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Original Research Article

Geospatial mapping of food outlets and assessment of students' dietary behaviours around a medical college in Hyderabad: a cross-sectional study

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ABSTRACT

Background: Food options in the vicinity of college can affect students' eating behaviours and nutritional status. However, there is a dearth of data on campus food environments in India. This study assessed the food environment surrounding a medical college using geospatial methods and examined its association with students' dietary behaviours and body mass index (BMI).

Methods: A cross-sectional study was conducted among 400 undergraduate medical students of Osmania Medical College, Hyderabad, India. The participants were selected using simple random sampling. Data on sociodemographic characteristics, food-purchasing patterns, dietary behaviours and perceptions of the food environment were collected. The geographic coordinates of the food outlets within a 500-meter radius of the college were mapped and analysed using QGIS software. Data was analysed using SPSS version 25.

Results: The mean BMI was 23.2±3.4 kg/m²; 43% overweight and 4% obese. Geospatial mapping identified the most common stalls as fast-food (32%), juice/tea (24%), restaurants/tiffin centres (21%) and fruit and vegetable vendors (20%). Packaged snacks (57%) and fried foods (48%) were the most frequently bought items. Almost 44% bought food from local outlets 2 -3 times a week. Most students perceived unhealthy foods to be widely available (71%). No significant association was observed between the frequency of food consumption from outside and BMI category (p=0.744).

Conclusions: The food environment on campus was characterised by a high density of unhealthy food outlets, with students frequently purchasing energy-dense foods. Improving campus nutrition policies and environmental interventions may help promote healthy food choices among students.

Keywords: Food environment, GIS, Food outlets, Dietary habits, Medical students

INTRODUCTION

Diet-related non-communicable diseases (NCDs) are now major public health problems, with unhealthy diets, being overweight and rapidly changing food systems playing a large role in preventable morbidity and mortality. The Global Burden of Disease analysis identified suboptimal diet as an important driver of NCD mortality, in particular high sodium intake and low consumption of fruits, vegetables, whole grains, nuts and seeds.[1] In 2022, 2.5 billion adults aged more than 18 years were overweight including over 890 million adults who were living with obesity.[2] The 2019-21 National Family Health Survey (NFHS) reports that 24 per cent of Indian women and 23 per cent of Indian men are overweight or obese.[3] The overall increase in overweight and obesity has been associated with not only individual behaviour, but also more extensive commercial, urban and policy environments that influence access to food and dietary choice.[4] Young adults, including university and medical

students, are a nutritionally vulnerable group as the transition to higher education is often associated with irregular meals, increased snacking, frequent consumption of foods prepared outside the home, and increased exposure to inexpensive energy-dense foods. Reviews of university food environments suggest that campus and nearby retail food environments can influence students' dietary intake, food purchasing, and perceptions of healthy food availability.[5] This is particularly the case for medical students, who may have health knowledge but are also bound by constraints of time, academic stress, peer influence, and easy access to unhealthy foods.

The "food environment" includes the physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices. Systematic reviews provide evidence that local food environments may influence diet quality, but the strength of associations is inconsistent across settings and methods.[6] Research on the food environment is particularly salient in low- and middle-income countries, where urbanization, informal vending, increasing disposable income, and aggressive marketing of processed foods are rapidly transforming food choices.[7]

Educational institutions are an important micro-environment for nutritional research and intervention. High availability of fast foods, sugar-sweetened beverages, fried snacks and other foods high in fat, salt and sugar has been recorded in studies around schools and colleges. A systematic scoping review identified that food environments around schools are often characterized by a wide availability of food outlets, particularly fast food outlets and convenience stores.[8]A study reported that the food and beverage choices in and around schools and colleges of Delhi-NCR were mostly high in fat, salt and sugar, and relatively less accessible and more expensive.[9]

Geographic information systems (GIS) provide an objective method of assessing food outlet distribution, density, proximity, and spatial accessibility. The use of GIS-based methods is increasing in public health nutrition because it enables researchers to go beyond self-reported exposure and visually map the food environment around a specific location.[10] These methods are particularly useful in institutional studies where buffers around campuses can be used to reveal the type and concentration of outlets to which students are routinely exposed. Evidence on food outlet density and diet-related outcomes in India is small but is growing. Patel et al found associations between restaurant density and dietary intake patterns in Delhi, but adjusted associations with overweight/obesity were not statistically significant.[11] Rautela et al studied the prevalence of obesity in relation to food outlet density in a hilly area of Uttarakhand and found that overweight prevalence was 14.8%, whereas obesity prevalence was 55.5%. Junk food consumption was indicated by 92.9% of the study participants which highlighted the role of local access to food in the Indian context.[12] Roy et al further demonstrated that the consumption of snack foods in Pune varied across rural, urban and slum settings, indicating that location and consumer context shape dietary behaviors.[13] Recently, Seth et al. assessed the retail food environment in an urban resettlement colony of Delhi, highlighting the need to study the availability, price and placement of healthier and less healthy food options in Indian communities.[14]

However, there is limited evidence on the GIS-based assessment of food outlets around medical colleges in India and their association with students' food-purchasing practices, perceptions, and BMI. Medical colleges are important settings as students spend long hours on the campus and often depend on nearby vendors, tea stalls, restaurants, bakeries and fast-food outlets for meals and snacks. Awareness of this environment can help to inform campus nutrition policies, vendor regulation, healthy canteen initiatives and urban planning approaches to support healthier food choices.

This cross-sectional study aimed to assess the food environment around Osmania Medical College, Hyderabad, using geospatial techniques and its association with medical students' dietary behaviours and BMI, and to examine the students' food purchasing practices and perceptions regarding availability, affordability and influence of nearby food outlets.

Objectives

Objectives were to map and classify the food outlets within a 500-metre radius of the college using geospatial techniques, to determine the proportion of food outlets around the college and their association with BMI and to assess the students' food-purchasing practices and perceptions about the food environment around the college.

METHODS

Study design and setting

A cross-sectional study was carried out among undergraduate medical students of Osmania Medical College, Hyderabad, Telangana, India, from October 2025 to December 2025.

The study investigated the food environment around the medical college using geospatial techniques and its association with students' dietary behaviour as well as BMI.

Study population

The study population comprised undergraduate medical students enrolled at Osmania Medical College during the study period.

Sample size calculation

The sample size was calculated using the formula

$N=z^2PQ/d^2$

Since there was no prior estimate of the prevalence of dietary behaviours among medical students, a prevalence of 50% was assumed and with a confidence level of 95% and 5% as margin of error, the sample size was calculated as 384, and it was rounded off to four hundred to account for non-response and incomplete responses.

Sampling procedure

The study consisted of a total of 400 undergraduate medical students. Participants were selected by simple random sampling from the list of eligible students obtained from academic records. Study participants were selected using computer-generated random numbers to ensure an equal probability of selection.

Inclusion criteria

Undergraduate medical students studying in Osmania Medical College during the study period, students from the first year to the fourth year of MBBS who were present during the data collection period, students available for anthropometric measurements and questionnaire administration during data collection were included in the study.

Exclusion criteria

Students absent during the data collection period. Students who were unavailable for assessment even after three repeated contacts during the study period were excluded from the study.

Data collection instruments

The data were collected using a pretested semi-structured questionnaire administered via Kobo Collect application. Anthropometric measurements like height and weight were taken by a stadiometer and digital weighing machine, respectively.

The questionnaire assessed sociodemographic characteristics, food-purchasing practices, frequency of purchasing food from outlets in the vicinity of the college, and perceptions of the surrounding food environment.

Anthropometric assessment

Height and weight measurements were taken using standardised anthropometric measurements. Height was measured using a stadiometer and recorded in centimetres, and body weight was measured using a digital weighing machine and recorded in kilograms.

Geospatial assessment of food outlets

A geospatial survey was done to identify food outlets within a 500-meter radius around the college campus. The geographic coordinates of the food outlets were obtained using the Kobo Collect application.

Each identified outlet was grouped based on its types of food offerings, including Fast food stalls, Juice and tea stalls, Restaurants and tiffin centres, Fruit and vegetable vendors, and Bakeries.

GIS mapping and spatial analysis

The study food environment was defined as a 500-meter buffer zone around the college campus. The geographic coordinates collected during the field survey were imported into QGIS software for spatial analysis. Mapping and classification of food outlets within the buffer zone were done. A spatial analysis was conducted to evaluate the distribution and relative proportion of different types of food outlets around the institution.

Study variables

Environmental variables consisted of the type of food outlet within the 500-metre buffer zone and the distribution of food outlets around the college campus. The individual-level student variables included age, gender, year of study, food-purchasing practices, frequency of purchasing foods from nearby outlets, types of foods commonly purchased, perceptions regarding availability and affordability of healthy foods, and BMI.

Statistical analysis

Data collected through Kobo Collect was exported to Microsoft excel 2019 for data management and cleaning. Statistical analysis was performed using SPSS version 25. Continuous variables were summarised using means and standard deviations (SD), and categorical variables were presented as frequencies and percentages. The association between frequency of outside food consumption and BMI category was examined using the chi-square test. A p value of less than 0.05 was considered statistically significant. Spatial analysis and map generation were performed using QGIS software.

RESULTS

As shown in Tables 1 and 2, 52% of the 400 participants were 18-20 years of age, and 53% were females. The mean BMI was 23.2±3.4 kg/m^2, 53% had normal BMI, 43% were overweight, and 4% were obese. Geospatial analysis (Figures 1 and 2) showed the majority of fast-food stalls (32%) were within a 500-metre radius from the college, followed by juice/tea stalls (24%) and restaurants/tiffin centres (21%). There was no significant association between frequency of outside food consumption and BMI, as shown in Table 3 (p=0.744).

Regarding food buying habits (Figures 3 and 4), packaged snacks (57%) and fried items (48%) were the most frequently bought food items, whereas 44% of students bought food from nearby places two to three times per week. As shown in Figure 5, the majority of students perceived that the food environment around them was dominated by unhealthy food options (71%) and only 13% perceived healthy foods to be affordable.

Table 1: Socio-demographic characteristics of study population, (n=400).

Variables	Category	N
Age (in years)	18-20	208 (52%)
	21-23	192 (48%)
Gender	Male	188 (47%)
	Female	212 (53%)
Year of study	1st year	92 (23%)
	2nd year	124 (31%)
	3rd year	80 (20%)
	4th year	104 (26%)

Table 2: Anthropometric characteristics and BMI distribution among study participants, (n=400).

Variables	Value*
Indicators	
Mean height (cm)	166±9.7
Mean weight (kg)	64.9±13.7
Mean BMI (kg/m^2)	23.2±3.4
BMI category	
Normal	212 (53%)
Overweight	172 (43%)
Obesity	16 (4%)

*Values represented as mean and standard deviations

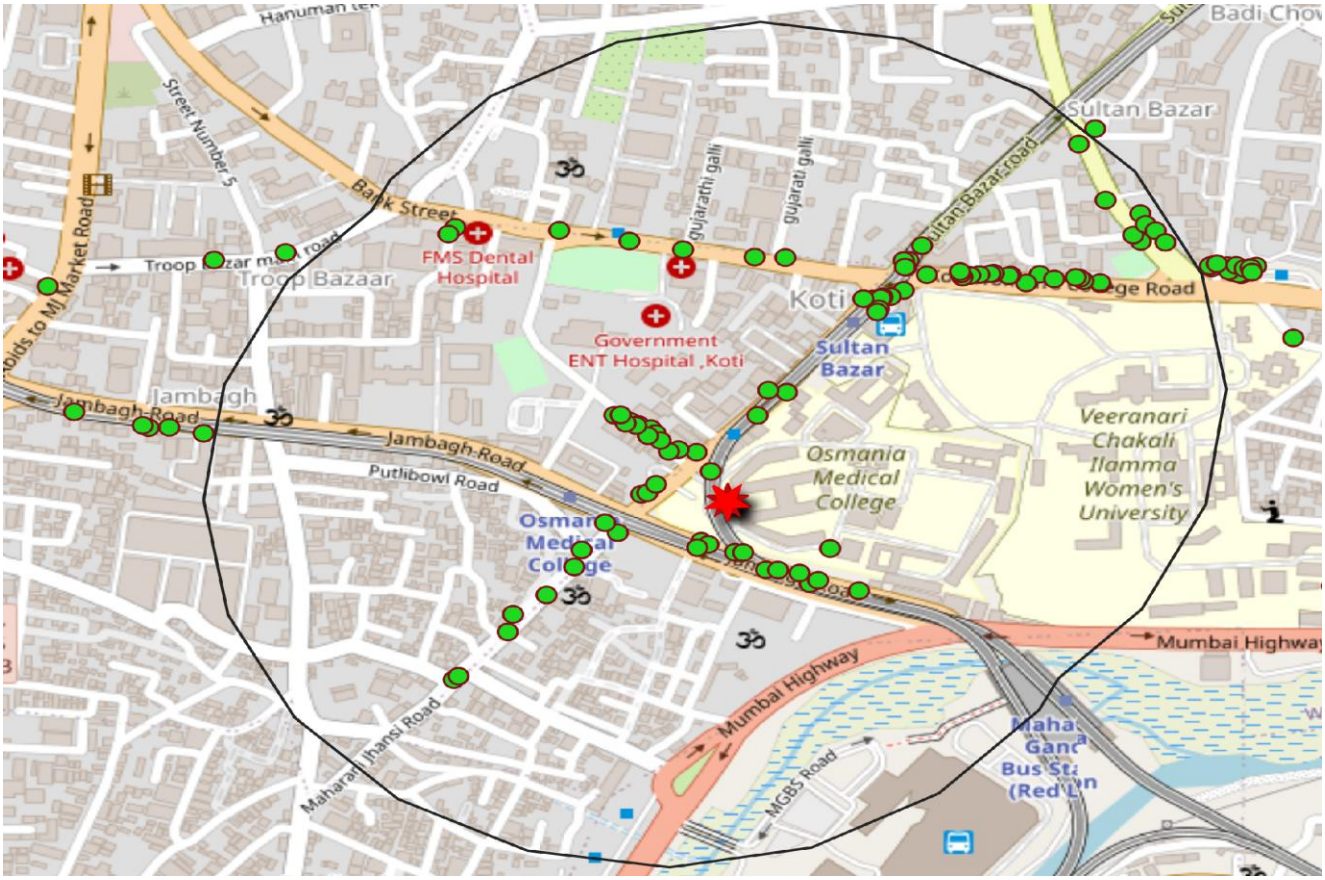

Figure 1: Map of the food outlets within a 500 m radius of the college.

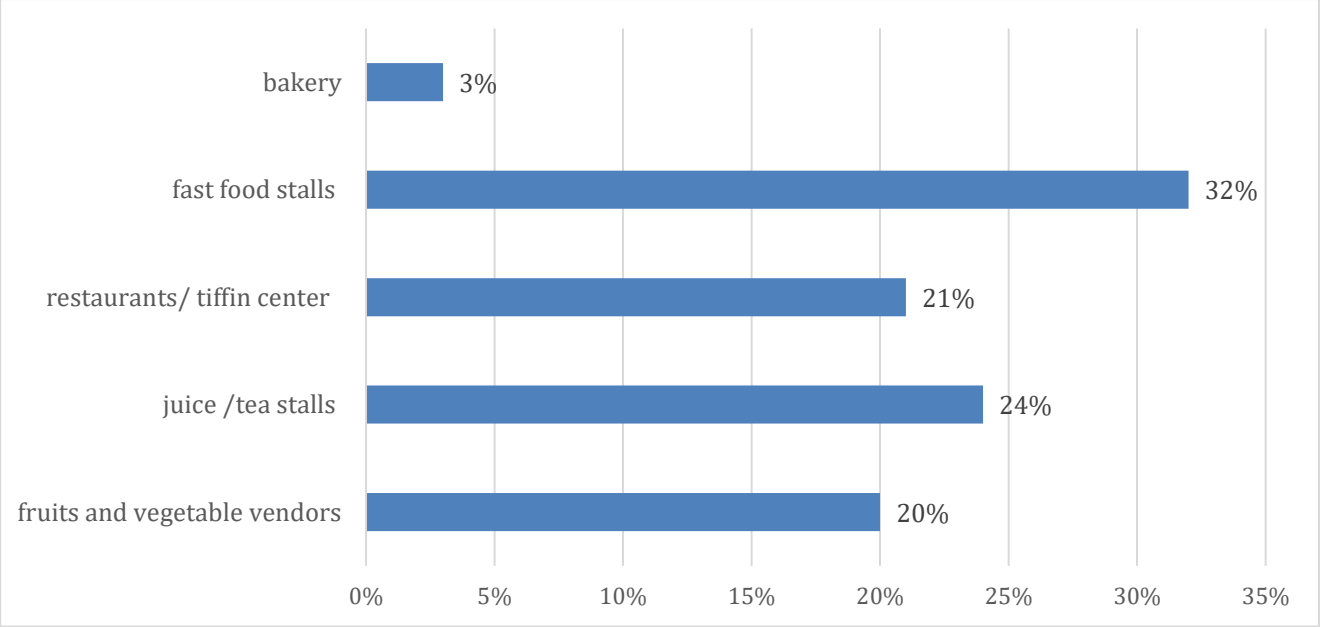

Figure 2: Classification of food outlets within a 500 m radius around the college.

Table 3: Association between frequency of outside food consumption and BMI category among study participants, (n=400).

Frequency of outside food	Normal BMI, n (%)	Overweight and obese, n (%)	Total, n (%)	P value*
Frequent (>2-3 times /week)	224 (68.3%)	104 (31.7%)	328 (82%)	
Infrequent (<once a week)	52 (72.2%)	20 (27.8%)	72 (18%)	0.744
Total	276	124	400	

*p value calculated using chi-square test

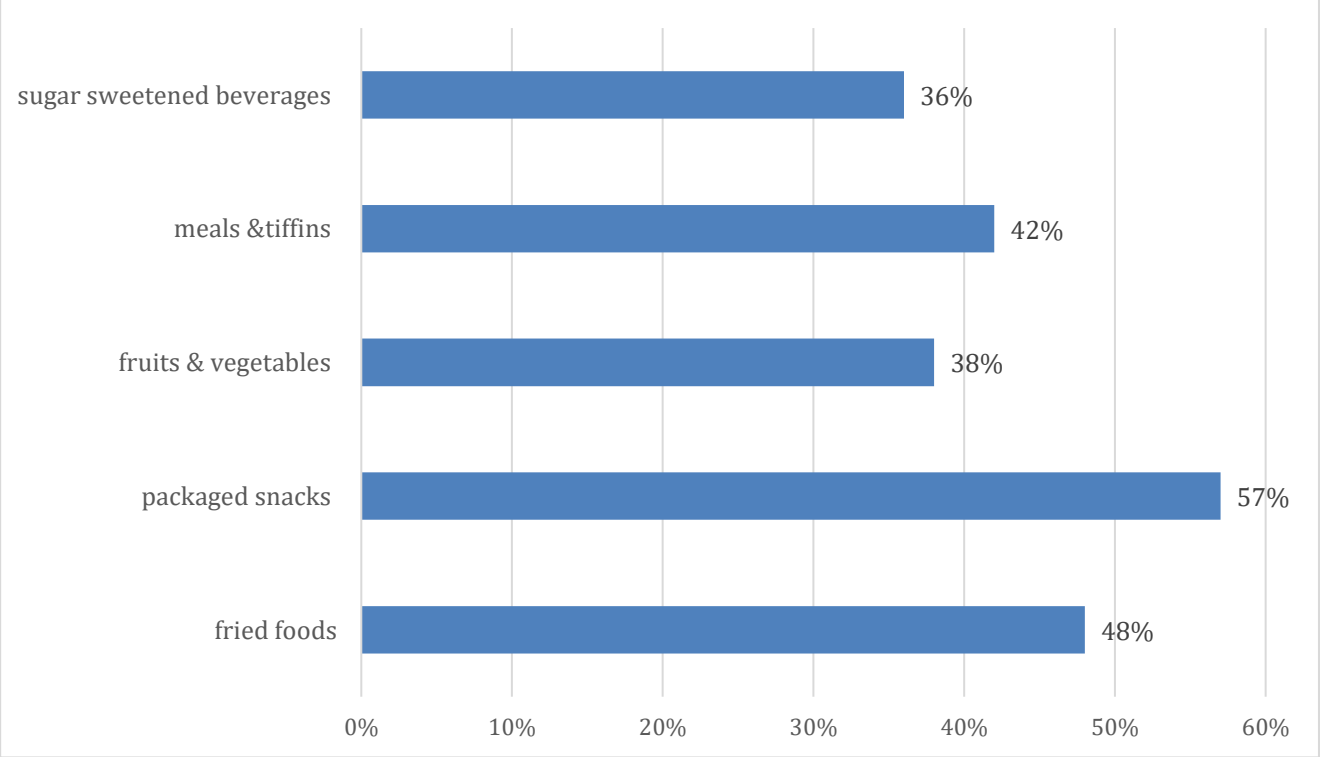

Figure 3: Type of food often purchased near college.

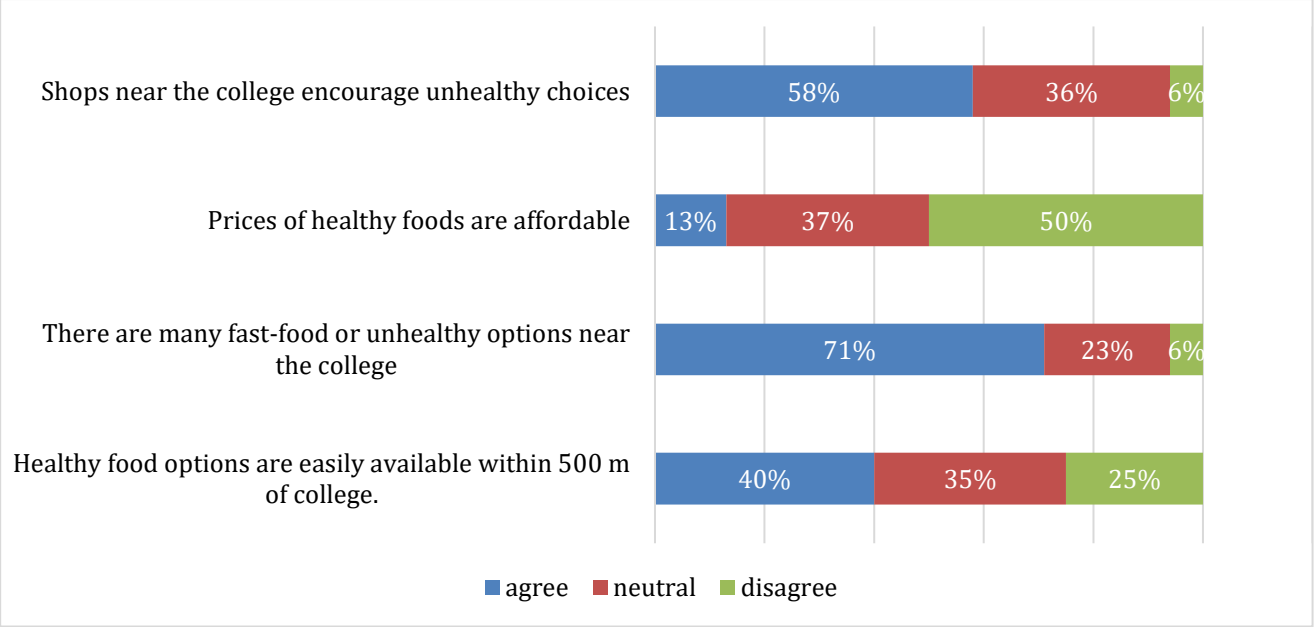

Figure 4: Perceptions regarding the food environment around the college.

DISCUSSION

The present study found that the food environment within a 500-metre radius of the medical college was dominated by fast food stalls, juice or tea stalls and restaurants or tiffin centres, indicating high accessibility to ready-to-eat and energy-dense foods. This pattern is similar to findings from Delhi, where Patel et al reported that higher restaurant density was associated with differences in dietary intake, including lower fruit intake and higher refined grain consumption, although the adjusted association with overweight/obesity was not statistically significant.[11] Rautela et al also highlighted the role of food outlet density as an environmental factor associated with obesity in an Indian context.[12]

The availability of fast-food stalls in the current study is in line with the notion that the food environments surrounding the educational institutions might encourage unhealthy dietary practices. Packaged snacks and fried foods were the most frequently purchased items by students, and this is consistent with Roy et al who reported high prevalence of consumption of snack foods in rural, urban and slum settings in Pune, with differences in the pattern of consumption by location and consumer characteristics.[13] The high prevalence of food purchase near the college, particularly two to three times per week, suggests that outlets in the vicinity may play an important role in the routine dietary decisions of students.

Student perceptions also corroborated the geospatial findings objectively. Most of the participants agreed that unhealthy food was easily available around the college, but few thought that healthy food was cheap. This is similar to the findings of Seth et al who pointed out the role of availability, price and placement of both healthy and unhealthy foods in urban Indian retail food environments.[14] Perceptions suggest that perceived affordability might restrict the use of even healthier foods when available.

In the present study, no statistically significant association was found between the frequency of food consumption outside and BMI categories (p=0.744). This finding is similar to that of Patel et al where restaurant density was associated with some dietary behaviours but not overweight/obesity after adjustment for confounders.[11] The international evidence is also mixed, with Atanasova et al finding that food environment factors are more consistently related to dietary intake than BMI, particularly in adults.[15] Thus, the lack of significant association between BMI and the present cross-sectional study should be interpreted with caution since BMI is influenced by multiple factors, including total energy intake, physical activity, sleep, stress, and long-term dietary patterns.

Overall, the studies suggested that food options around the medical college represented more exposure to food options with less nutritional value and less healthy food options. Students purchased more packaged and fried foods and believed that healthy ones were less affordable. The results indicate the benefits of institutional nutrition policies, better canteen options, improved vendor offerings, nutrition education, and active urban planning to facilitate the availability of healthy and affordable food to educational institutions.

The limitations of the study include the frequency of consuming outside food was self-reported and this increases the susceptibility of recall bias and social desirability bias. Additionally, the 500-metre buffer used

may not accurately represent the actual routes travelled by the students or all the food outlets accessible to them.

CONCLUSION

The current study identified and categorised food outlets in a 500-meter circumference around the college and examined the outlets' relationship with the students' BMI, food purchasing behaviours, and perceptions about the food environment. While a relationship was not found between food outlet density and BMI, the study demonstrated that dietary selection was the result of individual behaviours, preferences, and environmental conditions. The study reinforced the need to practice healthy eating, improve campus food environments, and employ food choice policies for students.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Afshin A, Sur PJ, Fay KA, Murray CJL, GBD 2017 Diet Collaborators. Health Effects of Dietary Risks in 195 Countries, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study 2017. The Lancet. 2019;393(10184):1958-72.
2. Obesity and overweight. World Health Organization; 2025. Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. Accessed on 19 January 2026.
3. Healthy population a key pillar to ensure resilient future: economic survey 2025-26. India: Mininstry of Finance; 2026. Available at: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2219931&reg= 48&lang=2. Accessed on 19 January 2026.
4. Swinburn BA, Kraak VI, Allender S, Dietz WH. The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission Report. The Lancet. 2019;393(10173):791-846.
5. Li X, Braakhuis A, Li Z, Roy R. How Does the University Food Environment Impact Student Dietary Behaviors? A Systematic Review. Front Nutr. 2022;9:840818.
6. Caspi CE, Sorensen G, Subramanian SV, Kawachi I. The local food environment and diet: A systematic review. Health Place. 2012;18(5):1172-87.
7. Turner C, Kalamatianou S, Drewnowski A, Kulkarni B, Kinra S, Kadiyala S. Food Environment Research in Low- and Middle-Income Countries: A Systematic Scoping Review. Adv Nutr. 2020;11:387-97.
8. França FCOD, Andrade IDS, Zandonadi RP, Sávio KE, Akutsu RDCCDA. Food Environment around Schools: A Systematic Scope Review. Nutrients. 2022;14(23):5090.
9. Bassi S, Bahl D, Arora M, Tullu FT, Dudeja S, Gupta R. Food environment in and around schools and colleges of Delhi and National Capital Region (NCR) in India. BMC Public Health. 2021;21(1):1767.
10. Charreire H, Casey R, Salze P, Simon C, Chaix B, Banos A, et al. Measuring the food environment using geographical information systems: a methodological review. Public Health Nutr. 2010;13:1773-85.
11. Patel O, Shahulhameed S, Shivashankar R, Tayyab M, Rahman A, Prabhakaran D, et al. Association between full service and fast food restaurant density, dietary intake and overweight/obesity among adults in Delhi, India. BMC Public Health. 2018;18(1):36.
12. Rautela YS, Reddy BV, Singh AK, Gupta A. The prevalence of obesity among adult population and its association with food outlet density in a hilly area of Uttarakhand. J Fam Med Prim Care. 2018;7(4):809-14.
13. Roy D, Boss R, Saroj S, Karandikar B, Pradhan M, Pandey H. Snack Food Consumption across the Pune Transect in India: A Comparison of Dietary Behaviors Based on Consumer Characteristics and Locations. Nutrients. 2021;13(12):4325.
14. Seth AK, Krishnan A, Nongkynrih B, Bairwa M. Retail Food Environment in an Urban Resettlement Colony of Delhi: A Community-Based Cross-Sectional Study. Indian J Community Med. 2025;50(6):927-32.
15. Atanasova P, Kusuma D, Pineda E, Frost G, Sassi F, Miraldo M. The impact of the consumer and neighbourhood food environment on dietary intake and obesity-related outcomes: A systematic review of causal impact studies. Soc Sci Med. 2022;299:114879.

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