Consumption of High-Fat, Salt, and Sugar Foods and its Determinants Among Medical Undergraduates in North Kerala: A Cross-Sectional Study

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Abstract:

Introduction: Rising HFSS food intake among young medical undergraduates contributes to early NCD risk among them**. Objectives:** To assess the consumption pattern of HFSS foods and the factors determining its choice among medical undergraduates in North Kerala. **Methods:** A cross-sectional study was done among medical undergraduates of a private medical college in North Kerala during 2024. Stratified random sampling were done and 202 participants were selected. A self-administered questionnaire was distributed to study participants and anthropometric assessments such as height, weight, and BMI was assessed. Data was entered in MS Excel and analysed using SPSS. **Results:** A significant proportion (51.5%) of participants regularly consumed HFSS foods, with taste (82%) being a primary motivator for their choices. Awareness levels regarding the health risks associated with HFSS foods varied among participants. Varying degrees of malnutrition such as Underweight (13.5%), Overweight (26.9 %) and Obesity (26%) were more among those who had high HFSS consumption. Those who perceived a negative impact of HFSS foods on their health was 1.4 times higher HFSS consumers than others and was an independent predictor (p 0.037) **Conclusion:** The study reveals critical insights into the dietary behaviours of young adults. More than half of the medical undergraduates reported high consumption of HFSS foods, correlating with rising obesity rates in this population. The study identifies key factors influencing their dietary choices, including convenience, affordability, and social influences such as peer pressure and marketing tactics.

Keywords: Fast foods, Feeding behaviours, Noncommunicable diseases, Obesity, Processed

Introduction:

Dietary practices and lifestyle are increasingly linked to NCDs like diabetes, obesity, cardiovascular disease, and some types of cancer.[1] According to the World Health Organization (WHO), NCDs account for over 71% of fatalities worldwide, with a significant share of these deaths happening in younger populations, specifically those between the ages of 15 and 29 years.[2] The increasing consumption of foods rich in High Fat, Salt, and Sugars (HFSS) among children and young people, is highlighted by the demographic shift towards rising NCDs in this age group.

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The growth of processed food industry in the past decade as a vital sector for reducing food loss and increasing the shelf-life of agricultural produce has emerged as an important sector for sustainable growth and development.[3] Thus, as this sector grows, there is an increase in Ultra processed foods also in market. The Foods processed with high amounts of total fat, saturated fats, trans fat, added sugar, and/or added salt & which contain low amounts of proteins, vitamins, photochemical, minerals and dietary fibre known to have negative impact on health if consumed regularly or in high amounts are referred to as HFSS foods.[3,4] Consuming them on a daily basis can cause obesity and lead to increased chance of developing NCDs including Diabetes, hypertension, coronary artery disease, etc.[1] Approximately 70% of individuals who are overweight or obese reside in low- and middle-income nations, such as India.[5] India consumes one of the largest amounts of salt and sugar per day in the world.[6] From 2011 to 2021, the retail sales value of ultra-processed food industry has increased at a compound annual growth rate of 13.37% overall and is projected to increase to 39% by 2032.[3]

The recent National Family Health Survey (2019-20) highlights the increasing trends of Obesity among children as well as adults in both rural and Urban settings.[7] The low cost, attractive packaging and commercial strategies of promotion has influenced the choice of consumers.[8] The global burden of diseases study shows that annually, 1.2 million deaths in India can be attributed to dietary risks alone.[5]

In this background this study aimed, to assess the consumption of HFSS foods and to determine the factors associated with its consumption among young medical undergraduate adults in North Kerala.

Methods:

A cross- sectional study was done during April to September 2024, among 202 Medical undergraduate students of a private medical college in North Kerala. Sample size estimation was done using the formula $\mathbf{N = Z_{(1-\alpha/2)}^2 \times P \times Q / d^2}$, In a study conducted by Motta L et al[9] among young adults in Gujarat, the average consumption of HFSS foods was estimated to be 43.2%.[9] Considering P as 43.2%, the calculated sample size was 168. However, 202 medical students were included in the study.

The participants were enrolled to study through stratified random sampling. The medical students were stratified according to their batches and 60 students were selected from each batch by lottery method using their Roll number register. After getting informed consent, a Self-administered questionnaire distributed which collected data about sociodemographic details, HFSS consumption patterns and awareness following which anthropometric assessments of Height and weight was done by investigators using calibrated stadiometer and analogue weighing machine.

A person who consumed daily/ 2-3 times a week of any kind of HFSS foods was classified as High HFSS consumer and a person who never consumed/ rarely consumed/ consumed once a week of any kind of HFSS foods was classified as Low HFSS consumer.

Data analysis: The data was collected using Online platform (Google forms) and converted into MS Excel and was analyzed using SPSS version 23 software (IBM Corp. Armonk, NY).[10] The quantitative variables were expressed as Mean ± SD and qualitative variables as frequency and percentage. The association between categorical variables was tested by Chi-square test or Fischer Exact test. A p value of <0.05 was considered as significant.

Ethical approval was obtained from the Institutional ethical Committee no: IECKMCT/57/2024 dated 16.05.2024.

Results:

A total of 202 students participated in the study. The mean ± SD age of participants were 21.7 ± 1.3 years with a range of 19-27 years. Majority of the participants were females (78.7%). Majority of them resided at Hostel (80.2%). About two-thirds of participants had an average monthly family income of Rs.10,001- 1,00,000. (Table 1)

Table 1: Socio-demographic profile of participants (N=202)

Variable	n	%
Gender		
Female	159	78.7
Male	42	20.8
Others	01	0.5
Current place of stay		
Home with family	38	18.8
Hostel	162	80.2
Alone as paying guest	02	1.0
Monthly Family Income in Rs (N=182)*		
Less than 10,000	26	14.3
10,001-50,000	60	33.0
50,001-1,00,000	58	31.9
1,00,001-5,00,00	28	15.4
> 5,00,000	10	5.4

Note. *20 participants were not aware of their family income

All the participants were aware about the HFSS foods with 60% (n=122) of participants were somewhat aware, followed by 32% (n=65) who were Very well aware whereas 7.4% (n=15) of them were not very aware. More than half of participants perceived that HFSS foods had a Negative effect on their health (52%) whereas 44% had no particular opinion. Although 3% perceived a positive impact for HFSS foods on their health.

The most regularly consumed HFSS foods were Confectioneries (54.5%), followed by fast food (53%) & sugary drinks (45%). Majority were buying the HFSS foods from college canteens (64.9%), followed by Supermarkets (48.5%) and from Restaurants (35.6%). About 45% of participants consumed fast foods such as Burgers, pizzas, French fries etc once in a week. About 30% consumed sugary beverages like soft drinks, packaged fruit juices etc at least 2-3 times a week. About 25% consumed salty snacks like salted chips/peanuts/ cashews etc once a week. One fourth of participants (24.3%) consumed sugary bakery items like confectioneries, croissants, peda etc. 2-3 times a week and 4% consumed daily. (Table 2)

Table 2: Distribution of HFSS food consumption among participants (N=202)

Variable	n	%
Type of food*		
Salted Chips	76	37.6
Sugary drinks	91	45
Fast foods	107	53
Confectionery	110	54.5
Packaged snacks	82	40.6
Regularly bought from*		
College canteens	131	64.9
Supermarkets	98	48.5
Shopping malls	35	17.3
Restaurants	72	35.6
Online food delivery	64	31.7
Bakery shops	1	0.50
Consumption of fast foods (Burgers, pizzas etc)		
Daily	1	0.5
2-3 times/week	23	11.4
Once a week	92	45.5
Rarely/never	86	42.6
Consumption of Sugary beverages		
Daily	3	1.5
2-3 times/week	58	28.7
Once a week	72	35.6
Rarely/never	69	34.2
Consumption of Salted Snacks		
Daily	1	0.5
2-3 times/week	48	23.8
Once a week	71	35.1
Rarely/never	82	40.6
Consumption of Sugary bakery items		
Daily	8	04.0
2-3 times/week	49	24.3
Once a week	71	35.1
Rarely/never	74	36.6

*Multiple responses

The major factor influencing the choice of HFSS foods as reported by participants were taste (82.2%) followed by social media influences like advertisements (48%) and lower Cost (31.2%). Majority of participants reported Friends (62%), social media (60%) and family

(34%) as sources of information regarding HFSS foods. About half of the participants read food labels sometimes, whereas 12% always read them before buying HFSS foods. Whereas one third rarely or never reads it. The mean BMI of participants was 22.5 ± 3.3 kg/m^2 with a range of 14.7-33.7kg/m^2. Most of them were within normal BMI whereas 25% were Overweight and 22% were obese. About 12% were underweight. (Table 3)

Table 3: Factors influencing HFSS choice and Anthropometric assessment of participants. (N=202)

Variable	n	%
Factors influencing choice of HFSS foods*		
Taste	166	82.2
Advertisements	17	8.4
Packaging	27	13.4
Cheaper	63	31.2
Offers & Discounts	39	19.3
Non-Availability of healthy alternatives (Convenience)	47	23.3
Social media influences	98	48.5
Sources of information*		
Media	64	31.7
Social media	121	59.9
Family	68	33.7
Friends	125	61.9
Advertisements	40	19.8
Reading food labels of HFSS foods		
Always	25	12.4
Sometimes	101	50.0
Rarely	62	30.7
Never	13	6.4
Not aware	1	0.5
Anthropometry (Asian classification of BMI) (n=198)		
Underweight	23	11.6
Normal	81	40.9
Overweight	50	25.3
Obese	44	22.2

*Multiple responses

About 51.5% (n=104) of participants were classified as High Consumers of HFSS foods and 48.5% (n= 98) as Low consumers. A significant number of participants were regularly taking HFSS foods of any type. The distribution of HFSS consumption was similar among females (51.6%) and males (50%). Similarly, the distribution of HFSS consumption was comparable between participants who were staying in Hostel and paying guest (50%), however those staying along with families had a higher HFSS consumption (58%), but this was not statistically significant. The consumption was more among those who were not aware about HFSS food (53.3%), compared to those who had some form of awareness (52.5%) but this was not statistically significant. Those who consumed larger serving size per meal time (71.4%) had a higher HFSS food intake than others but this was also not statistically significant. The participants who had perception of negative impact of HFSS foods on health were High consumers but, this was not statistically significant. Those participants who always combined soft drinks with HFSS foods had a higher HFSS consumption and this was statistically significant (p value <0.001). The distribution of High HFSS was more among those who practiced reading of food labels (60%), compared to others, but this was not a statistically significant association. (Table 4)

The logistic regression model was statistically significant, $x^2 = 19.14$, p 0.014, indicating that the predictors reliably distinguish between high and Low HFSS consumers. Gender, Place of stay, Family income, Self-perceived Awareness level about HFSS, Perception about impact of HFSS foods on their health and Practice of reading food labels were included in the model for predicting the independent predictors. Those who perceived a negative impact of HFSS foods on their health were 1.4 times higher HFSS consumers than others and was an independent predictor (p 0.037). Females, staying as Paying guest, income more than Rs

Table 4: Relationship of factors with HFSS consumption level (N=202)

Variables	High HFSS consumer, n (%)	Low HFSS consumer, n (%)	Total n (%)	p value
Gender				
Female	82 (51.6)	77 (48.4)	159 (100.0)	0.613
Male	21 (50.0)	21 (50.0)	42 (100.0)	
Others	1 (100)	0 (0)	1 (100)	
Place of stay				
Alone as paying guest	1 (50.0)	1 (50.0)	2 (100.0)	0.684
Home with family	22 (57.9)	16 (42.1)	38 (100.0)	
Hostel	81 (50.0)	81 (50.0)	162 (100.0)	
Monthly Family income (Rs.)				
Less than 10,000	9 (34.6)	17 (65.4)	26 (100.0)	0.237
10,001-50,000	34 (56.7)	26 (43.3)	60 (100.0)	
50,001-1,00,000	27 (46.6)	31 (53.4)	58 (100.0)	
1,00,001-5,00,00	13 (46.4)	15 (53.6)	28 (100.0)	
> 5,00,000	7 (70.0)	3 (30.0)	10 (100.0)	
Self-perceived awareness				
Very aware	32 (49.2)	33 (50.8)	65 (100)	0.905
Somewhat aware	64 (52.5)	58 (47.5)	12 (100.0)	
Not Aware	8 (53.3)	7 (46.7)	15 (100.0)	
Perception about impact on health				
Very negative	20 (57.1)	15 (42.9)	35 (100.0)	0.098
Somewhat negative	44 (61.1)	28 (38.9)	72 (100.0)	
Neutral	37 (41.6)	52 (58.4)	89 (100.0)	
Somewhat Positive	3 (60)	2 (40)	5 (100)	
Positive	0 (0)	1 (100)	1 (100)	
Frequency of combining soft drinks with other foods				
Always	9 (100)	0 (0)	9 (100)	<0.001
Sometimes	70 (61.4)	44 (38.6)	114 (100.0)	
Rarely/never	25 (31.6)	54 (68.4)	79 (100.0)	
Practice of reading Food labels				
Always	15 (60)	10 (40)	25 (100)	0.74
Sometimes	50 (49.5)	51 (50.5)	101 (100)	
Rarely/never	39 (51.3)	37 (48.7)	76 (100.0)	

10,000, Low awareness level, practice of reading food labels were not statistically significant independent predictors. (Table 5)

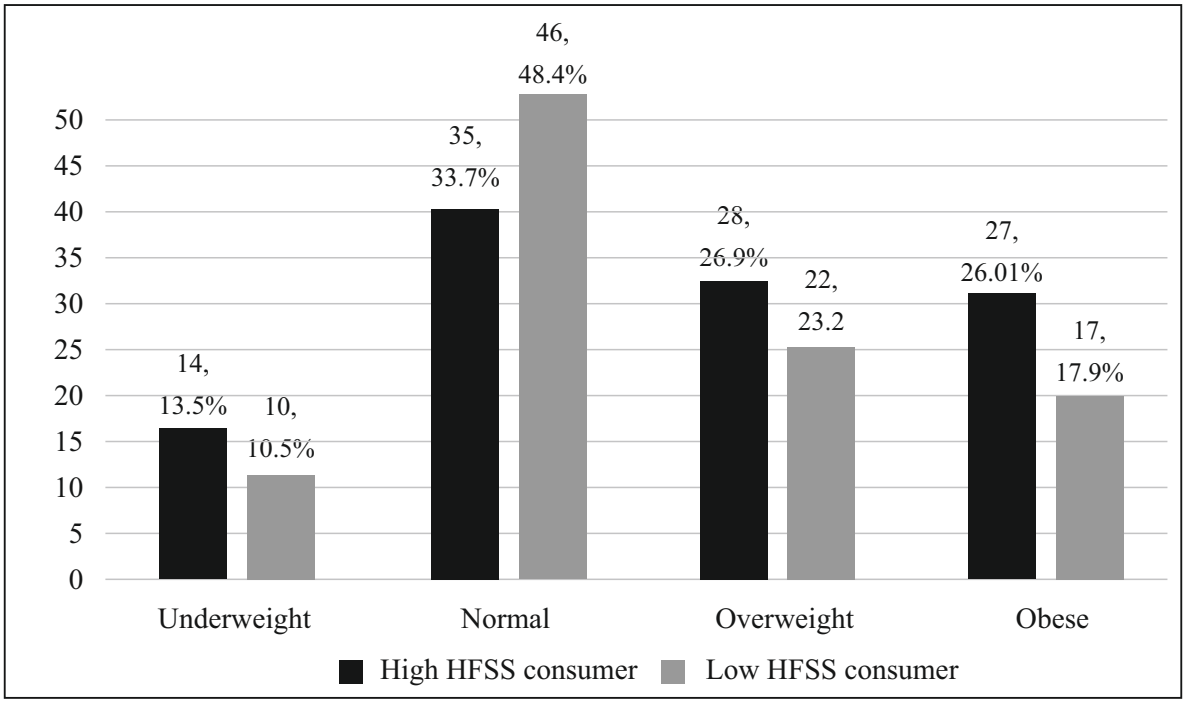
The distribution of Underweight (13.5%), Overweight (26.9 33.7%) and Obesity (26%) were more among those who had high Intake of HFSS foods than those who had low intake but not statistically significant (p value 0.191). (Figure 1)

Discussion:

Table 5: Multivariate Logistic regression for independent predictors of HFSS food consumption

Variables	Exp B (95% CI)	p value
Gender	1.186 (0.570-2.466)	0.649
Place of stay	1.273 (0.622-2.601)	0.509
Family Income	1.113 (0.839-1.478)	0.457
Self-perceived Awareness level about HFSS	1.176 (0.698-1.981)	0.542
Perception about impact of HFSS foods on their health	1.474(1.024- 2.121)	0.037
Practice of reading food labels	0.892(0.581- 1.369)	0.601

Figure 1: Relationship of HFSS intake with BMI



The study indicates that a significant majority of participants (92.6%) were aware of HFSS foods, with 60% being somewhat aware and 32% very well aware. This level of awareness is consistent with findings from international studies, which suggest that awareness often correlates with consumption patterns. In a similar study done in Karachi by Mirza et al though students had high level of awareness about unhealthy foods, a vast majority were consuming junk foods.[11] Also, in another qualitative study done in US by Sogari et al.[12], though the students knew the unhealthy diet practices but were not able to refrain from it. The sources of information were reported mainly as friends, family and social media similar to another study where websites and school were reported by Mizia et al in Poland.[13]

Interestingly, while 36% of participants perceived HFSS foods as having a negative impact on health, 44% had no opinion. This ambivalence may reflect a broader trend observed in many studies where individuals recognize the health risks associated with HFSS foods but continue to consume them due to taste preferences or social influences.[12] The major factors influencing food choices were reported as taste (82.2%), social influences (48%), and cost (31.2%). These factors are frequently reported as primary drivers behind dietary choices among young adults and children globally, emphasizing

the challenge of promoting healthier eating habits in a taste-driven market.[13-15]

In terms of consumption frequency, confectioneries (54.5%), fast foods (53%), and sugary drinks (45%) emerged as the most regularly consumed HFSS foods. This aligns with global trends where fast food consumption is notably high among young adults due to convenience and taste preferences.[3,17] Additionally, the preference for purchasing HFSS foods from college canteens (64.9%) reflects a social environment that promotes such dietary choices, similar to findings in other studies, where food accessibility in educational institutions impacts dietary habits.[13,16]

The study reveals that about 40% of participants consume medium portions at a time, which corresponds to meal portions. The portion sizes play a crucial role in dietary habits. Studies indicate that larger portion sizes contribute to increased calorie intake and are linked to obesity rates among young adults. Portion size control is one of the healthy dietary habits perceived by students in the study done by Mizia et al.[13]

Moreover, the frequency of fast-food consumption-45% once a week-echoes findings from various studies indicating that regular fast food consumption is prevalent among young adults globally.[17] However, the frequency of consumption of packaged foods was much lower than study done by Haseena et al.[18] in North of Kerala. Post COVID-19 pandemic, the consumption of junk foods has significantly increased among the youths as reported by Parker et al.[19] Studies have shown that they consumes fast food due to its convenience and palatability, despite being aware of its negative health implications.[13]

Participants expressed a desire for better access to healthier choices and more awareness programs, suggesting an acknowledgment of the need for systemic changes to support healthier eating behaviors. This sentiment is echoed in advocating for policy changes that enhance food environments in educational institutions to promote healthier options while reducing the availability of HFSS foods.[20] It also emphasizes the need to have food literacy among the children and young adults in order to make healthy choices in day-to-day life.

The Front of Package Labeling (FOPL) has not yet been enforced in India, to warn against the HFSS foods. However, only about 12% read the food labels every time and 50% read at least sometimes while purchasing the foods. This highlights that implementation of FOPL may have a good impact on the choice of purchasing these HFSS foods among young adults.

Conclusion:

The results of this study highlight the factors influencing the individual preferences, and awareness regarding the HFSS foods among the medical undergraduates. Due to accessibility, social influences and taste preferences, many individuals continue to consume HFSS foods despite being well aware of the health dangers involved. The noteworthy consumption trends especially for fast food and sugary drinks, emphasize the difficulties in encouraging healthier eating practices in a society that frequently places convenience and taste above nutritional content. Although people are aware of the issue, making better dietary choices is not always the result. This discrepancy highlights the necessity of focused interventions that address the underlying causes of consumption patterns in addition to increasing awareness.

To conclude, while there is a clear awareness of HFSS foods among young adults, translating this awareness into healthier eating habits remains a significant challenge. Addressing this issue requires a multifaceted approach involving education, policy changes, and improved access to healthier food options.

Recommendations:

Educational institutions ought to endeavour to make more healthful food options available in the campus canteen & premises. Working with neighbourhood businesses to provide wholesome substitutes may be able to influence consumer behaviour. Price

reduction/subsidizing the healthier foods and categorization of foods as green and red may encourage healthier choices among young adults at these outlets.

To reduce the excessive calorie intake from HFSS foods, encourage young adults to use portion management techniques. The visual signals/posters for proper serving sizes could be highlighted in institutional canteens as these are the common access zones of HFSS foods to medical undergraduates

Encourage the implementation of Front of Package Labelling (FOPL) laws in India to give consumers more lucidity about HFSS foods. This could empower consumers to make informed decisions at the point of purchase.

Declaration

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