International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

Prevalence of Childhood Obesity among Schoolchildren in Siddipet District, Telangana, India: Urban–Rural Differences and Early Glycemic Screening Findings

Dr. Atul G. Agrawal[1]*, Dr. Ankita A. Agrawal[2]

[1]Professor and Head, Department of Community Medicine, Surabhi Institute of Medical Sciences, Siddipet, Telangana, India, MBBS, MD Community Medicine, ACME, MBA, CCH, CSD, PGDHHM, PGDMCH, PGDAST

[2]Physiotherapist, Shree Sathya Sai Sanjeevani Mother and Child Hospital, Yavatmal, Maharashtra, India, MPT Orthopaedics

*Corresponding author: dratulu9@gmail.com

Abstract

Background. Excess adiposity in childhood tends to persist into adulthood and is associated with early cardiometabolic risk. Local estimates are needed to guide school-based prevention and appropriate clinical assessment in Telangana.

Objectives. To estimate the prevalence of overweight and obesity among schoolchildren in Siddipet district; to compare obesity and selected lifestyle factors between urban and rural children; and to describe glycemic screening findings across BMI categories.

Methods. A community-based cross-sectional study using multi-stage cluster sampling (12 school clusters: 6 urban, 6 rural) enrolled 450 schoolchildren aged 6–15 years (225 urban, 225 rural; 93.4% of 482 invited) between 21 March and 20 December 2025. A structured questionnaire recorded dietary, screen-time, physical-activity and family-history information. Height and weight were measured and BMI-for-age was classified using CDC percentiles. Spot urine glucose was tested in all children, and an oral glucose tolerance test (OGTT) was reported for children at higher risk. Proportions are presented with Wilson 95% confidence intervals; groups were compared using chi-square tests and odds ratios, with a cluster-robust sensitivity analysis.

Results. Sixty-four children (14.2%; 95% CI 11.3–17.8) were obese and 83 (18.4%; 15.1–22.3) were overweight, giving a combined excess-weight prevalence of 32.7% (28.5–37.1). Obesity was more frequent in urban than rural children (18.2% vs 10.2%; OR 1.96, 95% CI 1.13–3.39; $p = 0.015$; cluster-robust $p = 0.021$). Screen time above two hours daily (56.9% vs 37.3%) and junk-food intake more than three times weekly (63.1% vs 40.4%) were also more common in urban children (both $p < 0.001$); family history of T2DM did not differ ($p = 0.419$). Positive urine glucose was recorded in 14.1% of obese, 4.8% of overweight and 0.7% of normal-weight/underweight children; impaired OGTT in 10.9%, 3.6% and 0.3%, respectively.

Conclusions. One in three sampled schoolchildren had excess weight, with a higher burden in urban schools. Glycemic screening abnormalities clustered in children with obesity. Because the design is cross-sectional,

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

the findings indicate associations and screening priorities, not causation or future diabetes risk. School-based growth monitoring, healthier food and activity environments, and risk-based clinical referral are warranted.

Keywords: childhood obesity; overweight; school health; BMI-for-age; glycemic screening; urban–rural; Siddipet; India

KEY FINDINGS AT A GLANCE

32.7%	**14.2%**	**18.2% vs 10.2%**
Overweight or obesity 147 of 450 children	Obesity prevalence 64 of 450 children	Obesity in urban vs rural children

Cross-sectional estimates; findings describe the sampled children and do not establish causation.

1. Introduction

Childhood overweight and obesity are recognised public-health priorities. Worldwide, obesity among school-age children and adolescents has risen several-fold since 1990, and an estimated one in five children and adolescents now lives with excess weight. [1–3] Excess adiposity in childhood tracks into adult life, so children with obesity are considerably more likely than their peers to be adults with obesity. [4,5] Metabolic consequences may appear early: the prevalence of the metabolic syndrome rises with the severity of obesity, and impaired glucose tolerance is common among children and adolescents with marked obesity. [6,7] The causes are multifactorial, spanning food and built environments, sedentary behaviour, sleep, family context and biological susceptibility. [8,9]

India carries a double burden of malnutrition in which undernutrition and excess weight coexist. South Asian populations develop adiposity-related metabolic disease at lower BMI values than European populations, and metabolic risk may be programmed early in life. [10,11] This matters in a country with a large burden of diabetes and prediabetes. [12] Indian systematic reviews show wide variation in childhood obesity by region, age, socioeconomic position and the growth reference used. [13–15] A 2023 meta-analysis of 21 studies reported pooled prevalences of 8.4% for obesity and 12.4% for overweight, and found higher obesity risk among children in private schools. [14] Such pooled estimates cannot be applied directly to a district, because populations, years and BMI references differ.

Guidance has evolved rapidly. The Indian Academy of Pediatrics (IAP) recommends BMI-for-age assessment using its 2015 growth charts for children aged 5–18 years and evaluation for comorbidities in children with obesity. [16,17] The American Academy of Pediatrics, the American Diabetes Association and, in 2026, the World Health Organization have issued guidance emphasising family-centred care and risk-based, rather than indiscriminate, testing for dysglycemia. [18–21]

Siddipet district is undergoing social and environmental change that may influence diet and activity, yet local data on excess weight and early glycemic findings are limited. This study therefore aimed to (i) estimate the prevalence of overweight and obesity among schoolchildren aged 6–15 years; (ii) compare obesity and selected lifestyle factors between urban and rural children; and (iii) describe urine-glucose and OGTT findings across BMI categories.

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

2. Materials and Methods

2.1 Study design, setting and period

This community-based, cross-sectional descriptive study was conducted by the Department of Community Medicine, Surabhi Institute of Medical Sciences, Siddipet, Telangana, India, from 21 March to 20 December 2025. The report follows the STROBE statement for observational studies. [22]

2.2 Participants and sampling

The study population comprised school-going children aged 6–15 years. The sampling frame comprised all recognised co-educational primary and secondary schools in Siddipet district, in both rural blocks and urban municipal limits, as registered with the district educational authorities. A multi-stage cluster sampling design was used. [23] Twelve school clusters were selected (6 urban, 6 rural), with a mix of government and private institutions chosen to avoid socioeconomic bias, and class sections were sampled to represent ages and sexes. Of 14 schools approached, 12 agreed to participate (school-level response rate 85.7%); two private schools declined for administrative scheduling reasons and were replaced by a random secondary draw from the same stratum. Of 482 children invited and assessed for eligibility, 32 were excluded (absent on screening days, incomplete parental consent forms, or age outside 6–15 years) and 450 were enrolled and completed all protocol phases (93.4% of those invited): 225 urban and 225 rural (Figure 1).

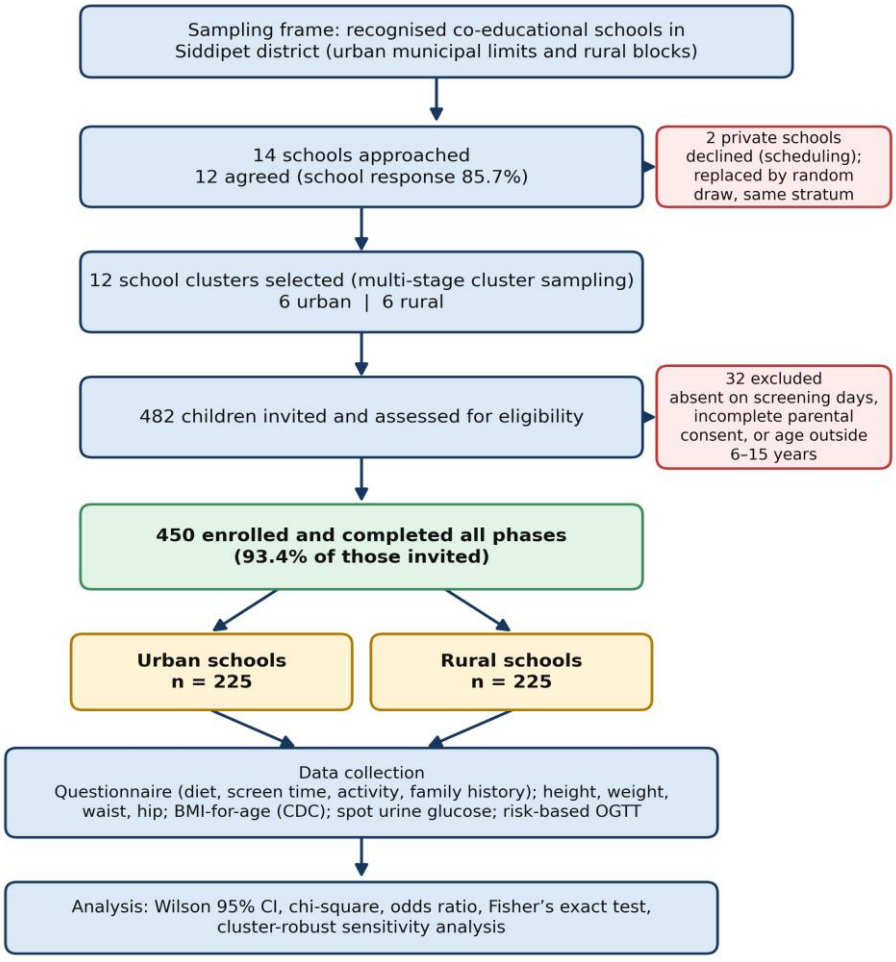

Figure 1. Study flowchart: sampling frame, school and participant flow, data collection and analysis (N = 450).

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

2.3 Data collection and anthropometry

A pre-tested structured questionnaire recorded demographic details, dietary habits, frequency of fast-food/junk-food consumption, daily screen time, physical activity and family history of diabetes or obesity. Weight was measured in light clothing without shoes to the nearest 0.1 kg using a calibrated digital scale. Height was measured to the nearest 0.1 cm with a stadiometer, with the head in the Frankfort horizontal plane. Waist and hip circumferences were measured with a non-stretchable tape.

2.4 BMI classification

BMI was calculated as weight (kg) divided by the square of height (m). BMI-for-age was classified using the CDC growth charts: underweight, <5th percentile; normal weight, 5th to <85th percentile; overweight, 85th to <95th percentile; and obesity, ≥95th percentile. [24] The CDC reference was used as specified in the study protocol. Other references define excess weight differently (Table 1): the WHO growth reference uses Z-scores, and the IAP 2015 charts use adult-equivalent cut-offs of 23 and 27 kg/m². [16,25] Prevalence estimates are therefore not interchangeable between references.

Table 1. Commonly used BMI-for-age classifications for school-age children.

Category	CDC percentile (used here)	WHO 2007 reference (5–19 y)	IAP 2015 charts (5–18 y)
Underweight / thinness	<5th percentile	BMI-for-age Z < −2 (thinness)	Lower percentile/SD curves of the chart
Normal weight	5th to <85th percentile	Z −2 to +1	Below the 23 kg/m² adult-equivalent curve
Overweight	85th to <95th percentile	Z > +1 to +2	On/above the 23 curve, below the 27 curve
Obesity	≥95th percentile	Z > +2	On/above the 27 kg/m² curve

Sources: CDC growth charts [24]; WHO growth reference [25]; IAP 2015 charts [16]. The present study used the CDC column.

2.5 Biochemical screening

Spot urine samples were tested for glycosuria with semi-quantitative reagent strips. An OGTT was reported for children with persistent glycosuria or high-risk features, including obesity with a family history of early-onset T2DM. Urine glucose is a screening signal only; diabetes and prediabetes are diagnosed using plasma glucose or HbA1c criteria (Table 2), confirmed by repeat testing in asymptomatic individuals. [26] Risk-based screening is recommended for youth with overweight or obesity who have additional risk factors, beginning at puberty or 10 years of age, whichever is earlier. [19]

Table 2. Reference thresholds for interpreting glycemic tests in children and adolescents.

Test	Normal	Prediabetes	Diabetes
Fasting plasma glucose (≥8 h fast)	<100 mg/dL (<5.6 mmol/L)	100–125 mg/dL	≥126 mg/dL (≥7.0 mmol/L)

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

Test	Normal	Prediabetes	Diabetes
2-h plasma glucose, 75-g OGTT	<140 mg/dL (<7.8 mmol/L)	140–199 mg/dL	≥200 mg/dL (≥11.1 mmol/L)
HbA1c	<5.7%	5.7–6.4%	≥6.5%
Urine glucose strip	Negative	Not a diagnostic test	Not a diagnostic test

Adapted from the American Diabetes Association Standards of Care [26]. In the absence of unequivocal hyperglycemia, a diagnosis requires confirmation by repeat testing. Paediatric OGTT commonly uses 1.75 g/kg glucose up to a maximum of 75 g.

2.6 Ethical considerations

The study was approved by SIMS Institutional Ethics Committee. Written consent was obtained from school principals and parents/guardians, and verbal assent was obtained from participating children.

2.7 Statistical analysis

Data were entered into a secure electronic database and analysed using SPSS Statistics (IBM Corp., version 29.0, Armonk, NY) and R (version 4.4.0). Categorical variables are summarised as frequencies and Wilson score 95% confidence intervals. [27] Urban and rural groups were compared with Pearson's chi-square test (df = 1), with effect size expressed as the odds ratio and Woolf (logit) 95% confidence interval. Glycemic findings across BMI categories were examined with Fisher's exact test because of small cell counts. A two-sided $p < 0.05$ was considered significant. Because children within schools are correlated, standard unadjusted tests may underestimate standard errors; the average design effect for clustered anthropometric outcomes was estimated at 1.25. Primary tables present unadjusted estimates, and sensitivity analyses used cluster-robust standard errors.

3. Results

3.1 Participant characteristics and BMI categories

The study included 450 children: 230 boys (51.1%) and 220 girls (48.9%), with 225 children (50.0%) each from urban and rural schools. Using CDC percentiles, 32 children (7.1%) were underweight, 271 (60.2%) were of normal weight, 83 (18.4%) were overweight and 64 (14.2%) were obese. The combined prevalence of overweight and obesity was 147/450 (32.7%; 95% CI 28.5–37.1) (Table 3; Figure 2).

Table 3. Baseline characteristics and BMI-for-age categories of the schoolchildren (N = 450).

Characteristic	Category	n	%	95% CI (%)
Sex	Male	230	51.1	46.5–55.7
	Female	220	48.9	44.3–53.5
Locality	Urban	225	50.0	45.4–54.6
	Rural	225	50.0	45.4–54.6
BMI-for-age	Underweight (<5th percentile)	32	7.1	5.1–9.9
	Normal weight (5th to <85th)	271	60.2	55.6–64.6

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

Characteristic	Category	n	%	95% CI (%)
	Overweight (85th to <95th)	83	18.4	15.1–22.3
	Obesity (≥95th percentile)	64	14.2	11.3–17.8
	Overweight + obesity (≥85th)	147	32.7	28.5–37.1

CI, Wilson score confidence interval.

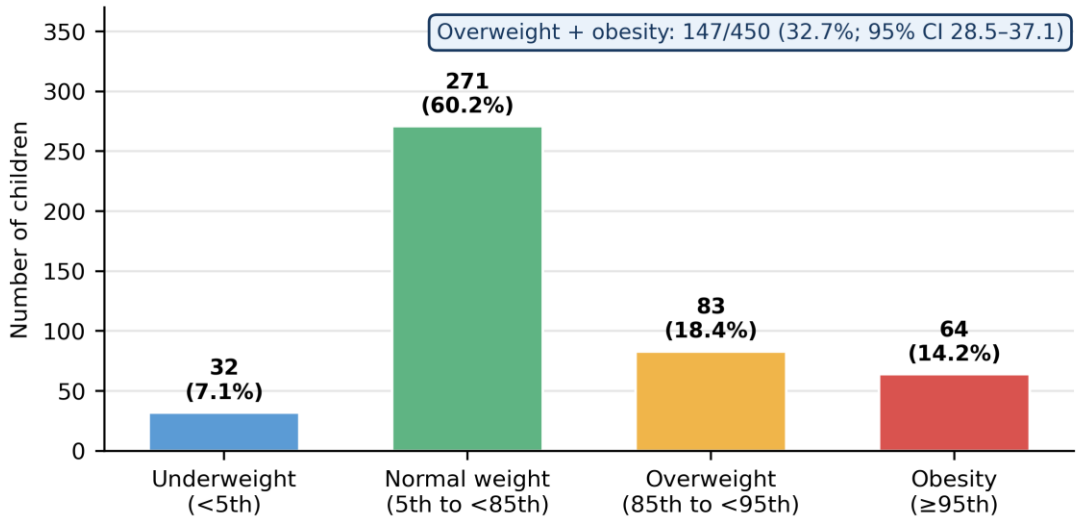

Figure 2. Distribution of BMI-for-age categories. One-third of children were overweight or obese.

3.2 Urban–rural comparison

Obesity was recorded in 41 of 225 urban children (18.2%) and 23 of 225 rural children (10.2%), a significant difference ($\chi^2 = 5.90$, p = 0.015; OR 1.96, 95% CI 1.13–3.39). Screen time above two hours daily (OR 2.22) and junk-food consumption more than three times weekly (OR 2.52) were also significantly more common among urban children, whereas family history of T2DM did not differ (p = 0.419) (Table 4; Figures 3 and 4). In the cluster-robust sensitivity analysis the urban–rural difference in obesity remained statistically significant (p = 0.021), indicating that clustering did not alter the main inference.

Table 4. Urban–rural comparison of obesity and selected reported risk factors.

Parameter	Urban (n = 225)	Rural (n = 225)	χ^2 (df 1)	p value	OR (95% CI)
Obesity (≥95th percentile)	41 (18.2%)	23 (10.2%)	5.90	0.015	1.96 (1.13–3.39)
Screen time >2 h/day	128 (56.9%)	84 (37.3%)	17.27	<0.001	2.22 (1.52–3.23)

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

Parameter	Urban (n = 225)	Rural (n = 225)	χ^2 (df 1)	p value	OR (95% CI)
Junk food >3 times/week	142 (63.1%)	91 (40.4%)	23.15	<0.001	2.52 (1.72–3.68)
Family history of T2DM	76 (33.8%)	68 (30.2%)	0.65	0.419	1.18 (0.79–1.75)

OR, odds ratio (urban vs rural; rural = reference). Pearson chi-square without continuity correction; Woolf 95% CI. Estimates are unadjusted for school-level clustering; the cluster-robust p value for obesity was 0.021.

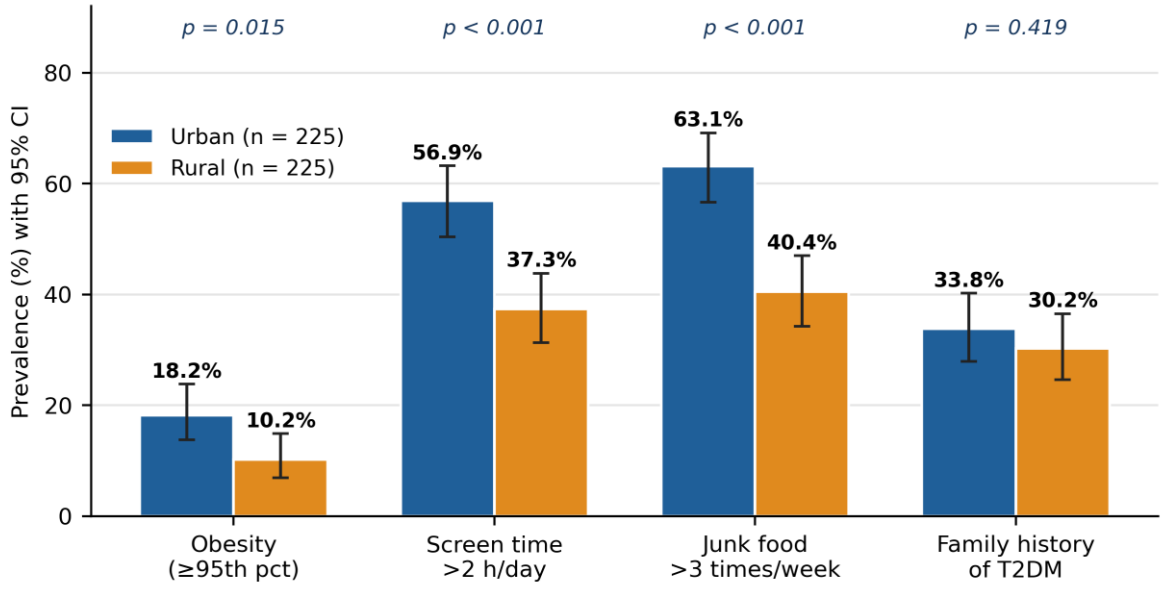

Figure 3. Prevalence of obesity and selected risk factors in urban and rural schoolchildren with 95% confidence intervals.

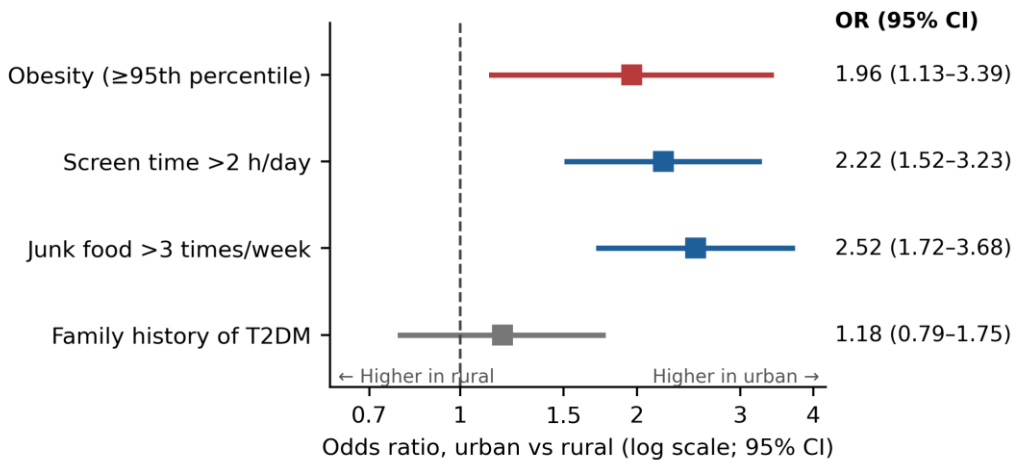

Figure 4. Forest plot of odds ratios (urban vs rural). Intervals that do not cross 1 (dashed line) indicate a statistically significant association.

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

3.3 Glycemic screening findings by BMI category

Positive urine glucose and impaired OGTT results increased stepwise across BMI categories (Table 5; Figure 5). Positive urine glucose was found in 9 of 64 children with obesity (14.1%), 4 of 83 with overweight (4.8%) and 2 of 303 with normal weight or underweight (0.7%). Impaired OGTT was reported in 7 (10.9%), 3 (3.6%) and 1 (0.3%) children, respectively. Compared with normal-weight/underweight children, children with obesity had higher proportions of both positive urine glucose and impaired OGTT (Fisher's exact $p < 0.001$ for each). The differences between obese and overweight children were not statistically significant (urine glucose $p = 0.077$; OGTT $p = 0.103$). These are screening findings, not confirmed diagnoses of prediabetes or diabetes.

Table 5. Urine glucose and OGTT screening findings by BMI-for-age category.

BMI category	Total, n	Positive urine glucose, n (%; 95% CI)	Impaired OGTT, n (%; 95% CI)
Normal weight / underweight	303	2 (0.7%; 0.2–2.4)	1 (0.3%; 0.1–1.8)
Overweight	83	4 (4.8%; 1.9–11.7)	3 (3.6%; 1.2–10.1)
Obesity	64	9 (14.1%; 7.6–24.6)	7 (10.9%; 5.4–20.9)

Percentages use the total number of children in each BMI category as the denominator. OGTT was targeted to higher-risk children; the number actually tested was not separately recorded.

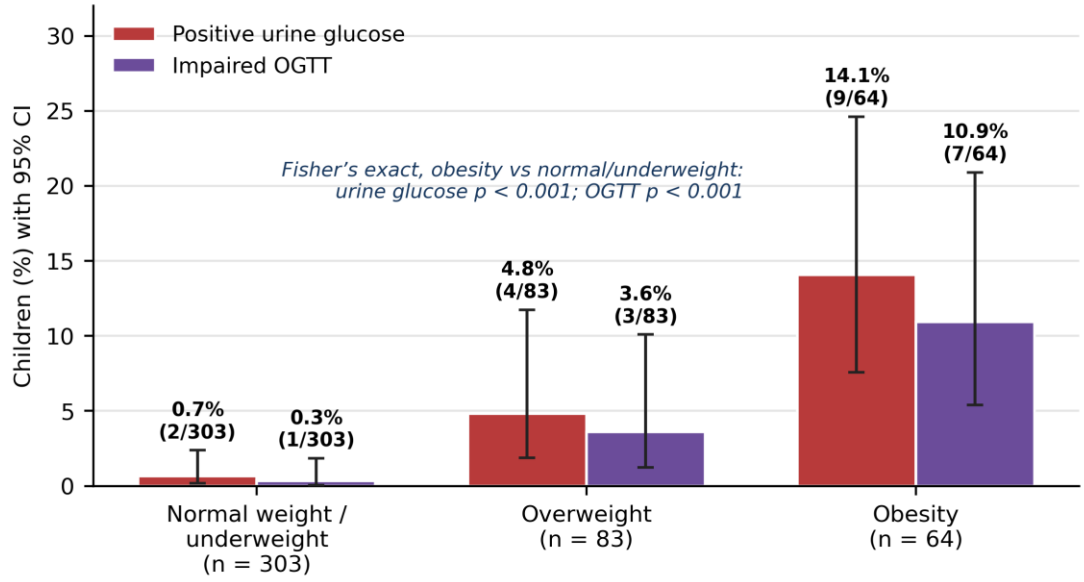

Figure 5. Positive urine glucose and impaired OGTT by BMI category, with 95% confidence intervals.

4. Discussion

In this sample of 450 schoolchildren from Siddipet district, 14.2% were obese and 18.4% overweight by CDC percentiles, a combined prevalence of 32.7%. This is higher than the pooled Indian estimates of 8.4% obesity and 12.4% overweight and the global pooled estimates of 8.5% obesity and 22.2% excess weight, although direct comparison is limited by differences in geography, age range, school type, survey year and growth

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

reference. [3,14,15] Because sampling was school-based and clustered, the estimates describe the sampled children rather than the whole district unless the design is shown to be representative.

Urban children had almost twice the odds of obesity compared with rural children (OR 1.96), in keeping with Indian reviews describing an urban–rural gradient as nutrition transition proceeds, with undernutrition still prominent in rural settings. [9,13,15] Urban children also more often reported screen time above two hours and frequent junk-food intake. Sedentary behaviour is associated with adverse adiposity indicators in children, and sugar-sweetened beverages and energy-dense foods promote weight gain. [28,29] National dietary guidance advises limiting such foods. [30] The conceptual framework in Figure 6 shows how these exposures interact with environmental and family factors; however, because exposure and outcome were measured simultaneously, this study cannot establish that they caused obesity.

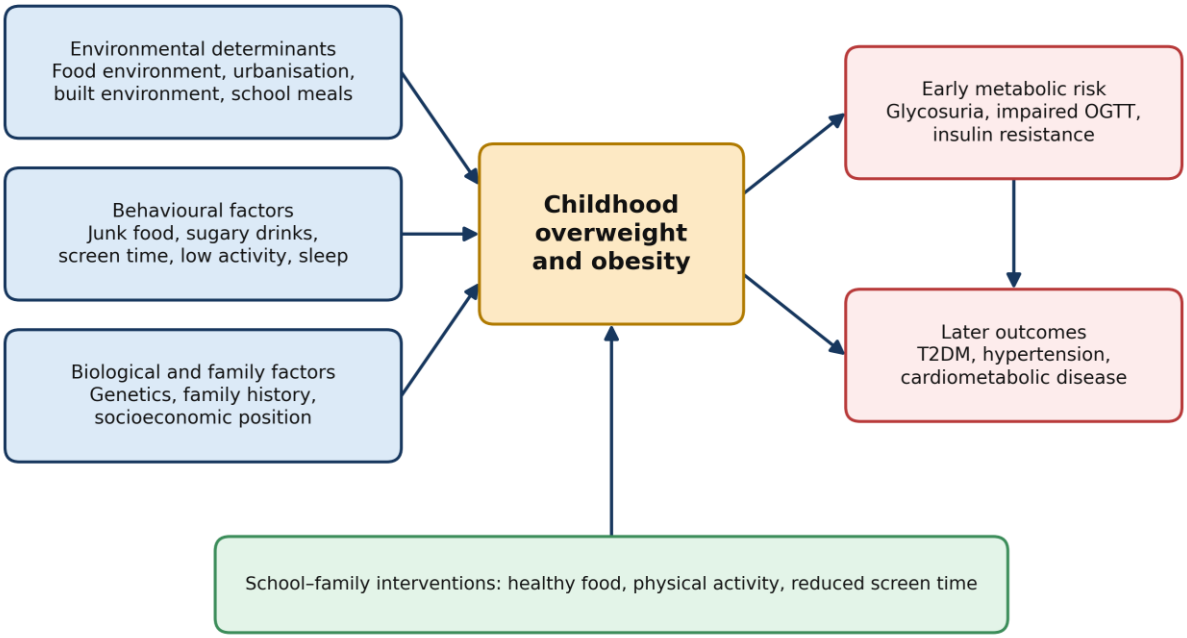

Figure 6. Conceptual framework: environmental, behavioural and biological determinants lead to excess weight, early metabolic risk and later disease; school-based interventions act at several points.

Positive urine glucose and impaired OGTT were concentrated in the obese category, consistent with reports that glucose intolerance and metabolic abnormalities rise with increasing severity of obesity in childhood. [6,7] This supports the rationale for clinically appropriate assessment of children with excess weight and additional risk factors. It does not show that BMI predicts future diabetes, as there was no follow-up. Current guidance advises risk-based screening of youth with overweight or obesity and at least one additional risk factor from puberty or 10 years, with plasma glucose or HbA1c rather than urine strips (Table 2), repeated at least every three years if normal. [19,26]

The choice of growth reference deserves attention. The IAP recommends its 2015 charts for Indian children aged 5–18 years because Indians develop metabolic risk at lower BMI. [16,17] Using CDC percentiles, as here, may therefore classify some children differently, and the prevalence reported should not be assumed equivalent to IAP-based estimates. Re-analysis with IAP and WHO references would improve comparability for Indian readers.

International Journal of Advanced Multidisciplinary Research and Innovation
E-ISSN: 3107-6157 editor@ijamri.com
Volume 2, Issue 5, September-October 2026

4.1 Strengths and limitations

Strengths include the inclusion of urban and rural schools in a multi-stage cluster design, high school-level (85.7%) and participant-level (93.4%) response, a sample of 450 children, standardised anthropometric procedures and the combination of questionnaire data with biochemical screening. Limitations include: (i) the cross-sectional design and absence of follow-up for diabetes outcomes; (ii) possible recall and social-desirability bias in self-reported diet and screen time; (iii) primary estimates and confidence intervals that are unadjusted for clustering (design effect 1.25, which widens intervals by roughly 12%), although a cluster-robust sensitivity analysis supported the main finding, and the small number of clusters (12) limits the precision of cluster-robust methods; (iv) incomplete documentation of the OGTT protocol (glucose load, thresholds) and of the number of children actually tested, so percentages in Table 5 use category totals and may understate positivity among those tested; (v) use of a semi-quantitative urine strip with low sensitivity as a first-line screen; and (vi) use of CDC rather than IAP charts.

4.2 Public-health implications

School-based prevention can combine periodic growth monitoring, healthier school food environments, daily physical activity, reduced sedentary time, family engagement and non-stigmatising counselling. WHO's 2026 guidelines, which cover children under 10 years and adolescents aged 10–19 years separately, stress integrated, family-centred care and attention to psychological well-being. [20,21] Children with overweight or obesity plus clinical risk factors should be referred for evaluation rather than screened indiscriminately, as outlined in Figure 7. [17,18] Programmes must also remain alert to coexisting undernutrition and avoid weight-based stigma.

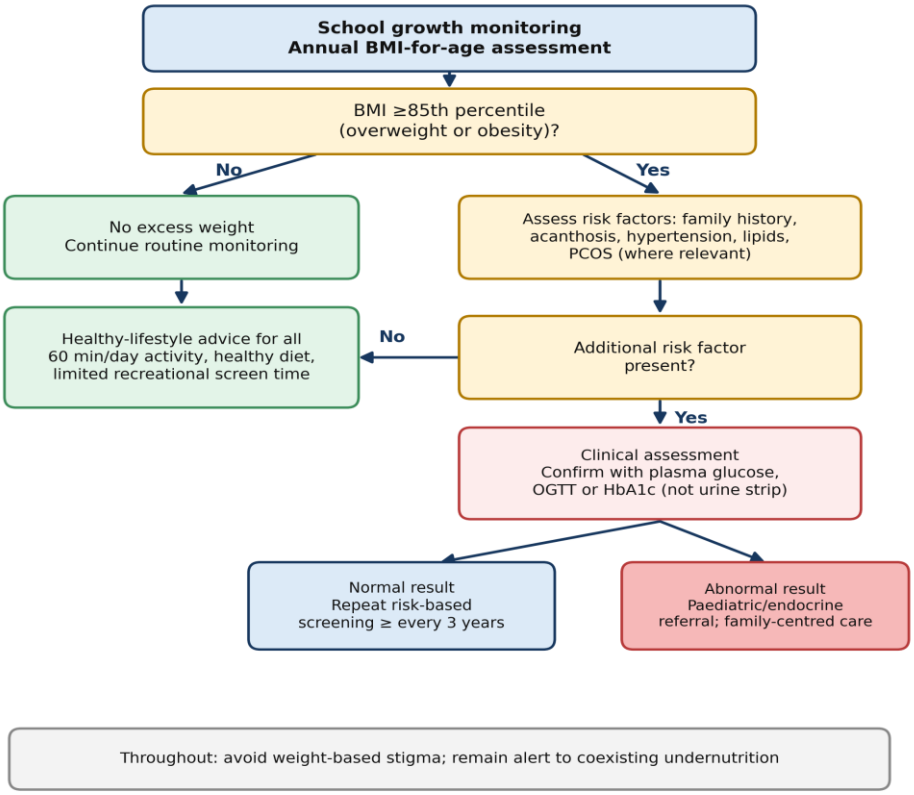

Figure 7. Suggested school-to-clinic pathway for children with excess weight, based on current paediatric and diabetes guidance.

5. Conclusion

Among 450 schoolchildren in Siddipet district, 14.2% were classified as obese and 18.4% as overweight, with obesity significantly more frequent in urban than rural children. Screen time and junk-food consumption were more frequent among urban children, and glycemic screening abnormalities were more frequent among children with obesity. These cross-sectional findings identify a need for stronger school-based prevention and risk-based clinical assessment, but they do not establish causation or predict future diabetes.

6. Recommendations

1. Introduce routine growth monitoring in school health services, using a clearly specified and locally appropriate BMI-for-age reference (preferably IAP 2015 for Indian children, reported alongside WHO or CDC for comparison).
2. Promote water instead of sugar-sweetened beverages, healthier canteen options, at least 60 minutes of daily physical activity, adequate sleep and limited recreational screen time through school–family partnerships.
3. Use risk-based clinical assessment for children with overweight or obesity plus additional risk factors, and confirm abnormal screening results with validated plasma glucose or HbA1c testing.
4. Conduct larger probability-sampled studies with cluster-adjusted analysis, confidence intervals and, where the aim is prediction, longitudinal follow-up.
5. Train teachers and school health staff in sensitive communication to prevent stigma and to support children with undernutrition as well as excess weight.

Declarations

Funding: Self-funded by the authors.

Conflict of interest: The authors declare no competing financial or non-financial interests.

Ethical approval and consent: Approved by SIMS Institutional Ethics Committee. Written parental consent and adolescent assent were obtained before enrolment.

Data availability: De-identified participant datasets are available from the corresponding author on reasonable academic request.

Author contributions: AGA: conceptualisation, methodology, intervention design, review of the statistical analysis, project administration, and writing – original draft. AA: investigation, data collection, participant recruitment, and writing – review and editing. Both authors approved the final manuscript.

References

1. World Health Organization. Report of the Commission on Ending Childhood Obesity. Geneva: WHO; 2016.
2. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in underweight and obesity from 1990 to 2022. Lancet. 2024;403(10431):1027–50.
3. Zhang X, Liu J, Ni Y, et al. Global prevalence of overweight and obesity in children and adolescents: a systematic review and meta-analysis. JAMA Pediatr. 2024;178(8):800–13.
4. Simmonds M, Llewellyn A, Owen CG, Woolacott N. Predicting adult obesity from childhood obesity. Obes Rev. 2016;17(2):95–107.

5. Singh AS, Mulder C, Twisk JWR, et al. Tracking of childhood overweight into adulthood. Obes Rev. 2008;9(5):474–88.
6. Weiss R, Dziura J, Burgert TS, et al. Obesity and the metabolic syndrome in children and adolescents. N Engl J Med. 2004;350(23):2362–74.
7. Sinha R, Fisch G, Teague G, et al. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. N Engl J Med. 2002;346(11):802–10.
8. Swinburn BA, Kraak VI, Allender S, et al. The global syndemic of obesity, undernutrition, and climate change. Lancet. 2019;393(10173):791–846.
9. Gupta N, Goel K, Shah P, Misra A. Childhood obesity in developing countries. Endocr Rev. 2012;33(1):48–70.
10. Misra A, Khurana L. Obesity and the metabolic syndrome in developing countries. J Clin Endocrinol Metab. 2008;93(11 Suppl 1):S9–30.
11. Yajnik CS. The lifecycle effects of nutrition and body size on adult adiposity, diabetes and cardiovascular disease. Obes Rev. 2002;3(3):217–24.
12. Anjana RM, Deepa M, Pradeepa R, et al. Prevalence of diabetes and prediabetes in 15 states of India: ICMR–INDIAB. Lancet Diabetes Endocrinol. 2017;5(8):585–96.
13. Ranjani H, Mehreen TS, Pradeepa R, et al. Epidemiology of childhood overweight & obesity in India. Indian J Med Res. 2016;143(2):160–74.
14. Singh S, Awasthi S, Kapoor V, et al. Childhood obesity in India: a two-decade meta-analysis. Clin Epidemiol Glob Health. 2023;24:101390.
15. Sharma N, Sanjeevi RR, Balasubramanian K, et al. Overweight and obesity among Indian school children and adolescents. Indian J Endocrinol Metab. 2024;28(2):104–16.
16. Khadilkar V, Yadav S, Agrawal KK, et al. Revised IAP growth charts for 5- to 18-year-old Indian children. Indian Pediatr. 2015;52(1):47–55.
17. Indian Academy of Pediatrics. Revised guidelines on evaluation, prevention and management of childhood obesity. Indian Pediatr. 2023;60(12):1013–31.
18. Hampl SE, Hassink SG, Skinner AC, et al. Clinical practice guideline for the evaluation and treatment of children and adolescents with obesity. Pediatrics. 2023;151(2):e2022060640.
19. American Diabetes Association. 14. Children and adolescents: Standards of Care in Diabetes—2026. Diabetes Care. 2026;49(Suppl 1):S297–320.
20. World Health Organization. WHO guidelines on the integrated management of obesity in children. Geneva: WHO; 2026.
21. World Health Organization. WHO guidelines on the integrated management of obesity in adolescents. Geneva: WHO; 2026.
22. von Elm E, Altman DG, Egger M, et al. The STROBE statement. Lancet. 2007;370(9596):1453–7.
23. Bennett S, Woods T, Liyanage WM, Smith DL. A simplified general method for cluster-sample surveys. World Health Stat Q. 1991;44(3):98–106.
24. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts. Vital Health Stat 11. 2002;(246):1–190.
25. de Onis M, Onyango AW, Borghi E, et al. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660–7.
26. American Diabetes Association. 2. Diagnosis and classification of diabetes: Standards of Care in Diabetes—2026. Diabetes Care. 2026;49(Suppl 1):S27–49.

27. Newcombe RG. Two-sided confidence intervals for the single proportion. Stat Med. 1998;17(8):857–72.
28. Tremblay MS, LeBlanc AG, Kho ME, et al. Systematic review of sedentary behaviour and health indicators in school-aged children. Int J Behav Nutr Phys Act. 2011;8:98.
29. Malik VS, Pan A, Willett WC, Hu FB. Sugar-sweetened beverages and weight gain. Am J Clin Nutr. 2013;98(4):1084–102.
30. ICMR–National Institute of Nutrition. Dietary Guidelines for Indians. Hyderabad: NIN; 2024.