Original Article

Effect of circuit training on body composition metrics among school students

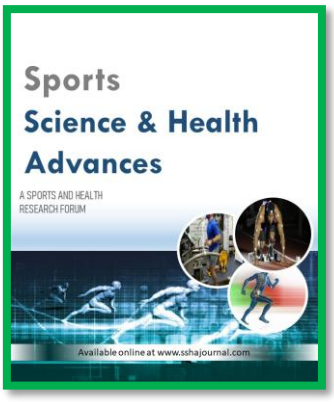
Nitesh Kumar Singh Kushwaha[1], Gajender Singh[2*], Harsh Kumar Mathur[3], Amit[4], Siddharth Sagre[5], Ravinder Pal Ahlawat[6], Jaiprakash Bhukar[7]

1,3,4,5, Research Scholar, Department of Physical Education and Sports, Central University of Haryana, India, 123031

[2]Assistant Professor, Department of Physical Education and Sports, Central University of Haryana, India, 123031

[6,7]Professor, Department of Physical Education and Sports, Central University of Haryana, India, 123031

*Correspondence: gajender@cuh.ac.in



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Abstract

Purpose: In recent times, students increasingly face problems related to being overweight, obese and under nutrition due to increasing screen time and sedentary lifestyle. The study aimed to analyze the effect of circuit training on body mass index and waist-hip ratio of school students. **Material and Methods**: An experimental research design was employed, involving 30 randomly selected students aged 10–15 years (20 boys and 10 girls). The selected group participated three days a week over a six-week circuit training intervention period. The statistical analysis was done using a paired simple t-test. **Result:** The findings of the present study reported a significant effect on body omposition metrics following the circuit training program ($p>0.05$). **Conclusion:** training for 40 minutes three times a week for 6 weeks had a significant impact on the body composition metrics of school students.

Keywords: Circuit, BMI, waist, students, training, obesity

Introduction

The rising incidence of obesity and lifestyle-related illnesses has highlighted the importance of prioritizing children's health for a healthier future (Garg, 2025). The rise in urban development, increasing reliance on technology, and shifts in eating patterns have collectively reduced physical activity levels, playing a major role in deteriorating body composition and the pearly emergence of lifestyle-related health issues (Battista et al., 2025). Recent study highlighted this concern by reporting a strong association between obesity and health-related physical fitness, indicating that individuals with reduced cardiopulmonary function are at a greater risk of cardiovascular disease compared to those with better cardiopulmonary capacity (Arena & Cahalin, 2013). Recent studies highlight a concerning rise in childhood obesity across both urban and rural regions of India, with an estimated prevalence of 19.7%, affecting approximately 14.7 million children and adolescents (Singh et al., 2023).

Physical exercise is essential for overall well-being and significantly contributes to the holistic development of school students (George et al., 2024). Among various physical activity interventions, circuit training has garnered attention as a time-efficient and versatile

modality that combines both aerobic and resistance-based components (Kumar et al., 2023). Circuit training is a structured and systematic exercise program that integrates multiple workout stations, typically ranging from 8 to 12, combining aerobic, calisthenic, flexibility, and resistance exercises performed sequentially within a designated time frame (Esan, 2018). Circuit training promotes improvements in local endurance and aerobic capacity in addition to increases in muscle size and strength system (Sonchan et al., 2017). During circuit training sessions, low training loads were employed to allow greater training volume and to effectively target key performance attributes in wrestlers, including strength, speed, power, and agility (Hermassi et al., 2019). A study conducted by Paoli et al. (2010) reported that high-intensity circuit training produced greater improvements in body composition, muscular strength, and blood lactate regulation among middle-aged adults when compared to endurance-based or low-intensity circuit workouts (Paoli et al., 2010).

Recent study revealed that consistent engagement in physical activity can lead to a reduction in body fat percentage and overall body weight, while simultaneously enhancing health-related physical fitness, particularly among obese women (Rahim & Nasrulloh, 2025). Numerous studies focus primarily on athletes or older adolescents, resulting in limited insight into its impact on younger, non-athletic students within school settings. Therefore, this study aims to assess the effect of circuit training on body composition metrics among school students.

Material and Methods

Participants

To achieve the purpose of the study, 30 school students (n=30) were recruited from a public school of Haryana, India. The participants were aged from 13 to 16 years, including 20 boys and 10 girls. Participants were provided with a verbal briefing about the study, and their written informed consent was collected before the research began.

Before and after the training, measurements of body mass index (BMI), waist circumference, and hip circumference were taken. The circuit training sessions were conducted on the school playground three times a week, initially lasting 30 minutes and progressively increasing to 40 minutes. The sessions were scheduled from 8:00 to 8:40 AM. Over the six weeks, training intensity gradually increased by adjusting the number of repetitions and sets. A researcher and an assistant coach supervised the sessions to ensure proper execution of exercises.

Training Program

The training program included a structured warm-up, exercise, and cool-down phase. Initially, each session consisted of a six-minute warm-up, 20 minutes of circuit training, and a four-minute cool-down. By the end of the intervention, the total session duration was extended to 40 minutes, comprising six minutes of warm-up exercises, 30 minutes of strength training, and four minutes of cool-down stretches. Each station had a one-minute exercise period, followed by a brief rest before rotating to the next station in a clockwise manner. During rest periods, participants engaged in light walking and breathing exercises. The training program was designed to allow sufficient muscle recovery between sessions, which were held on non-consecutive days. The six-week circuit training regimen included a variety of exercises, such as pull-ups, arm curls, sit-ups, modified push-ups, abdominal crunches, heel raises, modified dips, rowing torso exercises, and step-ups. The progressive nature of the training ensured continuous improvement in strength, endurance, and body composition among the participants.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics version 25.0. Mean and standard deviation were used to present the data. A paired t-test was employed to compare the pre-test and post-test values of the selected variables. For all statistical analysis the level of significance was set at 0.05.

Analyses and interpretation

Table 1 shows the mean, standard deviation (SD), and standard error (SE) for the BMI, waist circumference, and hip circumference measurements before and after the intervention.

Table1 Descriptive statistics of the tests

Variables	Pre-Mean	Pre SD	Post Mean	Post SD	t-value	p-value
BMI	12.79	4.57	12.41	4.44	15.06	0.000*
Waist Circumference	25.03	2.68	23.78	2.55	50.32	0.000*
Hip Circumference	30.62	3.59	29.70	3.48	45.93	0.000*

***-**significant at p<0.05.

The findings of the present study reported decreased in Body Mass Index (BMI) from a pre-test mean of 12.79 (±4.57) to a post-test mean of 12.41 (±4.44), with a t-value of 15.06 and a highly significant p-value (p = 0.000). Similarly, waist circumference showed a notable reduction from 25.03 cm (±2.68) to 23.78 cm (±2.55), supported by a t-value of 50.32 (p = 0.000). Hip circumference also decreased significantly, from 30.62 cm (±3.59) to 29.70 cm (±3.48), with a t-value of 45.93 and a p-value of 0.000. These results indicate the intervention had a statistically significant effect on all three body composition metrics.

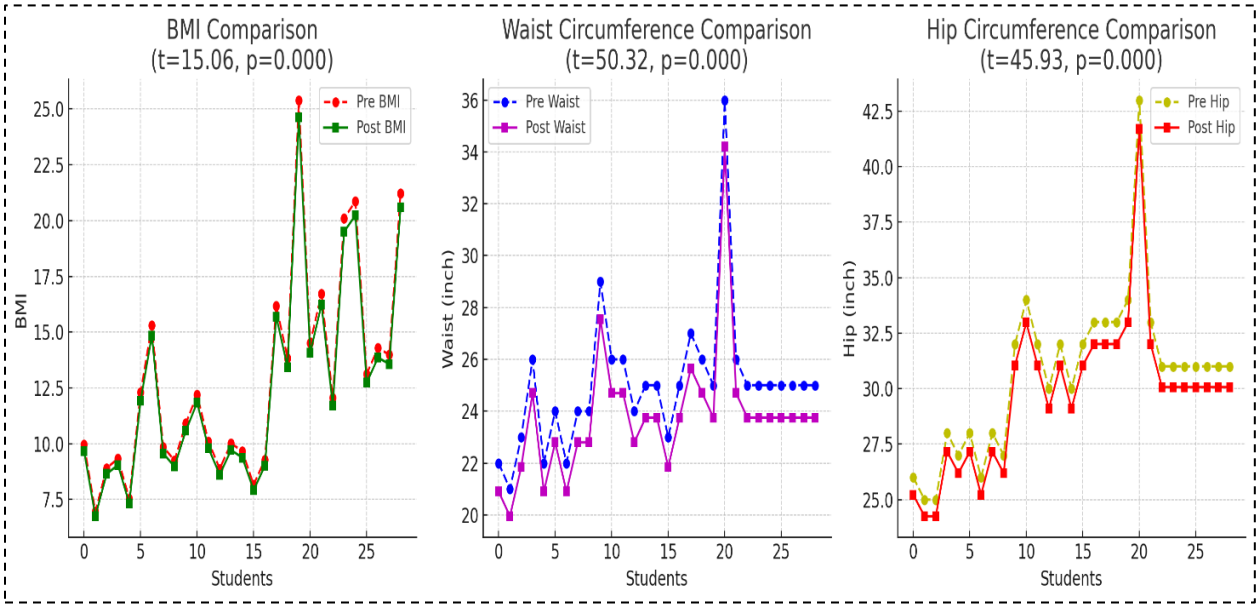

Figure1 (A) Pre- and post-assessment of BMI, waist, and hip circumference in students

This graph shows the pre- and post-test effects on waist circumference, hip ratio and BMI in students who underwent circuit training, with the training group having statistically significant greater effects on these parameters, with a p-value < 0.05.

Discussion

This research intends to examine the body composition metrics among school students after a six-week circuit training program. Circuit training has been widely recognized for improving muscular strength, endurance, and cardiovascular fitness while promoting fat loss. The findings reported a significant decrease in BMI among participants, indicating that circuit training effectively contributed to weight management and body composition changes.

Previous studies have highlighted the effectiveness of circuit training in boosting energy expenditure and metabolic rate, which aids in fat reduction (Benito et al., 2016). A study conducted on school students reported the significant improvements in BMI and improved body image perception following a 6-week strength and endurance circuit

training intervention (Plevková & Peráčková, 2019). Another study conducted on college students in Nigeria, reported significant results in the cardiovascular risk profile with improvements in waist-to-hip ratio after following a 12-week circuit strength training program (Esan, 2018). Likewise, in middle-aged individuals, high-intensity circuit training was found more beneficial than endurance exercises for lowering body weight, fat levels, and waist size (Paoli et al., 2010). Another study reported that engaging in a 12-week circuit training program resulted in substantial reductions in body weight, body fat, and BMI in obese college-aged women., while also improving physical fitness and metabolic health by decreasing waist circumference, triglyceride levels, and total cholesterol (Kim et al., 2018). Also, circuit training intervention showed positive effects on bone metabolism markers and bone mineral density in older women with osteopenia, suggesting their potential as effective strategies for the prevention and management of osteopenia and osteoporosis associated with age-related declines in bone density (K. Kim & Lee, 2019). However, an 8-week adapted circuit training regimen designed for physically less active secondary school student showed no significant change in BMI, although it did positively correlate with improved agility (Nulhasan & Mazalan, 2024).

Despite these positive findings, certain limitations must be acknowledged, including the need to examine a wider range of body composition metrics to enhance the generalizability of the results. Additionally, the small sample size (n=30) restricts the applicability of the findings to a broader population. Future research with a longer intervention period and a larger, more diverse sample is recommended to validate and extend these results.

Conclusion

In conclusion, this study reveals that circuit training consistently led to improvements in body composition metrics. Integrating such structured physical activity into school curriculums may contribute significantly to focusing childhood obesity and promoting long-term health benefits. Future studies should explore additional variables such as dietary habits, physiological variables and psychological factors influencing adherence to exercise programs.

Conflict of Interest

No conflict of Interest was declared among authors.

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ORCID

Nitesh Kumar Singh Kushwaha https://orcid.org/0009-0008-9465-6567
Gajender Singh https://orcid.org/0009-0004-0851-9103
Harsh Kumar Mathur https://orcid.org/0009-0000-9792-2201
Amit https://orcid.org/0009-0008-3034-7765
Siddharth Sagre https://orcid.org/0000-0001-6135-4687
Ravinder Pal Ahlawat https://orcid.org/0009-0007-3405-4567
Jaiprakash Bhukar https://orcid.org/0000-0002-4175-3741

References

Garg, R. K. (2025). The alarming rise of lifestyle diseases and their impact on public health: A comprehensive overview and strategies for overcoming the epidemic. Journal of Research in Medical Sciences, 30(1). https://doi.org/10.4103/jrms.jrms_54_24

Battista, F., Duregon, F., Vecchiato, M., Ermolao, A., & Neunhaeuserer, D. (2025). Sedentary lifestyle and physical inactivity: a mutual interplay with early and overt frailty. Nutrition Metabolism and Cardiovascular Diseases, 103971. https://doi.org/10.1016/j.numecd.2025.103971

Arena, R., & Cahalin, L. P. (2013). Evaluation of cardiorespiratory fitness and respiratory muscle function in the obese population. Progress in Cardiovascular Diseases, 56(4), 457–464. https://doi.org/10.1016/j.pcad.2013.08.001

Singh, S., Awasthi, S., Kapoor, V., & Mishra, P. (2023). Childhood obesity in India: A two-decade meta-analysis of prevalence and socioeconomic correlates. Clinical Epidemiology and Global Health, 23, 101390. https://doi.org/10.1016/j.cegh.2023.101390

George, M., Dhull, S., Upadhyay, K., & Srivastava, S. S. (2024). Exploring body composition metrics: Comparing percentage body fat, BMI, and body fat mass in college students. Sports Science & Health Advances, 2(1), 210–215. https://doi.org/10.60081/ssha.2.1.2024.210-215

Kumar, D., Nara, K., & Dhull, S. (2023). A comprehensive analysis of circuit training: Assessing the benefits and drawbacks for diverse fitness goals. Journal of Sports Science and Nutrition, 4(1), 190–193. https://doi.org/10.33545/27077012.2023.v4.i1c.194.

Esan, J. A. (2018). Effect of circuit strength training programme on waist-to-hip ratio of college students. Cypriot Journal of Educational Sciences, 13(3), 340–348. https://doi.org/10.18844/cjes.v13i3.936.

Sonchan, W., Moungmee, P., & Sootmongkol, A. (2017). The effects of a circuit training program on muscle strength, agility, anaerobic performance and cardiovascular endurance. World Academy of Science, Engineering and Technology, International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering, 11(4), 176–179. https://publications.waset.org/10007067/pdf

Hermassi, S., Wollny, R., Schwesig, R., Shephard, R. J., & Chelly, M. S. (2019). Effects of in-season circuit training on physical abilities in male handball players. The Journal of Strength & Conditioning Research, 33(4), 944-957.

Paoli, A., Pacelli, F., Bargossi, A. M., Marcolin, G., Guzzinati, S., Neri, M., Bianco, A., & Palma, A. (2010). Effects of three distinct protocols of fitness training on body composition, strength and blood lactate. PubMed, 50(1), 43–51. https://pubmed.ncbi.nlm.nih.gov/20308971

Rahim, A. M., & Nasrulloh, A. (2025). The synergistic effects of circuit training and diet on weight loss, body fat percentage, and BMI in obese Indonesian females: a randomized controlled trial. Deleted Journal, 3(1), 35–44. https://doi.org/10.17977/um086v3i12025p35-44

Benito, P. J., Alvarez-Sánchez, M., Díaz, V., Morencos, E., Peinado, A. B., Cupeiro, R., & Maffulli, N. (2016). Cardiovascular Fitness and Energy Expenditure Response during a Combined Aerobic and Circuit Weight Training Protocol. PLoS ONE, 11(11), e0164349. https://doi.org/10.1371/journal.pone.0164349

Plevková, L., & Peráčková, J. (2019). The effects of a 6-Week strength and endurance circuit training on body image of high school girls. Acta Facultatis Educationis Physicae Universitatis Comenianae, 59(2), 184–192. https://doi.org/10.2478/afepuc-2019-0016

Kim, J., Ko, Y., Seo, T., & Kim, Y. (2018). Effect of circuit training on body composition, physical fitness, and metabolic syndrome risk factors in obese female college students. Journal of Exercise Rehabilitation, 14(3), 460–465. https://doi.org/10.12965/jer.1836194.097

Kim, K., & Lee, H. (2019). Effects of circuit training interventions on bone metabolism markers and bone density of old women with osteopenia. Journal of Exercise Rehabilitation, 15(2), 302–307. https://doi.org/10.12965/jer.1836640.320

Nulhasan, N. A., & Mazalan, N. S. (2024). The effectiveness of circuit training on agility and body mass index among secondary school students in Putrajaya. International Journal of Social Science and Human Research, 7(05). https://doi.org/10.47191/ijsshr/v7-i05-73