

High Fat, High Sugar and High Salt Food Consumption among Adolescent Girls Residing in Mumbai City

Research Article

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Abstract

Background: The frequent consumption of high-fat, salt, and sugar (HFSS) foods among youngsters leads to a higher risk of overweight, obesity, and nutrient deficiencies, thereby raising concerns about the future risk of noncommunicable diseases (NCDs). The study aimed to assess the consumption pattern of HFSS food intake among adolescent girls in Mumbai and examine the influence of socioeconomic status on these habits.

Methods: A cross-sectional study was conducted among 1,035 adolescent girls aged 13–18 years who were selected through random and purposive sampling from four zones of Mumbai (North, South, East, and West). Participants were categorized as per their socioeconomic status (as per the Kuppuswamy scale). Data on HFSS food consumption were collected using a structured food frequency questionnaire and analysed using SPSS version 25.0.

Results: The findings revealed a high prevalence of HFSS food consumption among adolescent girls. Daily intake was most common for sugar as an ingredient in various recipes (55.8%), tea with sugar (48.1%), cream biscuits (39.2%), sweet biscuits (32.3%), and chocolates (31.8%). Weekly consumption was notable for *chaat* (47.4%), instant noodles (43.5%), *vada pav/samosa* (42.8%), and sugary beverages. Bakery items and processed foods like wafers and cheese were consumed predominantly on a weekly or monthly basis. Socioeconomic status significantly influenced HFSS food intake, with higher consumption observed among girls from higher socioeconomic backgrounds ($p < 0.05$).

Conclusion: This study highlights socioeconomic disparities in the widespread and frequent intake of HFSS foods among adolescent girls in Mumbai, underscoring an urgent need for targeted nutrition education and intervention programs to foster healthier eating behaviours and reduce the immediate as well as future risk of NCDs in this vulnerable population.

Keywords: Adolescents; HFSS (High Fat, Salt, And Sugar); Socioeconomic Status

Introduction

The World Health Organization (WHO) defines adolescence as the period from 10-19 years. This period is recognized as a crucial transitional phase of growth and development from childhood to adulthood, which requires good nutrition and a healthy lifestyle [1]. Adopting healthy eating patterns, that is, regular consumption of a variety of whole grains and nutrient-rich cereals (pearl millet, finger millet, etc.), legumes, seasonal fruits and vegetables, meat, milk, and eggs, is essential to support the final growth spurt during adolescence [2].

Medina et al. (2020) defined eating habits as “conscious, collective and repetitive behaviors which lead people to select, consume, and use certain foods or diets, in response to social and cultural influences” [3]. The consumption of poor-quality diets is one of the biggest contributors to the global burden of non-communicable diseases (NCDs). Amongst all age groups, the age group of adolescents has been consistently identified as a model displaying the consumption of a poor-quality diet, characterised by the low consumption of fruits and vegetables, whole grains, lean meat, and low-fat dairy, and the high intake of confectionery, high-sugar beverages, processed meats, refined grains, and ready-to-eat meals [4].

High-fat, salt, and sugar (HFSS) foods are those prepared with excessive amounts of cooking oil/fats, sugar, or salt. The Food Safety and Standards Authority of India (FSSAI) defines HFSS foods as processed food products that contain high levels of saturated fat, total sugar, or sodium. The declared nutritional values of these ingredients exceed the recommended limits of energy (kcal) from total sugar (<10% of total energy), energy from saturated fat (<10% of total energy), and sodium (<1 mg/1 kcal). The daily consumption of >15% of energy from visible ghee/oil/butter, salt intake of >5g/day, and >25g/day of sugar (for 2000 kcal/day) is considered high. High-fat foods include all deep-fried foods and foods prepared with high quantities of oil/fat, such as French fries, *samosa*, *kachoris*, *puris*, desserts, biscuits, cookies, cakes, and *parathas*. Processed foods/pre-packaged foods like chips, biscuits, *namkeen*, *papad*, and pickles are examples of high-salt foods. Commercially prepared jams, sauces, ice-creams, etc. can be considered examples of high-sugar foods. HFSS foods are considered unhealthy as they lack essential amino acids, fatty acids, and micronutrients and their excessive consumption increases the risk of noncommunicable diseases [5].

One of the main concerns regarding the consumption of HFSS foods during early life is the increasing prevalence of childhood overweight and obesity, which can lead to a range of health complications later in adulthood. However, due to the ease of availability, variety, appealing taste, attractive and persistent advertisements, and peer pressure, the intake of these foods continues to rise, particularly among children and adolescents. Additionally, the lack of awareness about the health risks associated with HFSS foods, combined with strong taste preferences and social influences, further contributes to unhealthy eating patterns [6,7].

Thus, the aim of the present study was to study the HFSS food consumption patterns among adolescent girls residing in Mumbai city.

Materials and methods

Study Population

The present study was conducted on adolescent girls (aged 13–18 years) residing in Mumbai City belonging to low (LSES), middle (MSES), and high (HSES) socioeconomic statuses.

Sample size and sampling technique

The study population (N=1035) was primarily selected using random sampling followed by purposive sampling. One ward from each of the four zones of Mumbai City (North, South, West and East) was selected randomly. From each ward, adolescent girls aged 13–18 years belonging to three different socio-economic strata (low, middle, and high-income groups as per Kuppuswamy scale, 2019) were included in the study.

Ethics approval

The research proposal was approved by the Institutional Ethical Committee (IEC) of Dr. BMN College of Home Science. The proposal has been registered with the Clinical Trials Registry - India CTRI/2021/07/034563. After obtaining assent from the participants, a duly signed informed consent was obtained from the parents of participants as the participants were minors.

Data Collection

Data on HFSS food consumption were collected using a food frequency questionnaire (FFQ). The questionnaire had two parts. Part A included questions on demographic details of the participants (gender, age, family type, monthly income, education, and occupation of parents). The modified Kuppuswamy Scale was used to determine the socio-economic status of study participants. Part B included questions on the frequency and quantity of HFSS foods consumed by the participants. A list of 25 food items classified into high-fat, high-salt and high-sugar foods was included in the FFQ. The FFQ was explained to the participants, and they were asked to select one frequency for the consumption of each food. The frequency of HFSS foods intake in this study is categorized as follows: less than 25% (low), 25–50% (moderately high), and more than 50% (high).

Data Analysis

Data collected were statistically analysed using SPSS software for Windows (version 25, 2017, IBM Corporation, Armonk, New York, United State). The frequencies of intake of food items are presented as percentages. The frequency of consumption of food was coded as: Never = 1, Monthly = 2, Weekly = 3 and Daily = 4. The frequency intake between the three SES were compared using the Kruskal–Wallis H test with Bonferroni correction to adjust for multiple comparisons. The data for frequency consumption for the three groups is presented as Mean ± SD, with a higher mean indicating more frequent intake. A p-value <0.05 after Bonferroni correction was considered statistically significant.

Results

The study was conducted among 1,035 adolescent girls aged 13–18 years residing in Mumbai city. The sample comprised 486 girls from LSES, 359 from MSES, and 190 from HSES backgrounds, ensuring

representation across all geographic, age, and socioeconomic groups (Table1).

Daily consumption of HFSS foods

The foods for which the frequency of daily intake was assessed among adolescent girls were categorized as high-sugar foods, high-fat-high-salt foods, and high-fat-high-sugar foods. The highest daily consumption was observed for items in the high-sugar foods category, with 55.8% reporting daily use of sugar (as an ingredient in various recipes), followed by 48.1% consuming tea typically sweetened with sugar. In the high-fat-high-salt category, toasts/bread/pav (25.4%) and savoury biscuits (24.4%) were most commonly consumed on a daily basis. Among high-fat-high-sugar foods, cream biscuits (39.2%), sweet biscuits (32.3%), and chocolate (31.8%) showed moderately high intake. (Table 2)

Weekly consumption of HFSS foods

The patterns observed highlighted the popularity of savory and snack foods rich in fats and salt. *Chaat* (47.4%), instant noodles (43.5%), and *vadapav/samosa* (42.8%) were frequently consumed on a weekly basis. In addition, a moderately high weekly intake was also observed for chocolate (40.4%) and cream biscuits (39.2%) followed by sugary beverages like non-aerated beverages (35.6%), aerated soft drinks (32%), coffee/cold coffee (30.2%), fruit juices/sweetened lime juice (29.6%), and fruit milkshakes/smoothies/*falooda* (28.6%) (Table 2)

Monthly consumption of HFSS foods

The consumption of packaged processed foods such as wafers/French fries (46.6%), fruit milkshakes/smoothies (40.1%), and *chaat* (39.3%) were the highest. Several high-fat-high-salt foods, including cheese (36.1%), *khari* (26.8%), and *farsan* (27.4%), as well as high-sugar beverages like fruit juices (31.4%) and aerated soft drinks (31.3%), also showed high monthly intakes (Table 2).

To summarise, high-sugar foods including the added sugar recipes and tea, health drinks, and coffee/cold coffee were integrated into the daily routines of adolescent girls, whereas high-fat-high-sugar foods (cream biscuits, sweet biscuits, chocolate) are also consumed frequently. Some of the high-fat-high-salt foods such as toasts/bread/pav and savoury biscuits are commonly eaten daily, but some other foods in the same category i.e. *vadapav/samosa*, instant noodles, *chaat* were typically consumed weekly or monthly.

Table 1: Distribution of Participants by 4 Zones and Socio-economic Strata (N=1,035)

Socio-Economic Strata	East Zone	West Zone	North Zone	South Zone
Low Socio-Economic Stratum (n=486)	125	128	100	133
Middle Socio-Economic Stratum (n=359)	105	123	46	85
High Socio-Economic Stratum (n=190)	64	61	21	44

Table 2: Frequency of Consumption of High-Fat, Salt, and Sugar (HFSS) foods by the participants (N=1035)

HFSS Foods	NEVER %	MONTHLY %	WEEKLY %	DAILY %
High-fat, High-salt Foods				
Toasts/ bread/pav	14.3	23.2	37.1	25.4
Savoury biscuits	22.4	18	35.2	24.4
<i>Papad</i>	22.6	28.4	30.3	18.6
Pickles/ <i>Chutney</i>	36	22.4	25.4	16.1
<i>Khari</i>	37.3	26.8	23.3	12.7
<i>Farsan-chivdas/chaklis/sev,etc</i>	35.2	27.4	26.2	11.2
<i>Vadapav/samosa</i>	9.7	38.3	42.8	9.3
Cheese	21.5	36.1	33.6	8.7
Instant noodles	16.7	32.9	43.5	7
<i>Chaat</i>	7	39.3	47.4	6.3
Wafers/French fries	20.4	46.6	27.1	6
High-fat High-sugar foods				
Cream biscuits	9.1	12.5	39.2	39.2
Sweet biscuits	17.5	12.8	37.5	32.3
Chocolate	10.4	17.4	40.4	31.8
Ice candy/ Ice cream/ <i>Kulfi</i>	12.9	29.3	43.3	14.6
High-sugar foods				
Sugar (as an ingredient in various recipes)	19.1	12.6	12.5	55.8
Tea with added sugar	32	7.2	12.7	48.1
Health drinks	41.9	18	18.1	22
Coffee/cold coffee	30	18.8	30.2	21
Honey	41.6	24.9	21.6	11.8
Fruit drinks	24.2	29.2	35.6	11.1
Fruit juices	28.7	31.4	29.6	10.3
Aerated soft drinks	27.1	31.3	32	9.7
Jam	47.2	25.5	18.7	8.5
Fruit milkshakes/smoothies/ <i>falooda</i>	24.7	40.1	28.6	6.6

Consumption patterns of HFSS foods as per the Socioeconomic Status

(Table 3-5) Present the socioeconomic disparities in the mean frequency of intake of HFSS foods. A significant difference was found in the intake of cheese (high-fat-high-salt food), ice cream (high-fat-high-sugar foods), honey, health drinks, tea, fruit juices, fruit milkshakes, aerated soft drinks, and fruit drinks (high sugar foods) across SES groups (p<0.05).

The frequency of cheese consumption was higher in adolescents in both MSES and HSES groups compared to that in the LSES group (p<0.05), with a similar trend observed for health drinks and fruit milkshakes. In contrast, tea consumption was higher among the LSES and MSES groups than that in the HSES group (p<0.05). Fruit juices and aerated soft drinks were more frequently consumed by adolescents in the MSES group compared to those in the LSES group (p<0.05).

Discussion

The present study provides a comprehensive assessment of HFSS food consumption patterns among 1,035 adolescent girls in Mumbai, highlighting the frequency and types of HFSS foods consumed, as

Table 3: Socioeconomic disparities in the Frequency Intake of High-fat, High-salt Foods Expressed as Mean ± SD (N=1035)

HFSS Foods	LSES (n=486)	MSES (n=359)	HSES (n=190)	P value
High-fat, High-salt Foods				
Toasts/ bread/pav	2.7±1.0	2.8±0.9	2.7±1.0	0.402
Savoury biscuits	2.6±1.1	2.7±1.1	2.5±1.1	0.071
Papad	2.5±1.1	2.5±1.0	2.4±1.0	0.340
Pickles/chutney	2.1±1.1	2.3±1.1	2.3±1.0	0.063
Khari	2.1±1.1	2.2±1.0	2.1±1.1	0.120
Farsan-chivdas/chaklis/sev,etc	2.1±1.0	2.2±1.0	2.2±1.1	0.233
Vadapav/samosa	2.6±0.8	2.5±0.7	2.5±0.8	0.463
Cheese	2.1±0.9	2.4±0.9*	2.4±0.9#	0.000
Instant noodles	2.4±0.9	2.5±0.8	2.4±0.9	0.451
Chaat	2.5±0.7	2.5±0.7	2.6±0.8	0.742
Wafers/French fries	2.1±0.8	2.2±0.7	2.2±0.9	0.151

*Significant difference between LSES and MSES
 # significant difference between LSES and HSES
 \$ significant difference between MSES and HSES

Table 4: Socioeconomic disparities in the frequency Intake of High-fat High-sugar Foods Expressed as Mean ± SD (N=1035)

HFSS Foods	LSES (n=486)	MSES (n=359)	HSES (n=190)	P value
High Fat High Sugar foods				
Cream biscuits	3.1±1.0	3.2±0.9	3.1±1.0	0.524
Sweet biscuits	2.8±1.1	2.9±1.0	2.9±1.1	0.316
Chocolate	2.8±1.0	3.0±0.9	2.9±1.0	0.281
Ice candy/ Ice cream/Kulfi	2.5±0.9	2.6±0.9	2.7±0.9#	0.042

* Significant difference between LSES and MSES
 # significant difference between LSES and HSES
 \$ significant difference between MSES and HSES

Table 5: Socioeconomic disparities in the frequency Intake of High-sugar Foods Expressed as Mean ± SD (N=1035)

HFSS Foods	LSES (n=486)	MSES (n=359)	HSES (n=190)	P value
High Sugar foods				
Sugar (as an ingredient in various recipes)	3.0±1.2	3.1±1.2	3.0±1.2	0.567
Tea with added sugar	2.8±1.3#	2.8±1.3\$	2.5±1.4	0.012
Health drinks	2.0±1.1	2.4±1.2*	2.3±1.3#	0.000
Coffee/cold coffee	2.4±1.2	2.4±1.1	2.5±1.1	0.595
Honey	1.9±1.0	2.2±1.1*	2.1±1.1	0.004
Fruit drinks	2.3±1.0	2.4±0.9	2.3±1.0	0.371
Fruit juices	2.1±1.0	2.3±0.9*	2.3±1.0	0.035
Aerated soft drinks	2.2±1.0	2.3±0.9*	2.4±1.0	0.013
Jam	1.9±1.0	2.0±1.0	1.8±1.0	0.069
Fruit milkshakes/smoothies	2.1±0.9	2.2±0.9*	2.3±0.9#	0.003

*Significant difference between LSES and MSES
 # significant difference between LSES and HSES
 \$ significant difference between MSES and HSES

well as the influence of socioeconomic status (SES) on these dietary habits.

Daily Consumption Patterns

The high daily sugar and sweet product consumption is particularly concerning, as the excessive intake of added sugars is a well-established risk factor for obesity and NCDs. Our findings

are consistent with those of a study conducted in Mumbai in 2022, which also reported sugar as the most frequently consumed HFSS item among adolescents daily, with early adolescents consuming sugar more often than late adolescents [8]. These findings are also consistent with those of Wadakappanavar et al. (2019), who also reported notably high snack consumption rates among both urban (85%) and rural (90%) children. Their study also highlighted that *benne* biscuits—made primarily from *maida*, ghee, and sugar—were the most frequently consumed snack, with a daily intake observed in 80.71% of children [9]. Similarly, Poornima B et al, (2024) studied frequency of HFSS food consumption among girls aged 11-16 years (n=129) and reported that 20% of the girls consumed fried and salty foods such as chips on a daily basis, 70% of the girls were consuming biscuits, cookies and chocolates daily. It was concluded that there was a significantly (p<0.05) higher consumption of bakery products, ice cream, packaged fruit juices and chips among all girls [10]

Weekly and Monthly Consumption Patterns

Approximately 30% of the participants preferred to consume high-salt and fat-rich savoury snacks such as *chaat*, instant noodles, and *vada pav/samosa*, as well as high- sugar and fat-rich foods, including ice cream and chocolates, every week. Sugary beverages, including fruit drinks and aerated soft drinks, also showed a moderately high weekly consumption. High-fat foods like wafers/ French fries and cheese were consumed predominantly on a monthly basis. These patterns showed similar findings from other Indian cities, such as Guwahati and Jaipur, where frequent fast food and snack consumption among adolescents was attributed to convenience, taste preferences, and lifestyle factors [11,12]. Some other factors responsible for adopting HFSS food among adolescent identified by Maitri P (2021) were nuclear family, skipping breakfast, time, taste and attractiveness of these foods, emotional eating, lack of nutritional knowledge, and role of advertising [13].

Socioeconomic Differences

A significant finding of this study is the influence of SES on HFSS food consumption. Girls from higher SES backgrounds reported greater intakes of cheese, flavoured milk, fruit milkshakes, and soft drinks (p<0.05), whereas tea consumption was higher among those from LSES and MSES groups (p<0.05). These results align with the findings of Gupta et al. (2018) in rural Himachal Pradesh, who reported the highest junk food consumption among children from high SES, which could be attributed to increased affordability and access [14].

The contribution of ultra processed foods to the total macronutrient intake of adolescents from two different socioeconomic status (SES) groups—middle-income and low-income families—in Delhi showed that adolescents in the middle-income group derive a significantly greater proportion—and greater absolute amounts—of their daily energy, carbohydrates, fat, and protein from ultra-processed foods when compared to those from the low-income group [15].

The widespread consumption of HFSS foods can be attributed to several factors, including easy availability, aggressive marketing, peer influence, and changing family dynamics. Arya and Dubey (2023) highlighted the role of food delivery apps, small family sizes, and the

prevalence of working mothers in promoting fast food intake among Indian adolescents [16].

In a study by Tawheed A et al. (2017) involving 51 respondents, 31.9% were aware of the high sugar content in fast foods, 68.8% recognized the high salt content, 74% knew about the high saturated fat content, and 51.5% were aware of their high cholesterol levels stressing on the fact, that in spite of having awareness, the consumption of these foods are still high in adolescents [17]

Shete and Wagh (2018) reported a positive association between junk food intake and higher body mass index among adolescents, indicating that poor dietary habits during adolescence are linked to higher risks of overweight, obesity, and nutrient deficiencies, which can persist into adulthood and elevate the risk of NCDs [18].

Conclusion

This study demonstrates a concerning widespread and frequent intake of high-fat, high-sugar, and high-salt foods by more than 30% of the adolescent girls residing in Mumbai. Socioeconomic status significantly influenced these dietary habits, with a higher percentage of participants from HSES groups showing greater consumptions of certain HFSS foods. These findings underscore an urgent need for targeted nutrition education and intervention programs to promote healthier eating behaviors among adolescent girls.

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