Food Environment in and Around Schools and Colleges of Delhi and National Capital Region (NCR) in India

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Abstract

Background: Food policies and the environment in and around educational institutes have the potential to influence food practices, eating patterns, and behaviours of children.

Methods: A mixed-methods, cross-sectional study was implemented to examine the existing food policies, food environment determinants, and food choices of school (9 schools; Private=6, Public=3) and college (n=4) going students from Delhi and National Capital Region (NCR), India. Data was collected from school (n=253) and college (n=57) students, parents of school students (n=190), teachers (n=12, schools=9, colleges=3), canteen operators of private schools (n=6) and colleges (n=4) using focus group discussions, in-depth interviews, surveys and structured observations (in and around schools and colleges).

Results: A variety of food and beverage options were available in and around educational institutes but the majority of these options were unhealthy i.e. high in fat, salt, and sugar, despite restrictions. The available healthy foods and beverages in the canteens as well as outside through vendors were priced higher compared to unhealthy options. During lunchtime, twelve vendors were seen around six schools (3 private and 3 public). The density of these vendors increased at the time of dispersal (n=37) with a higher number of outside private schools (n=27) compared to public schools (n=10). Around colleges, vendors (n=14) were seen throughout the day. The students from all private schools (n=6) and colleges (n=2) were exposed to the high fat, salt, and sugar food advertisements (n=10), whereas, no advertisements were observed around public schools. Private school students are more vulnerable compared to public schools due to the availability of canteen with unhealthier options, the higher density of vendors outside school, higher exposure to unhealthy food advertisements, the higher purchasing power of students to eat outside food, and the non-availability of any school meals programme.

Conclusion: The current food environment in and around educational institutes is conducive to establish and sustain unhealthy eating behaviours. It is imperative to ensure the availability of healthy food in and around their educational institutes to improve their health and wellbeing. Therefore, emphasise the need to address this challenge through regular monitoring and surveillance of the recently introduced FSSAI regulation 2020, to ensure its compliance and appropriate enforcement strategies.

Background

Overweight and obesity among children are known to elevate the risk of non-communicable diseases (NCDs) in adulthood (1). In all, 5% of NCDs are associated with obesity and overweight (2). Globally, overweight and obesity among children have increased substantially over the past few decades (3). The prevalence of overweight and obesity increased in India too, the Comprehensive National Nutrition Survey (CNNS) report 2016–18 revealed that 4.9% of boys and 4.7% of girls, aged 10–19 years, were overweight or obese (Body Mass Index for age; z-score > +1 SD) (4).

The complex web of factors including, the availability of energy-dense, nutrient-poor foods, and the presence of child-oriented marketing attributes to unhealthy food consumption patterns (5–8). The food environment greatly influences food choices and eating behaviours of children (9). Children spend much of their daytime in and around the school thus, a supportive food environment is critical in shaping a child’s overall development, impacting food intake, and weight status (10–13). The transition to college life is a critical period when youth begin to make all food decisions independently (14). In India, various interventions have been implemented to combat the rising wave of overweight and obesity among children and adolescents (15, 16) still less focus has been given to improve their overall food environment.

Food policies and the environment in educational institutes have the potential to influence food practices, eating habits, and behaviours of children and adolescents for improving their nutritional status, academic achievement, and health in adulthood (17). In India, various guidelines and directives have been issued to restrict the availability and accessibility of foods high in fat, salt, and sugar (HFSS) to students in and around their educational institutes. These guidelines and directives are aimed at improving the overall food environment. These have been primarily issued by the Ministry of Women and Child Development (WCD) (18), Food Safety and Standard Authority of India (FSSAI) (19, 20), Central Board of Secondary Education (CBSE) (21), and University Grant Commission (UGC) (22). Recently, FSSAI notified Food Safety and Standards (Safe food and balanced diets for children in school) Regulation, 2020 to ensure the availability of safe and balanced diet to school children (23).

Globally, enough evidence is available on the obesogenic food environment in and around the school and colleges and its impact on overweight and obesity. However, this evidence is lacking in India. We, thus, aim to examine the determinants of food environment (in and around schools and colleges) and existing food policies in schools and colleges located in Delhi and National Capital Region (NCR), India. We also assessed student’s food choices and how the existing food environment influences their choices. The existing guidelines, directives, and regulations issued by the government to improve the food environment were also reviewed.

Methods

Study design and setting

A mixed-methods, cross-sectional study was conducted during June-November, 2019, in nine schools, including private (n = 6) and public schools (n = 3) and colleges (n = 4) of Delhi and NCR, ensuring socio-economic and rural-urban representation. The prevalence of overweight (12.3%) and obesity (3.3%) among adolescents (10–19 years) in Delhi is among the top three in the country (4). Given the short study duration, the study was restricted only to Delhi and NCR, where researchers could complete the study on time.

Sampling and Participants
Purposive sampling was used to recruit schools, colleges, and study participants from Delhi-NCR. The co-educational schools with primary (I-V grades) and up to secondary (X grade) level education, the private school having canteen were eligible to be included in the study. Similarly, colleges affiliated to UGC and having a functional canteen were eligible for inclusion.

The school students (n = 253; 5–13 years) representing primary (classes 1-V), middle (classes VI-VIII), and secondary (classes IX) levels, college students (n = 57, 19–24 years), canteen operators (n = 10; Private schools = 6 & colleges = 4), teachers (n = 12; schools = 9, colleges = 3) and parents of all selected school students (n = 190) were included in the study. A written informed active consent from the participating schools (private and public), colleges, college students, teachers, canteen operators, parents, and written informed student assent from school students were obtained. A written informed consent was obtained for minors from their parent or guardian.

Data collection

The data was collected using focus group discussions (FGDs) with school and college students, surveys with teachers and parents of school students, in-depth interviews (IDIs) with canteen operators/member of the canteen management committee, observations in and around schools and colleges (during lunchtime and at school/college dispersal). A desk review of existing guidelines, directives, and regulation issued by the concerned government authorities was also conducted. All the study tools were pre-tested, before the commencement of the data collection to ensure contextual relevance, feasibility, and face validity.

In total, 32 FGDs (n = 310) were conducted with students from school (n = 25; 253) and college (n = 7; 57). These discussions were conducted using a semi-structured guide to understand students’ views and perceptions on their food habits, food choices, and the impact of food advertisements. IDIs with canteen operators or a member of the canteen management committee (n = 6 in schools and 4 in colleges) were conducted to assess the food environment i.e., availability, accessibility, and affordability of healthy, unhealthy/HFSS foods and beverages in school and college canteen. Views and perceptions of school and college teachers (n = 12) and parents of school children (n = 190/253) on the current food policies and environment were captured through self-administered surveys. The overall response rate for the parent survey was 75.1% (Private: 61% and Public: 38%). The reasons for non-participation included hesitance in sharing the information, poor literacy levels, and lack of time to fill the survey.

Determinants of the food environment, including availability, accessibility, and affordability of healthy and HFSS foods, advertisements, and marketing in and around (up to 200 meters) participating schools and colleges were also assessed through a structured observation checklist by the trained research staff. The checklist was developed based on the recommendations by WCD (18), FSSAI (19, 20), CBSE (21), UGC (22), and INFORMAS “Outdoor Advertising: School Zones” (24). A distance of 200 meters was assessed through GPS Field Area Measure (25). The information collected from teachers, parents, and students were validated through these observations by the study team.

The available food options were categorised into healthy and unhealthy using WHO’s nutrient profile model for the South-East Asia Region (SEAR), based on thresholds for fat, sodium, and sugar. The sodium threshold is 1 mg sodium:1 kcal energy or lower; the sugar threshold is equal to or higher than 10% of the total energy (kcal) for the product; the fat threshold is equal to or higher than 30% of the total energy (kcal). Any given food or beverage above these thresholds is marked as unhealthy (26). This model was used only for the packaged foods and beverages, to calculate these thresholds, using nutritional labels. All the existing schools and college canteen guidelines, directives, and regulation issued by the government were collated and reviewed to identify the existing gaps.

Data Analysis

Quantitative data was cleaned, entered (ACCESS software), and analysed using SPSS version 22 (27). All the audio recordings from FGDs and IDIs were transcribed in Hindi (the local language) (28) and translated into English for thematic analysis. For policy review, two authors independently (SB and DB) identified the variables enlisted in the guidelines, directives, and regulation. Any disagreement between two authors (SB and DB) was further resolved through a discussion with the third author (MA).

Results

This section describes the food environment i.e., availability, accessibility, and affordability of healthy and unhealthy foods, factors influencing the food environment (in and around schools and colleges), existing policies in the participating schools and colleges, and the students’ eating patterns and food choices.

Policy review

A review of existing guidelines, directive (18–22), and regulation (23) (Table 1) highlighted that all of these aims at improving the overall canteen environment in terms of availability and accessibility of healthy foods and beverages to students. The majority of these guidelines and directives emphasised enhancing school children’s health leaving college students behind. None of these guidelines and directives mentioned the pricing guidelines, which can encourage the consumption of healthy foods and curb the sale of unhealthy foods. The majority of these guidelines do not talk about restricted hours to access canteen services. Colour coding of the available foods in the school canteen has been recommended by two guidelines but without specifying the nodal person responsible for its monitoring. There is a lack of clarity on the implementation of these guidelines, making it difficult for various stakeholders, including schools as well as canteen operators to enforce them and ensure accountability. Information on portion size has been specified in terms of “right portion size,” but guidelines lack the operational definition of the “right portion size”. According to all the guidelines and directives, there should be no sale of HFSS foods in
and around the educational institution. But none of them specifies the punitive actions which can be taken in case of any sale of HFSS foods to the children. Marketing and advertisement guidelines have been specified concerning the HFSS foods but the disciplinary action is lacking. The recently notified Food Safety and Standards (Safe food and balanced diets for children in school) Regulation, 2020 (23) by FSSAI to ensure the availability of safe and wholesome food on school premises. The regulation is quite comprehensive, encompasses various aspects to protect and conserve the school food environment, including the promotion of safe food and balanced diet in and around the school campus, restrictions on advertisements, marketing, and selling of HFSS foods on the school campus or to school children in an area within fifty meters from the school gate in any direction and regular monitoring and surveillance mechanism through designating authorities, corporations, and committees.
## Table 1
Review of existing guidelines, directives and regulation

| S. No | Aim of the guideline, directive and regulation | WCD, 2015 (18) | FSSAI, 2015 (19) | CBSE, 2016 (21) | UGC, 2018 (22) | FSSAI, 2019 (20) | FSSAI, 2020 (23) |
|-------|-----------------------------------------------|----------------|-----------------|----------------|----------------|----------------|----------------|
| 1) Target Population | [WCD: Ministry of Women and Child Development; FSSAI: Food Safety and Standard Authority of India; CBSE: Central Board of Secondary Education;](#) | School students | School students | School students | College students | School students | School students |
| 2) Canteen policy | | | | | | | |
| a) Colour coding of foods to green, yellow and red | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ |
| b) 80% of available food in school should be of green category | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ |
| c) School Canteen Management Committee | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ |
| 3) Restriction on availability of HFSS foods in an institute | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 4) Restriction on availability of most common HFSS foods in the nearby area | 200 meters | 50 meters | 200 meters | ✗ | 50 meters | 50 meters |
| 5) Shops and restaurants selling proprietary foods within the vicinity of 200 meters of a school should not be permitted to sell these foods to school children in uniform. | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ |
| 6) Specification on portion size | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ |
| 7) Marketing and advertisement of HFSS foods to children | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ |
| No offer or free of sale of HFSS foods to children in an institute and around 50 meters | | | | | | | |
| 8) No logos, brand names, spokes character, product names, other product marketing on/in vending machines, etc. | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ |
| 9) Existence of display board restricting sale of HFSS foods inside the school premises | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ |

(WCD: Ministry of Women and Child Development; FSSAI: Food Safety and Standard Authority of India; CBSE: Central Board of Secondary Education; (√): if an instruction is given for a specific measure; (×): if an instruction is lacking for a specific measure)

### Availability of foods and beverages in and around participating schools and colleges

A variety of food and beverage options were available in canteens of participating private schools and colleges, this was evident from observations and reported data from multiple stakeholders (students, teachers, parents, and canteen operators). According to discussions with students, the most frequently
available packed and non-standardised proprietary foods and beverages were samosa (fried pastry with potatoes filling), burgers, potato chips, pizza, vegetable puff, potato cutlets, bread pakoda (bread fritters), french fries, ice-creams (milk-based and ice candies), sugar-sweetened carbonated beverages and sugar-sweetened non-carbonated beverages (e.g. packed juices with sugar). The available healthy options in the canteen were cereal-pulse combinations [fermented e.g. idli/uttapam with sambhar, rice and pulse combinations and non-fermented e.g. rajma rice (beans curry with rice), chole rice (chickpea curry with rice)], vegetable-cereal combination e.g., vegetable paratha (vegetable stuffed flatbread) and variety of beverages (lemonade without sugar, fresh seasonal fruit juices).

The majority of parents (92.6%) and all the canteen operators of schools reported the availability of red category foods and beverages (high in fat, salt, and sugar) more in comparison to green category/healthy foods and beverages (Table 2). While teacher-reported having school policies in place which restrict the sale of HFSS foods. For instance, all private schools (n=6/6) reported restricting the sale of sugar-sweetened beverages (carbonated), two private schools banned the sale of fried foods, and only one private school banned the sale of food items high in salt. Observations showed the availability of these foods in the school canteen and one school, the sale of sugar-sweetened beverages (carbonated) was observed, despite restrictions (Table 2). Among colleges, only one college in NCR had the policy to restrict the sale of sugar-sweetened beverages (carbonated) and none of them had any policy restricting the sale of HFSS foods. No difference was observed in the availability of healthy and unhealthy foods through observations and reported data by the canteen operators in both schools and colleges. But for beverages, a difference was noted with the canteen operators reporting more availability of healthy drinks but observations showed less availability of healthy beverages in schools (Table 2).

### Table 2

| Food and beverage classification** | Private Schools (N=6) | Colleges (N=4) |
|----------------------------------|-----------------------|----------------|
|                                  | Parents (N=118) | Canteen Operator-Schools (N=6) | Observations (N=6) | Canteen Operator-Colleges (N=4) | Observations (N=4) |
| N (%)                           | N (%)          | N (%)          | N (%)          | N (%)          | N (%)          |
| **Food category**               | **Food items**  | **Parents**   | **Canteen Operator-Schools** | **Observations** | **Parents**   | **Canteen Operator-Colleges** | **Observations** |
| Green                           | Cereal and pulse combos (beans curry with rice/chickpea curry with rice), vegetable sandwiches, fermented items (rice and pulse steamed cakes), fruits and vegetables | 96 (70.6) | 5 (83.3) | 5 (83.3) | 4 (100) | 4 (100) |
| Yellow                          | Ice-creams (milk-based) | Not reported | 2 (33.3) | 2 (33.3) | 4 (100) | 4 (100) |
| Red                             | Samosa (fried pastry), vegetable puffs, candies, chocolates, cookies, instant noodles, burgers, french fries, bread fritters, ice-cream (ice candy) | 126 (92.6) | 6 (100) | 6 (100) | 4 (100) | 4 (100) |
| **Category**                    | **Beverages**   | **Parents**   | **Canteen Operator-Schools** | **Observations** | **Parents** | **Canteen Operator-Colleges** | **Observations** |
| Green                           | Coconut water, fresh fruit juice, lemonade without sugar | 67 (49.3) | 2 (33.3) | 1 (16.6) | 2 (50) | 2 (50) |
| Yellow                          | Flavoured milk | 22 (16.2) | 3 (50) | 4 (66.6) | 3 (75) | 3 (75) |
| Red                             | Sugar Sweetened Beverages (carbonated) | 41 (30.1) | 1 (16.6) | 1 (16.6) | 4 (100) | 4 (100) |
| Red                             | Sugar Sweetened Beverages (Non-carbonated) e.g Fruit juices with sugar | 69 (50.7) | 6 (100) | 6 (100) | 4 (100) | 4 (100) |

* Only data from private schools, as none of the government schools had a canteen

** Foods and beverage classification based on "Guidelines for making wholesome, nutritious, safe and hygienic foods to school children in India", FSSAI 2015(19)

The majority of parents (77.6%) expressed that foods in the canteen should be colour coded (like green, yellow, and red) to encourage children to eat healthy foods. Only one out of ten canteen operators of schools and colleges were aware of this colour coding concept. But none of the canteens of private school (n=6) and college (n=4) displayed food based on three colour categories. Nor did they have any instructions from the authorities or management to follow this.

The foods and beverages, including healthy and unhealthy, were also available outside schools and colleges through vendors. Vendors were present and were selling foods like ice-creams (milk-based and ice-candies), candy floss, fried snacks, churan (sugar balls), instant noodles, cookies, salted savoury snacks, and tea (Table 3). There were fewer private schools (2 out of 6) in comparison to public schools (2 out of 3) who had vendors selling green category food (boiled chickpea salad with flatbread). The majority of colleges (3 out of 4) had vendors selling healthy options such as composite meals (Table 3).
### Table 3
Availability of foods and beverages outside schools and colleges through vendors

| Food and beverages classification** | Observations |
|-----------------------------------|--------------|
|                                   | Private-Schools n (%) | Government Schools n (%) | Colleges n (%) |
|                                   | N=6 | N=3 | N=4 |
| **Observations**                  |     |     |     |
| **Green**                         |     |     |     |
| Matra kulcha (Flat Breads with boiled chickpea salad) | 2 (33.3) | 2 (66.6) | 3 (75) |
| **Yellow**                        |     |     |     |
| Ice-creams (milk-based)           | 6 (100) | 3 (100) | 4 (100) |
| **Red**                           |     |     |     |
| Fried snacks with potato curry, sugar balls, instant noodles, candy floss, salted savoury snacks, cookies, chips, candies, ice-creams (ice candies) | 6 (100) | 3 (100) | 3 (75) |
| **Beverage category**             |     |     |     |
| **Yellow**                        |     |     |     |
| Tea                               | 5 (83.3) | 3 (100) | 4 (100) |
| **Red**                           |     |     |     |
| Carbonated sugar sweetened beverages | 1 (16.6) | 2 (50) | 4 (100) |

**Foods and beverage classification on the basis of guidelines for making wholesome, nutritious, safe and hygienic foods to school children in India, FSSAI 2015(19)**

The available packed foods and beverages in the canteen and around the participating schools and colleges were analysed using WHO's Nutrient Profile Model for SEAR (26), and it showed that all available packed foods were unhealthy i.e., either high in fat, salt, or sugar (Table 4).

### Table 4
Categorization of available packaged foods in and around school and colleges based on WHO's Nutrient Profile Model for SEAR

| Packed foods & beverages | Total Calories (per 100 grams/100 ml) (Kcals) | Total sugar/100 grams (g) | Total fat/100 grams (g) | Total Salt (mg) | Healthy or Unhealthy Food/beverage | Reason for categorization as healthy and unhealthy |
|--------------------------|---------------------------------------------|---------------------------|-------------------------|---------------|------------------------------------|--------------------------------------------------|
| Chips (Salted)           | 550                                         | 1                         | 34.3                    | 642           | Unhealthy                          | Salt and fat are higher than the recommendation |
| Ice cream – Choco vanilla | 290                                         | 15.2                      | 17.1                    | NA            | Unhealthy                          | Sugar and fat are higher than the recommendation |
| Biscuits                 | 489                                         | 16.1                      | 21.2                    | NA            | Unhealthy                          | Sugar and fat are higher than the recommendation |
| Fiber-rich biscuits      | 443                                         | 22                        | 11                      | 11.3          | Unhealthy                          | Sugar higher than the recommendation            |
| Honey oat biscuits       | 485                                         | 35                        | 20                      | 275           | Unhealthy                          | Fat and sugar are higher than the recommendation |
| Packed noodles           | 437                                         | 3.4                       | 15.7                    | 1232.2        | Unhealthy                          | Salt and fat are higher than the recommendation |
| Lemonade                 | 45                                          | 10.5                      | 0                       | 79            | Unhealthy                          | Sugar and salt higher than recommendation        |
| Sugar-sweetened beverage (Carbonated) | 44                                         | 11                        | 0                       | 0             | Unhealthy                          | Sugar higher than recommendation                |
| Juice (Litchi)           | 60                                          | 15                        | 0                       | 0             | Unhealthy                          | Sugar higher than the recommendation            |
| Mix fruit juice (Non-carbonated) | 56                                         | 13.7                      | 0                       | 4             | Unhealthy                          | Sugar higher than the recommendation            |
| Buttermilk               | 26                                          | 0                         | 1.1                     | 30            | Unhealthy                          | Salt and fat higher than the recommendation      |

**Foods and beverage classification on the basis of guidelines for making wholesome, nutritious, safe and hygienic foods to school children in India, FSSAI 2015(19)**

The available packed foods and beverages in the canteen and around the participating schools and colleges were analysed using WHO's Nutrient Profile Model for SEAR (26), and it showed that all available packed foods were unhealthy i.e., either high in fat, salt, or sugar (Table 4).
Accessibility of canteen services and vendors around schools and colleges

Teachers from all six private schools and the majority of the parents (85.8%) reported specific timings for canteen access by students (i.e during lunchtime), indicating restriction on the accessibility of canteen services. But interviews with canteen operators and observations showed students purchasing foods and beverages from the canteen other than lunchtime. This restriction on time was not practiced in any of the schools. Similarly, no restriction was seen in any of the recruited colleges for accessing canteen services by the students.

Similarly, children had easy access to foods and beverages through vendors both during lunchtime and at dispersal. During lunchtime, twelve vendors were observed around six schools (3 private and 3 public) within 50 meters from the school boundary. The number of vendors increased at the time of dispersal (n=37). Of these thirty-seven vendors, seventeen vendors were seen within 50 meters. The density of these vendors was found to be higher outside the private schools (n=27) in comparison to public schools (n=10) at the time of dispersal. Though vendors increased at the time of dispersal, the type of food sold by them was similar during the lunchtime and dispersal. Around colleges, vendors (n=14) were seen throughout the day within 200 meters of the college boundary.

It was also observed that students of private schools and colleges were taking foods and beverages from these vendors. Contradictory to our observations, teachers of all schools (public and private) specified that there were restrictions and students were not allowed to access food outlets or vendors around the school and one of the teachers from the recruited college also reported that they do not allow vendors outside their premises.

Affordability of available foods and beverages in school and college canteens

Data from IDIs and observations showed that food prices ranged from INR 5 (0.06 USD) to INR 40 (0.53 USD) in school canteens, while INR 10 (0.13 USD) to INR 60 (0.79 USD) in the college canteens. Table 5 highlights that the available healthy food and beverage (green and yellow category) was expensive in both schools and colleges than unhealthy foods (red category). But according to teachers, pricing guidelines for selling healthy foods at subsidised prices existed in schools (n=6) and colleges (n=2). Of the six schools, only one school of Delhi capped the price, and all foods and beverages were available at less than INR 15 (0.19 USD), irrespective of food type, i.e., healthy or unhealthy. The majority of parents of school children (82.6%) also expressed their inclination towards the subsidisation of healthy foods to encourage healthy eating. Prices of food outside college premises varied from INR 10 (0.13 USD) to INR 60 (0.79 USD) while it varied from INR 5 (0.06 USD) to 60 (0.79 USD) outside schools (Table -5). The price of healthy foods was higher than in unhealthy foods, both outside schools, and colleges.
### Table 5
Prices of available foods and beverages inside and outside schools and colleges

| Food and beverage classification** | Prices in INR (USD) |
|-----------------------------------|---------------------|
|                                   | Schools N=9 | Colleges N=4 |
| **Food category** | **Available food items (Inside)** | **Prices in INR (USD)** |
| Green | Cereal and pulse combos (beans curry with rice/chickpeas curry with rice), vegetable sandwiches, fermented items (rice and pulse steamed cakes), fruits and vegetables, flat bread with boiled chickpea salad | 15-35 (0.20-0.46) | 20-60 (0.26-0.80) |
| Yellow | Milk ice-creams | 20-25 (0.26-0.33) | 20-55 (0.26-0.73) |
| Red | Samosa (fried pastry), Vegetable puffs, candies, chocolates, cookies, instant noodles, burgers, french fries, bread fritters, chips, cookies, sugar balls, candy floss, fried snacks | 5-15 (0.06-0.20) | 10-50 (0.13-0.66) |

| **Beverage category** | **Available beverages (Inside)** | **Prices in INR (USD)** |
|-----------------------|----------------------------------|------------------------|
| Green | Coconut water, fresh fruit juice, lemonade without sugar | 10-40 (0.13-0.53) | 20-45 (0.26-0.60) |
| Yellow | Flavoured milk | 15-20 (0.20-0.26) | 25-35 (0.33-0.46) |
| Red | Sugar-Sweetened Beverages (carbonated) | 15-25 (0.20-0.33) | 20-35 (0.26-0.46) |
| Red | Sugar-Sweetened Beverages (non-carbonated, Fruit juices with sugar) | 10-35 (0.13-0.46) | 15-25 (0.20-0.33) |

| **Food category** | **Available food items (Outside)** | **Prices in INR (USD)** |
|-------------------|-----------------------------------|------------------------|
| Green | Matra kulcha (Flat Breads with boiled chickpea salad) | 25-60 (0.33-0.79) | 35-60 (0.46-0.79) |
| Yellow | Ice-creams (Milk based) | 20-55 (0.26-0.73) | 20-55 (0.26-0.73) |
| Red | Fried snacks with potato curry, sugar balls, instant noodles, candy floss, salted savoury snacks, cookies, chips, ice-creams (ice candies) | 5-25 (0.06-0.33) | 10-25 (0.13-0.33) |

| **Beverage category** | **Available beverage items (outside)** | **Prices in INR (USD)** |
|----------------------|---------------------------------------|------------------------|
| Yellow | Tea | 10 (0.13) | 10 (0.13) |
| Red | Sugar Sweetened Beverages (Carbonated) | 20-35 (0.26-0.46) | 15-35 (0.20-0.46) |

1 USD=74.81 INR

**Foods and beverage classification on basis of guidelines for making wholesome, nutritious, safe and hygienic foods to school children in India, FSSAI 2015(19)**
Exposure to food and beverage marketing

Students during discussions reported that food and beverage advertisements on television, in the school canteen, outside school, and through social media platforms impact their food choices. A total of ten food and beverage advertisements were observed across six schools and two colleges within an area of 200 meters. Advertisements of foods and beverages were seen only around private schools (n = 6). Most of these advertisements featured a single product, and only one advertisement promoted three branded food products in one advertisement. The distance of these advertisements from the main entrance of the school and college ranged from 100 meters to 180 meters. These advertisements were observed for ice-creams, carbonate sugar-sweetened beverages, ketchup, and frozen foods. The analysis of these advertised foods using the nutrient profile model showed that these were either high in fat, salt, or sugar. Of the ten advertisements, seven were medium size (> 1.3 m x 1.9 m but < 2.0 m x 2.5 m), two were small size (> A4 but < 1.3 m x 1.9 m), and one was large (> 2 m x 2.5 m). All the advertisements were displayed as posters on the shop, hawker’s cart, and bus stops. Additionally, advertisements were also seen inside the education institutes like in two of the recruited colleges, advertisements of carbonated sugar-sweetened beverages in the form of a poster, which were large and were seen in the canteen.

Other than food and beverage advertisements, sponsorship of school and college events by the foods and beverage companies including breakfast cereal, carbonated sugar-sweetened, butter, cookies, chocolate were also reported. The above-mentioned foods and beverage companies that sponsored these events within children and adolescent environments were either high in fat, salt, or sugar, while analysed using the nutrient profile model (26).

Food consumption patterns, and dietary behaviours of students

Discussions with students and findings from a survey with parents highlighted good dietary behaviour of the school students (private and public) as they reported consumption of milk, its products, fruits, and vegetables, daily. Around 90% of school students usually brought lunch from their home on school days, and only 1.1% ate from the school canteen, as reported by their parents. Few students during discussions also reported eating from the school canteen. With the availability of unhealthy foods and beverages in the canteen, students were more inclined towards those foods. They reported purchasing foods like samosa (fried pastry), vegetable puffs, and sugar-sweetened non-carbonated beverages from the canteen. As reported by parents, the students from private schools (45.5%) spend more pocket money on eating out compared to public schools (23.5%). In addition to eating in the canteen, students from both private and public schools reported eating out with their parents or friends at least once a week. Whereas, few students of private and public school reported eating out as occasion dependent i.e. once a month. The consumption of HFSS foods by students reported during discussions varied and ranged from once a week to once a month. The frequency of consumption for SSBs was once a week, despite their knowledge about the health consequences of these beverages.

Similarly, college students also preferred eating burgers, sandwiches, and sugar-sweetened beverages (carbonated) from the canteen. In comparison to school children, along with daily consumption of milk, fruits, and vegetables, college students reported intake of sugar-sweetened carbonated beverages three to four times a week. The reported reasons for the intake of sugar-sweetened carbonated beverages by the college students were examination stress, weather, addiction to sugar and caffeine, and feeling refreshed and energetic.

Discussion

The present study led to a comprehensive understanding of the food environment (availability, affordability, and accessibility) and existing policies that influence the food environment in and around schools and colleges, which directly influence students’ food choices. The study is also the first of its kind that reviews the existing policies and assesses determinants of the food environment from the perspectives of multiple stakeholders including, canteen operators, teachers, students (schools, colleges), and parents.

Policy analysis

Multiple guidelines and directives for creating an enabling food environment in and around educational institutes existed in India (18–22). The lack of comprehensiveness and plurality of these guidelines and directives made it challenging to implement these in their institutions. These are more inclined toward schools leaving colleges with uncertain directions (22) and indicates the gap in the directives issued to colleges.

The recently notified, Food Safety and Standards (Safe food and balanced diets for children in school) Regulation, 2020 (23) is a step in a positive direction. The regulation provides an opportunity to improve the health and wellbeing of school students by ensuring the availability of healthy and safe foods in and around school right from the initial years of life. Evidence from various countries has shown that the national school canteen guidelines are effective in reducing overweight/obesity rates (29). The implementation of canteen policy was evaluated in countries like Saudi Arabia (30) and Brazil (31) and showed that schools did not comply with the policies. To ensure the effective implementation of the regulations in India, specific attention must be given to monitoring and surveillance aspects, which is a key to ensure compliance (23). The new regulation (23) envisages to attain Sustainable Development Goal-3 (health and well-being), 4 (cognitive development and learning) (32), and also in alignment with the best practices of the developed nation to combat obesity (33–35).

The regulation is only applicable to schools and leaves behind higher institutions such as colleges/universities. UGC affiliated colleges have only one advisory with few directives (22). Besides, many higher educational institutes in India are not affiliated to UGC, like private institutes, medical colleges, etc. Similar to school regulations, the need of the hour is to have regulation for college regardless of their affiliations. Given the uniqueness in and around Indian colleges with various food outlets, vending machines, fast food restaurants, the policy should be tailored according to these contextual aspects.

Availability and accessibility of foods and beverages

A variety of foods and beverages options were available in canteens of both participating schools and colleges. Observations and analysis using the nutrient profile model showed that the majority of foods and beverages (unpacked and packed) available in the canteen were from the red category i.e., HFSS, despite
restrictions of selling these, as reported by teachers. Similar to our findings, studies carried out in schools and colleges in several parts of India (36–38) as well as a narrative review of the nutrition quality of the school canteen in South Asia (39) reported easy and high availability of energy-dense foods in school canteens. It is essential to regulate the availability of unhealthy foods in their environment as children neglect the consequences of unhealthy foods and consume readily available food within their environment (40). This indicates weak enforcement of existing guidelines and directives, even though these guidelines and directives restrict the availability of the HFSS foods in school (18–20, 21) and college canteens affiliated to UGC (22).

One of the directives to the schools is to categorise the non-standardised proprietary foods based on the colour coding concept as per the nutritional value to green, yellow, and red foods (18, 19). This is aimed to encourage the consumption of healthy foods and curb the sale of HFSS foods. Our study revealed that none of the schools and colleges were practicing colour coding methods in their canteens. Globally, interventions in schools have shown to successfully increase the consumption of healthy foods by using approaches like, ‘traffic light’ system approach. The programme led to a significant decline in the purchase of nutrient-poor foods during school hours (41). The findings of our study underscore the need to ensure nutrition labeling with appropriate colour coding, availability of nutritious food at affordable prices, and empowering students to make the right food choices. There is also a need for a sensitization drive for students to understand and comprehend these colour codes and for the school administration, including canteen operators on the benefits of colour coding the food items.

Similarity, the availability of HFSS foods through vendors around schools and colleges was another attributable factor influencing the food environment negatively. The guidelines recommend no sale of HFSS foods to school children within a distance of 50 meters (19, 20, 23) to 200 meters of school (18, 21). Our study revealed that more vendors were observed outside the private schools than public schools and throughout the day around the recruited colleges. This highlights the vulnerability of private school students and college students. There is a strong evidence base from India (42) as well as other countries (12) that the easy availability and accessibility of HFSS are key attributable factors influencing food choices, food purchasing, and intake among students. Thus, emphasising the need for implementing the newly introduced regulation (23) to strictly restrict the availability of HFSS within and around schools as a commitment of the Indian government under the National Multi-sectoral Action Plan for Prevention and Control of NCDs (2017–2022) (43).

### Affordability of foods and beverages

The available healthy food options were not subsidised in the canteen. In India, various food availability guidelines (18–20, 22) have been issued, but none of these mentions any price reduction strategy nor this aspect has been covered in the recently introduced regulation by FSSAI (23). Although teachers of private schools reported that such guidelines are in place in their school, but our observations showed that it was not practiced in most of the schools. Few studies conducted in Indian schools (17) to evaluate the affordability aspect of available foods indicated that available nutritious foods in these canteen sold at a higher price (17). In India, few studies have been done to evaluate the affordable aspect of college students. The price was found to be the most likable aspect of the college canteen by college students (37). This could be attributed to the phenomenon that students become independent during this phase and also the paying capacity improves as compared to previous years i.e. school age. Although the literature is scanty for college students but the subsidization of healthy food and beverage option in both schools and colleges would be appreciable in promoting the consumption of healthy foods. Healthy food generally costs more than unhealthy food, and people tend to buy unhealthy food due to price. The low-income populations are at most risk because, in contrast to high and middle-income groups, they are mostly unable to afford healthy nutrition (45). The study conducted in the United States to examine the effect of price reduction strategy of healthy foods on the sale of fruits and vegetables among the adolescent population showed that fruit sales increased by four folds and vegetables by double during the low-price period (46).

### Exposure to marketing

The study also reveals that school and college students were exposed to advertisements of foods and beverages both inside and outside their institutes despite the restriction as per the FSSAI guidelines (20, 23). Unhealthy food advertisements were recognised as one of the significant barriers preventing nutrition promotion and strongly influenced the intake of unhealthy foods in young people (47). In the present study, the advertisements outside schools and colleges were primarily of HFSS foods. The global evidence also highlighted that content of food advertising is mainly on nutrient-poor foods including, confectionery, salty snacks, and sugar-sweetened beverages (48–51) and commercials promoting healthy foods are rarely advertised. In our study, teachers reported events in schools and colleges sponsored by food companies like butter, chocolates, carbonated sugar-sweetened, etc. All these foods were either high in fat, salt, or sugar. Research has also shown that sponsorship can increase brand awareness, intentions to purchase sponsor products (52, 53) (healthy or unhealthy), and modify the brand image (54).

The overall findings of our study showed that both school and college children are spending their maximum time in an unhealthy environment. By school type, the private school students are more vulnerable in comparison to public schools due to various factors that influence the food environment like availability of HFSS foods in the canteen, around schools through vendors, the higher density of vendors outside the school, higher exposure to HFSS advertisements, higher purchasing power, and non-availability of any school meal programme. These factors may contribute to increasing the prevalence of overweight and obesity among children and adolescents. This is also evident from previous studies conducted in India by our group that private school students are at higher risk of overweight and obese in comparison to public school students (55). The national-level CNNS data also showed that the prevalence of overweight and obesity increases with an increase in the wealth index among adolescents (10–19 years) (4).

The government of India has taken several steps to mitigate the risk of developing overweight and obesity and improving the food environment, like the launch of the National School Health programme under Ayushman Bharat to promote healthy behaviours among the children (57), FSSAI’s Eat Right Campaign (58) and several other guidelines and directive. With the introduction of new regulation (23), regular inspection is a vital move to ensure its compliance and mid-course correction should be suggested to schools keeping in account the barriers faced by schools in enforcing the regulation.

A key strength of the study was the involvement of multiple stakeholders i.e, parents, teachers, students, and canteen operators, to get an insight into factors attributing to existing obesogenic food environments in and around schools and colleges. The study also employed a mixed-methods approach to validate
data from multiple sources. There is a limited amount of research available around the food environment in colleges of India, hence this study is unique in including young adults. However, the study findings may not be generalizable to schools and colleges outside Delhi and NCR. More research is needed to understand the implementation of the new FSSAI regulation, compliance of schools and understand the roadblocks faced by schools in their performance across states and Union Territories of India.

**Conclusion**

The findings from our study reveal various determinants influencing the obesogenic food environment in educational institutes in India, despite guidelines for food served in canteens and food availability outside schools. Thus, underscoring the need to address this challenge through regular monitoring and surveillance of the recently introduced regulation to ensure its compliance and appropriate enforcement strategies.

**List Of Abbreviations**

- CBSE Central Board of Secondary Education
- CNNS Comprehensive National Nutrition Survey
- FGD Focus Group Discussion
- FSSAI Food Safety and Standard Authority of India
- HFSS High in Fat, Salt and Sugar
- IDI In-Depth Interview
- INR Indian Rupee
- NCD Non-Communicable Diseases
- NCR National Capital Region
- SD Standard Deviation
- SEAR South East Asian Region
- UGC University Grant Commission
- USD United States Dollar
- WCD Ministry of Women and Child Development
- WHO World Health Organization

**Declarations**

**Ethics approval and consent to participate**

This study received ethical approval from the Public Health Foundation of India's (PHFI) Institutional Ethics Committee (IEC 420/19). Permission was sought from the appropriate authorities at the participating schools and colleges. A written informed active consent was taken from all the study participants and written informed consent was obtained from their parent or guardian for minors. All the necessary measures to safeguard participants' anonymity and confidentiality of information were respected.

**Consent for Publication**

Not Applicable

**Availability of data and materials**

The datasets used analysed for the current study are available from the corresponding author on reasonable request.

**Competing interests**

The authors declare that they have no competing interests.

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Authors’ Contributions

MA, RG, SB, and DB conceptualised the study. SB, DB & SD contributed to study administration. SB supervised data collection and management. DB, SB & SD contributed to the analysis and interpretation of results. SB, DB, SD drafted the manuscript. MA, FT, RG reviewed the manuscript critically for intellectual content. All authors reviewed and approved the final manuscript.

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