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Effects of Aerobic Training on Physical Fitness in Adolescent Girls

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ABSTRACT

Regular physical activity during adolescence is important for the development and maintenance of health-related physical fitness. The purpose of this study was to examine changes in body mass index (BMI), cardiovascular endurance, muscular endurance, and flexibility following an eight-week moderate aerobic training programme among female adolescents. A single-group pre-test/post-test experimental design was used at Government Girls High School Phool Nagar, Tehsil Pattoki, Pakistan. Forty female students aged 15–18 years were selected through purposive sampling. Participants completed supervised aerobic sessions four days per week, with each session lasting approximately 40–45 minutes. Activities included brisk walking, jogging, spot running, skipping, jumping jacks, high knees, and rhythmic aerobic movements. BMI, six-minute walk/run distance, one-minute sit-up repetitions, and sit-and-reach flexibility were assessed before and after the programme. Descriptive statistics, the Shapiro–Wilk test, and paired-samples t-tests were used. Mean BMI decreased from 23.03 (SD = 6.00) to 22.51 (SD = 5.91). Cardiovascular-endurance performance increased from 229.88 m (SD = 66.82) to 264.25 m (SD = 64.95), muscular endurance increased from 19.98 (SD = 1.67) to 22.70 (SD = 2.02) sit-ups, and flexibility increased from 71.08 cm (SD = 3.76) to 75.12 cm (SD = 3.72). All four pre-test/post-test comparisons were statistically significant ($p < .001$). The findings show favourable changes in the selected fitness measures over the intervention period. Because the study did not include a control group and was conducted in one school, the results should be interpreted as within-group changes rather than definitive evidence of causation. Larger controlled studies with follow-up assessments are recommended.

Introduction

Adolescence is a period of transition during which individuals experience substantial physical growth and changes in physiological functioning. These changes make the adolescent years an important time for developing positive movement habits and maintaining health-related physical fitness. Physical activity during this stage can support cardiorespiratory fitness, muscular fitness, healthy movement patterns, and general well-being. Physical activity guidance emphasizes that children and adolescents should engage in regular movement and reduce sedentary time as part of a healthy lifestyle (Bull et al., 2020; Chaput et al., 2020; World Health Organization [WHO], 2020).

The importance of physical activity is not limited to participation in competitive sports. Everyday activities such as walking, jogging, rhythmic movement, and active recreation can contribute to an individual's overall activity level. For school-aged adolescents, school-based opportunities may be particularly relevant because schools provide an organized environment in which activities can be scheduled, supervised, and adapted to students' abilities. A structured programme can also provide continuity that may be difficult to achieve through occasional or unplanned activity.

Physical fitness is a multidimensional concept. It includes several components that are related to health and functional capacity, but each component represents a different characteristic. Cardiorespiratory endurance concerns the capacity to sustain activity involving large muscle groups; muscular endurance concerns the ability to repeat muscular actions; flexibility concerns the range of movement available at particular joints or body regions; and body-size indicators such as BMI provide anthropometric information. No single measure can represent all dimensions of physical fitness. Reviews of youth fitness have therefore emphasized the need to consider multiple components and interpret test results in relation to growth and maturation (Armstrong & Welsman, 2020; Fühner et al., 2021).

Aerobic training commonly involves sustained or repeated rhythmic movements that use large muscle groups. Activities such as brisk walking, jogging, running in place, and rhythmic aerobic movements can be adjusted in duration and pace. In a school environment, these activities may be delivered without highly specialized equipment, although appropriate space, supervision, and planning remain important. The programme examined in the present study used a range of familiar activities and was organized over eight weeks.

Insufficient physical activity has remained a concern in adolescent populations. Guthold et al. (2020), using pooled data from population-based surveys across 146 countries, reported that a large proportion of adolescents did not meet recommended activity levels and that insufficient activity was more prevalent among girls than boys. Participation may be influenced by personal, social, and environmental circumstances. Duffey et al. (2021) identified barriers and facilitators that can shape physical-activity participation among adolescent girls, indicating that opportunities, support, and context matter when planning programmes for this group.

School settings may provide a practical route for increasing access to organized activity. A school programme can be incorporated into the timetable or designated activity periods and can use the available playground or open space. Nevertheless, the presence of a programme does not automatically guarantee long-term participation or improvements in every fitness component. Programme outcomes may depend on the activities selected, frequency, duration, intensity, attendance, implementation quality, and the characteristics of participants. Reviews of school-based interventions have described variation in intervention strategies and effects, supporting the importance of reporting programme details and outcomes clearly (Wu et al., 2023; Contardo Ayala et al., 2024).

The present study focused on adolescent female students in one government school in Pakistan. It examined changes in four selected measures following an eight-week moderate aerobic training programme. These measures were BMI, six-minute walk/run distance, one-minute sit-up repetitions, and sit-and-reach performance. The study was designed to provide a local account of pre-test and post-test changes in a school-based setting. Given the single-group design, the findings are interpreted as changes observed among the participants rather than proof that the intervention alone produced those changes.

Literature Review

Adolescent Physical Fitness and Aerobic Activity

Cardiorespiratory fitness is widely recognized as an important component of health-related physical fitness. It reflects the ability to sustain physical activity that places demands on the cardiovascular and respiratory systems. In young people, fitness test performance is influenced not only by habitual activity but also by growth, body size, maturation, and familiarity with the assessment. Armstrong and Welsman (2020) emphasized that youth cardiorespiratory fitness should be interpreted with attention to developmental characteristics. Therefore, field-test results should be reported in the form actually measured and should not be treated as equivalent to laboratory measurements of maximal oxygen uptake unless such testing has been conducted.

Aerobic activity may be delivered through continuous or intermittent movement. In school programmes, walking and jogging can be organized as continuous activities, while movements such as jumping jacks, high knees, and spot running can be included in repeated bouts. These activities differ in movement pattern and demand, but they share the feature of involving repeated rhythmic movement. The pace and duration can be adjusted to suit participants' abilities. Such adaptation is important in adolescent groups because students may enter a programme with different levels of previous activity and fitness.

Physical-activity recommendations provide a broad public-health framework rather than a prescription for one specific school intervention. Bull et al. (2020) and Chaput et al. (2020) summarized evidence informing the WHO recommendations for children and adolescents. The guidance encourages regular moderate-to-vigorous physical activity across the week and recognizes the importance of reducing sedentary behaviour. A scheduled programme lasting approximately 40–45 minutes on four school days per week represents one organized opportunity for movement; it should not be interpreted as necessarily fulfilling all recommended daily activity.

Fitness trends in children and adolescents have been examined across multiple decades. Fühner et al. (2021) reviewed secular trends in physical fitness and highlighted the value of monitoring youth fitness over time. Such evidence provides context for school-based initiatives, because physical fitness is influenced by broader patterns of activity and social change. However, population-level trends cannot determine the response of an individual school group to a particular intervention. Local assessment is therefore useful when it is conducted with consistent procedures and interpreted cautiously.

Muscular Endurance and Flexibility

Muscular endurance refers to the ability of a muscle group to perform repeated actions over a period of time. A one-minute sit-up test is a practical field assessment that records the number of repetitions completed within a fixed time. The score reflects performance on that particular task and may be influenced by movement technique, pacing, motivation, and consistency in test administration. It should not be interpreted as a comprehensive measure of total-body strength or muscular fitness. In the present study, the one-minute sit-up test was used as an indicator of repeated trunk-muscle performance.

Flexibility refers to the range of movement available at a joint or across a group of joints. It is not a single uniform quality because different tests assess different body regions. The sit-and-reach test is commonly used as a field measure related primarily to the lower back and posterior lower-limb region. Its result should therefore be interpreted as performance on that specific test rather than as a measure of flexibility throughout the entire body. Donti et al. (2022) reviewed evidence concerning flexibility development in youth and discussed the relevance of structured activity during growth and development.

The inclusion of muscular-endurance and flexibility assessments alongside an aerobic field test allows a broader description of physical-fitness performance. It does not mean that an aerobic programme is equivalent to a targeted resistance or flexibility intervention. Rather, the measures provide information about whether performance in several selected field tests changed during the same period. This distinction is important when discussing results, particularly when the programme's main emphasis was aerobic activity.

Body Mass Index and School-Based Programmes

Body mass index is calculated by dividing body mass in kilograms by height in metres squared. It is frequently used in research and public-health settings because it can be calculated from basic anthropometric measurements. However, BMI does not directly measure body fat and does not distinguish fat mass from lean mass. Interpretation in adolescents requires age- and sex-specific reference information rather than the adult cut-off categories. The Centers for Disease Control and Prevention (CDC, 2024) provides child and teen BMI categories based on age- and sex-related percentiles.

For this reason, the BMI values in the present study are reported as recorded group means and should not be used alone to classify the health status of individual adolescents. A decrease in mean BMI is an anthropometric change, but it does not establish the exact nature of a change in body composition. Growth and maturation may also influence height, body mass, and BMI during adolescence. The interpretation of this outcome should remain cautious and should not imply that a lower BMI is necessarily beneficial for every participant.

School-based interventions have used different approaches to encourage physical activity and reduce sedentary time. Contardo Ayala et al. (2024) reported that intervention strategies in secondary-school settings varied and that their effects and implementation characteristics differed. This variation suggests that researchers should describe the setting, programme duration, frequency, activity content, and delivery arrangements rather than treating all school interventions as identical. The present study contributes a description of one programme implemented in a government girls' school.

Research Gap and Rationale

Existing literature has examined adolescent physical activity, youth fitness, flexibility, and school-based intervention strategies. However, findings from broad international reviews cannot automatically be generalized to every local school environment. Differences in facilities, school schedules, opportunities for girls' participation, programme delivery, and participant characteristics

may influence how an intervention is implemented. The thesis identified a need to examine a practical moderate aerobic programme among adolescent female students in a Pakistani school setting.

The present study addressed this local question by measuring four selected outcomes before and after an eight-week programme. Its contribution is descriptive and context-specific: it reports the observed changes in BMI, six-minute walk/run distance, one-minute sit-up performance, and sit-and-reach performance among 40 female students. The absence of a comparison group means that the study cannot isolate the intervention effect from other influences, but the findings can inform the design of more rigorous future investigations.

Material And Methods

Research Design and Setting

A single-group pre-test/post-test experimental design was used. The study was conducted at Government Girls High School Phool Nagar, Tehsil Pattoki, Pakistan. The school setting provided an available environment for organizing supervised training sessions and conducting the physical-fitness assessments. The same participants completed the baseline assessments before the intervention and the post-test assessments after the eight-week programme. As there was no separate control group, the design allowed examination of within-participant change but did not provide a comparison against students who did not receive the programme.

Participants and Sampling

The sample consisted of 40 female students aged 15–18 years. Participants were selected through purposive sampling. The study was limited to female students enrolled at the selected school who were able to take part in the programme and assessments. The use of purposive sampling enabled the researcher to recruit participants from the intended school population; however, it also limits the extent to which the findings can be generalized to other schools or adolescent populations.

Measures

Four physical-fitness outcomes were assessed. BMI was calculated using recorded body mass and height. Cardiovascular endurance was assessed through the six-minute walk/run test, with the total distance covered during six minutes recorded in metres. Muscular endurance was assessed through the one-minute sit-up test, with the number of completed repetitions recorded. Flexibility was assessed using the sit-and-reach test, with performance recorded in centimetres. No questionnaire or psychological scale was used in this study.

The measures were selected to represent distinct aspects of physical-fitness performance. BMI provided an anthropometric indicator, the six-minute walk/run test provided a field measure of endurance performance, the sit-up test recorded repeated trunk-muscle performance, and the sit-and-reach test assessed a specific flexibility-related movement. Because each test represents a particular construct and body region, the results were interpreted separately rather than combined into a single overall score.

Intervention Programme

The intervention lasted eight weeks and was delivered four days per week. Each session lasted approximately 40–45 minutes and included a warm-up of about 5–10 minutes, a main aerobic activity period of approximately 25–30 minutes, and a cool-down with stretching of about 5–10 minutes. Activities listed in the programme included brisk walking, jogging, spot running, skipping, jumping jacks, high knees, and rhythmic aerobic movements. The programme was organized to progress gradually according to participants' abilities, and attendance was recorded.

The warm-up was intended to prepare participants for the main activity period through light movement. The main portion included the planned aerobic activities, while the cool-down provided a transition from the activity period and included stretching and controlled breathing. The structure provided a consistent session format across the intervention. The available study information describes the activities and approximate session durations; it does not provide a quantified heart-rate target or a measured percentage of maximal effort. Accordingly, the programme is described as moderate aerobic training as identified in the study materials, without assigning an intensity value that was not recorded.

Table 1. Summary of the Aerobic Training Programme

Programme element	Description
Duration	8 weeks
Frequency	4 days per week
Session length	Approximately 40–45 minutes
Warm-up	5–10 minutes
Main activity	25–30 minutes of moderate aerobic activity
Cool-down	5–10 minutes, including stretching and controlled breathing
Activities	Brisk walking, jogging, spot running, skipping, jumping jacks, high knees, and rhythmic aerobic movements
Monitoring	Attendance was recorded; activities progressed gradually according to participants' abilities

Table 2. Structure of an Individual Training Session

Session phase	Approximate duration	Content described in the programme	Role within the session
Warm-up	5–10 minutes	Light preparatory movement	Prepared participants for the main activity period.
Main activity	25–30 minutes	Brisk walking, jogging, spot running, skipping, jumping jacks, high knees, and rhythmic aerobic movements	Provided the main period of planned aerobic movement.
Cool-down	5–10 minutes	Stretching and controlled breathing	Provided a gradual transition after the main activity.

Note. The table organizes the session components and approximate durations reported in the study materials. It does not introduce additional exercise intensity targets or activities.

Procedure and Ethical Considerations

Permission was obtained from the school administration. The purpose and procedures of the study were explained to the students, and willingness/consent to participate was obtained as described in the thesis. Baseline measurements were recorded before the training programme. Following completion of the eight-week programme, the same assessments were administered again under similar conditions. The study materials did not report a formal institutional ethics approval number. This information should be added to the manuscript if approval was obtained and required by the target journal. For participants under 18 years, the authors should ensure that the appropriate parental or guardian consent and student assent procedures are accurately documented before submission.

The use of the same assessment procedures before and after the programme was intended to support comparability of the recorded results. Nevertheless, repeated field testing may be affected by familiarity with the test, differences in pacing, motivation, and measurement conditions. These considerations are relevant when interpreting pre-test/post-test changes. The manuscript should report any additional standardization procedures only if they were actually followed during data collection.

Statistical Analysis

Means and standard deviations were used to summarize the measurements. The Shapiro–Wilk test was applied to examine normality. Paired-samples t-tests compared pre-test and post-test scores, with statistical significance set at $p < .05$. The thesis reports that the Shapiro–Wilk results for the study variables were non-significant ($p > .05$). The reported t statistics were used to describe the within-participant comparisons. Cohen's dz values in Table 4 were calculated from the reported absolute t statistics divided by the square root of the sample size ($n = 40$); these values are derived estimates.

The paired-samples t-test was selected because the same participants completed both sets of assessments. This analysis evaluates whether the average difference between paired observations differs from zero. Statistical significance indicates that the observed mean difference was unlikely under the null model used for the test; it does not, by itself, establish practical importance or causation. Effect-size estimates can provide additional context, but the derived Cohen's dz values should be interpreted with attention to the design limitations and the fact that they were calculated from the reported t statistics.

Results

Forty female students aged 15–18 years participated in the study. Descriptive statistics for BMI, cardiovascular-endurance performance, muscular endurance, and flexibility are presented in Table 3. The mean BMI decreased from 23.03 (SD = 6.00) at pre-test to 22.51 (SD = 5.91) at post-test, representing a mean reduction of 0.52 units. Cardiovascular-endurance performance increased from 229.88 m (SD = 66.82) to 264.25 m (SD = 64.95), representing a mean increase of 34.37 m.

Mean one-minute sit-up performance increased from 19.98 repetitions (SD = 1.67) to 22.70 repetitions (SD = 2.02), a mean increase of 2.72 repetitions. Mean sit-and-reach performance increased from 71.08 cm (SD = 3.76) to 75.12 cm (SD = 3.72), a mean increase of 4.04 cm. These descriptive results indicate that the group mean moved in a favourable direction for each of the four recorded outcomes, although the interpretation of BMI differs from the performance-based field tests.

Table 3. Descriptive Statistics for Physical-Fitness Outcomes (N = 40)

Outcome	Pre-test M	Pre-test SD	Post-test M	Post-test SD	Mean change
BMI (kg/m^2)	23.03	6.00	22.51	5.91	−0.52
Cardiovascular endurance (m)	229.88	66.82	264.25	64.95	+34.37
Muscular endurance (sit-ups)	19.98	1.67	22.70	2.02	+2.72
Flexibility (cm)	71.08	3.76	75.12	3.72	+4.04

Note. M = mean; SD = standard deviation. Positive changes indicate higher post-test performance; BMI decreased by 0.52 units.

Paired-samples t-test results are presented in Table 4. All four pre-test/post-test comparisons were statistically significant at $p < .001$. BMI showed a statistically significant reduction ($t(39) = 15.64$, $p < .001$). Cardiovascular-endurance performance increased significantly ($t(39) = −16.79$, $p < .001$), as did muscular-endurance performance ($t(39) = −22.06$, $p < .001$) and flexibility performance ($t(39) = −28.73$, $p < .001$). The sign of the t statistic depends on the order in which the paired difference was calculated.

Table 4. Paired-Samples t-Test Results (N = 40)

Outcome	t(39)	p	Cohen's dz*
BMI	15.64	< .001	2.47
Cardiovascular endurance	−16.79	< .001	2.65
Muscular endurance	−22.06	< .001	3.49

Flexibility	−28.73	< .001	4.54

Note. *Cohen's dz is derived from the reported t statistic using |t|/√40. The sign of t depends on the order in which the paired difference was calculated.

Discussion

The present study examined changes in selected physical-fitness outcomes following an eight-week moderate aerobic training programme among 40 female students aged 15–18 years. The results showed a reduction in mean BMI and increases in six-minute walk/run distance, one-minute sit-up repetitions, and sit-and-reach performance. All four pre-test/post-test comparisons were statistically significant. These findings describe changes observed in the participating group over the study period. Because the design did not include a control group, it cannot establish that the programme alone caused the changes.

Body Mass Index

Mean BMI decreased by 0.52 units, from 23.03 to 22.51. This represents a modest change in the recorded anthropometric indicator. BMI is useful for describing the relationship between height and body mass, but it does not directly quantify body fat or distinguish fat mass from lean mass. In adolescents, interpretation should be based on age- and sex-specific references rather than adult categories (CDC, 2024). Consequently, the group mean values in this study should not be used to classify individual students or to make conclusions about their body composition.

The observed reduction should also be considered in the context of adolescent growth and development. Changes in height and body mass may occur during this life stage, and a single BMI value does not capture all aspects of health. Contardo Ayala et al. (2024) reported that school-based intervention outcomes related to physical activity and sedentary behaviour vary across programmes and implementation contexts. The current finding is therefore best reported as a decrease in the group mean BMI during the intervention period, rather than as proof of a specific body-composition change or a universal expected response to aerobic training.

Cardiovascular Endurance

Cardiovascular-endurance performance increased by 34.37 m in the six-minute walk/run test. The programme included activities such as brisk walking, jogging, spot running, and rhythmic aerobic movements. These activities involved repeated movement by large muscle groups and were consistent with the programme's aerobic focus. The increase in distance suggests that participants performed better on the same field test at post-test. This result is relevant to the broader recognition of cardiorespiratory fitness as an important component of youth fitness (Bull et al., 2020; Chaput et al., 2020).

The result should nevertheless be interpreted as improved six-minute walk/run performance rather than a direct measurement of maximal oxygen uptake. Field-test distance can be influenced by pacing, motivation, familiarity with the test, body size, growth, and environmental conditions. Armstrong and Welsman (2020) emphasized that youth cardiorespiratory fitness should be interpreted in a developmental context. The absence of a control group also means that the contribution of the programme cannot be separated from other influences during the eight-week period.

Muscular Endurance

Mean sit-up performance increased from 19.98 to 22.70 repetitions, representing a mean increase of 2.72 repetitions. The intervention was designed as moderate aerobic training and was not described as a specific abdominal-muscle training programme. However, the activities involved repeated whole-body movement and may have provided some ongoing muscular demands. The result should be interpreted narrowly as an improvement in one-minute sit-up performance. It should not be generalized to total-body muscular strength or all forms of muscular endurance.

The sit-up test is a field measure and can be affected by technique, pacing, participant effort, and familiarity with the movement. Consistent instructions and assessment conditions are therefore important when comparing results over time. The study's repeated testing approach provided a pre-test and post-test score for the same participants, but repeated exposure may also have helped students become more familiar with the assessment. This possibility should be considered alongside the intervention when interpreting the observed improvement.

Flexibility

Flexibility performance increased by 4.04 cm on the sit-and-reach test. The session structure included a cool-down period with stretching, which may have been relevant to the observed change. Donti et al. (2022) reviewed flexibility development in youth and discussed the potential for structured activity to influence flexibility-related outcomes. The present result is consistent with an improvement in performance on the selected flexibility test, but it should not be interpreted as a change in flexibility at every joint.

The sit-and-reach test primarily reflects movement involving the lower back and posterior lower-limb region. Individual differences in limb proportions and test technique can also influence scores. Therefore, the result provides a specific indicator rather than a complete assessment of flexibility. Future studies could include additional measures if a broader description of flexibility is required.

Overall Interpretation

Taken together, the results showed statistically significant within-group changes across all four selected measures. This pattern suggests that a school-based programme using accessible aerobic activities can be implemented alongside field-based monitoring of several fitness indicators. However, the outcomes should be kept distinct: BMI is an anthropometric indicator, while the other three measures represent performance on specific field tests. The four outcomes should not be treated as interchangeable or combined into a single claim about overall health.

Reviews of school-based interventions have emphasized that programme content, implementation, and outcomes vary (Wu et al., 2023; Contardo Ayala et al., 2024). The present study adds a local account from one government girls' school in Pakistan. Its value lies in documenting the programme structure and the changes observed in the participating group. Stronger causal conclusions would require a comparison group, clearer monitoring of activity intensity and attendance, and procedures that account for maturation and other physical activity.

Implications For Practice In Pakistani Educational Settings

Schools may consider providing regular, supervised opportunities for adolescent girls to participate in age-appropriate physical activity during physical education lessons or designated school activity periods. Activities such as brisk walking, jogging, spot running, and rhythmic aerobic movements can be organized in available open spaces and may not require highly specialized equipment. The activities should be adapted to students' abilities, and teachers should consider safe space, suitable footwear, warm-up, cool-down, hydration, and appropriate supervision.

Physical education teachers and school administrations may use consistently administered field assessments to monitor selected fitness outcomes where appropriate. The purpose of such assessment should be to understand performance and guide supportive physical-education planning, not to stigmatize or compare students. BMI should be interpreted using age- and sex-specific references for adolescents, and individual results should be handled sensitively. A single BMI value should not be used as a complete judgment of a student's health.

The findings may be useful as preliminary local evidence when discussing school-based aerobic activity. They should not, however, be treated as sufficient evidence for broad policy decisions. Larger studies across multiple schools and regions would be needed to determine whether similar changes are observed in different educational settings. Such research could also examine programme feasibility, attendance, student experience, and the resources required for sustained delivery.

Limitations

Several limitations should be considered when interpreting the findings. First, the study used a single-group pre-test/post-test design without a control group. Therefore, maturation, test familiarity, other physical activity, changes in routine, motivation, or differences in measurement conditions may have contributed to the observed changes. The design cannot determine how much of the pre-test/post-test difference was attributable specifically to the aerobic programme.

Second, the sample included 40 female students from one school and was selected through purposive sampling. The findings may not be generalizable to students in other schools, regions, educational systems, age groups, or to male adolescents. Third, the intervention lasted eight weeks, and no longer-term follow-up was reported. It is therefore not known whether the observed changes were maintained after the programme ended.

Fourth, the study used field-based measures. Each measure represents a specific aspect of fitness and may be affected by test technique, motivation, pacing, and measurement conditions. The six-minute walk/run test does not provide a direct laboratory

measurement of maximal oxygen uptake; the one-minute sit-up test does not measure total-body strength; the sit-and-reach test does not assess flexibility at every joint; and BMI does not directly measure body fat. Fifth, the available study information did not report a quantified heart-rate target or a formal measure of training intensity. These details would strengthen future reporting.

Finally, the study materials did not provide a formal institutional ethics approval number. The manuscript should accurately report the ethical review and consent procedures that were actually completed, including parental or guardian consent and student assent where required for participants under 18 years. These details should be verified before submission to a journal.

Recommendations For Future Research

Future research should include larger samples recruited from multiple schools to improve the diversity of participants and the generalizability of findings. Where feasible, researchers should use a control or comparison group so that changes in the intervention group can be compared with changes among students who did not receive the same programme. Random allocation, when appropriate and ethically feasible, would further strengthen the design.

Researchers should report programme intensity and attendance in greater detail. For example, future protocols may specify how intensity is monitored, how progression is determined, and how missed sessions are handled. Follow-up assessments after the intervention would help determine whether changes are maintained. Researchers may also consider additional validated measures when the aim is to assess a wider range of fitness components or body composition.

Future studies in Pakistani school settings could examine practical implementation factors, including timetable constraints, available space, teacher training, student participation, and institutional support. These factors may influence whether programmes can be delivered consistently. Research should also continue to consider the specific opportunities and barriers affecting adolescent girls' participation, as highlighted in the review by Duffey et al. (2021).

Conclusion

Following an eight-week moderate aerobic training programme, the 40 participating adolescent girls showed a decrease in mean BMI and increases in six-minute walk/run distance, one-minute sit-up repetitions, and sit-and-reach performance. All four pre-test/post-test differences were statistically significant ($p < .001$). The results indicate favourable within-group changes in the selected physical-fitness measures. However, because there was no control group and participants were recruited from one school through purposive sampling, the findings should not be interpreted as conclusive proof of causation or generalized to all adolescents. Controlled studies involving larger samples, detailed monitoring of programme delivery, and follow-up assessments are recommended.

Conflict Of Interest

The author declares no conflict of interest.

References

1. Armstrong, N., & Welsman, J. (2020). Traditional and new perspectives on youth cardiorespiratory fitness. Medicine & Science in Sports & Exercise, 52(12), 2563–2573. https://doi.org/10.1249/MSS.0000000000002418

2. Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J.-P., Chastin, S., Chou, R., et al. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. British Journal of Sports Medicine, 54(24), 1451–1462. https://doi.org/10.1136/bjsports-2020-102955

3. Centers for Disease Control and Prevention. (2024). Child and teen BMI categories. https://www.cdc.gov/bmi/child-teen-calculator/bmi-categories.html

4. Chaput, J.-P., Willumsen, J., Bull, F., Chou, R., Ekelund, U., Firth, J., Jago, R., Ortega, F. B., & Katzmarzyk, P. T. (2020). 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5–17 years: Summary of the evidence. International Journal of Behavioral Nutrition and Physical Activity, 17, Article 141. https://doi.org/10.1186/s12966-020-01037-z

5. Contardo Ayala, A. M., Parker, K., Mazzoli, E., Lander, N., Ridgers, N. D., Timperio, A., Lubans, D. R., Abbott, G., Koorts, H., & Salmon, J. (2024). Effectiveness of intervention strategies to increase adolescents' physical activity and reduce

sedentary time in secondary school settings, including factors related to implementation: A systematic review and meta-analysis. Sports Medicine–Open, 10, Article 25. https://doi.org/10.1186/s40798-024-00688-7

6. Donti, O., Konrad, A., Panidi, I., Dinas, P. C., & Bogdanis, G. C. (2022). Is there a "window of opportunity" for flexibility development in youth? A systematic review with meta-analysis. Sports Medicine–Open, 8, Article 88. https://doi.org/10.1186/s40798-022-00476-1
7. Duffey, K., Barbosa, A., Whiting, S., Mendes, R., Yordi Aguirre, I., Tcymbal, A., Abu-Omar, K., Gelius, P., & Breda, J. (2021). Barriers and facilitators of physical activity participation in adolescent girls: A systematic review of systematic reviews. Frontiers in Public Health, 9, Article 743935. https://doi.org/10.3389/fpubh.2021.743935
8. Fühner, T., Kliegl, R., Arntz, F., Kriemler, S., & Granacher, U. (2021). An update on secular trends in physical fitness of children and adolescents from 1972 to 2015: A systematic review. Sports Medicine, 51(2), 303–320. https://doi.org/10.1007/s40279-020-01373-x
9. Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1.6 million participants. The Lancet Child & Adolescent Health, 4(1), 23–35. https://doi.org/10.1016/S2352-4642(19)30323-2
10. Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. Annals of Cardiac Anaesthesia, 22(1), 67–72. https://doi.org/10.4103/aca.ACA_157_18
11. World Health Organization. (2020). WHO guidelines on physical activity and sedentary behaviour. https://www.who.int/publications/i/item/9789240015128
12. Wu, J., Yang, Y., Yu, H., Li, L., Chen, Y., & Sun, Y. (2023). Comparative effectiveness of school-based exercise interventions on physical fitness in children and adolescents: A systematic review and network meta-analysis. Frontiers in Public Health, 11, Article 1194779. https://doi.org/10.3389/fpubh.2023.1194779

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