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What influences food choices of adolescents in India and how their food environment can be improved?

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Abstract

Background Adolescence is a key period for public health interventions due to rapid physical, emotional, and intellectual development. Food environments greatly influence adolescents' food choices and diets and, consequently, their overall health. We aimed to understand adolescents' perceptions regarding factors influencing their food environment and to identify opportunities for accelerating actions to promote healthier food environments.

Methods We developed and disseminated a survey using U-Report, a social messaging tool by UNICEF, targeting adolescents aged 10–19 years. This U-poll-based survey was available online in 12 Indian languages from June to November 2022. Following the lifting of COVID-19 restrictions, the survey was also administered offline.

Results Responses were received from 143,878 adolescents across 36 states of India. More than half of the adolescents surveyed (67.6%) reported that food advertisements influence their food choices. Nearly 72.6% of participants reported reading food labels, and 62.8% reported that it is very important to simplify the nutrient information available on food packs. About 30.7% of adolescents indicated that they can't eat healthy foods due to higher prices (expensive/costly), while 15.3% reported that they don't eat healthy foods as they do not find them tasty.

Conclusion The study highlights multiple factors influencing adolescents' food choices in India, and underscores the importance of creating supportive food environments. The findings suggest potential areas for intervention such as improving accessibility, affordability, and appeal of healthy foods. Future efforts should explore comprehensive strategies for strengthening policies and guidelines around healthy food environments, while further research is needed to assess the effectiveness of such interventions.

Keywords Adolescents, Food environment, Perceptions, Food choices, India

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Background

India has the largest adolescent population in the world. Every fifth person in India is between 10 and 19 years [1]. This substantial proportion of the population will represent the largest section of the elderly in the future. Therefore, it is essential to create opportunities for them to lead fulfilling lives by promoting sustainable development. Improving adolescent healthy diets contributes to achieving Sustainable Development Goals (SDGs) by promoting better health outcomes (SDG 3), enhancing education and productivity (SDG 4), empowering gender equality (SDG 5), reducing inequalities (SDG 10), and ensuring sustainable food systems (SDG 2 and SDG 12). The findings of the ICMR-INDIAB study conducted in 2023 revealed that the prevalence of diabetes and other metabolic non-communicable diseases (NCDs) in India is considerably higher than previously estimated [2]. Another study conducted in 2019 highlighted a greater prevalence of hypertension in urban areas as compared to rural areas and the young adults [3]. The Ministry of Health and Family Welfare (MOHFW) Comprehensive National Nutrition Survey, 2016-18 highlighted that adolescents in every Indian state face an increased risk of diabetes (10.4% reported wit high fasting plasma glucose) and heart disease (16.1% reported high triglycerides), with greater consumption of unhealthy food including fried foods, sweets, and aerated drinks. Fruits and eggs are consumed daily by less than 10% of boys and girls, and over 25% of Indian adolescents do not consume green leafy vegetables even once a week. More girls than boys are unable to meet the 60 min per day recommended outdoor sports and exercise time, and screen time has increased significantly [4]. The prevalence of overweight (including obesity) varied from 1.6% (0–4 years) to 4.8% (10–19 years) [5]. The prevalence is consistently higher in urban, high-income groups, but the annual pace of increase is higher in rural and low-income urban communities. Major risk factors for obesity and overweight include physical inactivity and unhealthy dietary practices (low intake of fruits and vegetables, and high intake of processed foods high in fat, salt, and sugar (HFSS) [6]. These risk factors are largely the result of practices adopted at an early age, as well as the social, structural, and policy environment that influences choices and behaviours [7]. The challenge is to identify adverse individual, socio-contextual and environmental determinants of diets HFSS so that they can be influenced through policies and programmes to inculcate healthier behaviours. Bringing about such behaviour changes at the population level and creating supportive environments that help people make healthy choices are important underlying principles in promoting health.

Adolescents' poor diets are also the reflection of food systems and environments within which they live and interact. Ubiquitous availability of highly processed, nutrient-poor foods, as well as their marketing is on the rise in India [8]. In India, the widespread availability and aggressive marketing of highly processed, nutritionally deficient foods are increasing, despite existing governmental regulations and industry self-regulatory codes aimed at promoting healthy diets and lifestyles among children and adolescents [9]. To our knowledge, there is a notable lack of comprehensive studies in the Indian context that have looked into what prompts food choices of adolescents among the multifactorial issues that shape their food environment. To understand adolescents' perceptions of the factors influencing their food environment and to identify opportunities for accelerating actions that promote healthier food environments, the Socio-Ecological Model (SEM) offers a useful theoretical foundation. The SEM emphasizes that adolescents' food choices are shaped by multiple, interacting levels of influence—individual, interpersonal, organizational, community, and policy. It recognizes that food choice is not solely a matter of individual preference or knowledge, but the outcome of complex interactions between personal factors, social networks, and broader environmental and structural conditions. This study aimed to generate nationwide information across all Indian states, capturing factors influencing adolescent food choices that include food appeals, peer pressure, accessibility, taste preferences, food purchasing decisions, eating behaviours, lifestyles and their responses to policy and civic actions aimed to promote healthy food environments.

Methodology

Recruitment

An online self-administered poll survey was developed and conducted to reach adolescent boys and girls (aged 10–19 years) from 36 states/ union territories (UTs) of India in 12 Indian languages. Data was collected using three methods. First, the UNICEF U-report is a free tool for community participation, designed to assess the views/ opinions of targeted recipients on selected topics. Individual messages are confidential, but aggregated data is transparent. Information received can be disaggregated by age, gender, and country (states and UTs) in real time. The poll survey link was launched on June 29, 2022, and disseminated through adolescent networks and partners. The survey was conducted by leveraging channels of social networking, such as Facebook, Instagram, WhatsApp, X (formerly called Twitter), and Telegram. Registration was voluntary, and participants provided consent before initiating the survey, being an online WhatsApp-based tool, U-reporters incur no cost. Post-upliftment of COVID-19 restrictions, to capture some insights from media dark areas, adolescents in selected schools completed the survey offline in October and November 2022.

Finally, the links were disseminated through WhatsApp groups of schools and existing partners, CSO, etc.

U-poll survey

The U-poll survey was adapted [10] and finalised based on questionnaires used in prior studies conducted with adolescents in India [11, 12]. The survey aimed to assess factors influencing adolescent food choices and their perception of their food environments, particularly related to labelling, advertising, taste, accessibility and affordability, and promotion of unhealthy foods. The survey item pool was generated, reviewed by experts, and pretested before the administration.

An advisory group including adolescent representatives and experts from national and international organisations working in the field of nutrition guided the finalisation of the methodology, survey tool. and other related components under the Let's Fix Our Food (LFOF) initiative. The LFOF initiative was launched to create a space for adolescents to participate in and create a conducive food environment. The initiative aimed at creating health-promoting norms among adolescents, in families, homes, and communities. An adolescent network comprising both girls and boys ($n = 50$) representing 30 states of India was convened under the LFOF initiative to accelerate efforts to foster healthy food environments. The adolescent network members provided support in the dissemination of poll-survey links to their peers and network for maximum reach. In order to create a two-way dialogue platform for adolescents, activities like e-dialogues, capacity-building workshops, podcasts, and modules to raise awareness of the importance of fostering a healthy food environment were conducted with adolescents.

Data analysis

The survey was mainly conducted using online tools. In the case of remote areas or areas with less or no availability of Internet, the same digital tool was administered using paper-based questionnaires. After that, the data collected using the paper-based questionnaire was digitalised using Microsoft Excel spreadsheet. Furthermore, each data point was added to digital repositories.

Data extracted from the online server (or digital repository) was cleaned and checked for accuracy and missing values across each variable. The text data was translated from regional languages (Hindi, Bengali, Marwari, Malayalam, Marathi, Telugu, and Tamil) into English, with the real contexts of the responses provided by the participants.

All survey data were analysed using descriptive statistics and presented as means or proportions.

Table 1 Demographic characteristics of the participants (online mode only)

Background characteristics	*n*	% mean (SD)
Age mean (SD)	15.71 (2.21)	
Gender		
Male	69,228	50.05
Female	67,874	49.08
Other	1,204	0.87
Total	1,38,306	100
Education		
School	12,875	18.83
College	55,506	81.17
Total	1,38,306	100

NR (Non-response) excluded while presenting frequency/ percentage distribution

Results

The U-Report survey covered a sample of $n = 143,878$ across 36 Indian states/ UTs. The majority of the participants (84%) utilised WhatsApp to complete the survey, followed by 7% via Facebook, 0.4% via Telegram, and 5% via other modes (Fig. 1S, supplementary file). Considering the coordination issues post-upliftment of COVID-19 restrictions and to avoid screen time, schools in Delhi requested to administer the survey offline. In consultation with schools, all the adolescents from schools were invited to participate and data was entered and merged for analysis. Around 5,272 participants completed the survey through offline mode.

A total of 138,306 adolescents provided their demographic details via an online survey. Around half of the participants were male (51%), while the rest of the participants were female (49%). Fewer than 1% of participants reported their gender identities as 'other' (0.9%). The average age of the participants was 15.7 years. Nearly 81.2% were enrolled in colleges at the time of the survey (Table 1). Figure 1 and Table 1S (supplementary file) provide the geographical distribution of participants across Indian states/ UTs.

Around 36.4% ($n = 27,427$) of adolescents reported consuming fruits and vegetables three times a week, while 33.3% reported daily consumption (Table 2S). Nearly half ($n = 25,067$) of the adolescents (49.8%) reported occasional consumption of junk foods, while 14.7% ($n = 10,880$) consumed them twice a week. A total of 71,531 adolescents responded regarding their main sources of nutrition information. About half of the adolescents (49.5%) reported getting maximum nutrition information from schools. Around 20.8% reported 'online' as a source of nutrition information, followed by home (15.1%), friends (3.2%), and TV (3%) (Table 2). 43.8% ($n = 16,131$) of the participants believed that increasing nutrition information could help reduce consumption of unhealthy foods (Fig. 2).

Nearly half (48.6%) of participants ($n = 88,593$) reported that unhealthy eating habits could lead to both being overweight and underweight, while 28.9% of adolescents

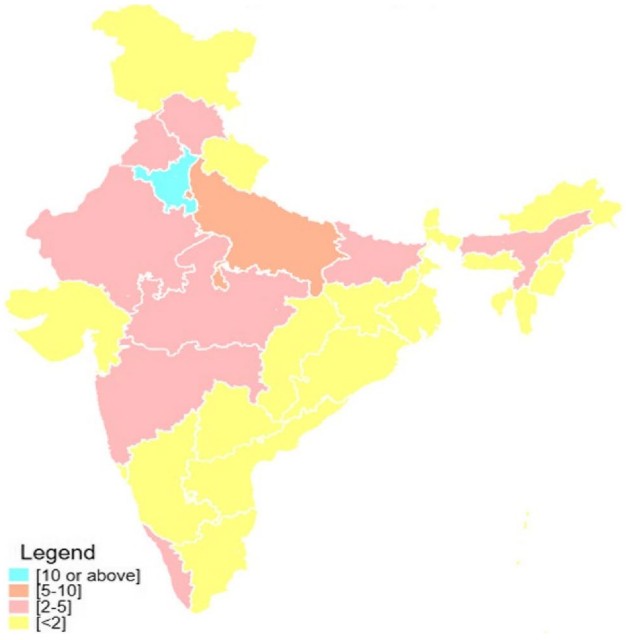

Fig. 1 Spatial distribution of the respondents (%) across Indian states

Table 2 Participants' source of information on nutrition

Where do you get the maximum information on nutrition?	*n*	%
Friends	2,265	3.17
Home	10,800	15.10
No information	3,478	4.86
Online	14,889	20.81
School	35,380	49.46
TV	2,179	3.05
Any other	2,540	3.55
Total	71,531	100

NR Non-response excluded while presenting frequency/ percentage distribution

reported that unhealthy eating habits could lead to overweight/ obesity only. Responses from 81,996 adolescents indicated that (72.6%) reported that they eat and have access to healthy foods, while 11.6% expressed the desire to eat healthily but lacked access to healthy food options. Around 5.3% of participants had access to healthy foods but chose not to consume them (Table 3).

Nearly one third ($n = 18,915$) of adolescents (30.7%) cited high prices as a barrier to consuming healthy food options, while 15.25% ($n = 9,395$) noted that they avoid healthy foods because they find them unappetizing (Fig. 3). Additionally, 10.5% ($n = 6,484$) of the adolescents indicated a lack of variety in healthy food options, and 10.6% ($n = 6,528$) indicated that they don't eat healthy foods as they aren't easily available. Regarding physical activity, nearly one-third of adolescents (30.2%; $n = 70,149$) believed that 30 min per day should be spent on physical activities, while 15% of adolescents preferred 60 min per day for physical activities. Conversely, 5.9% of adolescents reported that there is no need to spend time (daily) on physical activity. Among 68,778 adolescents who responded, 53.1% of the adolescents responded that they watch TV for less than 2 h per day, while 18.2% reported on watching TV 2–3 h per day, followed by 6.5% watching TV 4–5 h per day, 5.4% reported on watching TV more than 5 h per day, and 9.8% reported no specific preference on watching TV at all (Table 3).

Among 47,644 adolescents who responded,72.6% of adolescents reported that they read nutrition information on the food labels, while 27.4% do not read nutrition information when/ before buying packaged food. Nearly half (51%) of adolescents ($n = 34,315$) read nutrition information most of the time, 32.3% read sometimes, and 9.5% reported reading nutrition labels only when purchasing food items. About 7.1% reported rarely reading nutrition information (Table 4).

More than half (62.8%, $n = 34,315$) of adolescents reported that simplifying nutrient information on food

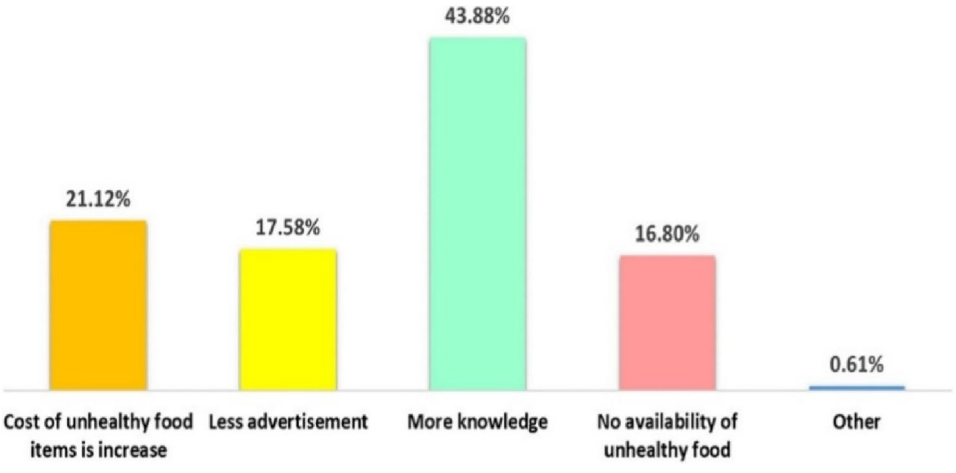

Fig. 2 Different ways to reduce consumption of unhealthy food

Table 3 Adolescents' perceptions of eating habits, physical activity, and screen time

What conditions can unhealthy eating habits lead to?	***n* (88,593)**	**%**
Overweight/ obesity only	25,569	28.86
Underweight only	8,325	9.40
Both overweight/obese and underweight	43,010	48.55
Won't make a difference	3,242	3.66
Don't know/other	8,447	9.53
What do you think about eating healthy?	**n (81,996)**	**%**
I eat healthily and have access to healthy foods	59,545	72.62
I want to eat healthily but don't have access to healthy foods	9,514	11.60
I have access to healthy foods but don't want to eat them	4,334	5.29
I don't know which foods are healthy	4,231	5.16
I don't have a preference for healthy or unhealthy food	4,185	5.10
Other	187	0.23
How many minutes of physical activity should people of your age do?	**n (70,149)**	**%**
15 min daily	10,625	15.15
30 min daily	21,152	30.15
45 min daily	9,950	14.18
60 min daily	10,565	15.06
I don't know	5,987	8.53
More than 60 min	7,622	10.87
Not needed daily	4,165	5.94
Other	83	0.12
How many hours a day should you spend watching TV or using mobile?	**n (**68,778**)**	**%**
2–3 h per day	12,498	18.17
4–5 h per day	4,441	6.46
I don't know	4,735	6.88
Less than 2 h per day	36,530	53.11
More than 5 h	3,709	5.39
No recommendations available	6,754	9.82
Other	111	0.16

NR (Non-response) excluded while presenting frequency/ percentage distribution

packets is very important, while 9.14% are not aware of such information on the food packets (Table 4). 67.6% ($n = 40,687$) of adolescents indicated that food advertisements influence their food choices, while 32.3% ($n = 19,471$) reported that food advertisements don't affect their food choices (Fig. 4).

Discussion

The study findings highlight adolescents' perspectives on factors influencing their food choices. To the best of our knowledge, this study was the first of its kind that aimed to collect the perception of adolescents in Pan-India on factors influencing their food choices. Nutrition education provided in schools is the major source of information as reported by adolescents in this study. Another study in India showed that nutrition knowledge in schools has a greater impact on adolescents' decision-making [13]. In contrast, a study conducted with school-going adolescents in Bangladesh reported that family members were the most used source by adolescents for nutritional information [14].

In the study, it was observed that adolescents were able to differentiate between healthy and unhealthy foods but their overall knowledge of nutrition seems to be inadequate. This finding is consistent with a study that reported poor knowledge about healthy lifestyle practices among school-going children aged 17–19 years. They were unaware of the long-term impact of unhealthy foods [15]. Therefore, adolescents need to have adequate nutrition knowledge to make healthy food choices. Also, despite having knowledge and access to healthy food options, adolescents preferred unhealthy foods due to their easy availability, ready-to-use packaging, and low prices. A study conducted in Nepal reported a higher intake of junk foods among school-going adolescents aged 14–19 years despite having adequate knowledge about the harmful effects of junk foods [16].

About 72.5% of adolescents reported reading nutrition information on food packs. However, 62.8% felt that this information should be simplified for easier understanding. Adolescents reported that more knowledge, easy-to-comprehend food labelling, and less advertisement will prevent eating unhealthy foods, aligning with the findings of an earlier study conducted in 2013 [17] and supported by India's FSSAI labelling updates (2020–2022/23), which mandated allergen/trans-fat disclosures, separate added sugars reporting, and enhanced nutrition panels [18]. The high percentage of adolescents (72.6%) who reported reading food labels is encouraging, indicating a growing awareness and interest in understanding the nutritional content of their food. However, the fact that 62.8% believe it is essential to simplify nutrient information on food packages reveals a gap in the current food labelling system. Simplified and clearer labelling could enhance comprehension and assist adolescents in making more informed food choices [19–21].

More than half (67.6%) of adolescents reported that food advertisements influence their food choices. The study demonstrates that advertisements and marketing of foods do impact adolescent food choices, and hence, they should be regulated not to mislead adolescents. These results are in accord with the findings of a recent study conducted with French adolescents aged 13–17 years, showing that they are attracted to food products high in fat, sugar, and salt (HFSS) as a result of advertisements targeted toward them [22]. Other studies conducted in Southern India also reported the same [23, 24]. Current regulations in India are scattered and do not address the

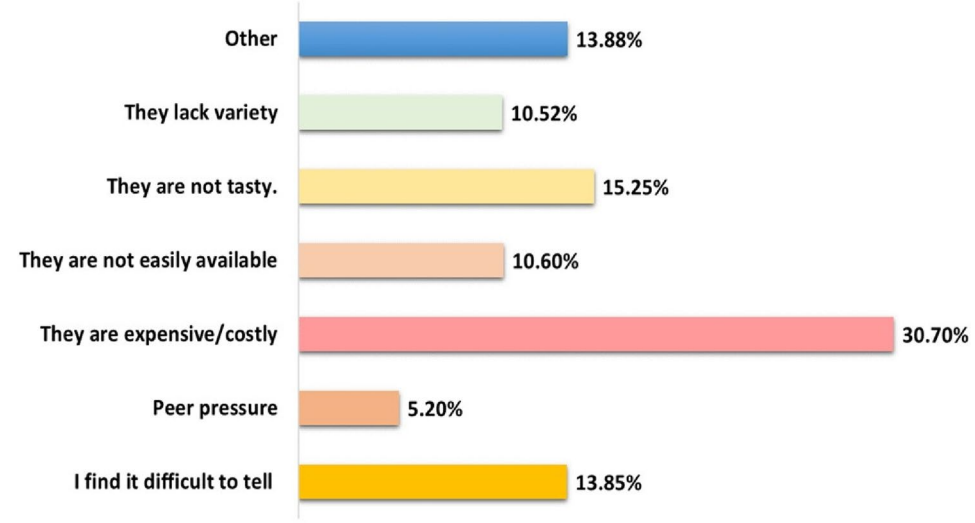

Fig. 3 Adolescents' perceived barriers to healthy eating

Table 4 Adolescents' practices and perceived importance of nutrition labelling

Do you read the nutrition information?	*n* (47,644)	%
No	13,040	27.37
Yes	34,581	72.58
Other	23	0.05
How often do you read this information?	*n* (34,315)	%
Most of the time	17,494	50.98
Only when purchasing	3,273	9.54
Rarely	2,441	7.11
Sometimes	11,089	32.32
Other	18	0.05
How important is it to simplify and emphasize this information?	*n* (44,991)	%
I don't know	3,391	7.54
Important	7,752	17.23
Not important	1,473	3.27
Very important	28,260	62.81
Not aware	4115	9.14

NR Non-response excluded while presenting frequency/ percentage distribution

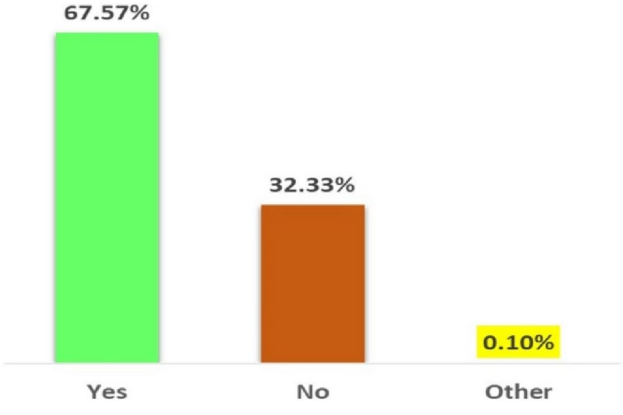

Fig. 4 Influence of food advertising on food choices

problem of regulating food HFSS advertisements targeted at children/ adolescents [9, 25–27].

These findings indicate that food advertisements significantly influence adolescents' dietary preferences. While this study did not assess policy impacts directly, the results highlight a potential area for further exploration evaluating how regulatory measures on food advertising might mitigate the influence of unhealthy food promotions among young audiences.

The study highlights the active participation of adolescents in fostering a healthy food environment. Consumption of a healthy diet is connected with nutrition literacy. Ensuring adequate nutrition education through school curriculum and reinforcing the same will improve nutrition knowledge, dietary practices, and healthy eating behaviour among adolescents. There is a need to provide easy-to-comprehend and adequate information on food packs. Overall, adolescents' insights and perceptions provide avenues to make necessary changes in policies conducive to healthy eating behaviours and a healthy food environment. Findings from our survey highlight critical insights into the food choices of adolescents in India and the factors influencing these choices.

Economic barriers also play a significant role in dietary decisions, with 30.7% of adolescents citing the high cost of healthy foods as a deterrent. The perceived high cost of healthy foods reported by adolescents underscores the economic barriers to healthy eating. Future research could examine how pricing strategies, subsidies, or incentive programmes might improve affordability and access to nutritious foods for adolescents [28, 29].

Taste preferences are another major factor, as indicated by 15.3% of participants who do not consume healthy foods because they find them unpalatable. Taste preferences emerged as a barrier to healthy eating for some

adolescents. Future interventions and school-based nutrition education initiatives could consider incorporating components that make healthy foods more appealing through creative preparation and taste-oriented nutrition education [28, 30].

The lack of variety in healthy food options, noted by 10.5% of respondents, points to the necessity of diversifying the availability of nutritious foods. Efforts should be made to introduce a wider range of healthy options in schools, markets, and other places frequented by adolescents.

Finally, the accessibility of healthy foods remains a challenge, with 10.6% of adolescents reporting that these foods are not easily available. Limited accessibility to healthy food options reported by adolescent's points to environmental barriers that merit further investigation. Subsequent studies could explore how improving food supply chains or availability in schools and local markets may enhance adolescents' access to healthier foods [27, 31].

Overall, our study underscores the complexity of factors influencing adolescents' food choices in India and highlights several areas for intervention. While this study provides valuable insights into adolescents' perceptions of factors influencing their food choices, the findings should be interpreted within the scope of self-reported data. Future research could build upon these insights to inform policy development and targeted interventions aimed at promoting a healthier food environment for adolescents. Further research is needed to explore the long-term impact of these interventions and to continue monitoring trends in adolescent food choices and health outcomes.

The application of the SEM reinforces these insights by illustrating how adolescents' food choices are influenced by interconnected individual, social, organizational, and policy-level factors. Strengthening the food environment, therefore, requires a coordinated, multi-level approach that not only addresses structural barriers—such as access, affordability, and marketing of foods—but also empowers adolescents as active participants in the process. Involving key stakeholders, including schools, communities, civil society, and government organisations, is essential to develop and implement comprehensive policies and guidelines that foster healthier and more supportive food environments for adolescents.

Strengths and limitations

There is a paucity of literature available on perceptions of adolescents on the healthy food environment in India. This is probably one of the first studies to collect perceptions and experiences of adolescents on their food habits, conducting a nationwide survey to fill that knowledge gap. The methodology used in this study emphasises the need to create a platform where adolescents are empowered to make an informed decision that supports improving their overall health and well-being. Despite its limitations, results from this study suggest that combined efforts to enhance adolescents' participation in creating a healthy food environment through capacity-building workshops, e-dialogues, and knowledge products may result in strengthening food policies.

Other limitations associated with the study are: The current study collated perceptions of adolescents based on convenience sampling, which may limit the representativeness of the sample and restrict the generalizability of the findings to the wider adolescent population in India. As the study relied on self-reported data, responses may be subject to recall or social desirability bias. Participants might have over- or under-reported. After the lifting of the COVID-19 restrictions, the school started an in-person routine; therefore, parents and teachers preferred offline mode to decrease the screen time of adolescents, and thus, the responses were limited. The format of U-Report was reported to be lengthy, which might have affected completion rates. In addition, the study did not conduct disaggregated analyses by gender, socioeconomic status, or urban–rural residence, which could have provided deeper insights into subgroup variations in food choices and perceptions. The absence of these analytical comparisons limits the ability to draw equity-focused conclusions. While this study provides valuable insights through a survey, future research should use representative or stratified sampling, include qualitative methods such as Focus Group Discussions (FGDs), and incorporate subgroup-specific analyses to enhance the robustness and contextual depth of findings. Finally, there was no provision of restricting the response field in the tool used for administering the survey, which led to a low response for some of the variables by the adolescents.

Implications

The findings suggest that there is a need for investment in emphasising the importance of nutrition education to address health and nutrition, including overweight/obesity in adolescents. More diligent evaluations are required, particularly on meaningful engagement of adolescents to strengthen policies around fostering a healthy food environment, not only for overweight/ obesity but also to tackle the triple burden of malnutrition among adolescents. It is essential to utilise different platforms such as schools and communities, information and communication technology, and mass media for improving physical activity, healthy eating behaviour, and providing nutrition education to adolescents.

Conclusion

The study emphasised the need to accelerate efforts to strengthen the food environment and provide opportunities and platforms to augment meaningful adolescent engagement to improve their health, nutrition, and well-being. Adolescents expressed the importance of voicing their thoughts to establish healthy eating behaviour. There is a need to involve all key stakeholders and government organisations to strengthen policies and guidelines around a healthy food environment.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40795-025-01224-w.

Supplementary Material 1.

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Authors' contributions
MA, SMG, TR, SC, and PM conceptualised the study and guided its implementation of the study. TR and AS drafted the manuscript. VKM analysed the data. MA, SMG, KB, TR, and PM revised the manuscript critically for intellectual content. All authors read and approved the final manuscript.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical clearance for the study was obtained in May 2022 from the Public Health Foundation of India Institutional Ethics Committee (TRC-IEC 486/22). The consent procedure was approved by the ethics committee and was followed accordingly. The Consent was provided and was to be completed by the participants/ parents/guardians before the initiation of the survey. Adhered to the Declaration of Helsinki. Consent was obtained before the initiation of the survey.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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