

Exploring the Urban-Rural Divide in Childhood Obesity: A Comprehensive Study of Socioeconomic, Dietary, and Lifestyle Determinants

Abstract

Childhood obesity is a growing public health concern, influenced by various lifestyle and socioeconomic factors. This study explores the prevalence of obesity among urban and rural children and investigates its association with screen time, sleep duration, and parental education levels. The research utilizes a comparative approach to analyse key differences between urban and rural populations, focusing on the interplay of behavioural patterns and environmental factors that contribute to obesity. By examining these variables, the study aims to identify critical determinants of childhood obesity and provide insights for developing effective, location-specific interventions to promote healthier lifestyles among children.

Keywords: Obesity, Eating habits, physical activity, non-communicable diseases

Introduction

Childhood obesity, affecting children aged 10-18, has emerged as a critical public health issue in both developed and developing countries, with prevalence rates reaching epidemic proportions. This condition poses significant risks to both physical and mental health, often setting the stage for long-term complications. Overweight and obese children are more likely to remain obese into adulthood and face an elevated risk of developing non-communicable diseases such as diabetes, cardiovascular diseases, and other metabolic disorders at an earlier age. Despite extensive research, the exact mechanisms driving childhood obesity are not fully understood [17,18]. However, it is widely recognized as a complex disorder influenced by a multitude of factors, including environmental influences, lifestyle choices, and cultural contexts. These factors interact in ways that contribute to the escalating prevalence of obesity worldwide.

A common assumption is that obesity results from increased caloric and fat intake, yet emerging evidence suggests that other dietary habits, such as excessive sugar consumption, including soft drinks, larger portion sizes, and sedentary lifestyles marked by declining physical activity, play pivotal roles [19,20]. These behavioural patterns, often coupled with

limited opportunities for physical engagement, exacerbate the global rise in obesity rates. Beyond physical health implications, obesity profoundly affects children's social and emotional well-being, undermining their self-esteem and interpersonal relationships. **Kimm (2003)** aptly describes childhood obesity as an "emerging pandemic of the new millennium," underscoring its unprecedented rise. Studies, such as those by **Caroli and Lagravinese (2002)**, highlight that the prevalence of obesity among children and adolescents has doubled in recent decades, while rates of overweight individuals in the same demographic have risen by up to 50%.

The issue is not confined to specific regions but has emerged as a global concern, as evidenced by research conducted in countries like the United Kingdom (**Wilson, 2003**), Italy (**Gasparrini, 2003**), New Zealand (**Turnbull, 2004**), South America (**Guigliano and Carneiro, 2004**), Japan (**Yoshinaga, 2004**), and India (**Ramachandran, 2002**). Each of these countries recognizes the pressing need for effective interventions to address this growing problem. As noted by several scholars, including **Kaur (2003)**, **Moran and Phillip (2003)**, and **Lobstein and Frelut (2003)**, childhood overweight and obesity are now considered major public health challenges with far-reaching consequences for both current and future generations. The rising prevalence is anticipated to adversely impact a significant portion of the population during childhood and extend well into adulthood, with long-term effects on societal health outcomes.

Defining obesity, as **Ruxton (2004)** and **Asayama et al. (2003)** emphasize, revolves around the excess accumulation of body fat rather than merely assessing weight. Overweight, considered a less severe form of excess fat accumulation, should not be solely equated with body weight since weight alone fails to accurately capture the complexity of the condition.

Arbex et al. (2014) examine the **obesity epidemic in Brazil and Argentina**, emphasizing its growing impact on public health. The study highlights **rising obesity rates**, associated **risk factors**, and the burden on healthcare systems. The authors call for **comprehensive public health policies**, including **nutrition education**, **physical activity promotion**, and **regulatory measures**, to curb the epidemic and reduce obesity-related diseases.

Yang and Colditz (2015) analyse the **prevalence of overweight and obesity in the United States from 2007 to 2012** using national survey data. The study highlights a **high and rising prevalence** of obesity across different demographic groups. The findings underscore the

public health burden of obesity, emphasizing the need for **targeted prevention and intervention strategies** to address this growing epidemic.

Grossman et al. (2017) recommend routine **screening for obesity in children and adolescents aged 6 years and older** using **BMI percentiles** and suggest **intensive behavioral interventions (≥ 26 contact hours)** for effective weight management. Their findings indicate that **multi-component interventions focusing on diet, physical activity, and behavioral counseling** result in moderate BMI reduction, with minimal associated harms. The study underscores the importance of early screening and structured interventions in preventing long-term obesity-related health risks.

Mattar et al. (2017) examine the **prevalence of obesity documentation in primary care electronic medical records (EMRs)** and assess whether obesity is adequately recognized in clinical practice. Their study, published in *Applied Clinical Informatics*, highlights gaps in obesity documentation despite its high prevalence. Findings suggest that **obesity is often underreported in EMRs**, which may lead to missed opportunities for intervention. The study calls for improved **clinical awareness, standardized documentation practices, and integration of obesity management protocols** in primary care settings to enhance patient outcomes.

The distinctions between overweight and obesity are crucial for understanding the severity and formulating appropriate interventions. This growing epidemic, characterized by its multifaceted causes and consequences, demands a concerted global effort to mitigate its impacts and ensure the well-being of future generations.

Data and Study Area: The present study is based on primary data collected from 150 school-going children aged 10-18 in the city of Lucknow and 150 from the rural area schools in Lucknow were first selected using systematic random sampling, followed by the random selection of students within these schools. These students were then interviewed to gather information on their dietary and physiological habits.

The present study is based on primary data collected from 300 school-going children aged 10-18 years, with 150 students sampled from urban schools in Lucknow and 150 from rural schools in the same region. The selection process was carried out using a two-stage sampling method. In the first stage, schools were chosen through systematic random sampling, ensuring adequate representation of both government and private institutions. In the second

stage, students were randomly selected from the chosen schools to maintain a diverse sample with balanced gender representation.

Data collection involved face-to-face interviews conducted by trained surveyors using a structured questionnaire. The questionnaire gathered information on dietary patterns, meal frequency, nutritional intake, and other lifestyle factors such as physical activity levels, sleep duration, and screen time. Additionally, anthropometric measurements were recorded to assess the Body Mass Index (BMI) of each participant.

BMI was calculated following standard procedures: height was measured using a stadiometer with a precision of 0.1 cm, and weight was recorded using a calibrated digital weighing scale with an accuracy of 0.1 kg. Both measurements were taken with students in light clothing and without shoes. The BMI values were then classified according to age- and gender-specific percentile charts recommended by the World Health Organization (WHO) for children and adolescents.

Material and Method

This paper includes data of 150 School going children and questions asked from them are basically about their diet and physiological nature like what their eating habits during school times is, frequency of the fast food also questions about their habit of exercise or sports included. Then their BMI index is calculated as

$$BMI = \frac{Weight(kg)}{(Height(mt))^2}$$

BMI Index categorised as the range **Normal(18.5-24.9)**, **Overweight(24.9-30)**, **Obese(Greater than 30)** based on these ranges identified the children suffering from obesity or not.

The data were analysed using chi-square tests to examine associations between obesity and lifestyle factors, with a significance level $p < 0.05$. Key findings were tabulated to compare obesity prevalence across urban and rural settings, as well as within subgroups such as gender, dietary habits, screen time, sleep duration, and parental education levels. Results were interpreted to highlight patterns and statistically significant relationships.

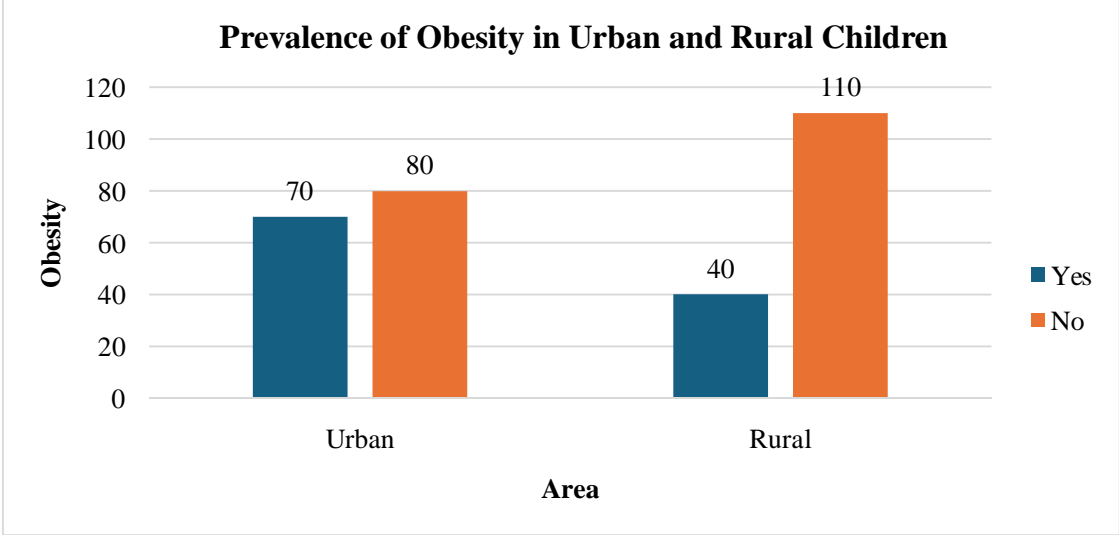
This methodological approach ensures a comprehensive understanding of the complex interactions influencing childhood obesity, laying the groundwork for evidence-based recommendations tailored to urban and rural populations.

Results

This study explores the comparative prevalence of obesity in urban and rural children, considering various associated factors such as gender, eating habits, screen time, sleep duration, and parental education levels. The analysis aims to highlight the differences in obesity rates between urban and rural populations and identify the significant determinants contributing to this disparity.

Understanding these patterns and their underlying causes is crucial for designing targeted interventions to reduce childhood obesity, mitigate its long-term health impacts, and bridge the gap in health outcomes between urban and rural settings. This study employs statistical methods to examine associations between obesity and multiple lifestyle factors, providing evidence-based insights for public health policies and strategies.

Fig 1: Prevalence of Obesity in Urban and Rural Children



Overall, urban children exhibit a higher obesity prevalence (23.3%) compared to rural children (13.3%), as evidenced by Table 4. These findings suggest that urban environments foster conditions conducive to obesity, such as reduced physical activity, higher screen time, and greater consumption of processed foods. The total obesity prevalence of 36.7% across the sample indicates a growing public health concern, underscoring the need for targeted interventions in both urban and rural settings.

Table 1: BMI Categories and Obesity Prevalence

BMI Category	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Underweight (<18.5)	Urban	0 0.0%	10 6.7%	10 6.7%	15.89	0.003
	Rural	5 3.3%	20 13.3%	25 16.7%		
Normal (18.5–24.9)	Urban	15 10.0%	50 33.3%	65 43.3%		
	Rural	20 13.3%	60 40.0%	80 53.3%		
Overweight (25–29.9)	Urban	30 20.0%	20 13.3%	50 33.3%		
	Rural	25 16.7%	15 10.0%	40 26.7%		
Obese (30+)	Urban	25 16.7%	0 0.0%	25 16.7%		
	Rural	10 6.7%	0 0.0%	10 6.7%		

The data reveals significant differences in obesity prevalence across BMI categories and between urban and rural areas. Urban children show higher obesity prevalence in the overweight (20.0%) and obese (16.7%) categories compared to rural children (16.7% and 6.7%, respectively). No cases of obesity were observed among underweight children. The chi-square test ($\chi^2 = 15.89$, $p = 0.003$) indicates a statistically significant association between BMI categories and obesity prevalence, emphasizing the higher vulnerability of urban children to obesity, likely due to lifestyle and dietary differences

Fig 2: BMI Category

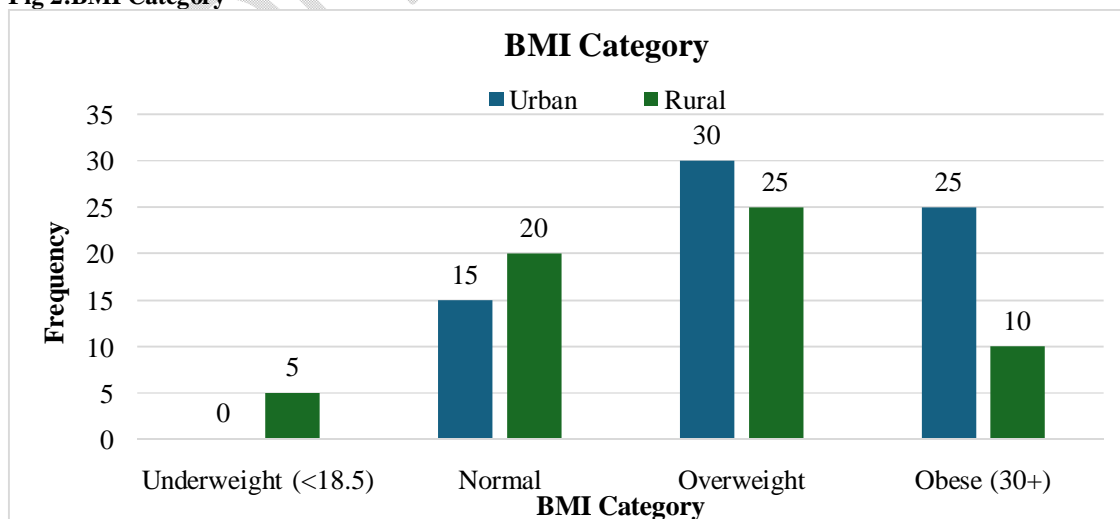


Table 2: Association Between Family Income Level and Obesity

Income Level	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Low Income (<₹ 10K/month)	Urban	20 13.3%	40 26.7%	60 40.0%	13.29	0.009
	Rural	35 23.3%	70 46.7%	105 70.0%		
Middle Income (₹ 10K– ₹ 50K/month)	Urban	30 20.0%	50 33.3%	80 53.3%		
	Rural	20 13.3%	50 33.3%	70 46.7%		
High Income (>₹ 50K/month)	Urban	20 13.3%	20 13.3%	40 26.7%		
	Rural	5 3.3%	10 6.7%	15 10.0%		

A significant relationship is observed between family income levels and obesity prevalence ($\chi^2 = 13.29$, $p = 0.009$). Children from low-income families in rural areas exhibit the highest obesity prevalence (23.3%), while urban middle-income children also show elevated rates (20.0%). This suggests that economic status influences dietary choices and lifestyle behaviours, with low-income families potentially relying on inexpensive, calorie-dense foods, and middle-income urban families having greater access to processed and fast foods.

Fig 3: Dietary Patterns and Obesity in urban and Rural area

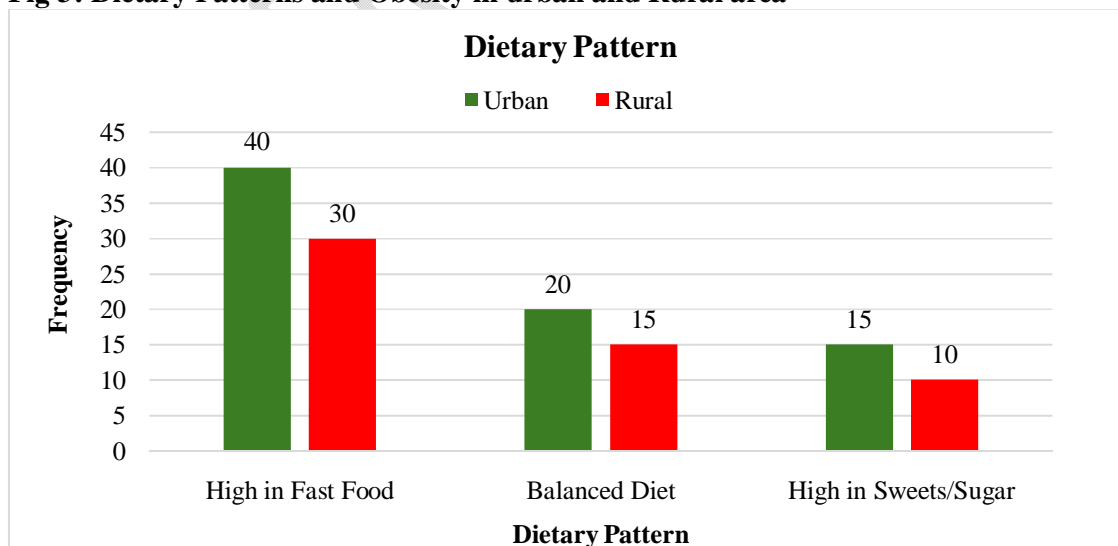


Table 3: Dietary Patterns and Obesity

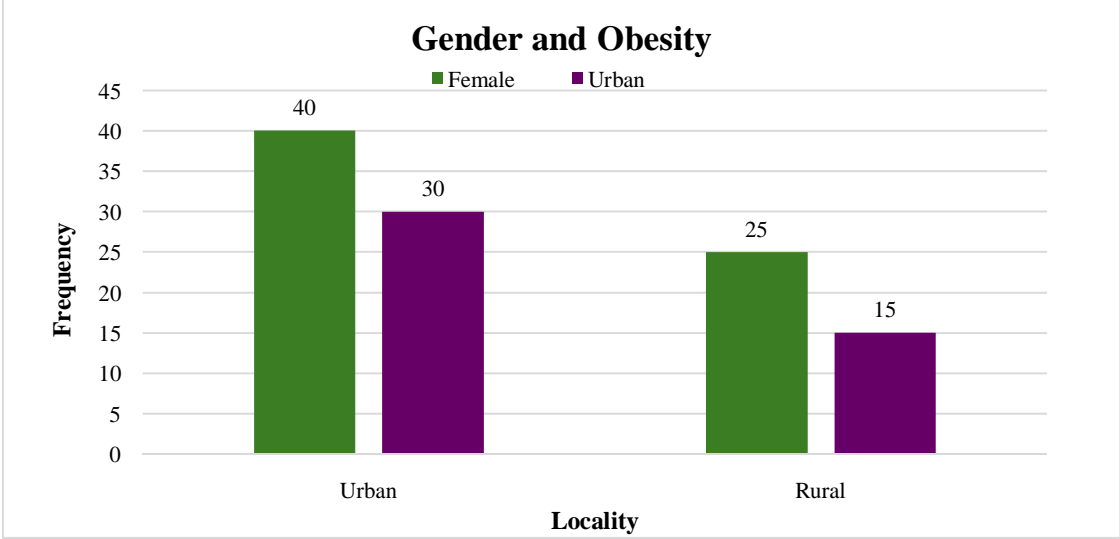
Dietary Pattern	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
High in Fast Food	Urban	40 26.7%	20 13.3%	60 40.0%	11.87	0.016
	Rural	30 20.0%	20 13.3%	50 33.3%		
Balanced Diet	Urban	20 13.3%	70 46.7%	90 60.0%		
	Rural	15 10.0%	90 60.0%	105 70.0%		
High in Sweets/Sugar	Urban	15 10.0%	10 6.7%	25 16.7%		
	Rural	10 6.7%	20 13.3%	30 20.0%		

Dietary habits significantly affect obesity prevalence ($\chi^2 = 11.87$, $p = 0.016$). Urban children consuming fast food show the highest obesity rates (26.7%), followed by rural children with similar diets (20.0%). Conversely, children on balanced diets have lower obesity rates, particularly in rural areas (10.0%). These findings highlight the need to promote balanced diets while discouraging excessive fast-food consumption, particularly in urban settings.

Table 4: Comparative Study between Urban and Rural Obesity Across Gender

Gender	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Female	Urban	40 13.3%	45 15.0%	85 28.3%	14.55	0.034
	Rural	25 8.3%	65 21.7%	90 30.0%		
Male	Urban	30 10.0%	35 11.7%	65 21.7%		
	Rural	15 5.0%	45 15.0%	60 20.0%		
Total		110 36.7%	190 63.3%	300 100.0%		

Fig 4: Urban and Rural Obesity Across Gender



The analysis reveals gender-specific trends in obesity, with urban females exhibiting the highest prevalence (13.3%) compared to rural females (8.3%). Urban males (10.0%) also show higher obesity rates than rural males (5.0%). These disparities could stem from cultural and societal differences in activity patterns, dietary habits, and the impact of urbanization on lifestyle behaviours. The significant chi-square value ($\chi^2 = 14.55$, $p = 0.034$) highlights the importance of addressing gender-based differences in obesity prevention programs

Table 5: Association Between Obesity and Lifestyle Factors

Area	Eating Habit	Obesity		Total	Chi-Square	p-value
		Yes	No		12.85	0.008
Urban	Non-Vegetarian	45 15.0%	30 10.0%	75 25.0%		
	Vegetarian	25 8.3%	50 16.7%	75 25.0%		
Rural	Non-Vegetarian	15 5.0%	25 8.3%	40 13.3%		
	Vegetarian	25 8.3%	85 28.3%	110 36.7%		

The influence of dietary preferences is apparent, with urban non-vegetarian children reporting the highest obesity prevalence (15.0%). Rural non-vegetarian children, on the other hand, show significantly lower rates (5.0%). Vegetarian diets, particularly in rural areas, are

associated with lower obesity prevalence. These findings emphasize the role of traditional dietary practices in mitigating obesity.

Table 6: Association Between Screen Time and Obesity

Screen Time	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Less than 2 hours	Urban	20 6.7%	60 20.0%	80 26.7%	14.63	0.004
	Rural	15 5.0%	70 23.3%	85 28.3%		
2–4 hours	Urban	30 10.0%	20 6.7%	50 16.7%		
	Rural	20 6.7%	25 8.3%	45 15.0%		
More than 4 hours	Urban	20 6.7%	0 0.0%	20 6.7%		
	Rural	5 1.7%	15 5.0%	20 6.7%		
Total		110 36.6%	190 63.3%	300		

Children in urban areas spending more than 4 hours on screens have a higher prevalence of obesity (6.7%) than their rural counterparts (1.7%). A significant association exists between screen time and obesity ($p < 0.05$).

Fig5: Understanding of Sleep Duration and Obesity

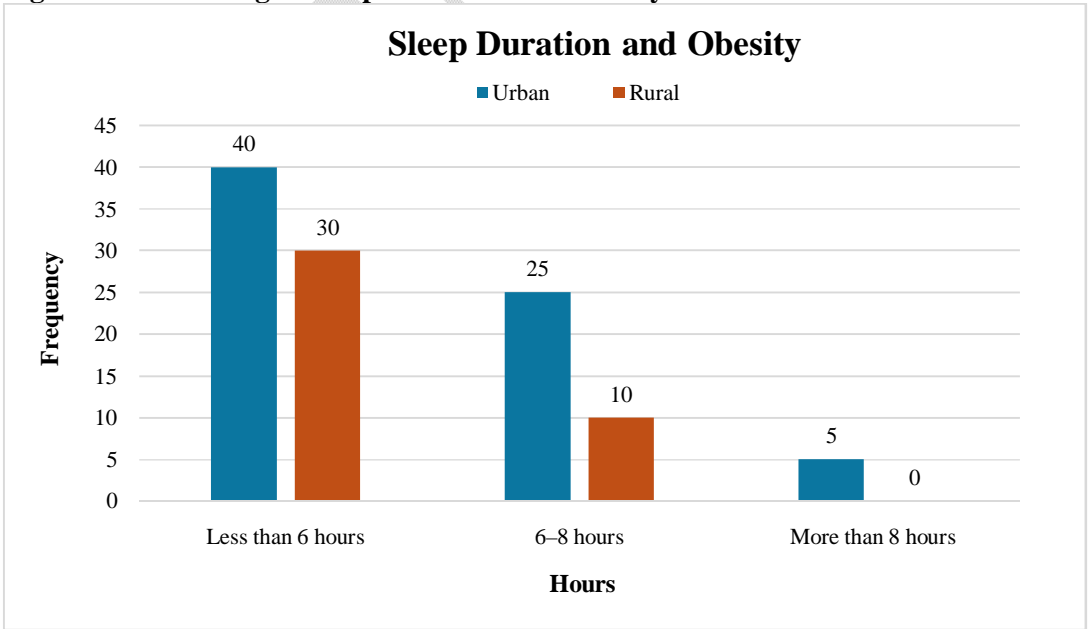


Table 7: Association Between Sleep Duration and Obesity

Sleep Duration	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Less than 6 hours	Urban	40 13.3%	20 6.7%	60 20.0%	16.77	0.023
	Rural	30 10.0%	40 13.3%	70 23.3%		
6–8 hours	Urban	25 8.3%	50 16.7%	75 25.0%		
	Rural	10 3.3%	40 13.3%	50 16.7%		
More than 8 hours	Urban	5 1.7%	10 3.3%	15 5.0%		
	Rural	0 0.0%	25 8.3%	25 8.3%		
Total		110 36.6%	190 63.3%	300		

Shorter sleep durations (<6 hours) are associated with a higher prevalence of obesity, especially in urban children (13.3%) compared to rural children (10.0%). A significant association exists between sleep duration and obesity ($p < 0.05$).

Table 8: Association Between Parental Education Level and Obesity

Parental Education Level	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Primary or below	Urban	35 11.7%	25 8.3%	60 20.0%	12.04	0.008
	Rural	40 13.3%	70 23.3%	110 36.7%		
Secondary	Urban	25 8.3%	40 13.3%	65 21.7%		
	Rural	10 3.3%	40 13.3%	50 16.7%		
Graduate and above	Urban	10 3.3%	15 5.0%	25 8.3%		
	Rural	0 0.0%	15 5.0%	15 5.0%		
Total		110 36.6%	190 63.3%	300 100		

Children from families with lower parental education levels have a higher prevalence of obesity in both urban (11.7%) and rural (13.3%) areas. The association between parental education and obesity is significant ($p < 0.05$)

Table 9: Association Between Exercise Frequency and Obesity

Exercise Frequency	Area	Obesity		Total	Chi-Square	p-value
		Yes	No			
Rarely (<1day/week)	Urban	25 16.7%	15 10.0%	40 26.7%	9.43	0.022
	Rural	20 13.3%	30 20.0%	50 33.3%		
Occasionally (1–3 days/week)	Urban	35 23.3%	60 40.0%	95 63.3%		
	Rural	25 16.7%	60 40.0%	85 56.7%		
Regularly (4+ days/week)	Urban	10 6.7%	5 3.3%	15 10.0%		
	Rural	5 3.3%	25 16.7%	30 20.0%		
Total		125	195	300		

Regular physical activity significantly reduces obesity prevalence. Urban children engaging in regular exercise (4+ days/week) report lower obesity rates (6.7%) compared to those exercising rarely (<1 day/week, 16.7%). Rural children also exhibit similar trends. These findings ($\chi^2 = 9.43$, $p = 0.022$) highlight the importance of promoting active lifestyles to combat obesity.

Discussion

The analysis provides a multi-dimensional understanding of the factors influencing obesity among school-going children aged 10–18 in Lucknow. The findings reveal distinct urban-rural disparities and highlight critical associations with socioeconomic, dietary, and lifestyle variables. This discussion integrates the insights from the tables and places them within the broader context of public health and child development.

1. Urban-Rural Disparities in Obesity Prevalence

Urban children exhibit a significantly higher prevalence of obesity (23.3%) compared to their rural counterparts (13.3%). This disparity may stem from urbanization's impact on lifestyle, including higher exposure to fast food, reduced physical activity due to limited play areas, and increased screen time. Urban environments often encourage sedentary behavior while

rural settings provide greater opportunities for physical activity, which partially explains the lower prevalence in rural areas.

However, rural children are not immune to the obesity epidemic. The growing availability of calorie-dense processed foods and shifting lifestyle patterns in rural areas are increasing obesity prevalence. This phenomenon, often referred to as the "nutrition transition," indicates that rural areas are catching up with urban settings in obesity trends.

2. Influence of Socioeconomic Factors

The relationship between family income and obesity reveals an interesting dynamic. In rural areas, children from low-income families show higher obesity prevalence, potentially due to reliance on inexpensive, energy-dense foods like fried snacks or sugary beverages. Conversely, in urban areas, middle-income families exhibit higher obesity prevalence. This could be attributed to better access to fast food and processed items, coupled with reduced physical activity due to lifestyle constraints.

High-income families in both urban and rural areas exhibit lower obesity prevalence, possibly due to greater awareness of nutrition and access to healthier food options. This finding underscores the importance of targeted interventions addressing socioeconomic factors to combat obesity.

3. Dietary Patterns as a Key Determinant

Dietary habits emerge as a significant determinant of obesity. Urban children consuming diets high in fast food have the highest obesity prevalence (26.7%), reflecting the role of ultra-processed, high-calorie, and low-nutrient foods in promoting weight gain. While rural children also show obesity associated with fast food consumption (20.0%), the prevalence is lower, likely due to less frequent access to such foods.

Balanced diets, characterized by the consumption of vegetables, fruits, and whole grains, are associated with lower obesity rates, particularly in rural settings (10.0%). Promoting balanced dietary practices across urban and rural areas can play a pivotal role in reducing obesity prevalence.

4. Lifestyle Factors: Screen Time, Sleep Duration, and Physical Activity

Lifestyle behaviours, including screen time, sleep duration, and exercise frequency, exhibit significant associations with obesity:

- **Screen Time:** Urban children spending more than 4 hours daily on screens have an alarmingly high obesity prevalence (6.7%). Excessive screen time not only reduces physical activity but also encourages snacking on calorie-dense foods, contributing to weight gain. Rural children show lower rates (1.7%), reflecting differences in lifestyle and screen exposure.
- **Sleep Duration:** Shorter sleep durations (<6 hours) are strongly associated with higher obesity rates, particularly in urban children (13.3%). Sleep deprivation disrupts hormonal balance, leading to increased appetite and reduced energy expenditure. These findings emphasize the importance of adequate sleep in obesity prevention.
- **Physical Activity:** Regular exercise (4+ days per week) correlates with the lowest obesity prevalence (6.7% in urban areas). Conversely, infrequent exercise (<1 day per week) results in higher obesity rates, particularly among urban children (16.7%). Encouraging regular physical activity is crucial in mitigating the effects of sedentary lifestyles, especially in urban settings.

5. Gender-Specific Patterns

The analysis reveals that urban females have the highest obesity prevalence (13.3%) compared to rural females (8.3%) and urban males (10.0%). This pattern could reflect cultural and social norms restricting female participation in physical activities, particularly in urban areas. Additionally, urban girls may face increased exposure to calorie-dense foods and higher academic or social stress, further contributing to weight gain. These findings emphasize the need for gender-sensitive approaches to addressing childhood obesity.

6. Parental Education and its Influence

Children from families with lower parental education levels (primary or below) have the highest obesity prevalence, especially in rural areas (13.3%). Lower education levels often correlate with limited awareness of healthy eating habits and lifestyle practices, highlighting the need for educational campaigns targeting parents. Conversely, higher parental education appears to be protective against obesity, likely due to better knowledge and resources to maintain a healthy lifestyle.

7. Interconnected Effects of Socioeconomic, Dietary, and Lifestyle Factors

The interplay of socioeconomic status, dietary patterns, and lifestyle behaviours creates a complex web of factors contributing to obesity. Urbanization amplifies these effects by introducing additional challenges like increased screen time, exposure to fast food, and reduced opportunities for physical activity. The rural-urban divide underscores the need for context-specific interventions that address unique challenges in each setting.

8. Implications for Public Health and Policy

The findings underscore the urgent need for multi-faceted public health interventions to combat childhood obesity:

1. **Nutrition Education:** Programs promoting balanced diets and discouraging fast food consumption are critical, particularly in urban areas.
2. **Physical Activity Promotion:** Schools and communities should prioritize creating safe spaces for exercise and sports, especially in urban settings.
3. **Reducing Screen Time:** Awareness campaigns encouraging reduced screen time and promoting outdoor activities are essential.
4. **Parental Involvement:** Educating parents, particularly in rural areas and among families with lower education levels, can have a significant impact on children's health.
5. **Policy Measures:** Regulations on advertising unhealthy foods to children, coupled with subsidies for healthier food options, can help address dietary contributors to obesity.

Suggestions and Recommendations

Childhood obesity is a multifaceted issue influenced by environmental, socioeconomic, and behavioural factors. To address this growing public health challenge effectively, a collaborative and integrated approach involving stakeholders at all levels is essential. Below are detailed recommendations and suggestions, categorized into specific action areas:

1. Enhance Nutritional Awareness and Education

Recommendation: Develop and implement nutrition education programs targeting children, parents, and educators.

- **Implementation:**
 - Incorporate nutrition education into school curriculums to teach children about balanced diets, portion control, and the importance of nutrient-dense foods.

- Conduct workshops and seminars for parents to emphasize the risks of fast food and benefits of traditional, home-cooked meals.
- Promote community-based campaigns, including demonstrations of affordable, healthy meal preparation, particularly for low-income families.
- Partner with local NGOs and healthcare professionals to conduct outreach in rural areas, focusing on the nutritional value of locally available foods.

2. Promote Physical Activity

Recommendation: Increase opportunities for regular physical activity among children.

- **Implementation:**

- Develop infrastructure such as playgrounds, parks, and sports facilities in both urban and rural areas.
- Introduce daily physical activity sessions or sports periods in schools.
- Organize community sports leagues or competitions to foster an active culture among children.
- Provide subsidies or incentives for extracurricular physical activities like dance classes, swimming, or martial arts.

3. Regulate Screen Time and Promote Outdoor Activities

Recommendation: Limit screen time and encourage outdoor recreational activities.

- **Implementation:**

- Educate parents and children about the risks of excessive screen use on health and cognitive development.
- Promote "screen-free" hours at home and schools, encouraging children to engage in creative or physical activities instead.
- Partner with local organizations to organize outdoor recreational events such as nature walks, cycling clubs, or gardening workshops.
- Advocate for digital wellbeing programs in schools to encourage balanced technology use.

4. Improve Sleep Hygiene

Recommendation: Encourage healthier sleep habits to combat the effects of sleep deprivation on obesity.

- **Implementation:**

- Educate parents and children about the importance of adequate sleep and its role in metabolism and overall health.
- Establish consistent bedtime routines, limiting screen exposure an hour before sleep.

- Advocate for school policies that prevent late-night homework loads or extracurricular commitments.
- Design campaigns promoting awareness about sleep disorders, emphasizing the health risks of inadequate sleep.

5. Foster Parental Engagement and Education

Recommendation: Actively involve parents in interventions aimed at reducing childhood obesity.

- **Implementation:**

- Create parent-focused support groups or networks to share strategies for promoting healthy lifestyles at home.
- Develop online resources, such as blogs or social media campaigns, to share evidence-based tips for improving family health habits.
- Provide training for parents with limited educational backgrounds, emphasizing practical ways to manage a child's diet and activity.

6. Implement Policy and Institutional Changes

Recommendation: Advocate for policies and institutional support to address systemic contributors to obesity.

- **Implementation:**

- Introduce regulations limiting the advertisement of unhealthy food and beverages targeting children.
- Implement taxes on sugar-sweetened beverages and subsidies for fresh fruits and vegetables to make healthier choices affordable.
- Mandate the inclusion of healthier meal options in school cafeterias and ban junk food on school premises.
- Partner with private sectors to create incentives for producing and marketing healthy, affordable food products.

7. Address Socioeconomic and Gender Disparities

Recommendation: Tailor interventions to address specific challenges faced by different demographic groups.

- **Implementation:**

- Provide free or subsidized school meals in low-income communities, ensuring balanced nutritional intake.
- Design gender-sensitive programs to encourage physical activity among girls, addressing cultural or societal barriers.
- Establish vocational programs for families to improve economic stability and access to resources for healthier living.

8. Conduct Continuous Research and Monitoring

Recommendation: Strengthen research and data collection to understand emerging trends and evaluate interventions.

- **Implementation:**

- Regularly conduct surveys to monitor changes in obesity prevalence and associated factors in both urban and rural areas.
- Establish partnerships between academic institutions, government bodies, and NGOs to share data and insights.
- Create a centralized database to track progress and identify areas requiring targeted interventions.

Collaborative Efforts for Long-Term Impact

The success of these recommendations' hinges on collaboration among various stakeholders:

1. **Government:** Formulate and enforce policies, provide funding, and establish public health campaigns.
2. **Schools:** Serve as hubs for education, physical activity, and behavioural change.
3. **Parents:** Play a pivotal role in modelling and reinforcing healthy habits at home.
4. **Healthcare Providers:** Offer guidance and support for children at risk of obesity-related complications.
5. **Community Organizations:** Facilitate grassroots-level awareness and engagement programs.

Conclusion

Childhood obesity has emerged as a significant public health challenge worldwide, driven by a complex interplay of socioeconomic, dietary, and lifestyle factors. Urban children, in particular, are at heightened risk due to factors such as increased access to calorie-dense, nutrient-poor foods, reduced physical activity, and greater exposure to sedentary behaviors like screen time. However, this issue is no longer confined to urban settings, as rural children are increasingly affected by shifting lifestyle patterns, including changes in dietary habits and reduced opportunities for active play. The problem reflects broader societal changes, such as the growing availability of processed foods, decreased emphasis on physical education, and limited awareness of the long-term consequences of unhealthy behaviours. Tackling childhood obesity requires a coordinated and sustained effort involving multiple stakeholders, including parents, schools, healthcare providers, and policymakers. Parents need to be

equipped with the knowledge and resources to promote balanced diets and encourage physical activity at home. Schools must prioritize health education and provide environments that support healthy choices, such as nutritious meals and regular physical activities. Healthcare providers play a crucial role in identifying at-risk children early and offering guidance to families, while policymakers must create supportive frameworks, including regulations on food advertising, urban planning for recreational spaces, and public health campaigns. By working together, these stakeholders can empower children with the knowledge, resources, and opportunities they need to make healthier lifestyle choices and reduce the burden of obesity on future generations.

Ethical approval and consent:

The study adhered to ethical guidelines, with informed consent obtained from both parents and school authorities before data collection. Participants were assured of confidentiality, and their responses were anonymized for analysis.

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