

School Sports Participation and Physical Fitness among Public Junior and Senior High School Students in Akuapem North Municipality, Ghana: A Mixed-Methods Cross-Sectional Study

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ABSTRACT

School sports can provide structured opportunities for adolescents to be physically active, yet evidence from Ghana linking school-sports participation with objectively assessed fitness remains limited. This study examined differences in physical fitness between students who participated in organized school sports and those who did not, explored age-group variation, and examined perceived facilitators and barriers to participation in public junior and senior high schools in Akuapem North Municipality. Methods: A mixed-methods cross-sectional design was used. The quantitative sample comprised 240 students (120 sports participants and 120 non-participants) selected from five public junior high schools and three public senior high schools. Fitness indicators included the 20-metre Progressive Aerobic Cardiovascular Endurance Run, push-ups, one-minute sit-ups, sit-and-reach flexibility, and Body Mass Index. Independent-samples *t* tests and one-way analysis of variance were complemented with 95% confidence intervals and effect sizes. Semi-structured interviews with purposively selected students and Physical Education teachers explored perceived benefits, social influences, resource constraints, and participation barriers. Results: Sports participants recorded higher mean scores for the Progressive Aerobic Cardiovascular Endurance Run (mean difference = 11.27 laps, 95% confidence interval 9.74 to 12.80; Hedges *g* = 1.86), push-ups (8.40 repetitions, 95% confidence interval 7.13 to 9.67; *g* = 1.67), sit-ups (8.50 repetitions, 95% confidence interval 6.95 to 10.05; *g* = 1.39), and flexibility (4.70 cm, 95% confidence interval 3.58 to 5.82; *g* = 1.06). Mean Body Mass Index was lower among participants by 1.50 kg/m² (95% confidence interval -2.26 to -0.74; *g* = -0.50). Fitness means also differed across age groups. Qualitative findings indicated perceived physical benefits and strong peer and teacher encouragement, but also academic workload, inadequate equipment and facilities, injury concerns, and gender-related expectations.

Keywords: adolescents; physical fitness; school sports; physical education; mixed methods; Ghana; PACER

INTRODUCTION

Background and Public-Health Context

Regular physical activity during childhood and adolescence supports cardiorespiratory and muscular fitness, cardiometabolic health, bone health, cognitive functioning and mental well-being. The World Health Organization recommends that children and adolescents aged 5–17 years accumulate an average of at least 60 minutes per day of moderate-to-vigorous, mostly aerobic, physical activity across the week, with vigorous and muscle- and bone-strengthening activities incorporated regularly (World Health Organization, 2020). Schools are therefore strategically important because they can offer structured opportunities for movement through Physical Education, inter-house competitions, athletics, team sports and other co-curricular activities, including for students whose opportunities outside school may be limited.

The need for school-based opportunities is reinforced by persistent global shortfalls in adolescent physical activity. Aubert et al. (2021) found substantial variation in surveillance estimates but a consistent pattern of insufficient activity among children and adolescents, lower activity among girls and declining activity with

age. These patterns matter because physical fitness is not simply a performance outcome; cardiorespiratory and muscular fitness in youth are associated with multiple markers of current and future health (Janssen & LeBlanc, 2010; Ortega et al., 2008). School sports may therefore contribute to both educational and public-health goals when participation is regular, inclusive and supported by adequate facilities and instruction.

International intervention evidence indicates that structured school-based exercise can improve several dimensions of fitness, although effects vary by programme type, intensity and study quality. A network meta-analysis of 66 randomized and quasi-randomized studies reported improvements across cardiorespiratory fitness, muscular fitness and body-composition outcomes, with different exercise modalities producing different magnitudes of benefit (Wu et al., 2023). A more recent meta-analysis similarly concluded that school-based behavioural interventions can improve physical activity and reduce sedentary behaviour, while emphasizing heterogeneity across intervention designs (Guo et al., 2025). These findings strengthen the rationale for studying school sport, but they do not remove the need for context-specific evidence from lower-resource educational settings.

In Ghana, concerns about adolescent weight status, uneven access to physical activity opportunities and implementation challenges in Physical Education make school-level evidence especially relevant. Amponsem-Boateng et al. (2024), in a study of second-cycle students across three Ghanaian regions, documented a substantial burden of overweight and obesity and highlighted gender and dietary factors as important correlates. Earlier work has also identified implementation barriers within Ghanaian Physical Education, including teacher-related constraints and competing accountability demands for other subjects (Der, 2015; Donkor & Hormenu, 2021). The practical value of school sports therefore depends not only on the existence of programmes but also on whether students can participate consistently and whether the school environment supports meaningful physical activity.

Problem Statement and Knowledge Gap

Although Ghanaian schools include Physical Education and organized sports within the educational environment, there remains limited municipality-level evidence comparing objective field-based fitness outcomes between students who participate in school sports and those who do not. Much of the international literature demonstrates benefits from experimentally delivered exercise interventions, whereas routine school sport operates under real-world constraints such as limited equipment, academic competition for timetable space, differences in teacher support and unequal opportunities by gender or socioeconomic circumstance. Evidence from routine school settings is consequently needed to establish whether participation status is associated with meaningful differences in fitness under existing programme conditions.

The original manuscript addressed this gap but required stronger methodological precision. In particular, a cross-sectional comparison cannot establish that sports participation caused the observed differences in fitness, and several potential confounders—including age, gender, socioeconomic position, nutrition, non-school physical activity and pre-existing fitness—were not jointly controlled statistically. The present revision therefore frames the quantitative findings as unadjusted associations, reports effect sizes and confidence intervals in addition to p-values, and distinguishes variables that were tested quantitatively from contextual influences explored qualitatively. This alignment is necessary to ensure that the conclusions do not extend beyond the design and data.

Study Objective

The study aimed to examine the association between participation in organized school sports and physical fitness among students in selected public junior and senior high schools in Akuapem North Municipality, to describe variation in fitness across age groups, and to explore students' and Physical Education teachers' perceptions of the benefits, motivations and barriers that shape participation. This places particular emphasis on the magnitude and uncertainty of group differences and on integrating the quantitative and qualitative strands without treating qualitatively explored contextual factors as statistically tested moderators.

THEORETICAL AND EMPIRICAL BACKGROUND

Social Cognitive Theory

Social Cognitive Theory proposes that behaviour is shaped by reciprocal interactions among personal factors, behaviour and the environment, with self-efficacy, observational learning and social reinforcement playing central roles (Bandura, 1997). In school sports, repeated successful participation can strengthen perceived competence, while peers, coaches and teachers may provide modelling, encouragement and reinforcement. The theory is therefore useful for interpreting why students who perceive themselves as capable, observe friends participating, or receive encouragement from adults may be more willing to enter and remain in sports programmes. It also cautions against interpreting participation as a purely individual choice because perceived competence can itself be shaped by prior opportunities and feedback.

Ecological Systems Theory

Ecological Systems Theory emphasizes that adolescent behaviour is embedded within interacting social and institutional contexts (Bronfenbrenner, 1994). At the immediate level, peers, teachers, school timetables, facilities and equipment can enable or constrain participation. Family support and school-home relationships operate at interconnected levels, while broader cultural expectations—including gendered beliefs about sport, can influence which activities are viewed as appropriate or worthwhile. This perspective is consistent with qualitative evidence showing that youth physical activity is affected by access, social support and socioeconomic circumstances (Humbert et al., 2006; Trost & Loprinzi, 2011).

Health Belief Model

The Health Belief Model adds a perceptual explanation for participation by proposing that health behaviour depends partly on perceived benefits, perceived barriers, perceived susceptibility and cues to action (Rosenstock et al., 1988). Applied to school sports, students may be more willing to participate when they believe that exercise improves fitness, health, appearance or well-being and when barriers such as time pressure, fear of injury, fatigue or inadequate facilities are manageable. The model is therefore most relevant to the qualitative strand of the present study, where students described both expected benefits and practical or psychological barriers.

Synthesis of the Theoretical Perspectives

The three perspectives are complementary rather than interchangeable. Social Cognitive Theory explains learning, efficacy and social reinforcement; Ecological Systems Theory locates participation within school, family and cultural settings; and the Health Belief Model focuses on perceived benefits and barriers. Together, they provide a framework for interpreting participation-related experiences. They do not, however, justify claiming statistical moderation unless the relevant variables are measured quantitatively and tested using interaction terms. In this study, age and participation status were examined quantitatively, whereas peer influence, teacher encouragement, resource constraints, injury concerns and gender-related expectations were principally explored qualitatively.

CONCEPTUAL FRAMEWORK AND ANALYTICAL ALIGNMENT

Conceptual Framework

The revised framework distinguishes the primary quantitative exposure from contextual influences. Organized school-sports participation is treated as the principal exposure, while field-based indicators of cardiorespiratory endurance, muscular endurance, flexibility and Body Mass Index are treated as outcomes. Age is examined as a demographic correlate through age-group comparisons. Gender and school level are reported descriptively. Social and environmental influences identified in the original framework, such as peer encouragement, teacher support, school resources, motivation, injury concerns, gender beliefs and parental support, are used to interpret participation qualitatively rather than being described as statistically

confirmed moderators. Figure 1 summarizes this revised analytical structure and distinguishes the measured quantitative pathway from contextual influences examined qualitatively.

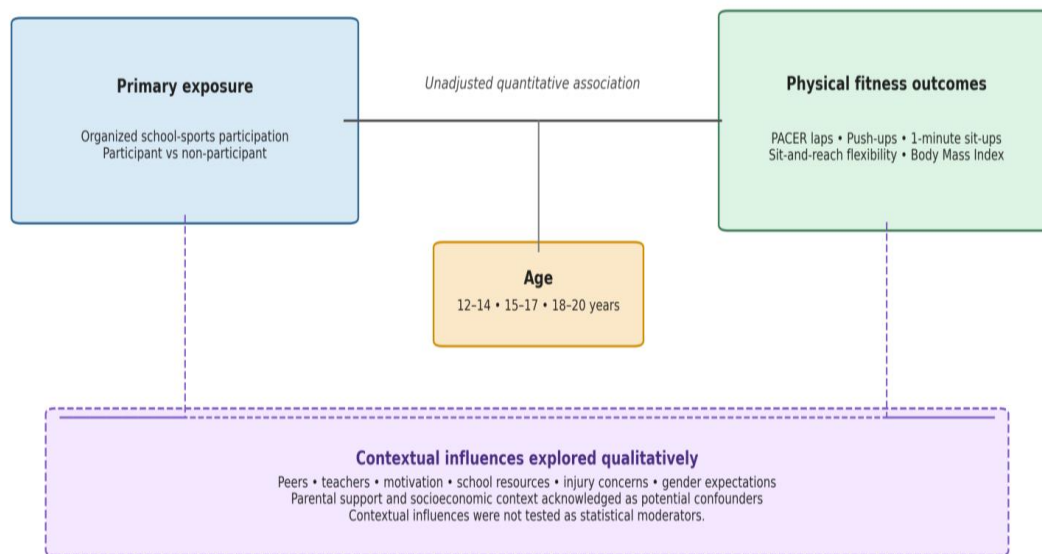


Figure 1. Revised conceptual framework and analytical alignment.

Note. The primary quantitative analysis compares organized school-sports participants with non-participants on field-based fitness outcomes. Age is examined separately as a demographic correlate. Social and environmental influences are interpreted qualitatively and are not presented as statistically tested moderators.

Table 1. Alignment of the revised conceptual framework with measured variables and analyses

Domain	Role in revised framework	Measurement in study	Analytical treatment
School-sports participation	Primary exposure	Participant versus non-participant status	Independent-samples comparisons
Physical fitness	Primary outcomes	PACER laps, push-ups, 1-minute sit-ups, sit-and-reach, BMI	Means, SDs, mean differences, 95% CIs, effect sizes
Age	Demographic correlate	12–14, 15–17, 18–20 years	One-way ANOVA with eta-squared
Gender and school level	Descriptive characteristics	Male/female; JHS/SHS	Descriptive reporting only
Peers, teachers, motivation, school resources, injury concerns, gender expectations	Contextual influences	Semi-structured interview evidence	Thematic analysis and mixed-methods interpretation
Parental support and socioeconomic context	Conceptual influences	Not independently quantified in the reported dataset	Acknowledged as potential confounders/contextual factors

Note. PACER = Progressive Aerobic Cardiovascular Endurance Run; BMI = Body Mass Index; JHS = Junior High School; SHS = Senior High School. Contextual variables are not labelled as statistical moderators because interaction effects were not tested.

Research questions

The study was guided by the following research questions:

1. Do students who participate in organized school sports differ from non-participants in cardiorespiratory endurance, muscular endurance, flexibility and Body Mass Index?
2. Do field-based fitness outcomes differ across the age groups 12–14, 15–17 and 18–20 years?
3. What benefits, motivations and barriers do students and Physical Education teachers associate with participation in school sports?
4. How do the qualitative findings help explain or qualify the quantitative differences in fitness?

MATERIALS AND METHODS

Study Design and Setting

A mixed-methods cross-sectional design was used in public junior and senior high schools in Akuapem North Municipality, Ghana. The quantitative strand used a comparative design to examine fitness differences between students who participated in organized school sports and students who did not. The qualitative strand used semi-structured interviews to explore how students and Physical Education teachers understood the benefits of school sports and the factors that enabled or constrained participation. The two strands were integrated at the interpretation stage through side-by-side comparison of statistical patterns and qualitative themes, consistent with the logic of mixed-methods complementarity (Creswell & Plano Clark, 2018).

Population, School Selection and Student Sampling

The sampling frame comprised five public Junior High Schools and three public Senior High Schools, with a combined enrolment of 4,235 students according to records from the Municipal Education Office. Schools were stratified by educational level and selected within strata. The student sample comprised 240 students: 120 who regularly participated in organized school sports and 120 who did not belong to school sports teams. The study used purposive selection at the student level to ensure representation of both participation categories. This approach supported direct group comparison but does not constitute probability sampling of individual students and therefore limits population-level generalization.

For the qualitative strand, students representing participant and non-participant perspectives and Physical Education teachers from the participating schools were purposively selected for semi-structured interviews. The source manuscript did not report the exact number of qualitative interviewees. That number, together with the allocation by student/teacher status and school level, should be inserted from the study records before final journal submission because transparent reporting of qualitative sample composition is necessary for appraisal of information adequacy and transferability.

Measures and Instruments

Cardiorespiratory endurance was assessed with the 20-metre Progressive Aerobic Cardiovascular Endurance Run. Two lines were marked 20 metres apart, and students completed repeated shuttles in time with an audio cadence that became progressively faster. A lap was counted when the student reached the required line within the prescribed signal. The test ended after the student failed to reach the line on two consecutive occasions. The total number of successfully completed shuttles was recorded, with higher scores indicating better cardiorespiratory endurance.

Muscular performance was represented by push-ups and one-minute sit-ups. Push-ups were counted when completed with correct form through the required movement range, providing a field-based indicator of upper-body muscular endurance/strength-endurance. One-minute sit-ups were used as an indicator of trunk muscular endurance, with the number of correctly completed repetitions recorded. Describing these tests as endurance-oriented measures is more consistent with repetition-based field testing than treating push-up

counts as a direct measure of maximal muscular strength.

Flexibility was assessed using the sit-and-reach test. After warm-up, students sat with the legs extended and feet placed against the sit-and-reach apparatus, reached forward in a controlled manner and held the furthest position briefly without bouncing. The furthest distance reached was recorded in centimetres; higher values indicated greater lower-back and hamstring flexibility.

Body Mass Index was calculated as body mass in kilograms divided by height in metres squared. Height was measured barefoot with a stadiometer to the nearest 0.1 cm, and weight was measured using a calibrated scale positioned on a flat, hard surface. Because the original manuscript did not document the age- and sex-specific classification standard used for students younger than 18 years, the revised inferential analysis emphasizes continuous Body Mass Index values rather than making strong claims from categorical labels. This is particularly important in a sample spanning ages 12–20 years, for whom adolescent and adult classification approaches are not identical.

A structured questionnaire collected demographic information, school level, types of sports programmes available and participation-related information. Likert-type items were piloted outside the sampled schools, and the reported internal-consistency coefficient was Cronbach's $\alpha = 0.82$. Semi-structured interview questions explored motivation for participation or non-participation, perceived benefits, barriers and suggestions for improving participation. Content relevance was reviewed by two university Physical Education lecturers, and field procedures were standardized through training of research assistants.

Data-Collection Procedure

Administrative permission was obtained from the Municipal Education Directorate and participating school heads. Students were informed about the study and participation was voluntary, with consent/guardian procedures used as applicable to age and the approved study protocol. Fitness assessments were conducted during morning sessions over a two-week period on school fields or courts. Questionnaires were administered after the fitness assessments to reduce the likelihood that questionnaire responses would influence physical-test effort. Semi-structured interviews were conducted in quiet locations, audio-recorded with permission and subsequently transcribed for analysis.

Quantitative Analysis

Quantitative data were analysed using Statistical Package for the Social Sciences, version 26. Frequencies and percentages summarized demographic characteristics, while means and standard deviations summarized fitness outcomes. Independent-samples *t* tests compared sports participants and non-participants. To strengthen interpretation beyond statistical significance, the revised analysis reports mean differences with 95% confidence intervals and Hedges' *g* standardized effect sizes. One-way analysis of variance examined unadjusted differences across the three age groups, with eta-squared reported as an omnibus effect-size estimate. Statistical significance was evaluated using a two-sided alpha level of 0.05. Graphical summaries were used to complement the tabulated estimates by displaying group means with 95% confidence intervals and standardized mean differences with 95% confidence intervals.

The inferential statistics presented in the revised results tables were calculated from the reported group means, standard deviations and sample sizes to ensure internal consistency among the descriptive statistics, test statistics, confidence intervals and effect sizes. These analyses remain unadjusted. Age, gender, school level, socioeconomic status, nutrition, non-school physical activity, baseline fitness and school-level clustering were not jointly modelled in the available analysis; accordingly, the estimates should be interpreted as group differences rather than adjusted programme effects.

Qualitative Analysis and Mixed-Methods Integration

Interview transcripts were analysed thematically using the six-phase process described by Braun and Clarke (2006): familiarization with the data, generation of initial codes, development of candidate themes, review

of themes against coded extracts and the wider dataset, definition and naming of themes, and production of an interpretive account. Coding focused on perceived physical benefits, motivation and social reinforcement, practical and psychosocial barriers, and suggestions for strengthening school sports. The analysis retained participants' language through illustrative quotations while interpreting themes in relation to the theoretical framework.

Integration occurred through a side-by-side comparison of the quantitative and qualitative findings. Convergence was identified when interview accounts of improved endurance, strength or energy corresponded with higher field-test performance among sports participants. Qualitative findings were also used for expansion: they provided plausible contextual explanations for why participation opportunities differed or why some students avoided sport despite recognizing its benefits. The qualitative strand was not used to claim causal mechanisms or statistically significant moderation.

Ethical Considerations

The study emphasized voluntary participation, the right to withdraw, confidentiality, anonymity in reporting, secure storage of research files and procedures intended to minimize physical risk during fitness testing. Administrative authorization was obtained from the relevant education authorities and school leadership. For international journal submission, the formal research-ethics committee or institutional review board name, approval status/reference number, and the precise assent/parental-consent arrangements for participants younger than 18 years must be inserted from the original study documentation; these details were not contained in the manuscript supplied for revision.

RESULTS

Participant Characteristics

The quantitative sample consisted of 240 students. Males accounted for 54.6% ($n = 131$) and females for 45.4% ($n = 109$). Junior High School students represented 40.8% ($n = 98$) of the sample and Senior High School students 59.2% ($n = 142$). The largest age group was 15–17 years (42.1%), followed by 18–20 years (33.7%) and 12–14 years (24.2%). The sports-participation comparison was balanced by design, with 120 participants and 120 non-participants.

Table 2. Demographic characteristics of the quantitative sample (N = 240)

Characteristic	Category	n	%
Gender	Male	131	54.6
	Female	109	45.4
School level	Junior High School	98	40.8
	Senior High School	142	59.2
Age	12–14 years	58	24.2
	15–17 years	101	42.1
	18–20 years	81	33.7

Note. Percentages may not sum to exactly 100 because of rounding.

Fitness Differences by School-Sports Participation

Sports participants recorded higher mean scores than non-participants on all four performance-based fitness measures. The mean difference in Progressive Aerobic Cardiovascular Endurance Run performance was 11.27 laps (95% confidence interval 9.74 to 12.80), corresponding to Hedges' $g = 1.86$. Participants also completed, on average, 8.40 more push-ups (95% confidence interval 7.13 to 9.67; $g = 1.67$) and 8.50 more

sit-ups in one minute (95% confidence interval 6.95 to 10.05; $g = 1.39$). The mean sit-and-reach difference was 4.70 cm (95% confidence interval 3.58 to 5.82; $g = 1.06$). All four comparisons had $p < .001$.

Mean Body Mass Index was 21.60 kg/m² among sports participants and 23.10 kg/m² among non-participants, a mean difference of -1.50 kg/m² (95% confidence interval -2.26 to -0.74; $p < .001$; $g = -0.50$). The negative sign indicates a lower mean Body Mass Index among participants. Because Body Mass Index does not distinguish fat mass from lean mass and because the study spans adolescence and early adulthood, the difference is reported as an anthropometric association rather than described as inherently healthier for every individual. Figure 2 displays the unadjusted group means and 95% confidence intervals for the five fitness outcomes, while Figure 3 summarizes the corresponding standardized mean differences and their 95% confidence intervals.

Table 3. Unadjusted fitness comparisons between school-sports participants and non-participants

Outcome	Participants (n=120) Mean $\pm$ SD	Non-participants (n=120) Mean $\pm$ SD	Mean difference (95% CI)	t(238)	p	Hedges g
PACER (laps)	38.42 $\pm$ 6.21	27.15 $\pm$ 5.84	11.27 (9.74, 12.80)	14.48	< .001	1.86
Push-ups (repetitions)	21.80 $\pm$ 5.30	13.40 $\pm$ 4.70	8.40 (7.13, 9.67)	12.99	< .001	1.67
Sit-ups, 1 min (repetitions)	33.10 $\pm$ 6.40	24.60 $\pm$ 5.80	8.50 (6.95, 10.05)	10.78	< .001	1.39
Sit-and-reach (cm)	27.40 $\pm$ 4.20	22.70 $\pm$ 4.60	4.70 (3.58, 5.82)	8.27	< .001	1.06
Body Mass Index (kg/m ²)	21.60 $\pm$ 2.80	23.10 $\pm$ 3.20	-1.50 (-2.26, -0.74)	-3.86	< .001	-0.5

Note. Positive mean differences favor sports participants for performance measures; the negative Body Mass Index difference indicates a lower mean among participants. Statistics were calculated from the reported means, standard deviations and equal group sizes to provide internally consistent confidence intervals and effect sizes. CI = confidence interval; PACER = Progressive Aerobic Cardiovascular Endurance Run.

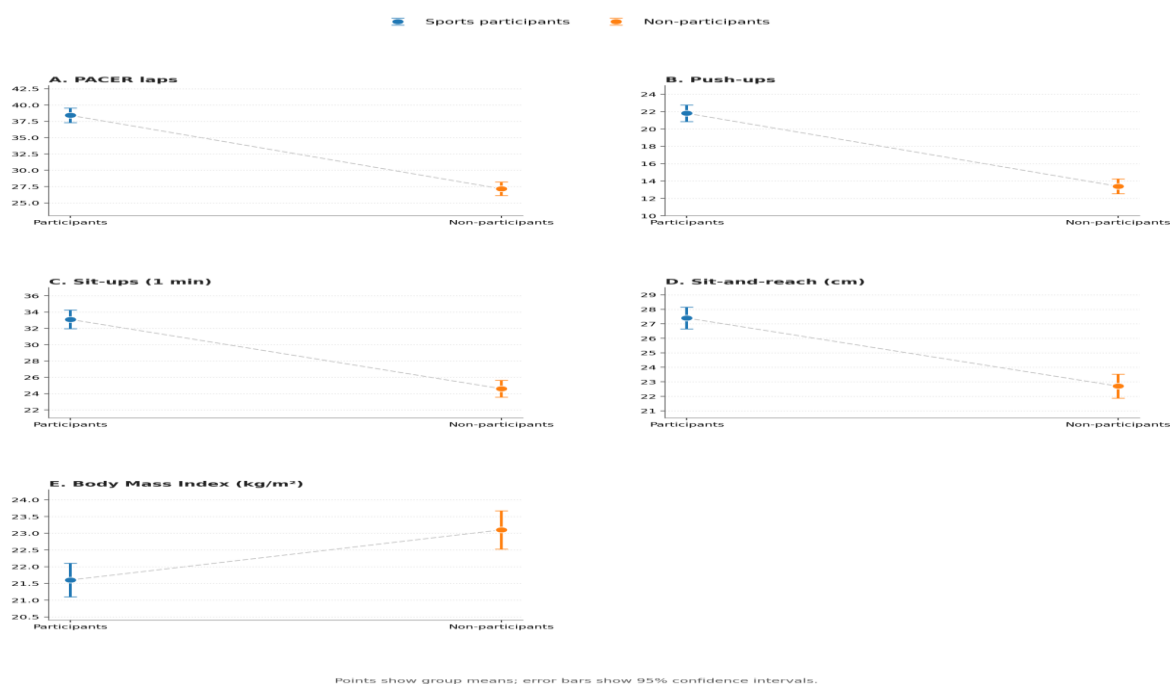


Figure 2. Unadjusted mean fitness outcomes by school-sports participation status.

Note. Points show group means and error bars show 95% confidence intervals for the means calculated from the reported summary statistics ($n = 120$ per group). The panels use outcome-specific scales; therefore, vertical distances should be interpreted within, not across, panels.

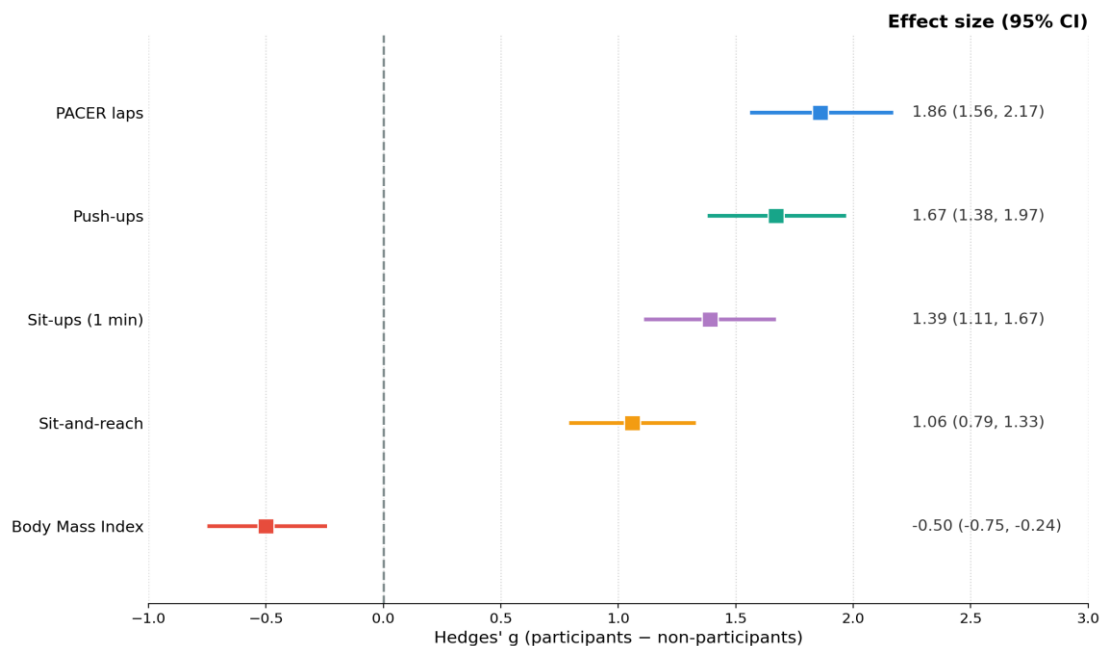


Figure 3. Standardized differences in fitness outcomes between school-sports participants and non-participants.

Note. Squares represent Hedges' g and horizontal lines represent 95% confidence intervals estimated from the reported group means, standard deviations, and sample sizes. Positive values indicate higher performance scores among sports participants; the negative Body Mass Index value indicates a lower mean Body Mass Index among participants. These are unadjusted cross-sectional differences, not causal programme effects.

Fitness Differences Across Age Groups

Descriptive means increased across the three age groups for the Progressive Aerobic Cardiovascular Endurance Run, push-ups, sit-ups, flexibility and Body Mass Index. Reconstructed one-way analyses of variance based on the reported group summary statistics indicated statistically significant omnibus age-group differences for each outcome (all $p < .001$). The largest age-associated proportion of variance among the reported measures was observed for push-ups (eta-squared = .256), followed by sit-ups (.232), Progressive Aerobic Cardiovascular Endurance Run performance (.205), flexibility (.159) and Body Mass Index (.091). These are unadjusted age-group differences and should not be interpreted as developmental effects independent of sport participation, sex, maturation or other covariates.

Table 4. Descriptive fitness statistics and unadjusted one-way analysis of variance by age group

Outcome	12–14 years ($n=58$)	15–17 years ($n=101$)	18–20 years ($n=81$)	F(2,23 7)	p	η^2
PACER (laps)	29.84 $\pm$ 5.12	33.96 $\pm$ 6.01	37.82 $\pm$ 6.44	30.51	< .001	0.205
Push-ups	15.32 $\pm$ 4.21	18.74 $\pm$ 5.03	22.91 $\pm$ 5.36	40.71	< .001	0.256
Sit-ups, 1 min	26.18 $\pm$ 5.09	30.47 $\pm$ 5.88	34.62 $\pm$ 6.22	35.87	< .001	0.232

Sit-and-reach (cm)	23.01 ± 4.38	25.64 ± 4.41	27.96 ± 4.15	22.32	< .001	0.159
Body Mass Index (kg/m ²)	21.08 ± 2.61	22.31 ± 2.94	23.54 ± 3.18	11.9	< .001	0.091

Note. ANOVA statistics and eta-squared values were calculated from the reported age-group means, standard deviations and sample sizes. Significant omnibus tests do not establish that every pair of age groups differs; post-hoc contrasts were not available in the source analysis.

Qualitative Findings

Four interrelated themes were evident in the qualitative material: perceived physical benefits; social motivation through peers and teachers; barriers to participation; and the need for better facilities and equipment. The themes help explain why participation may be attractive to some students yet difficult to sustain for others, and they also show that students' experiences of Physical Education and school sport are not uniformly positive.

Table 5. Qualitative themes and their contribution to interpretation

Theme	Illustrative evidence	Interpretation
Perceived physical benefits	"Sports make me feel fit and energetic. I don't get tired easily." (sports participant, Senior High School)	Students linked participation with endurance, energy and physical competence, consistent with perceived-benefit pathways in the Health Belief Model.
Fatigue and perceived difficulty	"During PE class, we have to run around the field at least once ... I have been skipping PE class because I don't want to die from the stress." (non-participant, Junior High School)	For some non-participants, anticipated exertion functioned as a barrier rather than a benefit, showing heterogeneity in perceived capability and risk.
Peer and teacher encouragement	"Most of my friends are in the football team, so I also joined." (sports participant, Junior High School)	Participation was socially reinforced, consistent with Social Cognitive Theory and the role of peer modelling.
Equipment and facility constraints	"We don't have enough balls or jerseys, so sometimes training is cancelled." / "There are barely enough badminton rackets ... we have to walk to another location outside the school in order to do sports."	Material shortages reduced programme consistency and convenience, illustrating the school-level constraints emphasized by Ecological Systems Theory.

Note. Quotations are retained from the source manuscript with only minimal punctuation editing for readability.

Additional barriers reported across the interviews included academic workload, fear of injury, inadequate sports fields, limited equipment, gender stereotypes and teacher-related constraints. These concerns are important because they identify mechanisms through which access to school sport can become unequal. They also qualify the quantitative comparison: higher fitness among current participants may coexist with structural conditions that selectively enable already motivated, confident or better-supported students to remain active.

Integrated Quantitative and Qualitative Findings

The two strands converged most clearly around perceived fitness benefits. Students' accounts of greater energy and endurance were consistent with the substantially higher cardiorespiratory and muscular-

performance scores observed among sports participants. At the same time, the qualitative evidence expanded the statistical findings by identifying barriers that the quantitative analysis did not measure directly, including equipment shortages, off-site access requirements, academic pressure and fear of injury. This integration supports a contextual interpretation: participation is associated with better measured fitness in the sample, but participation itself is shaped by social and environmental conditions.

DISCUSSION

School-Sports Participation and Cardiorespiratory Fitness

The largest participant–non-participant difference occurred in Progressive Aerobic Cardiovascular Endurance Run performance. Participants completed an average of 11.27 more laps, and the standardized difference was large. This pattern is consistent with the broader evidence that regular, structured school-based exercise can improve cardiorespiratory fitness. Wu et al. (2023), for example, found meaningful improvements in cardiorespiratory outcomes across school-based exercise interventions, while Guo et al. (2025) reported that school-based behavioural interventions can increase physical activity and reduce sedentary behaviour. The present study extends that literature by showing a strong association under routine school conditions in a Ghanaian municipality rather than under a researcher-delivered intervention.

The distinction between association and effect is critical. Students with greater baseline fitness, stronger motivation, more supportive peers or families, greater access to equipment, or more favourable body composition may be more likely to join and remain in school sports. Conversely, regular training may plausibly contribute to the observed fitness advantage. The cross-sectional design cannot separate these pathways. The evidence therefore supports the conclusion that participants were fitter on average at the time of measurement, not that participation alone caused the difference.

Muscular Endurance and Flexibility

Sports participants also outperformed non-participants on push-ups, one-minute sit-ups and sit-and-reach flexibility, with standardized differences ranging from approximately one to more than one and a half standard deviations. These findings are directionally consistent with evidence that school-based exercise can improve muscular fitness and mobility-related outcomes, particularly when activities provide repeated loading and movement through broad ranges of motion (Faigenbaum et al., 2009; Wu et al., 2023). Football, athletics, volleyball and similar school activities require repeated acceleration, stabilization, jumping, upper-body support and trunk control; regular exposure to these demands provides a plausible physiological basis for higher field-test performance among participants.

The terminology used to interpret the push-up test also matters. A maximum repetition count is better understood as muscular endurance or strength-endurance than as a direct measure of maximal muscular strength. Reframing the outcome in this way improves construct validity and aligns the interpretation with the field-testing procedure. The result remains substantively important: current sports participants demonstrated markedly greater capacity to sustain repeated upper-body effort than non-participants.

Body Mass Index and Weight-Related Interpretation

Sports participants had a lower mean Body Mass Index by 1.50 kg/m², a moderate standardized difference. This finding is compatible with intervention evidence showing that some forms of school-based exercise can reduce Body Mass Index or body-fat indicators (Wu et al., 2023), and it is relevant in the Ghanaian context given the reported burden of overweight and obesity among second-cycle students (Amponsem-Boateng et al., 2024). African school-based intervention evidence nevertheless shows that changes in weight status are not uniform and often depend on programme duration, intensity, nutrition and the baseline risk profile of participants (Adom et al., 2020). The Body Mass Index finding should therefore be interpreted conservatively. Body Mass Index is an indirect anthropometric index and cannot distinguish adipose tissue from lean mass. In addition, the sample spans ages 12–20 years, meaning that age- and sex-specific adolescent standards are required for younger participants while adult thresholds become relevant at older

ages. Because the original manuscript did not document the classification standard applied, the revised article avoids treating the reported category distribution as definitive evidence of “healthy” versus “unhealthy” weight and emphasizes the continuous group difference instead.

Age-Group Differences

Mean performance on all four field-based fitness tests increased across the age groups, and mean Body Mass Index also rose with age. These patterns are plausible in a cross-sectional adolescent sample because growth, maturation, body size, accumulated sport experience and age-related changes in strength can influence field-test performance. Importantly, the pattern should not be interpreted as evidence that older students are necessarily more physically active. Aubert et al. (2021) found a consistent global tendency for physical activity to decline with age even though physiological maturation may increase absolute performance on selected fitness tests. Fitness, physical activity behaviour and maturation are related but distinct constructs. The age findings also illustrate why adjusted analysis would strengthen future work. If older students were disproportionately represented among sports participants, part of the observed participant–non-participant difference could reflect age. Similar concerns apply to sex, school level, nutrition and non-school activity. A multivariable model with school-level clustering would allow the independent association between sports participation and each fitness outcome to be estimated more rigorously.

Social and Environmental Influences on Participation

The qualitative themes place the fitness differences within the realities of school participation. Peer involvement encouraged students to join teams, illustrating observational learning and social reinforcement. Teacher encouragement served as another cue to action, while perceived gains in fitness and energy strengthened the perceived-benefit side of participation. These findings align with Social Cognitive Theory and the Health Belief Model and are also consistent with prior qualitative evidence that adolescent physical activity depends on social support, perceived competence and access (Humbert et al., 2006; Trost & Loprinzi, 2011).

Barriers related to equipment, facilities and competing academic demands are especially salient in the Ghanaian educational context. Donkor and Hormenu (2021) found that inadequate Physical Education training, limited expertise, negative perceptions and accountability pressure from other subjects impeded effective Physical Education teaching in Ghanaian public schools. Der (2015) similarly documented implementation challenges in a Ghanaian Senior High School context. The present interviews add municipality-specific evidence that even when students value sport, participation can be interrupted by shortages of balls, jerseys, rackets and suitable spaces.

Gender-related expectations were also identified as a participation barrier. This is consistent with the international surveillance literature in which girls are, on average, less likely than boys to meet physical-activity recommendations (Aubert et al., 2021). The current quantitative dataset includes both male and female students but does not report sex-stratified fitness comparisons or an interaction between sex and participation. The qualitative evidence therefore justifies attention to gender equity in programme design, but it does not establish the magnitude of a gender effect in this sample.

Theoretical Interpretation and Mixed-Methods Contribution

Taken together, the findings support a layered interpretation. Social Cognitive Theory helps explain how peer participation and teacher encouragement can reinforce engagement; the Health Belief Model helps explain why perceived fitness benefits compete with perceived exertion, injury risk and time costs; and Ecological Systems Theory locates these perceptions within schools whose facilities, equipment and timetables either widen or restrict opportunities. The mixed-methods design is valuable because the fitness tests establish that participant groups differed meaningfully, while the interviews show why participation cannot be reduced to individual motivation alone. The revised conceptual framework deliberately avoids describing contextual factors as moderators because moderation is a statistical claim that requires measured interaction terms. Instead, the study provides quantitative evidence of unadjusted group differences and

qualitative evidence about contextual influences. This distinction improves analytical coherence and directly addresses the risk of overstating what the data demonstrate.

Implications for School Practice and Policy

The practical implication is not merely to offer more sport, but to make participation sufficiently regular, safe and accessible that a broad range of students can benefit. Protecting scheduled Physical Education time, maintaining usable fields and equipment, supporting teachers and coaches, and providing options beyond the most established team sports may reduce barriers for students who do not identify with football or athletics. Monitoring should include participation by sex and school level as well as simple, age-appropriate fitness indicators so that programme reach and outcomes can be assessed rather than assumed.

Policy interpretation should remain proportional to the evidence. The study provides strong local evidence that current school-sports participants have better fitness profiles on several field tests, but it does not estimate the causal effect of introducing or expanding a programme. Decisions about programme scale-up should therefore combine these findings with intervention evidence, resource feasibility and equity considerations. This is consistent with international evidence showing that school-based programmes can be effective while their impact depends on design and implementation quality (Wu et al., 2023; Guo et al., 2025).

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

Conclusion

Students who participated in organized school sports in the selected public junior and senior high schools demonstrated substantially higher cardiorespiratory endurance, muscular endurance and flexibility than non-participants, together with a lower mean Body Mass Index. The effect-size estimates indicate that the performance differences were not only statistically significant but also large for several field-based fitness outcomes. Qualitative evidence showed that students recognized physical benefits and were influenced by peers and teachers, while inadequate equipment, facility constraints, academic workload, injury concerns and gender-related expectations limited participation. These findings support the value of school sport as an important setting for adolescent physical activity, but they should be interpreted as cross-sectional associations. The data do not establish that school-sports participation caused the fitness differences because students were not randomized and several relevant confounders were not adjusted. The principal contribution of the study is therefore a context-specific, mixed-methods account showing that better measured fitness and participation in organized school sport co-occur in Akuapem North Municipality, while access to participation is shaped by social and institutional conditions.

Recommendations

Schools and education authorities should protect scheduled Physical Education and sports periods from routine substitution by other academic lessons and should provide a minimum package of functional equipment and safe activity space. Resource allocation should consider the sports actually offered and the number of students expected to participate, rather than relying only on the presence of a field or nominal programme.

Participation strategies should be inclusive. Schools should provide varied activities for students with different interests and ability levels, strengthen teacher and peer encouragement, address fear of injury through appropriate instruction and progression, and monitor whether girls and other less-represented groups have equitable access to teams, clubs and Physical Education opportunities. Future research should use longitudinal or quasi-experimental designs with baseline fitness measures and should quantify potential confounders such as sex, socioeconomic position, nutrition, out-of-school physical activity, parental support and motivation. Because students are nested within schools, multilevel modelling or cluster-robust standard errors should be considered. Adjusted models should estimate the independent association of sports participation with each fitness outcome and test theoretically justified interactions only when moderators are

directly measured.

Routine school monitoring could combine participation records with a small set of standardized fitness indicators, provided testing is age-appropriate, ethically supervised and used for programme improvement rather than stigmatization. For Body Mass Index, age- and sex-appropriate standards should be applied to minors, and categorical interpretations should be complemented by other indicators where feasible.

Limitations

The cross-sectional design is the principal limitation. Temporal order cannot be established, so the study cannot determine whether sports participation improved fitness, fitter students self-selected into sports, or both processes occurred. Purposive selection of students into participant and non-participant groups also limits population inference and may introduce selection bias. The quantitative analyses were unadjusted for several plausible confounders, including sex, school level, socioeconomic circumstances, diet, non-school physical activity, maturation and baseline fitness. Students were sampled from eight schools, yet school-level clustering was not modelled; treating all observations as statistically independent may underestimate uncertainty when students within the same school share facilities, teachers and programme environments.

Some measurement and reporting limitations also require caution. Body Mass Index is an indirect measure of body composition, and the original manuscript did not specify the age- and sex-specific classification standard used for minors. Formal assumption diagnostics for the t tests and analyses of variance were not reported. Participation status captured organized school-sport involvement but did not quantify frequency, duration, intensity or participation in physical activity outside school. For the qualitative strand, the source manuscript did not state the exact number of student and Physical Education teacher interviewees or provide a detailed account of how information adequacy was determined. The interviews nevertheless add explanatory context, but transferability would be strengthened by reporting the qualitative sample composition, school distribution and analytic reflexivity more explicitly. These details should be restored from the study records before final submission.

Declarations

Conflict of interest

The authors declare no conflict of interest.

Ethics Approval and Consent to Participate

Administrative permission was obtained from the Municipal Education Directorate and participating schools, and participation was voluntary. The final submission must state the approving institutional research-ethics committee or institutional review board and approval/reference number, together with the exact consent, assent and parental/guardian-consent procedures used for participants younger than 18 years.

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