

Compliance of Lifestyle Modifications among Overweight and Obese School Children Aged 7 to 12 Years: A Prospective Interventional Study

JAYALAKSHMI PABBATI¹, BANOTHU RAVI KUMAR², MANISHA REDDY MOGULLA³

ABSTRACT

Introduction: The recognition of obese and overweight children and their treatment is an important aspect of preventive paediatrics and public health, as a drastic increase in prevalence was observed globally in the past decade. The recommended initial step in the management of childhood obesity is lifestyle modification. Children spend most of their time in school; it is evident that the school environment is the ideal setting for childhood obesity intervention programmes.

Aim: To estimate the prevalence of obesity and overweight in school children aged 7-12 years, as well as their compliance with lifestyle modifications.

Materials and Methods: A prospective interventional study was conducted among 640 school children of five schools located in the five-kilometre radius of the Gandhi Medical College, Telangana, India over a period of 18 months from September 2022 to March 2024. The Student's paired t-test was used to compare the inter group variation in the mean value of Body Mass Index (BMI), time spent on physical activity and sedentary behaviour per day. The Chi-square test was used to

assess the categorical variables, such as number of episodes of the skipping of the breakfast and intake of junk/excess caloric intake in a week. Statistical significance was taken with a p-value of <0.05.

Results: Out of the 640 students screened, 148 (23.13%) were identified as obese and overweight. Among 148 students, 72 were overweight (11.25%), while 76 (11.88%) students were obese. The majority of overweight children were within the age category of seven to eight years, whereas children with obesity were predominantly observed in the 11 to 12 years age group. The present study revealed a higher female predominance, accounting for 86 (58.11%) in overweight and obese children. Following the lifestyle modifications, the average BMI for these children was reduced from 25.98 kg/m² to 20.67 kg/m², with the p-value of <0.001. Compliance to the lifestyle modification was observed in 123 (83.11%) overweight and obese children, while the dropout rate was seen in 25 (16.89%) children.

Conclusion: Lifestyle modifications effectively reduced obesity rates in children. High compliance rates indicate the potential for successful long-term lifestyle changes in children.

Keywords: Body mass index, Food habits, Malnutrition, Paediatric obesity, Physical activity

INTRODUCTION

The prevalence of childhood overweight and obesity is increasing drastically in both developing and developed countries in the past few decades [1,2]. According to a 2022 global analysis, the prevalence of childhood obesity increases from 8% in 1990 to 20% in 2022, with similar increases for males (21%) and girls (19%) [3]. The nutrition transition in developing nations is associated with changes in eating habits, a decrease in physical activity, and an increase in the prevalence of obesity [4]. Among Indian children, overweight prevalence ranges from 9% to 27.5%, whereas obesity prevalence ranges from 1% to 12.9% [5]. A study from Hyderabad in 2019 from affluent school of class 4-10, showed the prevalence of overweight and obesity was 35.84% and 24.63%, respectively [6]. The consequence of childhood obesity is its persistence into adulthood with all its adverse health outcomes include cardiovascular diseases, diabetes, osteoarthritis, gallbladder disease, and some sex hormone-sensitive cancers [7]. Additionally, it affects mental health in terms of poor psychological and emotional health, increased stress, depressive symptoms, and low self-esteem [8].

The gold standard technique to measure body composition is Dual-Energy X-ray Absorptiometry (DEXA). It cannot be used routinely because of its expensive nature and difficult to implement in practice. The most commonly used tool for screening and diagnosing obesity in clinical practice is BMI because it is easy

to use and inexpensive. It correlates well with direct measures of body fat, including skinfold thickness measurements, bioelectrical impedance, densitometry, and DEXA [8]. BMI is also used to assess the response to individualised treatment or public health measures over a period of time [9]. According to the Centre for Disease Control (CDC), BMI cut-offs to define overweight and obesity in 5-18-year-old children are $\geq 85^{\text{th}}$ percentile for overweight and $\geq 95^{\text{th}}$ percentile for obesity for age and sex [10]. The World Health Organisation (WHO) applies an alternative method that uses Standard Deviations (SD) or Z-scores instead of percentiles. According to this, being overweight is categorised as $>+1$ SD (BMI values of 25.4 kg/m² for males and 25.0 kg/m² for females at 19-year-old) and obesity is categorised as $>+2$ SD (BMI value of 29.7 kg/m² for both genders at 19-year-old) [11].

The International Obesity Task Force (IOTF) and WHO have suggested lower cut-offs to define overweight and obesity in Asians, as the Asian population is well-known to have more adiposity and also tends to have increased cardio-metabolic risk at lower BMI [12,13]. As per the Indian Academy of Paediatrics (IAP) revised BMI charts for 5-18-year-old Indian children, the 23 and 27 adult equivalent cut-offs indicate overweight and obesity respectively and these cut-offs are very close to WHO and IOTF suggested cut-offs for both sexes [9]. A clinical practice recommendation from the Endocrine Society, advises physicians to prescribe and encourage extensive, age-appropriate, culturally aware, family-centered lifestyle

changes (dietary, behavioural, and physical activity) to encourage BMI reduction [14].

The school environment is an ideal setting for childhood obesity intervention programmes as children spend a large part of their day in the school. Hence, the present study was undertaken with an aim to estimate the prevalence of obesity and overweight in 7-12-year-old school children and their compliance to lifestyle modifications.

MATERIALS AND METHODS

A prospective interventional study was done between September 2022 and March 2024 involving school children across five randomly selected schools within the five kilometre radius of the Gandhi Medical College and its attached tertiary care teaching. Study was commenced after obtaining approval from institute ethical committee (IEC/GMC/2022/11/13).

Inclusion criteria: Children aged between 7 and 12 years who were present when the study commenced and parents or guardians of the children, who were willing to participate were included in the study.

Exclusion criteria: Children who were less than seven years and more than 12-year-old, children with pre-existing medical or surgical illness, children who were absent on the day of study and children with parents or guardians not willing to give informed consent were excluded from the study.

Sample size: Taking the prevalence of compliance for lifestyle modifications for obesity as 75% [15], 95% confidence interval, 80% power of the study and absolute error of 3.5%.

Sample size is calculated as follows: $N = Z^2PQ/L^2$

Where, Z is constant (1.96), P=75%, Q= 100-P = 25, L = 3.5

On substituting these values,

$N = 1.96^2 \times 75 \times 25 / 3.5^2 = 7203 / 12.25 = 588 + 10\% \text{ (attrition)} = 646$ rounded off to 640.

Among the five schools, a total of 128 students from each school were selected randomly. Within each school, a selection of 26 students from grade 2 to 6 was made using random digits produced from the attendance register to guarantee an equitable representation of students from all schools.

Study Procedure

After obtaining the written consent, a detailed history was taken, a systemic examination was done, and it was recorded in a predesigned structured proforma. Height measured to the nearest 0.1 cm; weight recorded to the nearest 100 grams. Children were classified based on the revised IAP BMI growth charts for 5-18-year-old Indian children [16].

Parents were also interviewed separately regarding the diet, exercise, and presence of any symptom to identify the co-morbid conditions (if any). Specific information regarding sedentary behaviour (hours/day), exercise (hours/day), and eating habits like skipping breakfast and excess intake of junk foods were looked into. A structured pretested questionnaire was prepared. It consisted of two parts, part A and part B.

Part A contains a total of 22 questions to know the demographic data, co-morbid conditions, dietary habits, anthropometry and systemic examination of the child. The questionnaire of the 640 participants was screened and segregated participants based on BMI as overweight/ obese and normal weight.

Part B questionnaire was given to parents of child with overweight and obesity after initial screening and at the end of the study. It consists of 17 questions. Out of 17 questions, nine questions for knowing demographic data and BMI. Remaining eight questions, four questions were close ended questions, two questions were open ended and remaining two were close and open ended

questions, mainly to assess dietary habits, physical activity and Sedentary behaviour. It was developed based on 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5-17 years and screen time guidelines by Chaput JP et al., and Gupta P et al., study [17,18]. Dietary habits questions were prepared to assess unhealthy food habits. The Part B questionnaire was given to children and instructed to submit filled copy by their parents in the next day morning to the health educator.

A formal counselling was delivered by a researcher to overweight and obese children and parents about lifestyle modification. That include: (1) Dietary counselling focusing on reducing junk food intake to ≤ 1 time/week, avoiding skipping breakfast, and encouraging daily fruits and vegetables intake; (2) Physical activity target of at least an average 60 minutes/day of moderate to vigorous activity; vigorous-intensity aerobic activity (3) Behavioural modification including limiting screen time to < 2 hours/day for period of one hour with oral presentation and face to face interactions. Total three formal counselling sessions were done, one at the beginning of the study to the both the parents and children. The other two sessions after six months of initial session with an interval of six months between each session to the children mainly by a health educator.

Each session was planned for one hour, focusing mainly on physical activity and sedentary behaviour guidelines given by WHO and dietary habits to motivate and correct them if they were deviating from the planned intervention. Children who missed the counselling sessions were called for counselling on another day and instructed to submit the questionnaire. Compliance with lifestyle modification was acknowledged with a reduction in the BMI at the end of 18 months when compared to the initial BMI of the study. BMI was measured by researcher at the end of study period with blinding of baselines values and compliance with lifestyle modification was calculated based on improvement in BMI at the end of the study period.

STATISTICAL ANALYSIS

Data was analysed using Epi Info 7.2.0. Descriptive and inferential statistical analysis was used in the present study. Results on continuous measurements were presented as Mean $\pm$ SD (Min-Max) and results on categorical measurements were presented in Number (%). Student's paired t-test was used to compare inter group in the mean values of BMI; time spent on physical activity and sedentary behaviour per day. Chi-square test was used to assess the significance for categorical variables, such as number of episode of skipping of breakfast and intake of junk/excess caloric intake in a week. Significance was assessed at 5% level of significance.

RESULTS

The research sample featured a variety of demographics, encompassing age, gender, and family origin. Within the group of 640 participants, 149 (23.28%) were 10-year-old, followed by 133 (20.78%) were nine-year-old, 131 (20.47%) at the age of seven, and 108 (16.88%) were eight-year-old. Regarding gender 373 (58.28%) were male, while 267 (41.72%) were female. Concerning religious affiliation within the study group, 504 (78.75%) identified as Hindu, with 136 (21.25%) being Muslim. When looking at family structure, 294 (45.94%) were from nuclear families, 202 (31.56%) were from three-generation families, and 144 (22.5%) were from joint families. Among the study population, 573 (89.53%) were living together with their parents, and 67 (10.47%) of the students resided with a single parent. Concerning eating behaviours, 589 (92.03%) were consuming a variety of foods, and merely 51 (7.97%) identified as vegetarians [Table/Fig-1].

Within the subset of 148 children who were either overweight or obese, the majority of those who were overweight fell within the age category of seven to eight years, whereas cases of obesity

Variable		n (%)
Age (years)	7	131 (20.47)
	8	108 (16.88)
	9	133 (20.78)
	10	149 (23.28)
	11	66 (10.31)
	12	53 (8.28)
Gender	Male	373 (58.28)
	Female	267 (41.72)
Religion	Hindu	504 (78.75)
	Muslim	136 (21.25)
Type of family	Nuclear	294 (45.94)
	Joint	144 (22.5)
	Three generation	202 (31.56)
Marital status of Parents/ guardians	Married	573 (89.53)
	Single (divorced/widowed/separated)	67 (10.47)
Dietary habits	Mixed	589 (92.03)
	Vegetarian	51 (7.97)
Study population as per revised IAP BMI growth charts		
<3 rd percentile	Thinness	169 (26.40)
3 rd - 23 rd adult equivalent	Normal	323 (50.47)
23 rd - 27 th adult equivalent	Over weight	72 (11.25)
> 27 th adult equivalent	Obese	76 (11.88)

[Table/Fig-1]: Showing the demographic characters of study population.

were predominantly observed in children aged 11 to 12 years. The female predominance 86 (58.11%) was noted in the overweight and obese students [Table/Fig-2].

Variable	Total number of children (%) n=148	Number of children with overweight (%)	Number of children with obesity (%)
Age group in years			
7-8	59 (39.86)	32 (54.24)	27 (45.76)
9-10	56 (37.84)	29 (51.79)	27 (48.21)
11-12	33 (22.30)	11 (33.33)	22 (66.67)
Gender			
Male	62 (41.89)	33 (53.23)	29 (46.77)
Female	86 (58.11)	39 (45.35)	47 (54.65)

[Table/Fig-2]: Distribution of children with overweight and obesity according to age and gender.

Among 148 children classified as overweight or obese, 102 (68.92%) were engaged in outdoor activities, while 46 (31.08%) did not participate in outdoor games after school hours. Regarding screen time, 139 (93.92%) of the 148 children spent time on screens, whereas only 9 (6.08%) children were not involved in screen viewing.

In terms of physical activity and sedentary behaviour, the average time spent exercising rose sharply from 1.15 hours per day to 2.98 hours per day, with a p-value of <0.001, and the mean duration of sedentary behaviour was significantly reduced from 6.75 hours per day to 4.21 hours per day with a p-value of <0.001. A total of 148 children classified as overweight and obese underwent changes in their lifestyle. Following these modifications, the average BMI for these children reduced from 25.98 kg/m² to 20.67 kg/m², and the p-value (<0.001) was statistically significant [Table/Fig-3].

As per the parents, almost all parents encouraged their children to eat healthy diet and do exercise. Among 148, 132 (89.19%) children followed lifestyle advice given in counselling sessions while 16 (10.81%) did not follow.

Variables		Mean±Standard Deviation	p-value*
Exercise (hours/day)	Preintervention	1.15±0.85	<0.001
	Postintervention	2.98±0.98	
Sedentary Behaviour (hours/day)	Preintervention	6.75±0.97	<0.001
	Postintervention	4.21±1.24	
BMI change with lifestyle modification	Preintervention	25.98±2.89	<0.001
	Postintervention	20.67±1.98	

[Table/Fig-3]: Showing the changes in exercise (hour/day) and sedentary behaviour of the overweight and obese children (n=148).

*Student's Paired t-test was used to compare the pre and post intervention changes of BMI mean value, time spent on physical activity and sedentary behaviour per day; p-value: Significant

In the study group, the average number of junk food or excess calorie intake episodes remarkably decreased from 3.65 to 0.98, with a p-value of less than 0.001. Additionally, there was a notable reduction (p-value <0.001) in the percentage of children who were skipping breakfast [Table/Fig-4]. Out of the 148 children classified as overweight or obese, adherence to the lifestyle modification was observed in 123 (83.11%), while the dropout was seen in 25 (16.89%) children [Table/Fig-5].

Diet modifications	Preintervention	Postintervention	p-value*
No. of episodes of junk/ excess calorie intake mean ± SD	3.65±1.45	0.98±0.76	<0.001
No. of episodes of skipping Breakfast (%)	92/148 (62.16%)	21/148 (14.19%)	<0.001

[Table/Fig-4]: Showing the changes in the dietary habits of the overweight and obese children (n=148).

*Chi-square test was used to compare the pre and post intervention changes in number of episode of skipping of breakfast and intake of junk/excess caloric intake in a week, p-value: Significant

Compliance	n (%)
Present	123 (83.11)
Absent	25 (16.89)
Total	148 (100)

[Table/Fig-5]: Showing the lifestyle compliance of overweight and obese children (n=148).

DISCUSSION

The primary aim of the present study was to assess the burden of overweight and obesity and their compliance with lifestyle modifications among the school children aged 7-12 years. Lifestyle modifications were executed with the support of parents and health educators for overweight and obese children in the school.

Prevalence of overweight and obesity: The study found that among school-aged children, 11.25% were overweight and 11.88% were obese. The current study's results closely matched the meta-analysis performed by Singh S et al., in which the pooled prevalence of childhood obesity was estimated to be 8.4% and the prevalence of childhood overweight was 12.4% among children aged 2 to 18 [19].

There was a notable difference in the prevalence of child obesity between urban and rural regions in India. The pooled estimate of the prevalence was higher in urban areas (9.0%) than in rural ones (4.0%) [20]. According to the cross-sectional research undertaken in 2018, the students in classes 4-10 at a prestigious school in Hyderabad had an obesity and overweight rate of 24.6% and 35.8%, respectively [6]. The varying prevalence of obesity and overweight in the same urban area may be due to the diverse demographics of the study participants in the current research.

The lifestyle change was evaluated among youngsters between the ages of 7 and 12 in the current study. Different age groups of kids were included in several studies. For example, the Zorba ER et al., research looked at school children between the ages of 10 and 12, while Park JH et al. conducted a study among 12 and 13-year-

old school children to evaluate exercise training among overweight and obese children [21,22]. Regarding gender, the overweight and obese children showed a female predominance and the findings were similar to study done by Chandra N et al., [6].

Life style modification: In addition to exercise and diet, lifestyle interventions also include at least one other element, such as counselling, education, or daily instructions [23]. The lifestyle changes given to overweight and obese children in the current study included skipping breakfast, lowering their consumption of unhealthy foods, engaging in physical activity and exercise, and receiving parental counselling. Over the course of 18 months, the average BMI of overweight and obese children decreased from 25.98 kg/m² to 20.67 kg/m² as a result.

Similarly, a meta-analysis of 44 randomised controlled studies found that behavioural, dietary, and physical activity therapies can be helpful in treating and preventing obesity and related morbidity in adolescents aged 12-17 years [24]. Likewise, a meta-analysis by Mead E et al., in the age range of 6 to 11 years found that multi-component behaviour-changing interventions that include diet, physical activity, and behaviour change may be helpful in achieving modest weight, BMI, and BMI z-score reductions in the near term [25]. Compared to no intervention, a network meta-analysis on the efficacy of different treatments, such as diet with parents (D w/P), exercise without parents (E w/o P), and diet, exercise, and lifestyle with parents (D+E+L w/P), demonstrated a substantial impact on obese children between the ages of six and twelve [23].

Reduction in BMI and/or BMI z-score was noted in studies lasting at least one year [24-27]. Verduci E et al., conducted a study in 85 children of age more than six years to evaluate the effect of a one-year intervention, based on a norm caloric diet and physical activity, on BMI, blood lipid profile, glucose metabolism, and metabolic syndrome. Children's mean BMI z-score, triglycerides, and triglyceride glucose index all decreased at the conclusion of the intervention, while their HDL cholesterol increased [26]. Similarly, a multidisciplinary team evaluated 230 children aged 7 to 17 who were sent to a paediatric outpatient hospital for year-long interventional research. They were counselled regarding diet and physical activity during biannual clinic visits along with the family members. In between the hospital visits, appointments were made to meet the public health nurse at maternal and child health facilities or at nearby schools. In the analyses, the mean (SD) BMI z-score was reduced from 2.18 (0.30) to 2.05 (0.39) (p-value<0.001) in the group as a whole, and improvement in several cardiovascular risk factors was also noted [27].

The present study, done over an 18-month period, showed a significant decline in mean BMI among the study population. A systematic review on the impact of lifestyle intervention suggests that a longer duration of intervention is more associated with a decrease in BMI [28].

Compliance of lifestyle modifications: In the current study, the dropout rate was 16.89%, and the compliance for the lifestyle modification was 83.11%. Hassan H et al., conducted a study among 121 children to determine the factors associated with dropout and compliance of a multidisciplinary weight-loss program in Socially Deprived Areas (SDA) among the 121 children [29]. Forty-one (33.9%) of the participants left the program, while sixty-eight (56.2%) followed its guidelines. Children of parents who are overweight had a much lower risk of quitting the intervention than the children of normal weight parents. In another study, it was found that 75% of obese adolescents adhered to long-term, multidisciplinary lifestyle therapy [15].

Limitation(s)

The participants chosen for the research specifically consisted of students from city regions, thus the rates of prevalence might not be applicable to all children in the community. The research was constrained by the reliance on participants' self-reported information

regarding dietary habits and changes in physical inactivity. Standardised approaches and objective measurement tools for evaluating levels of physical exercise and dietary adjustments would have enhanced the study. Variations in BMI should have been noted at consistent intervals throughout the research duration and correlated with the degree of obesity.

CONCLUSION(S)

The study concluded that lifestyle modifications effectively reduced obesity rates in children. High compliance rates indicate the potential for successful long-term lifestyle changes in children. Educating children and/or their parents regarding healthy dietary behaviours, accompanied by a supportive environment in the institution, is essential in accomplishing long-term healthy lifestyle changes.

Research with a structured design that includes physical education instructors to involve obese and overweight children in daily exercise under supervision, encouraging classes at least once a week for all children, and the participation of parents are essential in future studies to enhance the effectiveness of interventions and may assist children in developing a healthy lifestyle.

Acknowledgement

Authors would like to thank all the Principals of the schools, health educator and parents of the study participants.

REFERENCES

- [1] Chinn S, Rona RJ. Prevalence and trends in overweight and obesity in three cross sectional studies of British Children, 1974-94. *BMJ*. 2001;322(7277):24-26.
- [2] Martorell R, Khan LK, Hughes ML, Grummer-Strawn LM. Overweight and obesity in preschool children from developing countries. *Int J Obes Relat Metab Disord*. 2000;24(8):959-67.
- [3] World Health Organization. Obesity and overweight [Internet]. Geneva: WHO; 2025. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. Accessed June 17th 2026.
- [4] Popkin BM. The nutrition transition in low-income countries: An emerging crisis. *Nutrition reviews*. 1994;52(9):285-98.
- [5] Vohra R, Bhardwaj P, Srivastava JP, Srivastava S, Vohra A. Overweight and obesity among school-going children of Lucknow city. *J Family Community Med*. 2011;18(2):59-62.
- [6] Chandra N, Anne B, Venkatesh K, Teja GD, Katkam SK. Prevalence of childhood obesity in an affluent school in Telangana using the recent IAP growth chart: A pilot study. *Indian J Endocrinol Metab*. 2019;23(4):428-32.
- [7] Goel A, Reddy S, Goel P, Spoorti R. Causes, consequences, and preventive strategies for childhood obesity: A narrative review. *Cureus*. 2024;16(7):e64985.
- [8] Hampl SE, Hassink SG, Skinner AC, Armstrong SC, Barlow SE, Bolling CF, et al. Clinical practice guideline for the evaluation and treatment of children and adolescents with obesity. *Pediatrics*. 2023;151(2):e2022060640.
- [9] Khadilkar V, Shah N, Harish R, Ayyavoo A, Bang A, Basu S, et al. Indian academy of pediatrics revised guidelines on evaluation, prevention and management of childhood obesity. *Indian Pediatrics*. 2023;60(12):1013-31.
- [10] Centers for Disease Control and Prevention. Child and Teen BMI Categories [Internet]. 2024. Available from: <https://www.cdc.gov/bmi/child-teen-calculator/bmi-categories.html>. Accessed June 17th, 2026.
- [11] Onis MD, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ*. 2007;85(9):660-67.
- [12] Cole TJ, Lobstein T. Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. *Pediatric Obesity*. 2012;7(4):284-94.
- [13] WHO/IASO/IOTF. The Asia-Pacific Perspective: Redefining Obesity and Its Treatment. Melbourne: Health Communications Australia; 2000.
- [14] Styne DM, Arslanian SA, Connor EL, Farooqi IS, Murad MH, Silverstein JH, et al. Pediatric obesity-assessment, treatment, and prevention: An Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab*. 2017;102(3):709-57.
- [15] Lofrano-Prado MC, Antunes HK, Prado VL, de Plano A, Caranti DA, Tock L, et al. Quality of life in Brazilian obese adolescents: Effects of a long-term multidisciplinary lifestyle therapy. *Health and Quality of Life Outcomes*. 2009;7(1):61.
- [16] Khadilkar VV, Khadilkar AV. Revised Indian Academy of Pediatrics 2015 growth charts for height, weight and body mass index for 5-18-year-old Indian children. *Indian J Endocrinol Metab*. 2015;19(4):470-76.
- [17] Chaput JP, Willumsen J, Bull F, Chou R, Ekelund U, Firth J, et al. 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5-17 years: Summary of the evidence. *Int J Behav Nutr Phys Act*. 2020;17(1):141.
- [18] Gupta P, Shah D, Bedi N, Galagali P, Dalwai S, Agrawal S, et al. Indian academy of pediatrics guidelines on screen time and digital wellness in infants, children and adolescents. *Indian Pediatr*. 2022;59:235-44.
- [19] Singh S, Awasthi S, Kapoor V, Mishra P. Childhood obesity in India: A two-decade meta-analysis of prevalence and socioeconomic correlates. *Clinical Epidemiology and Global Health*. 2023;23:101390.

- [20] Joyce IE, Kennedy OO, Abraham M, Gordon Y, Jesse O, Gabriel A, et al. Prevalence of childhood obesity and overweight in India: A meta-analysis. *Int J Med Sci Public Health*. 2024;5(11):70-130.
- [21] Zorba ER, Cengiz T, Karacabey K. Exercise training improves body composition, blood lipid profile and serum insulin levels in obese children. *J Sports Med Phys Fitness*. 2011;51(4):664-69.
- [22] Park JH, Miyashita M, Kwon YC, Park HT, Kim EH, Park JK, et al. A 12-week after-school physical activity programme improves endothelial cell function in overweight and obese children: A randomised controlled study. *BMC Pediatrics*. 2012;12(1):111.
- [23] Bae JH, Lee H. The effect of diet, exercise, and lifestyle intervention on childhood obesity: A network meta-analysis. *Clin Nutr*. 2021;40(5):3062-72.
- [24] Al-Khudairy L, Loveman E, Colquitt JL, Mead E, Johnson RE, Fraser H, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. *Cochrane Database Syst Rev*. 2017;6(6):CD012691.
- [25] Mead E, Brown T, Rees K, Azevedo LB, Whittaker V, Jones D, et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years. *Cochrane Database Syst Rev*. 2017;6(6):CD012651.
- [26] Verduci E, Lassandro C, Giaccherio R, Miniello VL, Banderali G, Radaelli G. Change in metabolic profile after 1-year nutritional-behavioural intervention in obese children. *Nutrients*. 2015;7(12):10089-99.
- [27] Kolsgaard ML, Joner G, Brunborg C, Anderssen SA, Tonstad S, Andersen LF. Reduction in BMI z-score and improvement in cardiometabolic risk factors in obese children and adolescents. The Oslo Adiposity Intervention Study-a hospital/public health nurse combined treatment. *BMC Pediatrics*. 2011;11(1):47.
- [28] Bondyra-Wiśniewska B, Myszkowska-Ryciak J, Harton A. Impact of lifestyle intervention programs for children and adolescents with overweight or obesity on body weight and selected cardiometabolic factors- A systematic review. *Int J Environ Res Public Health*. 2021;18(4):2061.
- [29] Hassan H, Snoeck Henkemans S, van Teeffelen J, Kornelisse K, Bindels PJ, Koes BW, et al. Determinants of dropout and compliance of children participating in a multidisciplinary intervention programme for overweight and obesity in socially deprived areas. *Family Practice*. 2023;40(2):345-51.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Paediatrics, Government Medical College, Medak, Telangana, India.
2. Associate Professor, Department of Paediatrics, Kakatiya Medical College, Warangal, Telangana, India.
3. Resident, Department of Paediatrics, Gandhi Medical College, Secunderabad, Telangana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Jayalakshmi Pabbati,
Plot No.-24, Flat No.-202, Krishna Nagar Colony, Wellington Road,
Picket, Secunderabad, Telangana, India.
E-mail: drplakshmi@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Mar 06, 2026
- Manual Googling: Jul 01, 2026
- iThenticate Software: Jul 04, 2026 (6%)

ETYMOLOGY: Author Origin**EMENDATIONS:** 8**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Feb 25, 2026**Date of Peer Review: **Mar 13, 2026**Date of Acceptance: **Jul 07, 2026**Date of Publishing: **Aug 01, 2026**