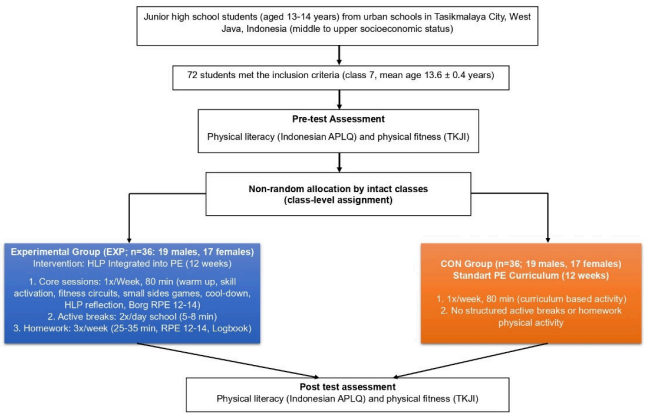

Fig. 1. Research Flows

Procedures

Experimental Group EXP)

Participants in the experimental group received a 12-week Healthy Lifestyle Program (HLP) intervention integrated into regular Physical Education instruction, delivered once per week, with a duration of 2 × 40 minutes (80 minutes) per session, for a total of 12 instructional sessions. Each core HLP session was conducted at school facilities (field/gymnasium) and followed the time structure presented in Table 1, consisting of briefing and readiness (5 minutes), dynamic warm-up (10 minutes), motor skill activation (10 minutes), a fitness circuit (20 minutes), small-sided games (20 minutes), a finisher (5 minutes), cool-down (5 minutes), and reflection with healthy lifestyle education (5 minutes), with themes mapped by weekly phases as shown in Table 2. The intended intensity for the core physical activity component was set at Borg RPE 12–14, representing moderate to "somewhat hard" intensity, so that the training load was sufficiently challenging while remaining controlled and safe for junior high school Physical Education contexts.

Table 1. Program Summary

Element	Description
Program duration	12 weeks.
Session duration	80 minutes (core HLP/Physical Education, 1× per week).
Time allocation per session	5 min briefing & readiness; 10 min dynamic warm-up; 10 min motor skill activation; 20 min fitness circuit; 20 min small-sided games; 5 min finisher; 5 min cool-down; 5 min reflection & healthy lifestyle education.
Borg RPE intensity	Target during the core physical activity: 12–14 (moderate to "somewhat hard")
Overall physical activity frequency	Core HLP 1×/week (80 minutes) + classroom active breaks 2×/school day (5–8 minutes/break) + home-based physical activity homework 3×/week (25–35 minutes/session, target RPE 12–14). This design is intended to move students closer to the recommendation of 60 minutes/day of physical activity for children and adolescents.
Healthy lifestyle enrichment	Brief education of 1 theme/week during the reflection segment (5 minutes) and reinforcement of messages by homeroom teachers during active breaks, focusing on daily active habits, hydration, breakfast/ snacking choices, sleep, and screen time management.
Target participants	Junior high school students (typically 12–14 years old, adjusted to the study sample).

Outside scheduled Physical Education sessions, the experimental group implemented classroom active breaks twice per school day (5–8 minutes per break), led by homeroom teachers using a standardized protocol to increase exposure to physical activity during school hours. In addition, participants were assigned structured physical activity homework three times per week, lasting 25–35 minutes per session and targeting Borg RPE 12–14 (Table 1 and Table 2), to help bring students closer to the recommendation of 60 minutes of daily physical activity for children and adolescents. The homework activities were designed and recommended by four Physical Education teachers who had been trained to use a standardized exercise menu to ensure consistency across classes, and each homework session was required to be recorded in a logbook (type of activity, duration, and RPE) as an indicator of adherence and as a means of monitoring intensity based on perceived exertion.

Table 2. Weekly Structure and Core Components of the Healthy Lifestyle Program (HLP)

Weeks	Core focus	School-based core components (80 min/session; high-level)	Target Borg RPE (during activity)	Healthy lifestyle literacy theme (core content)	Home-based component (dose summary only)
1–3	Adaptation and familiarization	Foundational movement skills + introductory circuit-based activity + participation-focused small-sided games	12–13 (within 12–14)	Daily active habits, hydration, and introduction to intensity self-monitoring using RPE	2–3×/week; 20–30 min/session; RPE 12–13
4–6	Progressive fitness development	Progressive circuit training (increased density) + small-sided games with higher engagement	12–14	Breakfast, healthier snack choices, and the energy–activity relationship	3×/week; 25–35 min/session; RPE 12–14
7–9	Integration and self-regulation	Combined aerobic intervals + functional circuit + decision-making games supporting physical literacy	13–14 (somewhat hard but controlled)	Sleep and recovery and their links to performance and motivation	3×/week; 25–35 min/session; RPE 13–14
10–12	Consolidation and independence	Mixed sessions (circuit + games) with stable intensity targets + reinforcement of sustainable routines	12–14 (stable)	Screen time management and development of a weekly physical activity plan	3×/week; 25–35 min/session; RPE 12–14

Note: The HLP was designed as a multicomponent intervention (school-based sessions + home-based physical activity). Adherence to the home-based component was monitored via student logbooks with parent/guardian verification, while full operational procedures (example activity packages, detailed session content, and monitoring templates) are provided in Supplementary Tables S1–S2 (Appendix/Supplement)

Facilitators and Training

The HLP intervention was delivered by four certified Physical Education teachers who completed an 8-hour program training session prior to implementation. The training covered the development of safe physical activity plans (including safety principles, posture, and injury prevention), techniques for monitoring training load using the Borg RPE (with emphasis on the 12–14 target as moderate to "somewhat hard" intensity), and reinforcement of the healthy lifestyle content to be delivered briefly and consistently during the reflection segment. A rating of 12–14 on the Borg RPE scale is commonly used to indicate moderate to somewhat hard exercise intensity.

The training also included procedures to standardize research data collection, including administration protocols for the physical literacy test (APLQ) and the physical fitness test (TKJI), to ensure consistent pretest–posttest implementation across facilitators. Because the HLP intervention included classroom active breaks, homeroom teachers served as implementers, carrying out a brief, standardized protocol rather than merely supervising. Homeroom teachers received a short orientation before the program began and were provided with ready-to-use materials (movement scripts, activity sequences, and safety guidance) to ensure consistent implementation across classes and documentation through a daily checklist.

Intensity control at the Borg RPE 12–14 target remained the responsibility of the Physical Education teachers during the core HLP sessions and the home-based physical activity homework, whereas classroom active breaks functioned as brief additional physical activity during school hours controlled through standardized procedures and adherence recording.

Monitoring instruments are provided in the Appendix/Supplement to support replication and transparent reporting of implementation fidelity.

Control Group (CON)

Students in the control group participated in conventional Physical Education lessons aligned with the school curriculum, with the same frequency and duration as the experimental group, namely one 80-minute session per week for 12 weeks. Instruction in the control group represented the school's "natural activity" condition; therefore, no additional components were provided, such as structured classroom active breaks, and no programmed physical activity homework was assigned, as summarized in Table 3. Accordingly, any changes observed in the control group were expected to reflect the effects of routine instruction, while differences in change between groups could be interpreted as the impact of the HLP intervention.

Instrument

Physical Literacy

The Adolescent Physical Literacy Questionnaire (APLQ), translated into Bahasa Indonesia, will be used to assess physical literacy. It includes psychological and behavioral aspects, knowledge and awareness, competence, and physical activity levels. The questionnaire consists of 25 items, scored from 1 to 5, where 1 indicates low physical literacy and 5 indicates high physical literacy. The reliability of the APLQ has been established with a Cronbach's alpha of 0.951, and the validity ranges from 0.680 to 0.790 (Mohammadzadeh et al., 2022). In this study, a 20% subsample of participants

Table 3. Summary of the Control Group Program

Element	Description
Physical Education instruction	1 session/week, 80 minutes in duration, with content following the school's standard curriculum.
Physical activity during school	No structured classroom active breaks (students follow the school's normal routine).
Home-based physical activity	No programmed physical activity homework (students follow their usual habits at home).
Healthy lifestyle component	No specific healthy lifestyle module provided by the researchers (only routine school education, if any).

Table 4. Format of Conventional Physical Education Sessions (Control Group)

Session segment	Duration	Activities	Teacher role	Student focus
Warm-up	10 minutes	Light jogging and general dynamic stretching, consistent with the school's usual Physical Education routine.	Leads the warm-up and ensures students' readiness.	Follows instructions and prepares the body.
Main activity	50 minutes	Standard curriculum-based Physical Education content (e.g., basic techniques of games/sports according to the school lesson plan).	Teaches the content, demonstrates skills, provides corrections, and manages the class.	Practices skills aligned with the lesson content and participates in learning activities.
Cool-down	20 minutes	Static stretching, light relaxation, and session closure.	Directs the cool-down and closes the lesson.	Recovers and follows the closing routine.

was independently rated by two Physical Education teachers to estimate inter-rater agreement for the Adolescent Physical Literacy Questionnaire (APLQ). Inter-rater reliability for the total APLQ physical literacy score demonstrated good consistency, with an ICC (two-way random, absolute agreement) of 0.82 (95% CI = 0.77–0.87), indicating adequate agreement between raters.

Physical Fitness (TKJI)

Physical fitness will be assessed using the Indonesian Physical Fitness Test (Tes Kesegaran Jasmani Indonesia; TKJI) for adolescents aged 13–15 years. The TKJI battery comprises a 50-meter sprint (speed), pull-ups (upper-body strength), sit-ups (abdominal strength and endurance), a vertical jump (explosive leg power), and a 1,000-meter middle-distance run for males and an 800-meter middle-distance run for females to assess cardiorespiratory endurance.

The validity and reliability of the TKJI are reported to be high, with a validity coefficient of 0.720 and a reliability of 0.920 (Dulanlebit, 2020). In this study, a 20% subsample of participants was independently assessed by two trained raters to estimate inter-rater agreement for the TKJI. Inter-rater reliability for the total TKJI score was excellent, with an ICC (two-way random, absolute agreement) of 0.88 (95% CI = 0.83–0.92), indicating high consistency between raters across all physical test items.

Statistical Analysis

Data were analyzed using SPSS. Prior to inferential testing, all datasets were screened for completeness and accuracy. Descriptive statistics were calculated for all physical literacy and physical fitness variables at pre-test and post-test. These statistics included means, standard deviations, minimum values, and maximum values. The content validity of the healthy lifestyle program was examined using Aiken's V coefficient based on expert judgments across predefined evaluation aspects. Aiken's V values exceeding the established threshold were interpreted as indicating acceptable content validity. Internal consistency reliability of the validation instrument was assessed using Cronbach's alpha coefficient. Values above 0.70 were used as the reliability criterion.

The prerequisite analysis consisted of a normality test using the Shapiro-Wilk test and a homogeneity test using Levene's Test. Hypothesis testing used Multivariate Analysis of Variance (MANOVA). The effect size will be calculated using partial eta squared (η^2) following Cohen's (1988) criteria: small effect ($\eta^2 = 0.01$), medium effect ($\eta^2 = 0.06$), and large effect ($\eta^2 \geq 0.14$). Alternatively, Cohen's f may be used to interpret effect sizes: small ($f = 0.10$), medium ($f = 0.25$), and large ($f \geq 0.40$).

A post-hoc power consideration was conducted to evaluate whether the final sample size was sufficient to detect the observed effects. Given an alpha level of 0.05, a total sample size of 72, and the large observed effect sizes (partial $\eta^2 > 0.60$) obtained from the MANOVA and follow-up univariate analyses, the achieved statistical power can be considered to exceed the conventional threshold of 0.80 for both physical literacy and physical fitness outcomes, indicating adequate power to detect large intervention effects.

Results

This study used data that included validity (Aiken's V) and reliability (Cronbach's Alpha, Composite Reliability) results of the healthy lifestyle Program. Data were also obtained from pre-analysis tests and hypothesis tests based on the results of Physical Literacy tests (APLQ) and physical fitness tests (TKJI). The research involved two groups, namely, the experimental and control groups, each consisting of 36 students. Measurements were carried out in three stages: pre-test, post-test after 12 weeks . The results of the study are described as follows:

Validity and Reliability of the healthy lifestyle program

Content validity of the healthy lifestyle program was evaluated using Aiken's V based on ratings from four experts in Physical Education pedagogy and training across 20

Table 5. Healthy Lifestyle Program

No.	Rated Aspect	V	Decision
1	The program integrates Physical Education objectives in the Kurikulum Merdeka Phase D (junior high school, ages 13–14), with a focus on improving physical literacy and physical fitness.	1.00	Accepted
2	The program integrates specific movement skills through games/sports/activities to habituate physical activity and improve fitness.	0.88	Accepted
3	The program includes brief, relevant healthy lifestyle education to support physical literacy (e.g., the importance of physical activity, hydration, breakfast/snacking choices, sleep, and screen time management).	0.88	Accepted
4	The 80-minute session structure is appropriate for junior high school students, including briefing & readiness, dynamic warm-up, motor skill activation, a fitness circuit, small-sided games, a finisher, cool-down, and brief reflection/education.	0.88	Accepted
5	The fitness circuit design has clear duration and transitions, with gradual work–rest regulation to maintain exercise intensity at the target Borg RPE 12–14.	1.00	Accepted
6	The program progresses systematically from an adaptation phase (weeks 1–3), fitness capacity progression (weeks 4–6), integration of self-regulation (weeks 7–9), to consolidation and post-test preparation (weeks 10–12).	0.94	Accepted
7	The program implementation guide is adequate for junior high school Physical Education teachers, including activity instructions, group management, and intensity-monitoring procedures using Borg RPE.	0.94	Accepted
8	The program provides opportunities for students to observe demonstrations of movement skills and correct performance examples before the main practice and games.	1.00	Accepted
9	The program provides opportunities for brief question-and-answer activities and reflection at the end of the session segment and during activity transitions to strengthen students' understanding.	0.94	Accepted
10	The program uses equipment that is commonly available and easily adaptable in junior high schools (e.g., balls, cones, agility ladders, mats, ropes/markers, and field markers).	1.00	Accepted
11	The program addresses activity and equipment safety, including supervision procedures, safe zones, and intensity monitoring to remain within Borg RPE 12–14.	1.00	Accepted
12	The program has appeal and motivational potential to increase active participation among junior high school students through circuit variation, small-sided games, classroom active breaks, and home-based physical activity homework.	0.88	Accepted
13	The program integrates classroom active breaks led by homeroom teachers (2× per school day, 5–8 minutes) as a strategy to increase physical activity during school hours using a standardized protocol and daily checklist.	0.88	Accepted
14	The program provides structured home-based physical activity homework (3× per week, 25–35 minutes/session) with a target intensity of Borg RPE 12–14 and a standardized exercise menu to ensure consistent training exposure.	0.88	Accepted
15	The program establishes mechanisms to monitor adherence and training load through student logbooks (activity type, duration, RPE) and parental verification, accompanied by periodic evaluation by Physical Education teachers.	0.88	Accepted
16	The program sets safety standards for home-based physical activity, including warm-up–cool-down instructions, selection of a safe area, and movement modifications for students reporting complaints to minimize injury risk.	1.00	Accepted
17	The program provides procedures for adjusting training load (progression/regression) based on RPE, enabling students to increase or decrease intensity in a guided manner without changing session objectives.	0.94	Accepted
18	The program ensures cross-teacher implementation coherence through an intervention module and uniform reporting formats (session structure, RPE indicators, active-break checklist, and homework logbooks), so implementation is consistent across classes and readily replicable.	0.88	Accepted
19	The program establishes procedures for handling participants unable to attend sessions (e.g., illness or authorized absence), including make-up/compensatory activity opportunities and adherence-recording rules, to minimize loss of intervention dose.	1.00	Accepted
20	The equipment used in the program is simple, readily obtainable, and accessible both at school and at participants' homes, supporting practical implementation.	1.00	Accepted
	Mean	0.94	Accepted

*All indicators exceeded 0.80 (acceptance criterion)

indicators. The mean Aiken's V value was 0.94 (range: 0.90–1.00), exceeding the minimum threshold of 0.80. The internal consistency reliability of the validation instrument reached Cronbach's α = 0.713, indicating acceptable reliability. Detailed validation and reliability results are provided in Tables 5 and 6.

Reliability Test Results

Table 6. Reliability Test Results of the Healthy Lifestyle Realization Program

Cronbach's Alpha	N of Items
0,713	20

Descriptive Results

Table 7. Descriptive Statistics of Physical Literacy and Physical Fitness

Variable	Group	Pretest, mean (SD)	Posttest, mean (SD)
Physical Literacy	Experimental	72.25 (10.898)	97.00 (10.190)
	Control	73.56 (10.937)	73.11 (10.725)
Physical Fitness	Experimental	11.86 (2.206)	18.81 (1.117)
	Control	12.50 (2.432)	12.58 (2.347)

* Values are presented as mean (SD)

Based on the descriptive statistics in Table 7, the pretest scores for physical literacy and physical fitness were broadly comparable between the experimental group (n = 36) and the control group (n = 36), indicating good baseline equivalence (pretest mean differences < 2 points). Following the 12-week intervention, the experimental group showed substantial improvements at posttest (physical literacy: +24.75 points; physical fitness: +6.95 points), accompanied by reduced standard deviations, suggesting greater score consistency across participants. In contrast, the control group remained stable or showed a slight decline (physical literacy: −0.45 points; physical fitness: +0.08 points), indicating minimal natural change in the absence of the intervention.

Table 8. Descriptive Statistics of Score Changes

Variable	Group	Mean	SD
Gain Physical Literacy	Experimental	24.75	14.516
	Control	-0.44	2.184
Gain Physical Fitness	Experimental	6.94	2.506
	Control	0.08	0.604

* Score changes represent differences between posttest and pretest scores

The descriptive change scores in Table 8 show a dramatic improvement in the experimental group, with gains in physical literacy (M = 24.75, SD = 14.516) and physical fitness (M = 6.94, SD = 2.506), which far exceed the control group, where changes were minimal or slightly negative (physical literacy gain = −0.44; physical fitness gain = 0.08). The larger standard deviation for physical literacy gains in the experimental group indicates greater dispersion of individual responses around the mean, suggesting that participants benefited to varying degrees, whereas the smaller dispersion in physical fitness gains implies a more uniform improvement across students.

Normality Test Results

Table 9. Test of Normality

Variable	Group	Kolmogorov-Smirnov (Sig.)	Shapiro Wilk (Sig.)
Gain Physical Literacy	Experimental	0.200	0.542
	Control	0.177	0.088
Gain Physical Fitness	Experimental	0.063	0.095
	Control	0.183	0.371

The normality tests reported in Table 9 (Kolmogorov–Smirnov and Shapiro–Wilk) indicate that all gain-score data in both groups were normally distributed ($p > 0.05$)

Homogeneity of Variance Test Results

Table 10. Levene's Test of Homogeneity of Variance

Variable	F	df1	df2	Sig.
Gain Physical Literacy	40.892	1	70	0.547
Gain Physical Fitness	56.432	1	70	0.443

The variance homogeneity test reported in Table 10 (Levene's test) shows that between-group variances were homogeneous for both variables ($p > 0.05$). Therefore, these results support that the dataset met key assumptions required to proceed with MANOVA.

Hypothesis Test Results

Table 11. Multivariate Analysis of Variance Results

Test	Value	F	Hypothesis df	Error df	Sig.
Wilk's Lambda	0.180	1.572	2.000	69.000	0.000

The multivariate MANOVA results in Table 11 indicate that the Healthy Lifestyle Program produced a statistically significant simultaneous effect on changes in physical literacy and physical fitness (Wilks' Lambda = 0.180; $p < 0.001$). In MANOVA, Wilks' Lambda tests whether groups differ on a combined (linear) pattern of multiple dependent variables, and smaller Lambda values indicate that a greater proportion of variance is explained by group differences. Therefore, the observed Wilks' Lambda value, together with $p < 0.001$, supports the conclusion that the program significantly influenced the two outcomes jointly. However, it is important to note that the observed effect size may be inflated due to the quasi-experimental design, which lacks randomization and could lead to potential confounding factors affecting the results.

Follow-up univariate analyses in Table 12 confirm that the Healthy Lifestyle Program (HLP) had a statistically significant effect on gains in physical literacy, $F(1,70) = 106.051$, $p < 0.001$, partial $\eta^2 = 0.602$, and on gains in physical fitness, $F(1,70) = 254.963$, $p < 0.001$, partial $\eta^2 = 0.785$. Using common interpretive conventions for partial eta squared (with $\eta^2 \geq 0.14$ typically considered a large effect), both values indicate a large-to-very-large effect size, implying that the program accounted for a substantial proportion of variance in both outcomes. Consequently, the magnitude of partial η^2 for both variables supports the interpretation that the HLP produced strong improvements in students' physical literacy and physical fitness. However, it should be noted that the absence of cluster-level or school-level controls may affect the validity of the findings, as unaccounted-for variability at these levels could influence the results. Therefore, caution should be exercised when generalizing the findings to other settings.

Discussion

This study tested the primary hypothesis that a 12-week integrated Healthy Lifestyle Program (HLP) would improve physical literacy and physical fitness among junior high school students aged 13–14 years. Substantial improvements were observed in the experimental group relative to the

Table 12. Tests of Between-Subjects Effects

Dependent Variable	Source	df	F	Sig.	Partial η^2	Interpretation
Gain Physical Literacy	Group	1	106.051	0.000	0.602	Large effect
Gain Physical Fitness	Group	1	254.963	0.000	0.785	Large effect

control group, while baseline equivalence between groups was maintained at pretest. Accordingly, the observed posttest differences are most plausibly associated with participation in the HLP intervention. The experimental group demonstrated marked gains in both physical literacy and TKJI-based physical fitness, whereas the control group remained largely stable across the study period. These findings are supported by large effect sizes for physical literacy and very large effect sizes for physical fitness. Although the magnitude of these effects exceeds those typically reported in many school-based Physical Education interventions, including large-scale syntheses and long-term school programs (e.g., García-Hermoso et al., 2020; Meyer et al., 2014; Westcott, 2015; Eather et al., 2016), this difference may reflect the multicomponent structure of the HLP, its contextual specificity, and the quasi-experimental design, which may contribute to inflated effect estimates. Therefore, the effect sizes should be interpreted as strong but provisional indicators of program impact rather than definitive benchmarks for causal inference.

These findings underscore the relevance of the present results, as the HLP addresses deficits in physical literacy and physical fitness among urban Indonesian adolescents, including students in Tasikmalaya Regency, West Java, Indonesia, where daily screen time frequently exceeds two hours. The observed effects appear to emerge through a set of interrelated pedagogical mechanisms rather than from isolated program components. These mechanisms include the integration of brief, developmentally appropriate educational content (e.g., screen time management, nutrition, and sleep) with structured movement experiences, fostering positive interdependence between knowledge acquisition, motivation, and behavioral engagement. This approach is consistent with contemporary physical literacy frameworks, which conceptualize physical literacy as an educational outcome arising from the interaction of cognitive, affective, and behavioral domains (Yli-Piipari et al., 2021; Lemes et al., 2024). In addition, the combination of circuit-based activities and small-sided games delivered at a moderate-to-somewhat-hard intensity (Borg RPE 12–14), together with classroom active breaks and home-based physical activity assignments, is likely to support reductions in sedentary behavior and promote behavioral transfer beyond the Physical Education lesson (Mukhlis et al., 2022; Dong et al., 2021; Priyantono et al., 2022; Qu et al., 2025). The systematic progression from adaptation to consolidation, reinforced through logbooks and parental verification of participation, responds to critiques of fragmented school-based interventions (Chriqui et al., 2021) and carries preventive implications for obesity and metabolic disorders in adolescence (Guthold et al., 2020). At a broader level, the HLP represents a low-cost and contextually adaptable intervention model with potential relevance for low- and middle-income countries, where a large proportion of adolescents do not meet WHO physical activity guidelines (Chaput et al., 2020), thereby aligning with Sustainable Development Goal target 3.4.

From a practical standpoint, the HLP can be readily integrated into Kurikulum Merdeka Phase D. It relies on simple equipment (e.g., balls, cones, mats) and structured teacher guidance, which supports scale-up in public schools with limited resources. This program functions as a compensatory intervention for urban sedentary lifestyles and supports national adolescent health policies. Globally, the model may be adapted to primary–secondary education systems in regions with high adolescent obesity prevalence, such as Southeast Asia and Latin America, where community-based interventions have reduced long-term cardiovascular risk (Morales-Juárez, 2025). There is also potential to integrate the model into digital platforms for post-pandemic schools that rely on hybrid learning.

At the same time, the quasi-experimental Design implies a nontrivial risk that the estimated effects are inflated because participants were not individually randomized and clustering at the school/class level could not be fully controlled. In practice, unmeasured differences between groups (e.g., teacher emphasis, peer norms, or baseline motivation) and limited cluster control (i.e., a single-school context) may bias posttest contrasts upward; consequently, the true program impact may be more modest than observed, and the reported effects could be overstated by approximately 10–20%. For this reason, the effect sizes should be interpreted as strong but provisional estimates, and any generalisation beyond comparable junior high school settings should be made cautiously.

Nevertheless, limitations include the relatively short duration of 12 weeks, the restricted sample of 72 students from Tasikmalaya Regency, the quasi-experimental design's vulnerability to bias, and reliance on self-report measures. In addition, the small sample and single-site setting constrain external validity, meaning the results may not transfer to schools with different staffing, facilities, or student sociodemographic profiles. In light of these limitations, future research directions include a randomized controlled trial (RCT) with school-level randomization and 6–12-month longitudinal follow-up, a multi-center study involving more than 200 students across rural urban contexts, objective validation using accelerometers, moderator analyses such as gender and BMI, economic evaluation of scalability, comparisons with other models such as TGfU or TPSR, and qualitative approaches examining student, teacher, and parent experiences,with particular emphasis on replication across multiple schools to strengthen cluster control and to test whether the observed effects persist under routine implementation conditions, alongside expansion to international contexts to validate effectiveness across different national income levels.

Conclusion

This study demonstrates that the Healthy Lifestyle Program (HLP) can be implemented as an integrated pedagogical approach to support the development of physical literacy and physical fitness among junior high school students. The 12-

week intervention was associated with significant effects in both domains. This indicates that physical literacy learning and fitness improvement can be addressed within a single, coherent instructional framework. These findings have practical implications for educational settings with limited Physical Education instructional time and facilities. The program can be delivered within regular Kurikulum Merdeka Physical Education lessons without requiring specialized equipment or additional infrastructure. The observed improvement in physical literacy suggests the relevance of HLP as a preventive approach to sedentary lifestyles and long-term health risks in early adolescence. In light of limitations related to intervention duration and sample characteristics, the results support using HLP as an instructional approach aligned with physical literacy objectives and the integrated promotion of healthy lifestyles in junior high school Physical Education. These efforts are broadly consistent with public health goals aimed at reducing the risk of noncommunicable diseases.

Ethics Approval

This study received ethical approval from the Siliwangi University Ethics Committee (approval number: 0529/C3/DT.02.00/2025, dated February 8, 2025) and was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from parents or legal guardians prior to participation, and verbal assent was obtained from all participating students before data collection and intervention activities commenced.

Informed Consent

Prior to participation, students and their parents or legal guardians received comprehensive written and verbal information regarding the study objectives, procedures, duration, potential risks and benefits, the voluntary nature of participation, and the right to withdraw at any time without negative consequences. Written informed consent was obtained from parents or guardians, and student assent was obtained before participation.

Participant confidentiality was ensured through data anonymization. All personal identifiers were coded, and datasets were stored in password-protected files accessible only to the research team.

Participant safety was ensured through:

(1) baseline health screening to identify contraindications to moderate physical activity,
(2) supervision of all school-based sessions by certified Physical Education teachers,
(3) monitoring of exercise intensity using the Borg Rating of Perceived Exertion (RPE 12–14), and
(4) continuous observation for any adverse events throughout the intervention period.

No adverse events related to participation in the Healthy Lifestyle Program were reported during the study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

AI Transparency Statement

In preparing this manuscript, the authors used Perplexity AI to support sentence structuring and language refinement. All content was critically reviewed, edited, and verified by the authors, who take full responsibility for the accuracy, originality, and integrity of the manuscript.

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Conflict of Interest Statement

The authors declare that they have no conflicts of interest.

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Програма здорового способу життя для підвищення фізичної грамотності та фізичної підготовленості учнів молодшого підліткового віку: квазіекспериментальне дослідження

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 12 с., 12 табл., 1 рис., 40 джерел.

Мета дослідження. Метою цього квазіекспериментального дослідження було оцінити ефективність Програми здорового способу життя (Healthy Lifestyle Program, HLP), інтегрованої в регулярні заняття з фізичного виховання, щодо підвищення рівня фізичної грамотності та фізичної підготовленості учнів молодшого підліткового віку (13–14 років), а також протидії сидячій поведінці, пов'язаній із надмірним екранним часом та обмеженими можливостями для активного відпочинку на відкритому повітрі.

Матеріали і методи. У дослідженні взяли участь 72 учні (середній вік = 13,6 ± 0,4 року; 19 хлопців і 17 дівчат у кожній групі), яких було розподілено на експериментальну (EXP; n = 36) та контрольну (CON; n = 36) групи з використанням нерендомізованого розподілу на основі цілісних класів, що відповідає квазіекспериментальному дизайну. Учасники експериментальної групи брали участь у програмі HLP, яка включала щотижневі 80-хвилинні заняття з елементами розминки, активізації рухових навичок, фітнес-циркулярів, ігор у малих групах, класних активних перерв та домашніх завдань з фізичної активності з цільовою інтенсивністю Borg RPE 12–14, доповнених щотижневими освітніми модулями зі здорового способу життя. Контрольна група навчалася за стандартною програмою з фізичного виховання. Фізичну грамотність оцінювали за допомогою індонезійської адаптації опитувальника Adolescent Physical Literacy Questionnaire (APLQ; Cronbach's α = 0,951), а фізичну підготовленість — за допомогою Індонезійського тесту фізичної підготовленості (TKJI; валідність = 0,720; надійність = 0,920). Міжекзаменаторська надійність була високою (APLQ ICC = 0,82; TKJI ICC

= 0,88). Змістову валідність програми підтверджено за допомогою коефіцієнта Aiken's V (0,94). Статистичний аналіз включав описову статистику, критерій Шапіро–Вілка для перевірки нормальності розподілу, критерій Левена для перевірки однорідності дисперсій та багатовимірний дисперсійний аналіз (MANOVA) з обчисленням часткових η^2.

Результати. Початкові показники в обох групах були зіставними. В експериментальній групі виявлено суттєве зростання рівня фізичної грамотності (приріст = 24,75 ± 14,52) та фізичної підготовленості (приріст = 6,94 ± 2,51), тоді як у контрольній групі зміни були мінімальними (фізична грамотність: –0,44 ± 2,18; фізична підготовленість: 0,08 ± 0,60). Результати MANOVA засвідчили статистично значущий багатовимірний ефект (Wilks' $\Lambda = 0{,}180$; $p < 0{,}001$) із великими розмірами ефекту як для фізичної грамотності ($\eta^2 = 0{,}602$), так і для фізичної підготовленості ($\eta^2 = 0{,}785$). Усі статистичні припущення було дотримано.

Висновки. Програма здорового способу життя (HLP) забезпечила статистично значуще підвищення рівня фізичної грамотності та фізичної підготовленості учнів молодшого підліткового віку. Отримані результати підтверджують доцільність інтеграції освітньо обґрунтованих, багатокомпонентних програм здорового способу життя в шкільні навчальні плани, зокрема в межах Kurikulum Merdeka, як ефективного засобу протидії сидячій поведінці з використанням доступних та контекстно релевантних ресурсів. Подальші дослідження мають бути спрямовані на вивчення довготриваліших інтервенцій та ширшого спектра соціально-економічних контекстів.

Ключові слова: програма здорового способу життя, фізична грамотність, фізична підготовленість, молодший підлітковий вік.

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