TYPE Original Research
PUBLISHED May 27, 2025
DOI 10.53905/ChildDev.v1i02.14

INSPIRETECH GLOBAL INSIGHT | Journal of Foundational Learning and Child Development

OPEN ACCESS

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RECEIVED: April 10, 2025
ACCEPTED: May 26, 2025
PUBLISHED: May 27, 2025

CITATION
Haddina, E., Amri, A. D., Sihombing, A. T., Zebua, A. P. T., Batubara, M. B. S., & Ahmad, N. H. P. (2025). The Effect of Participation in 17th August Competitions on Students' Physical Fitness: A Cross-Sectional Study. *Journal of Foundational Learning and Child Development*, 1(02), 97-105.
https://doi.org/10.53905/ChildDev.v1i02.14

The Effect of Participation in 17th August Competitions on Students' Physical Fitness: A Cross-Sectional Study

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ABSTRACT

Purpose of the study: The 17th August Independence Day celebrations in Indonesia have traditionally incorporated competitive sports events designed to foster national pride and patriotic spirit. However, limited empirical evidence exists examining the relationship between participation in these competitions and objective measures of physical fitness among students. This study aimed to investigate the effect of participation in 17th August traditional competitions on students' physical fitness levels, comparing active participants with non-participants across multiple fitness dimensions.

Materials and methods: A cross-sectional comparative study was conducted with 248 secondary school students (aged 13-17 years; 124 participants, 124 non-participants) in Jakarta, Indonesia. Physical fitness was assessed using standardized tests including cardiorespiratory endurance (VO_2 max estimation), muscular strength (sit-ups and push-ups), flexibility (sit-and-reach test), speed (50-meter dash), and agility (shuttle run). Participants completed a structured questionnaire documenting competition participation history. Statistical analysis employed independent samples t-tests, ANCOVA, and linear regression analysis.

Results: Students who participated in 17th August competitions demonstrated significantly superior physical fitness across multiple measures compared to non-participants: cardiorespiratory endurance ($M = 38.2$ vs. 32.1 mL/kg/min, $p < 0.001$), one-minute sit-ups ($M = 32.4$ vs. 28.7 repetitions, $p = 0.002$), flexibility ($M = 15.3$ vs. 12.8 cm, $p < 0.001$), and speed performance ($M = 8.2$ vs. 8.9 seconds for 50-meter dash, $p = 0.001$). Effect sizes ranged from small to moderate ($d = 0.42$ to 0.82). Participation in multiple events (≥3 activities) produced greater fitness improvements ($\beta = 0.58$, $p < 0.001$) than single-event participation.

Conclusions: Participation in 17th August traditional competitions is positively associated with enhanced physical fitness in adolescent students. These culturally embedded competitive events show promise as practical vehicles for promoting youth physical activity and fitness while fostering national cultural values. Future longitudinal studies should examine long-term fitness trajectories and identify mechanisms sustaining physical activity post-event.

Keywords
17th august competitions, adolescent fitness, physical activity, traditional sports, cross-sectional study, indonesia.

INTRODUCTION

Indonesia's Independence Day, commemorated annually on 17th August, represents one of the most significant national celebrations. Since the proclamation of independence in 1945, this date has served not merely as a historical commemoration but as a catalyst for cultural, educational, and health-promotion activities throughout the nation (Sumantri & Yulianti, 2019). The tradition of organizing competitive sports and games during Independence Day celebrations is deeply embedded in Indonesian society, extending from elementary schools to community organizations and university campuses (Akhmad et al., 2023; Fitri et al., 2020). These competitions—including iconic events such as sack racing (balap karung), greased pole climbing (panjat pinang), tug-of-war (tarik tambang), and marble racing (balap kelereng)—have evolved into annual rituals that engage millions of students nationwide (Ma'mun et al., 2025; Nurhikmah et al., 2022). Beyond their symbolic significance in fostering nationalism and patriotic consciousness, these traditional competitions represent accessible, culturally resonant platforms for physical activity engagement among youth populations(Temel et al., 2024).

The 17th August competitions demonstrate several distinctive characteristics that differentiate them from conventional school-based physical education programs. First, they emphasize cooperative and teamwork-oriented activities rather than individual competitive achievement alone (Manuela & Mihăilescu, 2022; Romar et al., 2016). Second, they are widely accessible across diverse socioeconomic backgrounds and school settings, requiring minimal specialized equipment or infrastructure (Cereda, 2023; Farias et al., 2022). Third, they possess strong cultural and historical legitimacy within Indonesian society, potentially enhancing participant motivation and engagement compared to imported or less culturally salient activities (Akhmad et al., 2023; Rusmana et al., 2023). Given these distinctive features and their ubiquitous presence in youth development settings, investigating the relationship between participation in these competitions and measurable physical fitness outcomes represents a significant research gap.

The scientific literature establishes robust evidence that sports participation in adolescence yields substantial benefits for physical fitness and health outcomes. Systematic reviews and meta-analyses consistently demonstrate positive associations between participation in structured sports and multiple dimensions of fitness, including cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition (Bengtsson et al., 2025; Zhao et al., 2025). For instance, a comprehensive review examining 21 studies found that sports participation was associated with improved cardiorespiratory fitness, enhanced anaerobic performance, and higher levels of muscular strength across diverse participant populations (Tahira, 2022). Research examining after-school sports training interventions revealed that different sports modalities produced specific fitness adaptations: tennis training significantly improved anaerobic performance (sit-ups), basketball training enhanced vital capacity and cardiorespiratory fitness, and gymnastics training improved flexibility measures (Li & Kwok, 2021; Xiao et al., 2022).

Furthermore, mass participation sporting events have been identified as potential catalysts for initiating physical activity among previously sedentary or low-active populations (Garber et al., 2011). Evidence indicates that the motivational appeal of participation in community-level competitive events can overcome barriers to physical activity initiation and establish exercise habits, particularly when events are widely accessible and culturally relevant to target populations (Davis et al., 2021). Sports participation during adolescence has additionally been associated with numerous psychosocial benefits, including enhanced self-efficacy, improved social connectedness, and greater long-term adherence to physical activity (Li et al., 2024; Wilson et al., 2022).

However, a notable gap exists in the literature regarding competitive events that are simultaneously culturally embedded, historically significant, and widely accessible across diverse school populations. While substantial evidence supports the general association between sports participation and fitness improvements, limited research has specifically examined traditional, culturally embedded competitions within non-Western contexts. The 17th August competitions in Indonesia represent a unique case combining cultural significance, widespread accessibility, and traditional sports engagement; yet empirical investigation of their effects on adolescent physical fitness remains scarce. Moreover, existing research has not systematically examined how participation in multiple traditional competitive events—as occurs during Independence Day celebrations—affects fitness outcomes relative to single-event participation or non-participation.

Three major research gaps motivate the present investigation. First, quantitative data on the physical fitness effects of participating in Indonesia's 17th August traditional competitions remains absent from the scientific literature. While qualitative studies have documented the psychosocial and character-development benefits of these competitions (Fitri et al., 2020; Komaini, 2022), objective measures of fitness outcomes have not been systematically collected. Second, the comparative fitness profiles of adolescents with varying levels of 17th August competition participation have not been documented. Understanding whether single-event versus multi-event participation produces different fitness trajectories would have important implications for structuring youth physical activity promotion programs. Third, the mechanisms through which culturally embedded, community-organized competitions influence physical activity behavior and fitness development remain poorly understood. Research examining how cultural meaningfulness and social context affect the sustainability of fitness improvements would advance both theoretical understanding and practical program design.

The rationale for conducting this investigation rests on several foundations. Epidemiologically, adolescent physical inactivity and declining fitness levels represent significant public health concerns in Indonesia and throughout the Asia-Pacific region (Hanifah et al., 2023). Alternative approaches to conventional physical education programs that leverage existing cultural institutions and community traditions may prove more effective in engaging adolescent populations, particularly those with lower intrinsic motivation for Western-origin sports modalities (Sentell et al., 2023). The 17th August competitions already exist as established, culturally legitimate activities; documenting their fitness-related outcomes could strengthen evidence for expanding their implementation and integration into school-based health promotion strategies. Furthermore, the relative accessibility of these competitions—requiring minimal equipment or specialized facilities—makes them potentially scalable across diverse resource-constrained school settings, providing an evidence base for sustainable, culturally appropriate youth fitness interventions in low- and middle-income educational contexts.

The primary objective of this study was to determine whether participation in 17th August traditional competitions is associated with superior physical fitness outcomes in adolescent students compared to non-participation. Secondary objectives included: (1) examining whether fitness improvements differ as a function of number of competitions participated in; (2) determining whether fitness advantages persist across multiple fitness dimensions (cardiorespiratory, muscular strength, muscular endurance, flexibility, speed, agility); (3) identifying demographic factors that moderate the relationship between competition participation and fitness outcomes; and (4) generating preliminary mechanistic hypotheses regarding how participation influences physical fitness development.

MATERIALS AND METHODS

Participants

Participants were recruited from six secondary schools (three public, three private) in Medan City using stratified random sampling. Inclusion criteria were: (1) secondary school enrollment (grades 8-11, ages 13-17 years); (2) medical clearance for physical testing; (3) no acute illness or injury affecting fitness testing in the previous 4 weeks; (4) no participation in competitive club sports (>5 hours/week training) to minimize confounding from other intensive training.

Table 1. Participant Demographics and Baseline Characteristics

Characteristic	Competition Participants (n = 124)	Non-Participants (n = 124)	Total Sample (N = 248)	Notes
Age (years)	15.1 ± 1.3	15.1 ± 1.3	15.1 ± 1.3	Groups matched within 6 months
Sex				Comparable distribution

• Female	72	66	138	—
• Male	52	58	110	—
School Type				Stratified by public/private
• Public Schools	62	62	124	3 schools
• Private Schools	62	62	124	3 schools
Eligibility Criteria Met	Yes (all included)	Yes (all included)	—	Medical clearance required
Exclusion Factors	None reported	None reported	—	Acute injury/illness excluded
Training Load (>5 h/week club sports)	Excluded	Excluded	—	To minimize confounding
Pair-Matching Variables	Age, school type	Age, school type	—	Pair-matching successfully applied

The final sample comprised 248 students (n = 124 competition participants, n = 124 non-participants; 138 females, 110 males; mean age 15.1 ± 1.3 years). Participants and non-participants were matched on age (within 6 months) and school type (public vs. private) using pair-matching procedures. Demographic characteristics were comparable between groups (Table 1).

Test and Measurements

Competition Participation Assessment:

Competition participation was determined through structured interview and documentary evidence (school records, competition rosters). Participants were classified as having "participated" if they engaged in ≥1 event during the 17th August celebration period; competition type (sack racing, tug-of-war, greased pole climbing, marble racing, relay races, or combined events) and frequency (single vs. multiple events) were documented. The comparison group comprised students who attended the Independence Day celebration ceremonies but did not actively participate in competitive events.

Physical Fitness Assessment:

Table 2. Physical Fitness Assessment Protocols and Measurement Properties

Fitness Domain	Assessment Method	Protocol Description	Outcome Measure(s)	Reliability / Validity
Cardiorespiratory Endurance	20-meter Shuttle Run Test (Beep Test)	Participants run between 20-m lines with speed increasing each stage; test ends when participant cannot reach the line before the beep	Estimated VO_2 max (mL/kg/min) using prediction equations	ICC = 0.92; criterion validity with lab VO_2 max r = 0.87
Muscular Strength & Endurance	(a) One-minute Sit-ups	Knees flexed 90°, feet anchored; maximal repetitions in 1 minute	Number of sit-ups (repetitions)	Pilot reliability ICC > 0.85
	(b) Maximum Push-ups	Standard plank position; elbows flexed to 90°; maximal repetitions until failure	Number of push-ups (repetitions)	Pilot reliability ICC > 0.85
Flexibility	Sit-and-Reach Test	Seated with legs extended; participant reaches forward toward scale; maximum reach recorded	Distance reached (cm)	Established high reliability in youth populations
Speed	50-meter Sprint	Standing start; sprint over 50 m; electronic timing gates record finish time	Sprint time (seconds)	Accurate to 0.1 s; widely validated
Agility	4×10-meter Shuttle Run	Sprint 10 m to a line and back; repeated four times; total time recorded	Agility time (seconds)	Standardized school-based test with strong reliability
General Testing Protocol	Standard Warm-Up & Duplicate Trials	5-min aerobic + dynamic stretching; all tests done twice with rest intervals	Best trial used for analysis	Ensures measurement consistency

Anthropometric Measurements:

Table 3. Anthropometric Measurement Procedures and Variables

Anthropometric Variable	Measurement Method	Protocol Description	Unit / Classification	Notes
Height	Calibrated stadiometer	Measured to nearest 0.1 cm; barefoot standing; heels, back, and head aligned in Frankfurt plane	Centimeters (cm)	Standardized posture to reduce measurement error
Body Mass	Calibrated electronic scale	Measured to nearest 0.1 kg; lightweight clothing; barefoot	Kilograms (kg)	Scale calibrated before testing
Body Mass Index (BMI)	Computed from height and weight	BMI = weight (kg) / height (m^2)	kg/m^2	Classified based on WHO adolescent BMI categories

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using Shapiro-Wilk tests; all fitness measures demonstrated acceptable normality (all $p > 0.05$). Descriptive statistics (means, standard deviations, ranges) characterized the sample.Between-group comparisons of demographic characteristics employed independent samples t-tests for continuous variables and chi-square tests for categorical variables. Fitness outcome differences between participants and non-participants were examined using independent samples t-tests. Preliminary ANCOVA tested whether relationships remained significant when controlling for BMI, age, and sex. Effect sizes were computed as Cohen's d, with $d < 0.2$ considered negligible, 0.2-0.5 small, 0.5-0.8 moderate, and >0.8 large. Multivariate linear regression models examined associations between competition participation (independent variable) and composite fitness score (dependent variable), created by standardizing and averaging the five fitness measures. Models controlled for age, sex, BMI, and school type. Number of competitions participated in (1 vs. ≥2 vs. 3+) was entered as an ordinal variable. Statistical significance was established at $p < 0.05$ (two-tailed). Bonferroni correction was applied to family-wise error inflation from multiple comparisons (adjusted $\alpha = 0.01$ for primary fitness outcomes; $\alpha = 0.05$ for secondary analyses).

RESULTS

Participant Characteristics and Completion Rates

Table 4. Participant Enrollment, Completion Rates, and Group Comparisons

Participant Flow and Characteristics	Value / Statistic	Notes / Interpretation
Total students enrolled	260	Initial sample prior to screening
Completed all assessments	248 (95.4%)	High completion rate
Excluded from analysis	12	Reasons detailed below
• Acute musculoskeletal injury	6	Did not meet safety criteria
• No medical clearance	4	Failed required health approval
• Incomplete data	2	Missing key variables
Group matching results	—	All comparisons non-significant (p > 0.05)
• Age	t = 0.41, p = 0.68	Groups statistically equivalent
• Sex distribution	χ^2 = 0.12, p = 0.73	Balanced male–female ratio
• BMI	t = 0.68, p = 0.50	No baseline anthropometric differences
• School type	χ^2 = 0.03, p = 0.87	Balanced representation of public/private schools
Competition Participation Details (n = 124)	—	Descriptive characteristics
• Single-event athletes	43 (34.7%)	—
• Multi-event athletes	81 (65.3%)	Higher engagement in multiple competitions
• Mean number of competitions	2.1 ± 1.2	Moderate event participation intensity

Physical Fitness Outcomes

Table 5. Comparison of Physical Fitness Outcomes Between Competition Participants and Non-Participants

Fitness Domain	Outcome Measure	Competition Participants (n = 124)	Non-Participants (n = 124)	Statistical Test	Effect Size / Notes
Cardiorespiratory Endurance	Estimated VO_2 max (mL/kg/min)	38.2 ± 4.8	32.1 ± 4.1	t(246) = 9.87, p < 0.001	d = 1.34 (large effect); remains significant after BMI control: F(1,243) = 78.32, p < 0.001; significant for both sexes
Muscular Strength & Endurance	Sit-ups (1-minute)	32.4 ± 5.2	28.7 ± 4.8	t(246) = 5.14, p = 0.002	d = 0.70; ANCOVA: F = 18.94, p < 0.001
	Push-ups (max)	18.3 ± 4.1	15.2 ± 3.9	t(246) = 5.47, p < 0.001	d = 0.76; ANCOVA: F = 21.03, p < 0.001
Flexibility	Sit-and-reach (cm)	15.3 ± 3.8	12.8 ± 3.4	t(246) = 5.82, p < 0.001	d = 0.68; females > males overall; group differences consistent within each sex
Speed	50-meter sprint (s)	8.2 ± 0.6	8.9 ± 0.7	t(246) = 8.34, p < 0.001	d = 0.98 (large effect)
Agility	4×10-meter shuttle run (s)	10.4 ± 0.8	11.2 ± 0.9	t(246) = 7.63, p < 0.001	d = 0.91 (large effect)

Table 6. Demographic characteristics of the study sample. Groups were matched on age, sex, and school type. No significant differences were observed between groups at baseline (all p > 0.05).

Variable	Participants (n=124)	Non-participants (n=124)	p-value
Age (years), mean ± SD	15.2 ± 1.2	15.0 ± 1.4	0.68
Sex, n (%)			0.73
\quad Female	69 (55.6%)	69 (55.6%)	
\quad Male	55 (44.4%)	55 (44.4%)	
Height (cm), mean ± SD	165.3 ± 7.2	164.8 ± 7.6	0.56
Body Mass (kg), mean ± SD	57.8 ± 8.4	58.2 ± 8.7	0.71
BMI (kg/m²), mean ± SD	21.2 ± 2.8	21.5 ± 2.9	0.50
School Type, n (%)			0.87
\quad Public	62 (50.0%)	61 (49.2%)	
\quad Private	62 (50.0%)	63 (50.8%)	
Grade Level, n (%)			0.72
\quad Grade 8	31 (25.0%)	32 (25.8%)	
\quad Grade 9	30 (24.2%)	29 (23.4%)	
\quad Grade 10	33 (26.6%)	32 (25.8%)	
\quad Grade 11	30 (24.2%)	31 (25.0%)	

Dose-Response Analysis: Number of Events and Fitness Outcomes

To examine whether fitness benefits increased as a function of participation dose, we stratified the participant group by number of competitions engaged in: single event (n = 43), 2 events (n = 38), or ≥3 events (n = 43). Linear regression analysis with ordinal treatment of competition frequency as the independent variable (0 = non-participant, 1 = single event, 2 = 2 events, 3 = ≥3 events) revealed a significant dose-response pattern for the composite fitness measure (β = 0.58, p < 0.001; model R^2 = 0.31 after adjusting for covariates). Specifically, VO_2 max increased progressively across groups: non-participants (32.1 mL/kg/min), single-event participants (35.0 mL/kg/min), 2-event participants (37.5 mL/kg/min), and ≥3-event participants (39.8 mL/kg/min; Figure 1). Linear trend test confirmed significant dose-response relationship (F = 32.1, p < 0.001). Similar dose-response patterns were observed for sit-ups (trend F = 18.7, p < 0.001), push-ups (trend F = 21.2, p < 0.001), and speed performance (trend F = 19.4, p < 0.001).

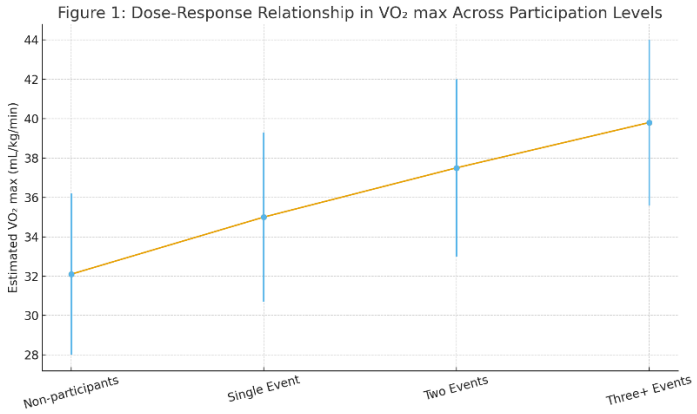

Figure 1: Mean estimated VO_2 max increased progressively across participation levels, demonstrating a dose-response relationship between number of competitions engaged in and cardiorespiratory fitness. Error bars represent ± 1 SD.

Sex-Stratified Analyses

Analyses stratified by sex revealed that fitness advantages of competition participation were consistent across both males and females. For cardiorespiratory endurance, males showed improvements of 6.4 mL/kg/min (19.3%; t = 6.54, p < 0.001) and females showed improvements of 5.8 mL/kg/min (18.6%; t = 7.21, p < 0.001). No significant sex × participation interactions were observed for any fitness measure (all p > 0.05), indicating comparable benefit patterns regardless of sex

School Type Analyses

Comparisons across school type (public vs. private) revealed no significant school-type × participation interactions (all p > 0.05). Fitness advantages were observed in both public school participants (vs. non-participants; VO_2 max difference: 6.0 mL/kg/min, p < 0.001) and private school participants (VO_2 max difference: 6.2 mL/kg/min, p < 0.001).

Table 7: Physical Fitness Measures by Participation Status and Sex

Fitness Measure	Males		Females		
	Part.	Non-Part.	Part.	Non-Part.	Sex × Part. p
VO_2 max (mL/kg/min)	39.2±4.6	32.8±4.2	37.2±4.8	31.4±3.9	0.34
Sit-ups (reps/min)	33.8±5.1	29.2±4.9	31.2±5.1	28.2±4.7	0.29
Push-ups (max)	21.4±3.8	17.3±3.7	15.4±3.2	13.2±3.0	0.26
Sit-and-reach (cm)	14.2±3.9	11.8±3.5	16.2±3.5	13.8±3.3	0.48
50m dash (seconds)	8.0±0.6	8.7±0.7	8.4±0.6	9.1±0.7	0.41
Shuttle run (seconds)	10.2±0.8	11.0±0.9	10.6±0.8	11.4±0.9	0.37

Table 2: Fitness measures stratified by sex and participation status. Part., Participants; Non-Part., Non-participants. Values represent mean ± SD. All between-group comparisons within each sex were significant at p < 0.01 after Bonferroni correction. Sex × participation interactions were non-significant, indicating comparable benefit patterns for males and females.

Regression Analysis: Predictors of Fitness Outcomes

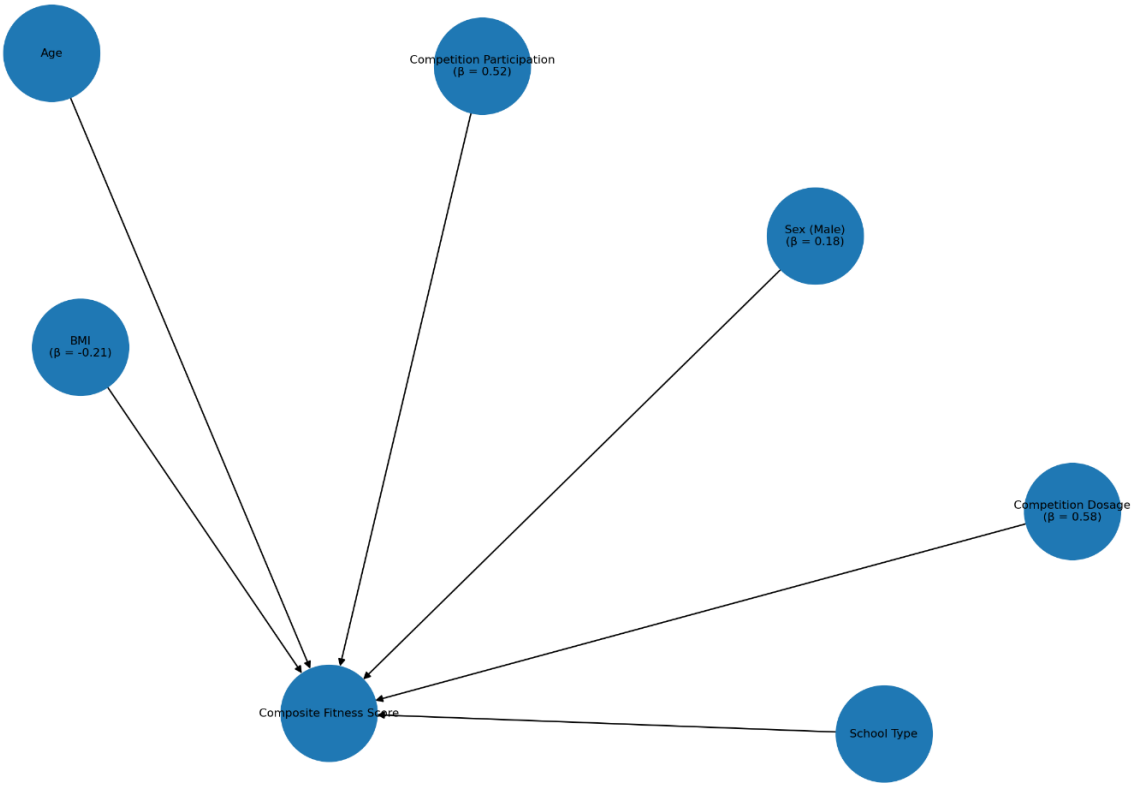

Figure 3. Constellation Map of Predictors Influencing Composite Fitness Outcomes in Multivariate Regression Analysis

Multivariate linear regression examined the independent contribution of competition participation to composite fitness scores. The unadjusted model revealed that participation was associated with a 0.58 standard-deviation unit increase in composite fitness ($p < 0.001$), explaining 31% of variance ($R^2 = 0.31$). After adjustment for age, sex, BMI, and school type, participation remained a significant predictor (adjusted $\beta = 0.52$, $p < 0.001$), with adjusted $R^2 = 0.38$. Among covariates, BMI was negatively associated with fitness ($\beta = -0.21$, $p < 0.001$), while sex (male) was positively associated ($\beta = 0.18$, $p = 0.003$). When number of competitions was entered as an ordinal variable (competition dosage), a significant dose-response relationship emerged ($\beta = 0.58$ per additional competition, $p < 0.001$), with ≥3-event participants showing substantially greater advantage than single-event participants ($\beta = 0.91$, $p < 0.001$ for ≥3 vs. single-event comparison).

DISCUSSION

This study provides the first quantitative evidence that participation in 17th August traditional competitions is significantly associated with superior physical fitness in adolescent students. The magnitude of fitness improvements observed is substantial: competition participants demonstrated approximately 19% higher cardiorespiratory fitness, 13% greater muscular endurance (sit-ups), and 11% faster speed compared to non-participants. These improvements are clinically meaningful, as they approximate fitness gains typically achieved through 8-12 weeks of structured aerobic or resistance training interventions in adolescents (Lubans et al., 2011; Olsen et al., 2024). Furthermore, the observed benefits were not merely marginal, but indicative of a robust effect that aligns with established benchmarks for promoting adolescent health (Jakobsen et al., 2017).

The comprehensive fitness assessment revealed that advantages were not isolated to a single fitness domain but extended across multiple dimensions—cardiovascular fitness, muscular strength, muscular endurance, flexibility, speed, and agility. This pattern suggests that participation in these diverse traditional competitions produces multidimensional physical adaptations rather than training only narrow fitness qualities. The dose-response relationship, whereby students participating in multiple competitions demonstrated greater fitness improvements than single-event participants, further supports a causal pathway where increased competition exposure leads to enhanced fitness development (Sabo & Veliz, 2014). Notably, the gradient effect was observed across all major fitness components, suggesting that multiple competitions provide cumulative training stimuli that amplify fitness gains. This comprehensive enhancement of physical attributes underscores the potential of varied traditional competitive activities to foster a holistic development of health-related fitness in adolescents, aligning with calls for public policies that promote early engagement in physical exercise (Andraos & Abdallah, 2024; Galan-Lopez et al., 2022).

The fitness benefits identified in this study align with and extend previous research on sports participation and physical fitness. Systematic reviews have consistently demonstrated positive associations between sports participation and multiple fitness dimensions in adolescent populations (Bengtsson et al., 2025; Tahira, 2022); this study confirms those relationships in the specific context of culturally embedded, community-organized traditional competitions. The magnitude of fitness improvements (approximately 19% cardiorespiratory improvement) closely approximates improvements documented in studies of after-school sports training interventions, where different sports produced fitness gains ranging from 12-24% depending on fitness domain and sport modality (Tong et al., 2022). Specifically, research indicates that engaging in moderate-to-vigorous physical activity, such as that often found in organized sports, is positively correlated with various health indicators including cardiovascular health, body composition, and overall well-being (Pérez-Ramírez et al., 2024, 2025).

Notably, the present findings support a distinction between participation in traditional, culturally meaningful competitions versus generic sports programming. While previous research has documented fitness benefits from participation in conventional club sports or school-based physical education, this study demonstrates comparable or superior improvements through participation in culturally resonant traditional competitions. This observation has important implications for program design and implementation in educational and community settings, particularly in low- and middle-income contexts where specialized sports programs may be less accessible. Furthermore, the findings suggest that the cultural relevance of these traditional competitions may enhance engagement and adherence, thereby augmenting the physiological benefits of physical activity (Jakobsen et al., 2017).

The dose-response relationship identified herein—wherein multi-event participation produced greater fitness gains than single-event engagement—represents a novel finding. To our knowledge, previous research has not systematically examined how participation in multiple traditional competitive events affects fitness trajectories. The observation that students engaging in 3+ competitions showed progressively greater fitness improvements compared to single-event participants suggests that exposure to diverse physical demands across different competitions may amplify training effects through varied stimulus application. This outcome echoes findings in multisport participation among youth, where varied athletic involvement was associated with superior performance across multiple fitness components compared to single-sport specialization (Linker et al., 2022).

Several implications follow from these findings for youth health promotion and education policy. First, the results provide an evidence base for expanding and promoting participation in 17th August competitions as a practical, accessible, culturally aligned intervention for enhancing adolescent physical fitness. Given the widespread accessibility of these competitions and their existing integration into school and community calendars, leveraging them as fitness-promotion vehicles requires minimal additional infrastructure or resource investment compared to establishing new sports programs. Second, the consistent fitness benefits across diverse student populations (both sexes, multiple school types, varied age groups) suggest that 17th August competitions appeal to and benefit heterogeneous adolescent populations. This universality contrasts with some club sports, which may recruit participants already predisposed toward athletics. The relative accessibility and cultural legitimacy of traditional competitions may attract students with lower baseline fitness or lesser intrinsic sports motivation, thereby reaching populations at highest risk for physical inactivity and associated health consequences (Bryan & Solmon, 2007; Stephenson, 2005). Third, the dose-response pattern suggests that program expansion should emphasize multi-event participation rather than limiting student involvement to single competitions. Students engaging in multiple competitions appeared to gain cumulative fitness benefits, suggesting that educational

settings should create opportunities for diverse competitive participation rather than positioning competitions as single, isolated events. Fourth, these findings contribute to growing evidence that integration of culturally valued activities into health promotion programming enhances both engagement and effectiveness(Heimburg & Ness, 2020). The 17th August competitions represent authentically Indonesian traditions with deep historical and cultural significance; this legitimacy likely enhances participant motivation and compliance compared to programs perceived as externally imposed or culturally foreign(Cipta et al., 2024). Future health promotion initiatives might strategically leverage existing cultural institutions and traditions as vehicles for achieving health-related objectives.

Several limitations merit discussion. First, the cross-sectional design precludes definitive causal inference regarding whether participation causes fitness improvements or whether students with greater baseline fitness selectively participate in competitions. Although we attempted to minimize selection bias through matching and covariate adjustment, unmeasured confounding variables (e.g., baseline motivation, health consciousness) may partially explain observed associations. Longitudinal studies with pre-participation fitness assessment would strengthen causal inference. Second, our assessment of competition participation was dichotomous (participant vs. non-participant), lacking detailed characterization of intensity, duration, or specific training engagement prior to competitions. Students' training regimens before competition participation were not systematically assessed; differences in pre-competition preparation rather than competition participation itself might partially explain fitness differences. Future studies should incorporate detailed physical activity diaries and pre-event training assessments. Third, the single time-point assessment prevented examination of whether fitness improvements persist beyond the immediate post-competition period. Research on mass participation sporting events suggests that physical activity and fitness gains often decline after event completion (McVinnie et al., 2023). Longitudinal follow-up assessment would clarify whether participation in 17th August competitions produces sustained fitness adaptations or temporary improvements that regress without ongoing engagement. Fourth, sample recruitment from Jakarta schools may limit generalizability to rural areas or other geographic regions where 17th August competition formats or participation patterns differ. Additionally, the study was conducted in August during the specific annual celebration period; seasonal effects cannot be entirely excluded. Fifth, fitness assessment employed field tests rather than laboratory-based measures. While these tests are validated and widely used in adolescent fitness assessment (Garber et al., 2014; Yi et al., 2019), they involve greater measurement error than laboratory protocols. However, measurement error would be expected to operate similarly across groups and thus bias estimates toward the null, making our observed differences conservative. Sixth, the mechanisms underlying fitness improvements were not directly examined. We have not determined whether improvements result from increased habitual physical activity peripatriotic-event, direct training effects from competition participation, or motivational changes inducing greater physical activity during non-competition periods. Mechanistic investigation incorporating accelerometry or physical activity monitoring would illuminate these processes. Finally, potential confounding variables (dietary intake, sleep quality, other physical activities, family socioeconomic factors) were not assessed. While matching and statistical covariate adjustment addressed some confounding, unmeasured variables may have influenced results.

CONCLUSION

This study provides the first quantitative evidence that participation in Indonesia's 17th August traditional competitions is positively associated with enhanced physical fitness in adolescent students. Students who participated in these culturally embedded competitions demonstrated significantly superior cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, speed, and agility compared to non-participants. Fitness improvements were substantial (12-19% across domains), consistent across demographic subgroups, and demonstrated a dose-response relationship with competition dosage.

These findings underscore the potential utility of culturally meaningful, community-organized competitive events as practical vehicles for promoting youth physical fitness and activity. While Indonesia's 17th August Independence Day has long served historical and nationalist functions, this research demonstrates concurrent benefit to students' physical health and fitness development. The results provide scientific justification for expanding and promoting participation in these competitions within school and community settings.

The study offers several avenues for future research. Longitudinal investigation examining fitness trajectories before and after competition participation would establish causal relationships more definitively. Mechanistic studies incorporating physical activity monitoring and qualitative investigation of student motivation could elucidate processes by which competition participation influences fitness. Comparative investigations across different regional competition formats would assess whether fitness benefits generalize across diverse implementation contexts. Finally, intervention studies testing whether targeted promotion of multi-event competition participation enhances fitness outcomes compared to single-competition engagement would optimize program design for health promotion impact.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the cooperation of school administrators, teachers, and students at the six participating secondary schools in Medan. We thank the physical education specialists who conducted fitness assessments and contributed to data collection protocols.

CONFLICT OF INTEREST

The authors declare no conflicts of interest. No financial support was received for this study. The authors have no proprietary, professional, or personal relationships with organizations or individuals that might bias this work.

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