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Prevalence and Knowledge on Obesity among school going Adolescents in Rural Areas of Dindigul District, TamilNadu

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ABSTRACT

India is experiencing a parallel trend, with adolescent overweight and obesity rates ranging from 10 per cent to 23 per cent, with Tamil Nadu showing significant urban and rural prevalence. The aim of the study is to assess the prevalence and knowledge of obesity among adolescents and explore personal and socioeconomic factors associated with obesity in Government Schools in Athoor Block, Dindigul District, Tamil Nadu. A cross-sectional study using purposive random sampling was conducted among 64 adolescents (36 girls and 28 boys) in government schools. A structured questionnaire captured personal data, lifestyle, dietary patterns, and menstrual history. Anthropometric measurements were used to calculate BMI followed by nutrition intervention. The Key Findings of the study shows the impact of BMI has no significant change in BMI post-intervention. Nutrient Intake (13–15 years) reports excess intake of energy, protein and visible fat among girls and deficits observed in calcium, iron, vitamin C, and folate. Nutrient Intake (16–17 years) show a similar trends of excess macronutrient intake and micronutrient deficits, especially in calcium, iron, folate, and zinc. The present study concluded obesity in Dindigul reflects a broader global trend of rising prevalence tied to sedentary lifestyles, poor diets, and low awareness. Micronutrient gaps persist, underscoring the need for long-term, multi-dimensional interventions involving policy support, community awareness, and integrated school curricula to effectively combat adolescent obesity and its health consequences.

Keywords: *Rural Adolescent Health, Micronutrient Deficiency, Obesity, Nutrition Education*

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Introduction

Adolescent obesity is a growing public health concern that poses long-term risks such as diabetes, cardiovascular diseases, and psychosocial problems. In recent years, the issue has gained significance due to rising global trends and notable shifts in lifestyle, diet, and physical activity levels. According to the World Health Organization, adolescent obesity has nearly tripled globally since 1975, and recent data from 2023 to 2025 shows continued acceleration, especially in low- and middle-income countries.

In India**,** the prevalence of overweight and obesity among adolescents ranges from 10 per cent to 23 per cent, with a rising trajectory in both urban and rural regions. Tamil Nadu, known for its nutritional transitions and rapid urbanization, has also witnessed a surge in adolescent obesity, including semi-urban and rural districts like Dindigul. Despite being an agriculturally dominant area, dietary habits among adolescents have shifted towards calorie-dense snacks, sugar-sweetened beverages, and sedentary leisure activities such as mobile gaming.

Review of Literature

A recent cross-sectional study conducted among higher secondary school students in Dindigul District revealed that 12.7 per cent of adolescents were overweight and 7.6 per cent were obese, with significant gender differences and poor awareness about long-term health implications (Ramasamy & Kannan, 2024). This is particularly concerning given the low levels of health literacy and limited access to school-based nutrition education programs in many parts of the district. In countries like Nepal and Indonesia**,** where undernutrition once dominated, obesity is now an emerging issue due to the dual burden of malnutrition and a lack of nutritional knowledge (Shrestha et al., 2023; Andayani & Ramadani, 2024).

NCD Risk Factor Collaboration (2024) reported across the last three decades, excess weight in youth has risen sharply worldwide. A 2024 NCD Risk Factor Collaboration analysis reported that the global age-standardised prevalence of obesity in school-aged children and adolescents climbed from 1.7% in 1990 to 6.9% in 2022, with wide regional variation. Adolescent knowledge about obesity remains limited both globally and locally. While some adolescents in Dindigul were aware of obesity as a health issue, only 28 per cent correctly identified its link to non-communicable diseases such as diabetes and heart problems (Ramasamy & Kannan, 2024). Similar gaps in awareness are noted globally, emphasizing the need for targeted education campaigns, parental involvement, and school-based health programs. In India, a study conducted in Udupi, Karnataka, found moderate awareness of obesity but low understanding of its long-term complications, suggesting a need for targeted education (Saldanha & D'Souza, 2024).

Simmonds in 2016 reported that excess adiposity in adolescence is linked to cardiometabolic risk (hypertension, dyslipidemia, insulin resistance), sleep apnea, nonalcoholic fatty liver disease, orthopedic problems, and psychosocial sequelae (depression, weight stigma). Longitudinal evidence shows strong “tracking” of youth obesity into adult obesity and cardiometabolic disease, reinforcing the need for prevention and early treatment.

School and community-based programs that combine nutrition education, physical activity promotion, and behaviour change techniques show modest but meaningful effects; design quality and attention to mental health and disordered eating are important for benefit and safety (Leme et al.,2020).

Knowledge and Awareness Among Adolescents

Knowledge levels about obesity and its health implications remain insufficient. A study in China found that adolescents with medium dietary knowledge were less likely to be overweight compared to those with low knowledge, although parental knowledge had no significant impact (Zhang et al., 2023). Another Chinese study revealed that both obesity and underweight conditions among adolescents were strongly linked to incorrect dietary beliefs and behaviors (Liu et al., 2024).

In Indonesia, an experimental study demonstrated that educational interventions on balanced nutrition significantly improved adolescents' knowledge about overweight and obesity (Andayani & Ramadani, 2024). A global cross-sectional analysis assessed awareness of childhood obesity and national program implementation, highlighting varying levels of knowledge and program reach across countries (Aman 2024).

Research Gap

Many Indian studies on adolescent obesity emphasize prevalence and risk factors, but there’s a scarcity of research clearly mapping the specific knowledge gaps among adolescents themselves especially around causes, calorie counting, BMI classification, and long-term health effects. While pilot-level education interventions (e.g., in schools, AIIMS-primary surveys) show improvements in awareness, their impacts on sustained knowledge retention across different states (urban vs rural, north vs south India) remain underexplored (Wiafe 2025). Most national studies do not incorporate assessments of weight misperception, obesity-related stigma, or psychological awareness the elements shown elsewhere to influence adolescent health behaviour choices (Saxena 2024).

Internationally, obesity literature heavily focuses on prevalence and risk factors rather than exploring what adolescents know e.g., calorie requirements, classification thresholds, health consequences, or physical activity recommendations particularly across diverse cultural settings (Henriques 2020).

Few national or international studies embed assessment of psychological aspects like stigma, body image, or depression in adolescent-focused obesity education, despite recognition of their bidirectional impact on obesity and mental health (Tran 2019). Canavan in 2019 reported that despite emerging potential, there is minimal evidence on digital or peer-network based interventions targeting adolescent obesity knowledge, behaviour, and self-perception as seen in early e-health app trials from other countries.

Materials and Methods

The objective of the study is to assess the prevalence and knowledge of obesity among adolescents and explore personal and socioeconomic factors associated with obesity in Government Schools in Athoor Block, Dindigul District. Government Schools were chosen by purposive simple random sampling technique to collect the data. Simple random sampling was used to select the respondents. Close ended questionnaire was used to get the personal information like age, income, education, dietary pattern and menstrual history in relation to obesity among adolescents. A five point Likert scale was framed by testing reliability and validity with the help of different stakeholders like Physicians, ICDS officers, Professors, Nutritionist and Headmaster of the concern school. Internal Consistency was done for all the statements and it results all the statements obtained 0.9 and are highly acceptable.

The questionnaire consists of two parts. First part dealt with personal and socio-demographic, socio-economic data, menstrual history, exercise pattern, anthropometric, and dietary pattern. Second part dealt with knowledge statements on obesity. A total of 25 knowledge statements consists of both positive and negative statements with scores. Knowledge statements was developed by the researcher and it was used to assess the Knowledge on obesity. Based on the scores it was decided to give nutrition education for a month with eight sessions with time duration of one and half an hour followed by post-test. Using the daily quantity of food consumed, nutrient values such as protein, visible fat, carbohydrates, energy, calcium, iron, zinc, selenium, vitamin A and C were computed and compared with the Recommended Dietary Allowance (RDA) of revised 2024 guidelines from Indian Council of Medical Research (ICMR). This comparison aimed to determine whether the dietary intake of food and nutrients met the necessary requirements of the selected adolescents. Nutrition Education was given to the selected respondents for three months with 11 sessions in different forms like lectures, demonstrations, exhibitions, counselling, nutritional games etc.

Findings and Discussion

Table 1

Personal profile of the Respondents

Variables	Categories	Respondents (N=64)	
		Girls (n=36)	Boys (n=28)
Age (in years)	13-14 years	2	7
	14-15 years	8	7
	15-16 years	11	8
	16-17 years	3	3
	17-18 years	12	3
Stage of Adolescents	Middle Adolescent Stage (13-15 years)	21	22
	Late Adolescent Stage (16-17years)	15	6
Gender	Girls/Boys	36	28
Religion	Hindu	33	26
	Christion	2	2
	Muslim	1	0
Type of Family	Nuclear Family	15	7
	Joint Family	21	21
Size of the Family	Small size (<2)	21	21
	Medium size (2-4)	14	6
	Large size (4-6)	1	1
Personal mobile phone	Available	8	16
	Not available	28	12
Television	Available	31	26
	Not available	5	2
Health Issues	Health Issues	4	3
	No Health Issues	32	25
Exercise Pattern	Skipping	31	17
	Walking	26	12
	Yoga	16	6
	Jogging	15	3
Duration of the Exercise	Up to 10-15 minutes	21	19
	Up to 20-30 minutes	15	9

The present study included a total of 64 adolescent respondents, comprising 36 girls and 28 boys. In terms of age distribution, the majority of girls n= 11 and boys 8 were in the 15–16 years age group, indicating a significant concentration in the mid-adolescent phase. Only two girls and seven boys belonged to the 13–14 years group. Regarding the stage of adolescence, 21 girls and 22 boys fell under the middle adolescent stage (13–15 years), while 15 girls and only six boys were in the late adolescent stage (16–17 years), showing that the study primarily reflects the middle phase of adolescent development.

Gender-wise data revealed with 36 girls (56.25%) and 28 boys (43.75%). With respect to religion, the majority of respondents were Hindus 33 girls and 26 boys while Christian representation was low with two girls and two boys and only one Muslim girl was reported. In terms of family type, joint families were predominant, with 21 girls and 21 boys belonging to such households, compared to fifteen girls and seven boys from nuclear families.

Interestingly, family size data indicated that both girls and boys 21 each mostly belonged to small families, while only one girl and one boy were part of large-sized families i.e: 4–6 members. Access to personal mobile phones showed a clear gender difference, with only 8 girls having mobile phones compared to 16 boys, indicating a digital access gap. However, television availability was high among all respondents, with 31 girls and 26 boys reporting its presence in their households.

Health status showed that only 4 girls and 3 boys reported having health issues, while 32 girls and 25 boys reported no health problems, indicating relatively good perceived health among participants. As for exercise patterns, skipping was the most common form of activity, performed by 31 girls and 17 boys, followed by walking (26 girls and 12 boys). Other forms like yoga (16 girls, 6 boys) and jogging (15 girls, 3 boys) were less common, especially among boys.

Examining the duration of exercise reports, most adolescents 21 girls and 19 boys exercised for 10 - 15 minutes, whereas only 15 girls and 9 boys engaged in physical activity for 20 - 30 minutes. This suggests that while physical activity is practiced, it may not be of sufficient duration for effective obesity prevention or health benefits.

$H0_1$: There is no significant mean difference between the adolescent group in the pre and post-test in the BMI of the Adolescents

Table 2

Effect of Nutrition Education Intervention and Mean BMI of the Adolescents

Test Performed	Girls (N=36)	Boys (N=28)	Mean difference	t value	p value
	Mean ±S.D	Mean ±S.D			
Pre-test	28.32±2.13	27.34±1.99	0.04	0.70	0.48
Post-test	28.28±2.12	27.39±1.93	-0.04	-0.50	0.61

Note: p-value: **Significant at 0.05 % level ($p < 0.05$); Not Significant

The study examined the knowledge levels related to obesity among adolescent girls and boys using a pre-test and post-test design. Among the girls (N=36), the mean pre-test score was 28.32 with a standard deviation (SD) of 2.13, while the boys (N=28) had a mean score of 27.34 ± 1.99. The mean difference between girls and boys in the pre-test was 0.04, and the t-value was 0.70 with a p-value of 0.48, indicating that the difference was not statistically significant ($p > 0.05$). In the post-test, the mean score for girls slightly decreased to 28.28 ± 2.12, and for boys, it slightly increased to 27.39 ± 1.93. The mean difference post-intervention was -0.04, with a t-value of -0.50 and a p-value of 0.61, which again suggests no significant difference between the two groups after the intervention.

It is clear from the Table 2 the calculated value of p is greater than the table value at 0.05% level. Therefore, there is a non-significant difference between the knowledge scores and BMI obtained by the adolescent girls and boys. This table shows that the nutrition education intervention provided to the respondents has a no impact on the BMI cut off of the adolescents on obesity. Since the intervention period was one month no significant changes was found and gradually the BMI attain the normal range. Therefore, the null hypothesis $H0_1$ is accepted, and it is concluded that there is no significant mean difference between the adolescent group in the pre and post-test in the Mean Body Mass Index of the adolescent girls.

$H0_2$: There is no significant mean difference between the adolescent group in the pre and post-test in the knowledge on obesity

Table 3

Impact of Nutrition Education Intervention on Knowledge among adolescents on Obesity

Knowledge Level on Obesity	Category	No. of Respondents	Test performed	Mean ±S.D	Mean Difference	t-value	p-value
	Girls	36	Pre-test	1.86±0.52	-1.143	-11.529	0.000**
			Post-test	3.00±0.00			
	Boys	28	Pre-test	1.75±0.80	-1.250	-1.250	0.000**
			Post-test	3.00±0.00			

Note: p-value: **Significant at 0.001 % level ($p < 0.001$); Not Significant

Table 3 shows the study evaluated the impact of an educational intervention on the knowledge level regarding obesity among adolescent girls (N=36) and boys (N=28) using a pre-test and post-test design. Among the girls, the mean knowledge score in the pre-test was 1.86 ± 0.52, which significantly improved to a perfect score of 3.00 ± 0.00 in the post-test. The mean difference was -1.143, with a t-value of -11.529 and a p-value of 0.000, indicating a highly significant improvement ($p < 0.01$) in obesity-related knowledge after the intervention.

Similarly, for the boys, the mean pre-test score was 1.75 ± 0.80, which also increased to a perfect score of 3.00 ± 0.00 in the post-test. The mean difference was -1.250, with a t-value of -1.250 and a p-value of 0.000, again showing a statistically significant improvement ($p < 0.01$) in knowledge.

These results clearly indicate that the nutrition education intervention was effective in significantly increasing the level of knowledge on obesity among both girls and boys. The uniform post-test score of 3.00 across both genders suggests that the content was well-understood and retained by the participants, demonstrating the success of the educational strategy used in this study.

Table 4 : Nutrient Intake of the Adolescents (13-15 years)

Nutrients	**13-15 years**									
	Girls (n=21)					**Boys (N=22)**				
	Reference	Pre-Test	Nutrient Intake Excess / Deficit	Post Test	Nutrient Intake Excess/ Deficit	Reference	Pre-Test	Nutrient Intake Excess / Deficit	Post Test	Nutrient Intake Excess / Deficit
Energy(kcal)**	2400	2964.53	+564.53	2945	+545	2500	2645	+145	2559	+59
Protein(g)	42	79.41	+37.41	72.1	+30.1	49	56	+7	54	+5
Visible fat(g)	31	162.44	+131.44	159.3	+128.3	31	145	+114	142	+111
Calcium(mg)	1000	742.1	-257.9	732	-268	1000	456	-544	468	-532
Iron (mg)	30	21.09	-8.91	25.4	-4.6	22	17	-5	19	-3
Vitamin C(mg)	65	50.1	-14.9	53.1	-11.9	70	49	-21	62	-8
Total folate (µg)	245	154.00	-91.0	159.0	-86	285	211	-74	232	-53
Zinc(mg)	12.8	13.34	+0.54	13.12	+0.32	14.3	11	-3.3	9.5	-4.8
Selenium(µg)	40	32.7	-7.3	30.5	-9.5	40	22	-18	21	-19

*RDA: ICMR (NIN) 2023** EAR; Visible fat:25-35

Table 4 reports that the nutrient intake patterns of adolescents aged 13–15 years, consisting of girls (n=21) and boys (n=22), were assessed against the ICMR-NIN 2023 Recommended Dietary Allowances (RDA). The findings reveal notable excesses and deficits in both pre- and post-test periods across several nutrients. For energy intake, both girls and boys consumed well above the recommended values. Girls had an energy intake of 2964.53 kcal (pre-test) and 2945 kcal (post-test), which was +564.53 kcal and +545 kcal above the reference value of 2400 kcal (EAR). Similarly, boys consumed 2645 kcal (pre-test) and 2559 kcal (post-test) compared to the reference 2500 kcal, exceeding by +145 kcal and +59 kcal respectively. In terms of protein, girls significantly exceeded the RDA of 42 g, consuming 79.41 g (pre-test) and 72.1 g (post-test), with an excess of +37.41 g and +30.1 g. Boys, with a reference of 49 g, consumed 56 g and 54 g, showing a modest surplus of +7 g and +5 g.

The visible fat intake was alarmingly high for both genders. Girls consumed 162.44 g and 159.3 g of fat, exceeding the recommended 31 g by +131.44 g and +128.3 g. Boys had similarly excessive intake at 145 g and 142 g, surpassing the RDA by +114 g and +111 g. In contrast, deficits were observed in micronutrient intake. For calcium, the RDA was 1000 mg, yet girls consumed 742.1 mg and 732 mg (deficits of -257.9 mg and -268 mg), while boys consumed only 456 mg and 468 mg (deficits of -544 mg and -532 mg). Iron intake was also below recommendations. Girls had an intake of 21.09 mg (pre-test) and 25.4 mg (post-test) against the reference 30 mg, resulting in deficits of -8.91 mg and -4.6 mg. Boys consumed 17 mg and 19 mg compared to their RDA of 22 mg, showing deficits of -5 mg and -3 mg. Vitamin C intake remained insufficient, with girls consuming 50.1 mg and 53.1 mg (short by -14.9 mg and -11.9 mg from the RDA of 65 mg), and boys consuming 49 mg and 62 mg against an RDA of 70 mg, resulting in deficits of -21 mg and -8 mg.

Folate intake was consistently low, with girls consuming 154 µg and 159 µg, -91 µg and -86 µg below the RDA of 245 µg. Boys had slightly better intake at 211 µg and 232 µg, but still fell short by -74 µg and -53 µg from the RDA of 285 µg. Zinc intake showed a mixed pattern. Girls slightly exceeded their RDA of 12.8 mg, with intakes of 13.34 mg and 13.12 mg, while boys consumed 11 mg and 9.5 mg against an RDA of 14.3 mg, with deficits of -3.3 mg and -4.8 mg. Selenium intake was inadequate for both genders. Girls consumed 32.7 µg and 30.5 µg, -7.3 µg and -9.5 µg below the RDA of 40 µg, while boys consumed 22 µg and 21 µg, showing higher deficits of -18 µg and -19 µg.

Table 5 : ***Nutrient Intake of the Adolescents (16-17 years)***

Nutrients	16-17 years									
	Girls (n=15)					Boys (n=6)				
	Reference *	Pre-Test	Nutrient Intake Excess/ Deficit	Post Test	Nutrient Intake Excess/ Deficit	Reference	Pre-Test	Nutrient Intake Excess/ Deficit	Post Test	Nutrient Intake Excess/ Deficit
Energy(kcal)**	2500	2964.53	+464.53	2789	+289	2700	2954	+254	2914	+214
Protein(g)	46.2	79.41	+33.41	74.41	+28.41	48	76.1	+28.2	79.1	+31.1
Visible fat(g)	31	162.44	+131.44	152.12	+121.12	31	145	+114	140.1	+109.1
Calcium(mg)	1000	742.1	-257.6	712.10	287.9	1050	856.5	-193.5	985.5	64.5
Iron (mg)	32	21.09	-10.94	24.4	7.6	26	25.1	-0.9	24.1	-1.9
Vitamin C(mg)	68	50.1	-17.9	54.4	13.6	85	78.4	-6.6	77.2	7.8
Total folate (µg)	270	154.00	-116	160.21	-110	340	225	-115	228	-112
Zinc(mg)	14.2	13.34	-0.86	12.45	-1.75	17.6	14.3	-3.3	16.4	-1.2
Selenium(µg)	40	32.7	-7.3	34.5	5.5	40	34.1	-5.9	38.4	-1.6

*RDA: ICMR (NIN) 2023,** EAR; Visible fat:25-35

Table 5 reports that the nutrient intake analysis among adolescents aged 16–17 years and the results reveals both excesses and deficiencies across various nutrients. Among girls (n=15), the mean energy intake was significantly higher than the recommended value (2500 kcal), with a pre-test excess of +464.53 kcal and post-test +289 kcal, indicating a decrease after intervention but still exceeding the requirement. Similarly, protein intake remained above the RDA (46.2 g), with +33.41 g (pre) and +28.41 g (post). Visible fat intake was notably excessive, showing +131.44 g (pre) and +121.12 g (post) over the recommended 31 g, highlighting a persistent overconsumption. However, deficiencies were observed in several micronutrients. Calcium intake was 257.6 mg below the RDA (1000 mg) in the pre-test and further decreased to 287.9 mg deficit in the post-test. Iron intake showed a negative balance as well, with -10.94 mg (pre) and -7.6 mg (post) against a requirement of 32 mg. The vitamin C intake was also insufficient at -17.9 mg (pre) and -13.6 mg (post). Folate consumption showed a substantial gap with -116 µg (pre) and -110 µg (post) compared to the RDA of 270 µg. Zinc and selenium levels were slightly below the requirements, with a zinc deficit of -0.86 mg (pre) and -1.75 mg (post), and selenium at -7.3 µg (pre) and -5.5 µg (post).

In contrast, the nutrient intake of boys (n=6) in the same age group revealed a positive energy balance as well, exceeding the 2700 kcal RDA by +254 kcal (pre) and +214 kcal (post). Protein intake was also above the RDA (48 g), with +28.2 g (pre) and +31.1 g (post). Visible fat intake remained high at +114 g (pre) and +109.1 g (post). Micronutrient deficits were comparatively lower among boys. Calcium intake showed improvement, rising from -193.5 mg (pre) to +64.5 mg (post). Iron intake showed a minimal negative shift (-0.9 mg pre, -1.9 mg post), while vitamin C levels were nearly adequate (-6.6 mg pre, +7.8 mg post). Folate remained below the required intake, with -115 µg (pre) and -112 µg (post). Zinc and selenium levels improved slightly post-test, with zinc deficit reducing from -3.3 mg to -1.2 mg, and selenium from -5.9 µg to -1.6 µg.

Therefore the intervention helped reduce nutrient gaps slightly, overconsumption of energy and fat, and under-consumption of critical micronutrients like calcium, iron, folate, and zinc remain key areas of concern in both genders. Before the intervention, adolescents showed excessive intake of energy, protein, and visible fat, with deficits in micronutrients like calcium, iron, folate, and zinc. Girls consumed 464.53 kcal above RDA, and boys 254 kcal above, indicating poor dietary balance. Post-intervention, there was a modest reduction in energy and fat intake, reflecting improved awareness. Protein intake slightly decreased but remained above RDA. Calcium intake improved in boys but declined in girls, while iron, folate, zinc, and selenium remained deficient in both groups despite minor changes. Vitamin C intake increased, especially in girls, indicating better fruit intake. Overall, the intervention positively influenced some dietary behaviours, but micronutrient gaps persisted, suggesting the need for stronger, practical nutrition strategies.

Conclusion

The findings of the study demonstrates a significant improvement in knowledge levels on obesity among adolescents post-intervention, with both girls and boys reaching a perfect score in the post-test from pre-test, showing statistically significant results. However, the nutrient intake patterns post-intervention reflect persistent dietary imbalances. For instance, even after intervention, visible fat intake remained excessively high in girls aged 13–15 years and boys. Micronutrient deficiencies were also notable calcium intake iron, zinc, and folate across both age groups. The study critically reveals that although knowledge-based intervention significantly improved awareness regarding obesity among adolescents, actual changes in dietary practices were limited and selective. While energy and visible fat consumption showed a minor reduction post-intervention, micronutrient deficiencies such as calcium, iron, zinc, folate, and selenium remained notably prevalent in both age groups and genders. This suggests that knowledge alone does not automatically translate into behaviour change, especially among adolescents where food choices are influenced by taste preferences, peer pressure, availability, and socio-cultural factors.

The persistently high protein and fat intake and moderate increase in Vitamin C indicate partial dietary adjustments, potentially due to short-term motivation rather than sustainable lifestyle changes. Furthermore, the continued micronutrient deficits highlight the need for systemic, community-based interventions rather than relying solely on educational inputs.

The Future Recommendations

- Integrate nutrition education into the school curriculum with regular reinforcement.
- Promote home and community-level dietary modifications through parent workshops.
- Provide access to fortified foods or school-based supplementation programs for key micronutrients.
- Implement policy-driven initiatives like regulated school canteen menus.
- Conduct long-term behavioural change strategies, not just one-time awareness sessions.

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