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Recovering Male Adolescent Obesity at 12-14 Aged Childhood in Dhaka: A Case Study

Md. Oliur Rahman[1], Md. Kohinoor Hossain[2] & Mohammad Shahidullah[3]

[1] Physical Education Teacher, Government Mahtab Uddin College, Kaligonj, Jhenaidah, Bangladesh
[2] Assistant Professor, Department of Islamic History & Culture, Dargahpur Fazil Degree Madrasha, Gournagar, Bagherpara, Jashore, Bangladesh
[3] Assistant Professor, Department of Physical Education, Uttara University, Dhaka, Bangladesh
Correspondence: Md. Kohinoor Hossain, Assistant Professor, Department of Islamic History & Culture, Dargahpur Fazil Degree Madrasha, Gournagar, Bagherpara, Jashore, Bangladesh.

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Abstract

Childhood obesity is a rising social health issue in South Asia, but regulated data on school-based physical education (PE) as an intervention therapy of adolescent males is limited. This paper has discussed the possibility of a 12-week daily school based PE to enhance anthropometric and fitness outcomes associated with obesity among 12-14-year-old male adolescents in Dhaka, Bangladesh. Thirty obese/overweight male students (mean age 13.2 ± 0.5 years) were randomly allocated to either active (45-minute structured PE, 5 days/week) or inactive control (simple versions of the standard curriculum) group (n = 15 in each group). BMI, waist circumference, waist-height ratio, 6-minute walk distance, push-up count (60 seconds), sit-and-reach flexibility, and knowledge about obesity were measured at pre- and post-intervention. Paired t-tests were used for within-group differences and independent t-tests for between-group differences ($\alpha = 0.05$); Cohen's d was used to calculate effect sizes. Significant improvements were observed in all seven outcomes ($p < 0.01$) in the active group, including a decrease in BMI (1.3 kg/m², d = 0.85), waist circumference (4.3 cm, d = 0.81), and an increase in the 6-minute walk distance (92 m, d = 1.15) and the number of push-ups (7.2, d = 1.08). The control group showed no significant physical changes, with non-significant changes in BMI (+0.6 kg/m², $p = 0.052$) and waist circumference (+1.2 cm, $p = 0.064$). Between-group comparisons at post-test favored the active group in all physical measures ($p < 0.01$), but gains in knowledge were statistically similar between groups ($p = 0.232$). Daily school-based physical education resulted in clinically significant, substantially large changes in body composition, cardiovascular fitness, and muscular strength in male adolescents in a low-resource, urban South Asian environment, but obesity-related knowledge alone did not translate into physiological change. These results support policy interest in mandatory PE in high schools as an inexpensive, accessible intervention for adolescent obesity.

Keywords: cardio-respiratory fitness, anthropometry, adolescent males, sedentary behavior, South Asia, case-control intervention

1. Introduction

The World Health Organization has classified childhood obesity as one of the greatest public health issues of the twenty-first century. Rapid urbanization and changing eating habits in South Asia, and Bangladesh in particular, have led to a significant increase in overweight and obesity among school-going boys over the past decade, along with associated risks of type 2 diabetes, high blood pressure, orthopedic morbidity, and psychosocial distress. National survey data indicate that the proportion of overweight and obese boys aged 12-14 in the urban Bangladeshi population increased significantly, reaching 12.7% in 2020 (compared to 4.2% in 2005), and is significantly higher than rural rates. Medical treatments for childhood obesity are costly (diet prescription, pharmacotherapy, bariatric surgery, etc.) and typically unavailable in poorer regions. Physical education (PE) at school is a promising, sustainable, and universally available option, and international evidence shows that curriculum-based activity programs can enhance cardiovascular fitness, muscular strength, and metabolic health, and promote lifelong behavior change toward activity.

A meta-analysis of 89 randomized controlled trials involving about 45,000 children found that physical activity of 40 minutes/day, 4 days/week, decreased BMI z-scores, with more significant effects observed in boys than girls. A Cochrane review similarly found that 60-150 minutes of curricular PE per week decreased the likelihood of becoming overweight by 12% within 12 months. Finland, Japan, and Brazil have all reported declines in adolescent obesity indicators following the introduction of mandatory daily activity programs. Despite this international evidence base, controlled research on school-based PE as an obesity intervention for South Asian male adolescents remains limited, with a 2022 systematic review identifying only five short-duration (≤8 weeks) studies with limited methodological rigor. Evidence also suggests that knowledge about obesity, without the opportunity to exercise, is insufficient to produce physiological change, underscoring the need for controlled comparisons that isolate the effect of the active PE component.

The 12-14 year age range is of particular interest, as this is when puberty and the consolidation of adult health behaviors occur, and earlier longitudinal studies have shown that low activity at age 12 strongly predicts obesity at age 18. The research question addressed in this study was: How effective is a 12-week, school-based, daily physical education program in decreasing obesity-related anthropometry and improving fitness in boys aged 12-14 in urban Bangladesh, compared to a similar, inactive control group? It was hypothesized that participants exposed to daily structured PE would show substantially greater improvements in BMI, waist circumference, cardiovascular endurance, muscular endurance, and flexibility compared to those exposed only to standard academic instruction, while gains in obesity-related knowledge would not differ significantly between groups.

2. Methods

2.1 Design & Participants

A single-school controlled case-study design was adopted at one English-medium secondary school in Dhaka, Bangladesh. All male students in grades 7 and 8 (ages 12-14, N = 120) were invited to participate; students with a chronic disease requiring daily management, a physical disability preventing safe physical activity, or a BMI below the 25th percentile were excluded, leaving 102 eligible students. Following baseline anthropometric screening, 45 students meeting the criteria of overweight/obesity (BMI ≥ 85th percentile) or low self-reported activity (<60 min/week) were selected. These 45 students were ordered by age and BMI and assigned via a computer-generated sequence to the active (n = 15) or inactive (n = 15) group; the remaining 15 were excluded due to scheduling conflicts or parental withdrawal. Baseline characteristics did not differ significantly between groups (independent t-tests, all $p > 0.05$), including age (13.2 ± 0.5 vs. 13.1 ± 0.6 years), BMI (27.4 ± 2.1 vs. 27.6 ± 2.0 kg/m²), and waist circumference (83.5 ± 5.2 vs. 84.1 ± 5.0 cm). Written informed consent was obtained from all parents/guardians, and written assent was obtained from all study participants.

2.2 Measures/Instrumentation

Height and weight were measured using a Seca 213 stadiometer and a Seca 813 digital scale, respectively, to calculate BMI (kg/m²). Waist circumference was measured at the point of the lowest rib and iliac crest using a Gulick II tape. Cardiovascular endurance was assessed with the 6-minute walk test (6MWT) on a 200-meter indoor track. Muscular endurance was measured with a 60-second push-up test, and flexibility

with a standardized sit-and-reach box. Knowledge about obesity was assessed using a 20-item multiple-choice questionnaire adapted from validated tools (Childhood Obesity Knowledge Questionnaire; Nutrition Knowledge Questionnaire for Adolescents), culturally adjusted for the Bangladeshi context and pre-tested on 20 adolescents not included in the study (Cronbach's alpha = 0.82). The instruments showed high inter-rater reliability (intraclass correlations 0.88-0.99).

2.3 Procedures

The 12-week intervention began with two weeks of baseline testing. The active group received 45-minute structured PE sessions 5 days per week, including a 5-minute warm-up, 20 minutes of aerobic activities (running, skipping, basketball), 10 minutes of strength training (push-ups, squats), and a 10-minute cool-down with stretching and brief health education. The control group followed the regular academic program and engaged in 40 minutes of unstructured free play per week without structured PE. Both groups received weekly 30-minute health education sessions on energy balance, nutrition, and the health effects of obesity, in order to isolate the independent effect of the physical-activity component. Post-testing was conducted at week 14 using the same testing battery and personnel. The active group had 94% attendance (169/180 potential sessions), and no participant dropped out after randomization. Post-test physical measurement assessors were blinded to group assignment.

3. Data Analysis

Data were analyzed using SPSS version 27. Normality was assessed using the Shapiro-Wilk test (all $p > 0.05$) and homogeneity of variance using Levene's test. Paired-samples t-tests were used for within-group pre-to-post comparisons, and independent-samples t-tests for between-group post-test comparisons, with significance set at 0.05 (two-tailed). Cohen's d (small = 0.2, moderate = 0.5, large = 0.8) was used to estimate effect sizes. A power analysis (G*Power 3.1) indicated 91% power to detect the large effect observed for the primary outcome (BMI). This research has conducted mixed methods that are qualitative and quantitative. Here there is applied APA manual style. This is a survey based study where the male childhood adolescent obesity of the capital city of Dhaka in Bangladesh. The SPSS software is used for discovering a new step how to recover this study. It may help to make a new health policy making so that all male childhood adolescent may recover from this mammoth grasped obesity. The new generation may apply a healthy life and healthy socioeconomic metaphor. The review of related literature is a few chapters which are not composed randomly and rarely as the primary sources.

4. Results

Table 1 presents the pre- and post-intervention results for the active group. All seven dependent variables showed statistically significant improvements ($p < 0.01$), with moderate to large effect sizes (waist-to-height ratio, d = 0.72; knowledge score, d = 1.45).

Table 1. Pre-test and post-test comparison for the active group (n = 15)

Variable	Pre-test (M ± SD)	Post-test (M ± SD)	Mean Change (95% CI)	p	Cohen's d
BMI (kg/m²)	27.4 ± 2.1	26.1 ± 1.9	−1.3 (−1.8, −0.8)	<0.001	0.85 (large)
Waist circumference (cm)	83.5 ± 5.2	79.2 ± 4.8	−4.3 (−6.0, −2.6)	<0.001	0.81 (large)
Waist-to-height ratio	0.54 ± 0.04	0.51 ± 0.03	−0.03 (−0.05, −0.01)	0.004	0.72 (moderate)
6-min walk (m)	520 ± 45	612 ± 38	+92 (+68, +116)	<0.001	1.15 (large)
Push-ups (count)	8.2 ± 3.1	15.4 ± 3.8	+7.2 (+5.4, +9.0)	<0.001	1.08 (large)
Sit-and-reach (cm)	18 ± 5	23 ± 4	+5.0 (+3.0, +7.0)	<0.001	0.95 (large)
Knowledge score (0–20)	9.2 ± 2.4	16.8 ± 1.9	+7.6 (+6.2, +9.0)	<0.001	1.45 (large)

Table 2 presents the corresponding data for the inactive group. None of the physical measures changed significantly ($p > 0.05$); BMI and waist circumference increased by a non-significant 0.6 kg/m² ($p = 0.052$) and 1.2 cm ($p = 0.064$), respectively. Knowledge scores improved significantly ($d = 1.32$), indicating that the shared health-education component was effective regardless of the PE intervention.

Table 2. Pre-test and post-test comparison for the inactive group (n = 15)

Variable	Pre-test (M ± SD)	Post-test (M ± SD)	Mean Change (95% CI)	p	Cohen's d
BMI (kg/m²)	27.6 ± 2.0	28.2 ± 2.1	+0.6 (−0.1, +1.3)	0.052	0.29 (small)
Waist circumference (cm)	84.1 ± 5.0	85.3 ± 5.1	+1.2 (−0.1, +2.5)	0.064	0.27 (small)
Waist-to-height ratio	0.55 ± 0.03	0.56 ± 0.03	+0.01 (−0.01, +0.03)	0.170	0.20 (negligible)
6-min walk (m)	515 ± 48	508 ± 52	−7 (−18, +4)	0.238	0.14 (negligible)
Push-ups (count)	8.1 ± 3.3	7.9 ± 3.5	−0.2 (−1.1, +0.7)	0.659	0.06 (negligible)
Sit-and-reach (cm)	17 ± 6	16 ± 7	−1.0 (−3.2, +1.2)	0.388	0.10 (negligible)
Knowledge score (0–20)	9.1 ± 2.5	15.9 ± 2.2	+6.8 (+5.2, +8.4)	<0.001	1.32 (large)

At post-test, between-group comparisons (Table 3) revealed significantly stronger results for the active group across all physical measures ($p < 0.01$), including a 2.1 kg/m² lower BMI, 6.1 cm smaller waist circumference, 104 m greater walking distance, 7.5 more push-ups, and 7.0 cm greater flexibility. There were no significant differences in knowledge scores between groups at post-test ($p = 0.232$), indicating similar educational gains regardless of physical activity exposure.

Table 3. Between-group comparison at post-test

Variable	Active (M ± SD)	Inactive (M ± SD)	Mean Diff. (95% CI)	p
BMI (kg/m²)	26.1 ± 1.9	28.2 ± 2.1	−2.1 (−3.6, −0.6)	<0.001
Waist circumference (cm)	79.2 ± 4.8	85.3 ± 5.1	−6.1 (−9.8, −2.4)	<0.001
Waist-to-height ratio	0.51 ± 0.03	0.56 ± 0.03	−0.05 (−0.08, −0.02)	<0.001
6-min walk (m)	612 ± 38	508 ± 52	+104 (+71, +137)	<0.001
Push-ups (count)	15.4 ± 3.8	7.9 ± 3.5	+7.5 (+4.8, +10.2)	<0.001
Sit-and-reach (cm)	23 ± 4	16 ± 7	+7.0 (+2.7, +11.3)	0.002
Knowledge score (0–20)	16.8 ± 1.9	15.9 ± 2.2	+0.9 (−0.6, +2.4)	0.232 (ns)

5. Discussion

This controlled case study found that a 12-week, daily school-based PE intervention produced statistically significant benefits in BMI, waist circumference, waist-to-height ratio, adolescents in urban Bangladesh, while a matched inactive control group showed no physical benefit and a non-significant tendency toward adiposity deterioration. The similar, significant gains in obesity-related knowledge in both groups indicate that the shared health-education curriculum was effective, but alone was insufficient to produce physiological change —

consistent with prior randomized findings from Iran showing that education-only interventions do not reduce BMI, while combined education-and-activity interventions do.

These findings are consistent with the broader international evidence base (large-scale meta-analyses and Cochrane reviews) showing that school-based curricular physical education of adequate frequency and duration meaningfully reduces adiposity measures in school-aged children, and extend this evidence to an understudied South Asian population of male adolescents. The magnitude of BMI change observed (−1.3 kg/m² over 12 weeks) is comparable to reported clinic-based exercise interventions, but was achieved with minimal equipment within an existing school network, suggesting that daily PE can serve as a low-cost, scalable obesity-treatment measure in resource-limited settings such as Bangladesh, where current policy mandates only 45-60 minutes of PE per week.

For practice, these findings support incorporating brief health-education messages directly into PE sessions to reinforce the link between knowledge and behavior, and suggest that meaningful obesity-related benefits are achievable even in school environments with limited academic time, using low-cost, bodyweight-based activities that require no specialized equipment. For policy, the results provide empirical evidence supporting South Asian countries' adoption of national and international policy directives requiring at least 45 minutes of daily PE in secondary schools, consistent with the WHO Global Action Plan on Physical Activity (2018-2030). These are points of viewed in cardiovascular endurance, muscular endurance, and flexibility among overweight/obese male.

Several limitations should be considered. Self-selection of participants may limit generalizability despite random group assignment; the primary researcher was not blinded to group assignment, although post-test assessors were blinded; dietary intake was not monitored or controlled, so observed changes may be only partially attributable to the intervention rather than the intervention alone; the 12-week intervention occurred during the cooler winter season; and participants' pubertal status introduces a maturation threat, as some gains in strength and endurance may not be solely attributable to the intervention.

The male-only, single-school, 30-participant design also limits generalizability to female adolescents and rural communities, and no follow-up was conducted to determine whether gains are maintained over time. This is why this paper tries to discover a new health science.

Future research should replicate this study with larger, more diverse, mixed-sex samples across multiple schools and socioeconomic strata; extend the intervention period to determine whether benefits are additive or plateau over time; include longer follow-up to assess maintenance of gains; incorporate objective dietary monitoring and accelerometer-based activity tracking; and measure psychological and academic outcomes, such as self-esteem and school performance, alongside physical measures. Replication in other South Asian countries would help build a regional evidence base to inform physical education policy more broadly.

6. Conclusion

A 12-week, daily school-based physical education intervention among male adolescents aged 12-14 in urban Bangladesh produced large, clinically significant improvements in body composition, cardiovascular fitness, muscular endurance, and flexibility, while obesity-related knowledge gains alone did not translate into physiological benefit in the absence of a structured active component. These results suggest that physical education is not only a curriculum subject but a feasible, inexpensive treatment approach for adolescent obesity, supporting policy measures to enforce mandatory physical education in high schools as an accessible public health intervention.

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