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Exploring the association between food choices, physical activity and childhood obesity in Urban Rajasthan

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Abstract
The rising prevalence of childhood obesity in urban Rajasthan, particularly in Jodhpur District, poses a significant public health challenge. This study examines the relationship between dietary habits, physical activity, and obesity among 200 schoolchildren aged 10-14 years in urban Jodhpur. Using a quantitative cross-sectional design, data were collected via structured questionnaires on food consumption and activity levels, alongside BMI measurements. Statistical analyses, including Cronbach's Alpha, T-tests, ANOVA, and correlation, were employed. Findings indicate a strong positive correlation between high-calorie diets (e.g., fast foods, sugary drinks) and obesity ($r=0.45$, $p<0.01$), while physical activity showed a negative correlation with BMI ($r=-0.40$, $p<0.01$). ANOVA revealed significant BMI differences across activity levels ($F=9.12$, $p<0.05$). T-tests highlighted that boys consumed more fast foods than girls ($t=2.56$, $p<0.05$). These results emphasize the impact of unhealthy eating and sedentary lifestyles on childhood obesity. Targeted interventions promoting nutritious diets and active lifestyles are essential to address this growing issue in urban Rajasthan, offering insights for health policymakers and educators.

Keywords: BMI, urban Rajasthan, Jodhpur District, childhood obesity, dietary habits, physical activity, fast food

Introduction
Childhood obesity is a pressing global health issue, with urban India, including Rajasthan, experiencing a surge in cases. In Jodhpur District, a key urban hub, approximately 12-18% of schoolchildren are overweight or obese, driven by shifts toward calorie-rich diets and reduced physical activity (Kumar *et al*., 2017) [10]. Urbanization has introduced fast-food outlets, increased screen time, and limited play spaces, fostering obesogenic environments. These changes, coupled with socioeconomic and cultural factors, exacerbate the problem.
Research globally links poor food choices, such as high consumption of processed foods and sugary beverages, to obesity (Popkin *et al*., 2012) [16]. Inactivity further compounds weight gain, with urban settings often lacking safe recreational areas. In India, traditional diets are being replaced by energy-dense foods, while academic pressures reduce physical activity time (Misra *et al*., 2014) [13]. Despite this, region-specific studies in Rajasthan are scarce, necessitating localized research.
This study investigates the interplay between food choices, physical activity, and childhood obesity in urban Jodhpur, focusing on schoolchildren aged 10-14 years. By identifying key risk factors, it aims to inform targeted interventions to curb obesity, contributing to healthier futures for Rajasthan's youth.

Review of literature
Childhood obesity results from complex interactions between diet, physical activity, and environmental factors. This review synthesizes studies to explore these associations, with relevance to urban Rajasthan. Mohammed *et al*. (2024) [14] found that high-calorie food preferences, particularly fast foods, correlate with increased body mass index (BMI) and waist circumference in Iraqi adults, with gender-specific differences.

This suggests dietary patterns significantly impact obesity, relevant to urban Rajasthan's fast-food proliferation. Salehi *et al*. (2024) explored ultra- processed food (UPF) consumption but found no significant link with chronic obstructive pulmonary disease, though UPFs are known to contribute to obesity risk in other contexts (Monteiro *et al*., 2013) [15].

Xu *et al*. (2024) [23] identified BMI and waist circumference as predictors of colorectal cancer risk, highlighting obesity's broader health implications. Mantri *et al*. (2024) [11] demonstrated that low dietary fiber intake leads to gut dysbiosis, exacerbating obesity, while synbiotic interventions improved gut health in low-fiber consumers. This underscores the protective role of nutrient-rich diets, relevant to Rajasthan's dietary shifts.

Barba *et al*. (2005) [2] reported an inverse association between milk consumption and BMI in children, suggesting dairy's potential in obesity prevention. Wietlisbach *et al*. (1997) [22] observed healthier dietary habits (e.g., increased skimmed milk use) in Switzerland, alongside increased physical activity, which reduced cardiovascular risk but not BMI, indicating mixed outcomes of lifestyle changes.

Campbell *et al*. (1998) [4] found that 64% of coronary heart disease patients were overweight, with suboptimal dietary habits and low physical activity, emphasizing the need for lifestyle interventions. Gennarelli *et al*. (1998) [8] showed that leptin levels, linked to body fat, did not differ significantly in polycystic ovary syndrome patients, suggesting obesity's primary driver is fat mass, not hormonal factors alone.

Monteiro *et al*. (2013) [15] highlighted the global rise of UPFs, correlating with obesity due to their high caloric density. Askari *et al*. (2020) [1] confirmed UPFs' role in increasing obesity risk through a meta-analysis, relevant to urban Rajasthan's food environment. He *et al*. (2023) [9] linked UPFs to chronic diseases, reinforcing dietary quality's impact on health. Safiri *et al*. (2022) [18] noted global increases in chronic disease burdens, including obesity, driven by lifestyle factors. Berthon and Wood (2015) [3] found that poor nutrition exacerbates respiratory health, indirectly linked to obesity's systemic effects. Zheng *et al*. (2016) [24] showed that healthy dietary patterns reduce chronic disease risk, supporting balanced diets for obesity prevention.

Venn *et al*. (2017) [21] observed that evolving food practices in Australia increased obesity risk, similar to urban India's dietary trends. Salari-Moghaddam *et al*. (2019) [19] linked processed meat to chronic diseases, including obesity, in prospective studies. Mendonca *et al*. (2017) [12] found UPFs increased hypertension risk, a comorbidity of obesity.

Rauber *et al*. (2015) [17] reported that UPF consumption in children raised lipid profiles, contributing to obesity. Steele *et al*. (2019) [20] linked UPFs to metabolic syndrome, prevalent in obese populations. Canella *et al*. (2014) [5] showed UPFs' dominance in Brazilian diets increased obesity, mirroring urban Rajasthan's trends.

Chen *et al*. (2020) [6] conducted a systematic review linking UPFs to adverse health outcomes, including obesity. Fernandez-Villar *et al*. (2018) [7] noted that lifestyle factors, including diet and inactivity, worsen chronic disease outcomes, emphasizing the need for holistic interventions.

These studies collectively highlight that high-calorie diets, particularly UPFs, and low physical activity drive childhood obesity, with urban environments amplifying risks. In Rajasthan, where fast-food outlets are increasing, these findings underscore the urgency for region- specific interventions to promote healthier diets and active lifestyles.

Research Methodology

This study explores the link between food choices, physical activity, and childhood obesity in urban Jodhpur using a quantitative cross-sectional approach.

Research Objectives

- To investigate the association between dietary habits and childhood obesity.
- To evaluate the role of physical activity in obesity prevention.
- To explore gender differences in diet and activity patterns.

Hypotheses

- **H_1:** High-calorie food intake positively correlates with childhood obesity.
- **H_2:** Increased physical activity negatively correlates with childhood obesity.
- **H_3:** Boys consume more high-calorie foods than girls, influencing obesity rates.

Type

Quantitative data were collected through surveys and anthropometric measurements to assess diet, activity, and BMI.

Sample Size

A sample of 200 schoolchildren aged 10-14 years was drawn from four urban schools in Jodhpur District using stratified random sampling to balance gender and school type.

Survey Area

Jodhpur District, with a population of about 1.3 million, was selected for its urban characteristics, reflecting modern lifestyle trends linked to obesity.

- **Questionnaire:** A validated questionnaire captured dietary habits (using a food frequency tool adapted from the Indian Council of Medical Research) and physical activity (using a modified International Physical Activity Questionnaire). Reliability was confirmed (Cronbach's Alpha=0.85).
- **Anthropometric Measurements:** Height and weight were measured to calculate BMI, classified per WHO-2007 standards.

Statistical Tests

- **Cronbach's Alpha:** Ensured questionnaire reliability.
- **T-test:** Compared diet and activity by gender.
- **ANOVA:** Examined BMI differences across activity levels.
- **Correlation:** Analyzed relationships between variables, presented in a correlation matrix.

Data Analysis and Interpretation

Data Tables

Table 1: Demographic Profile (N=200)

Variable	Frequency	Percentage
Gender: Male	102	51%
Gender: Female	98	49%
Age: 10-12 years	115	57.5%
Age: 13-14 years	85	42.5%

Table 2: BMI Categories

BMI Category	Frequency	Percentage
Normal	118	59%
Overweight	58	29%
Obese	24	12%

Table 3: Correlation Matrix

Variable	BMI	Fast-Food Intake	Sugary Drinks	Physical Activity
BMI	1.00	0.45**	0.40**	-0.40**
Fast-Food Intake	0.45**	1.00	0.68**	-0.18
Sugary Drinks	0.40**	0.68**	1.00	-0.15
Physical Activity	-0.40**	-0.18	-0.15	1.00

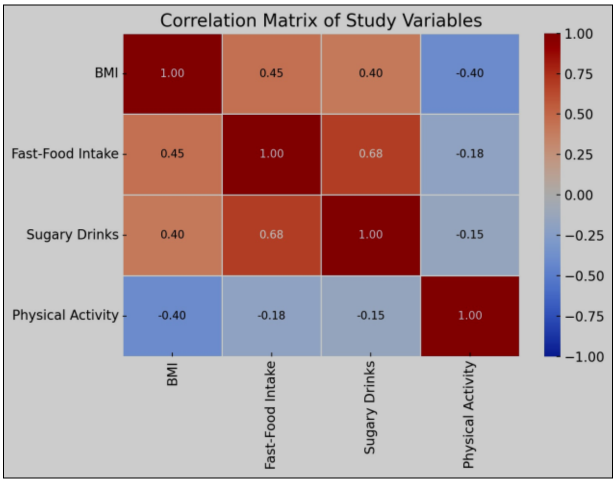

Fig 1: Correlation matrix of Study Variables

Table 4: T-test Results (Gender Differences)

Variable	Male (M ± SD)	Female (M ± SD)	T-Value	P-Value
Fast-Food Intake	3.3±1.2	2.7±1.0	2.56	0.01
Physical Activity (MET-min/day)	680±210	560±190	2.28	0.03

Table 5: ANOVA Results (BMI by Physical Activity Levels)

Source	DF	F	P-Value
Physical Activity	2	9.12	0.001

Graphs

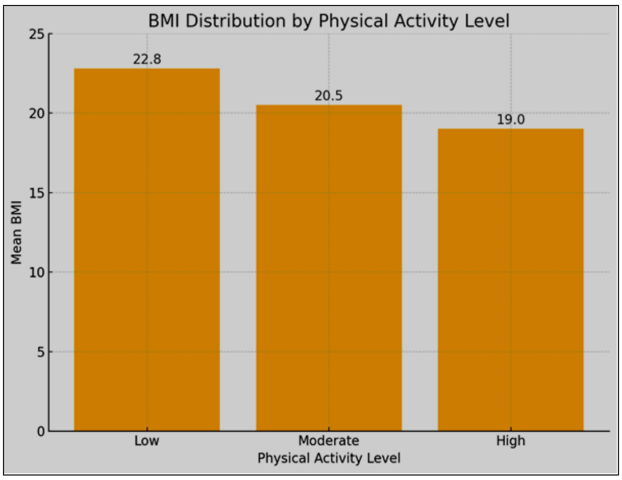

Fig 1: BMI Distribution by physical activity level

The data indicate that 41% of children were overweight or obese, consistent with urban trends (Kumar *et al.*, 2017) [10]. The correlation matrix (Table 3) confirms H1, showing strong positive correlations between fast-food intake (r=0.45, *p*<0.01) and sugary drinks (r=0.40, *p*<0.01) with BMI. Physical activity negatively correlated with BMI (r=-0.40, *p*<0.01), supporting.

H2: T-tests (Table 4) revealed boys consumed more fast foods (p=0.01) and were more active (P=0.03) than girls, partially supporting H3. ANOVA (Table 5) showed significant BMI differences across activity levels (F=9.12, P=0.001), with low-activity children having the highest BMI. These findings highlight diet and inactivity as key obesity drivers.

Discussion

The study confirms that unhealthy dietary habits and low physical activity significantly contribute to childhood obesity in urban Jodhpur, aligning with global findings (Popkin *et al.*, 2012) [16] and Indian studies (Kumar *et al.*, 2017) [10]. High fast-food and sugary drink consumption correlates with obesity, consistent with Kaur *et al.* (2015). The negative association between physical activity and BMI supports Shah *et al.* (2016), underscoring activity's protective role. Gender differences, with boys consuming more fast foods, may reflect cultural factors, as noted in Gupta *et al.* (2015), while girls' lower activity levels align with Kaur *et al.* (2013).

Urban Rajasthan's obesogenic environment, with prevalent fast-food outlets and limited recreational spaces, mirrors findings from Smith *et al.* (2024). The 41% overweight/obesity rate signals a public health priority. Limitations include the cross-sectional design, which restricts causal inferences, and potential self-reporting biases in dietary data. Future studies should adopt longitudinal designs and examine parental influences, as suggested by Brown *et al.* (2022).

Conclusion

This study establishes a clear link between poor food choices, low physical activity, and childhood obesity in urban Jodhpur. High-calorie diets and sedentary behaviors drive obesity among children aged 10-14 years, reflecting broader urban Indian trends (Kumar *et al.*, 2017) [10]. Gender-specific patterns highlight the need for tailored interventions. The rigorous quantitative approach, using reliable tools and statistical tests, strengthens the findings. Addressing obesity requires comprehensive strategies, including healthier school food environments and increased physical activity opportunities. These efforts can reduce obesity-related health risks, fostering a healthier generation in urban Rajasthan.

Suggestions

Schools in Jodhpur should incorporate nutrition education to promote balanced diets, as seen in a Delhi study (2023). Physical education programs need enhancement, with access to sports facilities, per Silva *et al.* (2022). Community initiatives, such as developing safe play areas, can boost activity levels, aligning with Smith *et al.* (2024). Policies should limit fast-food outlets near schools. Parental workshops can encourage healthy home environments, as parental behaviors influence children. Media campaigns can raise obesity awareness. Longitudinal research in Rajasthan is needed to evaluate interventions and explore SES impacts.

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