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Gender Disparities in Selected Health Behaviors Among Indian Adults (15-49): Insights from the National Family Health Survey (NFHS-5) 2019-21

Priyanka Yadav Jagtap^{1*} and Nandita Saikia²

Abstract

Background: Understanding gender-specific health behaviors is crucial for assessing mortality risks, but research in India remains limited due to paucity of data. This study fills the gap by examining gender differences in smoking, alcohol consumption, and dietary diversity among adults, with rural-urban variations.

Methods: Using data from the National Family Health Survey (NFHS-5, 2019-21), individuals aged 15-49 years were analyzed via bivariate and multivariate techniques. Binary logistic regression assessed the likelihood of engaging in selected behaviors by gender and socioeconomic factors.

Results: Tobacco use is substantially higher among men (42.2%) than women (6.5%), and alcohol consumption is more prevalent in men (25.4% vs. 1.9%). Men also demonstrate greater dietary diversity (28.3% vs. 23.6%). Gender patterns persist across rural and urban areas; rural men consume more alcohol and tobacco than urban men (34.3% vs. 31.2%), while rural women have lower dietary diversity than urban women (21.3% vs. 30.7%). Among women, smokeless tobacco use (5.5%) exceeds smoking (0.5%), particularly in rural areas. Men are 25.6 times more likely to consume substances and 1.34 times more likely to have diverse diets than women.

Conclusion: The study highlights pronounced gender and rural-urban disparities in health behaviors among Indian adults. Men are far more likely to consume tobacco and alcohol but exhibit better dietary diversity than women. Targeted, gender-sensitive public health interventions, especially in rural areas, are essential to address these inequalities and promote healthier lifestyles.

Keywords

Alcohol,
Diversified diet,
Gender, India,
NFHS, Selected
substance use,
Tobacco.

*Corresponding Author

¹ Independent Researcher, United States. Email- Id: drpriyanka.connects@gmail.com

² Professor (Public Health and Mortality Studies), International Institute for Population Sciences, Mumbai. Email- id: nanditasts@gmail.com

Background

Public health research underscores the profound impact of unhealthy behaviors on morbidity and mortality (WHO, 2013; WHO, 2014). Most diseases are linked to health behaviors (WHO, 2008; Lloyd-Jones et al., 2010). Therefore, defining and measuring health behaviors are critical for effective policy development (Conner & Norman, 2017). Disparities in health behaviors and dietary patterns significantly contribute to social variations in health outcomes (Stringhini et al., 2010), affecting premature mortality and recovery from illness. Despite their importance, understanding these behaviors and their clustering remains limited, complicating intervention strategies (Spring et al., 2012).

Interestingly, health behaviors vary across social classes, socioeconomic status, gender, race, and geography, influencing key risk factors for chronic diseases such as harmful alcohol use, smoking, sedentary lifestyles, and poor dietary practices (Borrell et al., 2000; Braveman et al., 2010; Pampel et al., 2010; Ding et al., 2015; Malta et al., 2015). Lynch et al. (1997) established that socioeconomic status inversely affects behavioral and psychosocial characteristics, which are crucial in determining health risks. Gender differences in smoking, diet, and access to health care contribute to divergent mortality patterns between men and women (Gjonça, 1999). Given the dynamic nature of health and mortality trends, understanding these gender disparities is crucial (Charmaz, 1995). Gender identities influence illness experiences and health outcomes, underscoring the importance of examining gender in epidemiological studies (Vlassoff, 2007). Gender differences in health behaviors are essential for addressing health

disparities and informing policy, planning, and health services. A more systematic approach to gender-focused research is needed.

In India, gender disparities in mortality have been documented extensively (Saikia, 2019; Bora & Saikia, 2015; Canudas-Romo, Saikia, & Diamond-Smith, 2015; Dhakad & Saikia, 2023). In the Indian context, gender differences in health behaviors reflect sociocultural norms shaped by patriarchal structures (Sen, 1992; Dasgupta, 2003). Compared with men, women's restricted access to alcohol and tobacco is influenced by sociocultural factors, limiting their usage (Wilsnak et al., 2005; Pathania, 2011; Hitchman & Fong, 2011). Despite Indian women having greater life expectancies, they report poorer health and lower healthcare expenditures than men do (Saikia et al., 2016; Bora & Saikia, 2015; Canudas-Romo et al., 2015). However, studies on gender disparities in health behaviors among Indian adults are rare (Patel & Chauhan, 2020; Singh & Chattopadhyay, 2023; Marla & Padmaja, 2023). A limited number of studies have assessed gender differences in health behaviors, which may explain the gender gap in life expectancy and overall health outcomes.

Given the above context, to fill the research gaps, we analyzed National Family Health Survey (NFHS 5- 2019-2021) data to explore gender differentials in smoking, alcohol consumption, and dietary habits. Understanding these behaviors is crucial, as they are significant risk factors for chronic diseases and mortality (WHO, 2009). The analysis uncovered how gender influences these health behaviors among Indian adults, hypothesizing variations in both positive and negative health practices by gender.

Conceptual Framework

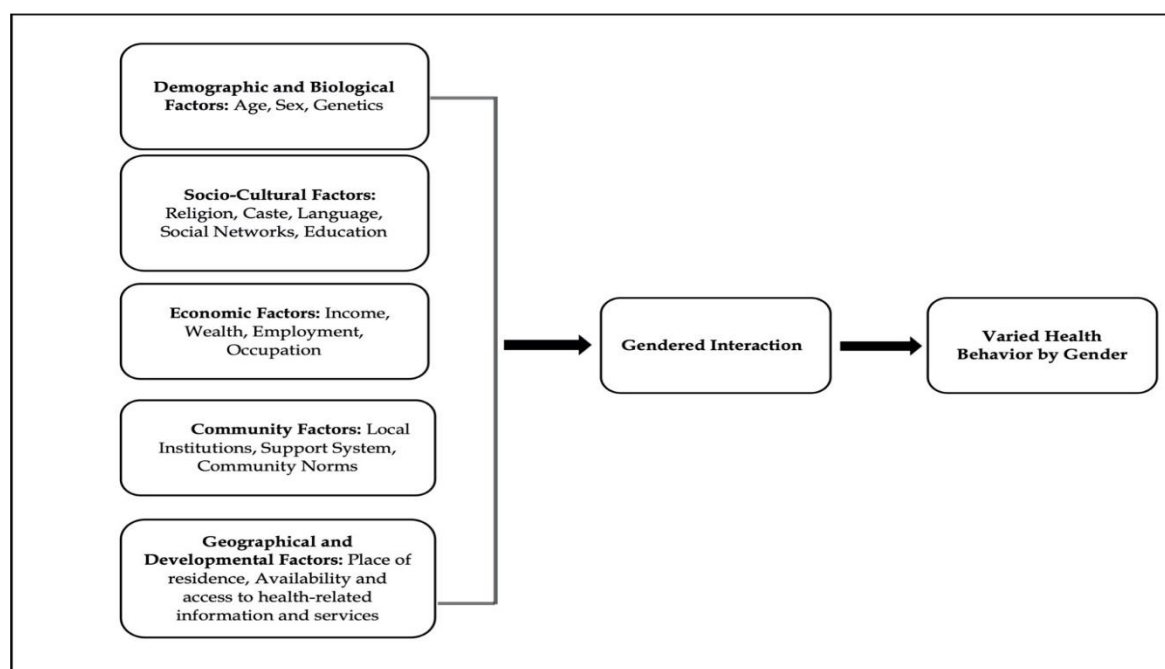
Gender relations in society are dynamic and evolving and are influenced by societal progress and changing norms. As women increasingly occupy roles historically dominated by men, there is a growing need for a nuanced examination of gender dynamics. However, traditional gender roles still intersect with social, economic, and cultural factors, creating diverse patterns of exposure to health risks and differential access to health information, services, and care. These disparities significantly impact health outcomes (WHO, 2002). Despite sporadic recognition, gender has not been fully integrated as a critical determinant in health promotion efforts (Gelb et al., 2012). Gender interacts with socioeconomic and contextual variables to shape health and behavioral outcomes differently for men and women (Vlassoff, 2007). To comprehensively understand these dynamics, it is essential to consider the complexity and

intersectionality of social, cultural, and economic contexts alongside demographic and epidemiological indicators.

This study adopts a gendered perspective to explore how inherent and contextual factors influence individual behaviors, particularly in the Indian context, where gender-specific behaviors are pronounced. The framework posits that the interaction of gender with various background factors contributes to distinct health behaviors across genders. By examining these interactions, the study aims to elucidate the nuanced pathways through which gender influences health behaviors, thereby informing targeted interventions and policies aimed at promoting health equity.

From the understanding developed from the available literature, this study conceptualizes the framework below in figure 1.

Figure 1 Conceptual Framework of Gender Differences in Selected Health Behaviors



Source: Synthesized by the authors from previous studies

Data and methods

Data Source

The NFHS-5 (2019–21) data were used to examine health behaviors by gender. Data were analyzed via Stata software, with a focus on individuals aged 15–49 years, categorized by urban and rural residence.

The NFHS, initiated in the early 1990s, is a comprehensive survey that provides critical data on population, health, and nutrition across India and its states. NFHS-5 (2019–21) (IIPS, 2022) is the fifth round of this survey, followed by NFHS-1 (1992–93), NFHS-2 (1998–99), NFHS-3 (2005–06) and NFHS-4 (2015–16) (IIPS, 2018). These surveys offer essential indicators of family welfare, maternal and child health, nutrition, and health behaviors.

The NFHS-5 adhered to the DHS (Demographic and Health Survey) via standardized questionnaires, sample strategies, and field methodology. A two-stage sampling design was adopted in the NFHS-5 (IIPS, 2022). The NFHS-5 (2019–21) includes 724,115 women and 93,144 men in the 15–49 years age group. The focus was on individual-level socioeconomic information relevant to health behaviors such as tobacco use, alcohol consumption, and diet, ensuring a comprehensive gender comparison.

Ethics statement

The present study is based on publicly available NFHS 5 datasets with no identifiable information on the survey participants; hence, there is no requirement of ethics statement.

Methods

We performed a chi-square test for

significance assessment. Behavioral factors were examined through bivariate and multivariate statistical analyses. Binary logistic regression was employed to establish associations between outcome variables (use of selected substances and a diversified diet) and other explanatory factors. The use of selected substances was coded as 1 and 0 for no use of selected substances, whereas diet diversity was coded as 1 for a diversified diet and 0 for a lack of diversity in a diet.

The binary logistic regression model is typically presented in the following compact form:

$$\text{Logit} [P(Y = 1)] = \beta_0 + \beta_1 X + \epsilon$$

The parameter β_0 estimates the log odds of the use of selected substances or a diversified diet for the reference group, whereas β_1 estimates the maximum likelihood of the differential log odds associated with predictor X compared with the reference group. ϵ represents the residual in the model.

Indicators

In this study, categories of selected substances are defined on the basis of literature sources (Saunders et al., 1993; Wilson et al., 1999; Johnson et al., 2007; Girish et al., 2010; Pulvers et al., 2014).

Variables related to alcohol and tobacco use are defined on the basis of the current use of alcohol/tobacco. Categories were defined on the basis of questions such as “How often do you consume alcohol/tobacco? and What type of alcohol/tobacco do you usually consume?”. The frequency of alcohol is recoded according to the availability of categories of variables in the NFHS data.

Table 1 Description of selected health behavior variables used in the present study, NFHS-2019-21, India

Indicators	Categories	
Alcohol consumption	Light alcohol consumption (<i>low alcoholic content approximately 15% or less</i>) Beer; wine, <i>tadi madi</i>	Hard alcohol consumption (<i>Higher Alcoholic content ranged from 40% to 50%</i>) Hard liquor and country liquor
Tobacco	Smoke <i>Cigarette, pipe, cigars, bidis, hookah</i>	Smokeless <i>Chewing tobacco, snuff, gutkha/paan masala, paan, khaini</i>
Frequency of Alcohol Consumption	Moderate <i>Less than once a week and about once a week</i>	High frequency <i>Consumes alcohol daily</i>
Frequency of Smoking	Moderate <i>Smokes 1-10 Cigarettes/Bidis daily</i>	Heavy <i>Smokes more than 10 Cigarettes/Bidis daily</i>
Consumption of any of selected substances	Use of substance <i>Includes smoking bidis, cigarettes, and drinking alcohol</i>	Not Using <i>Not consuming any of these</i>

Table 1 gives the description of important variables used in the present study, besides that analysis also combined both the categories of alcohol (consuming both light and hard alcohol) and tobacco (consuming both smoking and smokeless together) to obtain an all-inclusive picture of selected substance consumption.

The Diet Diversity Index

Diet, comprising a complex mix of foods and nutrients (Kant et al., 1993), is crucial for adults because of their high energy needs from work and reproduction. A varied diet including vegetables, fruits, dairy, and meat is essential for optimal health (Lichtenstein et al., 2006).

While NFHS data lack detailed nutrient intake data, dietary diversity is inferred from food frequency. The diet diversity index in this study integrates dietary diversity and food intake frequencies. Adapted from

Kennedy et al. (1995), the index incorporates consumption frequencies of vegetables, fruits, dairy, eggs, fish, and meat.

In this study, we developed a diet diversity index on the basis of the frequency of consumption of various food items. We considered healthy foods, such as vegetable proteins from pulses or beans; green leafy vegetables; fruits; and animal proteins, such as milk/curd, eggs, fish, chicken, or meat, as well as unhealthy foods, including fried food and aerated drinks. The consumption frequencies were categorized as daily, weekly, occasionally, or never. Responses regarding the frequency of consumption were assigned values as follows: 3 for daily consumption, 2 for weekly consumption, 1 for occasional consumption, and 0 for never consumed. For unhealthy foods, the scoring was reversed, with 3 indicating never consumed and 0 indicating daily consumption. The diet diversity score was computed by aggregating these values,

resulting in a range from zero (indicating no dietary diversity) to twenty-one (indicating high dietary diversity).

On the basis of this score, diets were classified into three categories: “less diversified diet/unhealthy”, “moderately diversified diet/moderate”, and “diversified diet/healthy”. A 'Diversified Diet' is characterized by the daily consumption of vegetable and animal proteins and minimal or occasional consumption of unhealthy foods. Conversely, a 'less diversified diet' is characterized by occasional consumption of

healthy foods combined with regular consumption of unhealthy foods. The composite variable for the Diet Diversity Index was calculated separately for women and men. This index enables comprehensive assessment and cross-regional comparison of dietary diversity in simple ways.

Results from bivariate analysis

Table 2 presents gender-wise tobacco and alcohol consumption among Indian adults (15-49).

Table 2 Prevalence (per 100) of Tobacco and Alcohol Consumption by Gender and Residence Type (Rural/Urban) Among Adults Aged 15–49 in India: NFHS-5 (2019–21)

Indicator	NFHS 5 (2019-2021)		
	Female	Male	Total
Overall			
Tobacco	6.5	42.19	10.57
		<i>Pearson chi2 = 110000 Pr = 0.000</i>	
Alcohol	1.87	25.43	4.56
		<i>Pearson chi2 = 110000 Pr = 0.000</i>	
Urban			
Tobacco	4.58	35.23	8.22
		<i>Pearson chi2 = 27000 Pr = 0.000</i>	
Alcohol	0.92	23.72	3.63
		<i>Pearson chi2 = 32000 Pr = 0.000</i>	
Rural			
Tobacco	7.13	44.63	11.35
		<i>Pearson chi2 = 86000 Pr = 0.000</i>	
Alcohol	2.18	26.03	4.86
		<i>Pearson chi2 = 75000 Pr = 0.000</i>	
Overall			
Use of any selected Substance	2.14	33.56	5.73
		<i>Pearson chi2(2) = 150000, Pr = 0.000</i>	
Urban			
Use of any selected Substance	1.13	31.2	4.71
		<i>Pearson chi2(2) = 43000, Pr = 0.000</i>	
Rural			
Use of any selected Substance	2.47	34.38	6.06
		<i>Pearson chi2(2) = 110000, Pr = 0.000</i>	

Males have a significantly greater rate of tobacco use than females do. The difference was statistically significant. Tobacco use is

lower in urban areas for both genders, but males still have a much higher rate than females do. Such consumption is higher in

rural areas for both genders, with males still significantly outpacing females. In the case of alcohol, males also have a much greater prevalence of alcohol use than females do. Alcohol consumption is lower in urban areas than in rural areas for both genders, but the male–female disparity persists in both rural and urban areas. Males are far more likely to use any selected substance than females are in both rural and urban areas.

Table 3 presents the prevalence of different forms of tobacco and alcohol consumption among adults aged 15–49 years in India, based on data from the NFHS-5 (2019–2021). The data are broken down by sex (female or male) and include categories for different forms of tobacco and alcohol consumption. A Pearson chi-square test was also used to assess the statistical significance of the

gender differences. A significantly greater percentage of females (93.5%) reported not using tobacco than did males (57.81%). The majority of both genders do not consume tobacco, but males are more likely to consume it. It seems that tobacco smoking is predominantly a male behavior, with 18.76% of males reporting smoking, whereas only 0.52% of females do. Smokeless tobacco is more common among males (20.83%) than females (5.53%). However, this form of tobacco is the most prevalent among females compared to other forms. A small percentage of both genders use both forms of tobacco, with males (2.6%) being more likely to do so than females (0.43%). The chi-square test revealed that the differences in tobacco consumption by gender were statistically significant, with a p-value of 0.000.

Table 3 Prevalence of Different Forms of Tobacco and Alcohol Consumption by Gender Among Adults Aged 15–49 in India: NFHS-5 (2019–21)

INDICATORS	NFHS 5 (2019-21)		
	Female	Male	Total
TOBACCO			
None	93.5	57.81	89.43
With Smoke Only	0.52	18.76	2.6
With Smokeless Only	5.53	20.83	7.27
Both Smoke and Smokeless	0.43	2.6	0.7
<i>Pearson chi2(3) = 150000 Pr = 0.000</i>			
ALCOHOL			
None	98.13	74.57	95.44
Light Alcohol	1.06	10.4	2.13
Hard Alcohol	0.37	8.18	1.26
Both Light and Hard Alcohol	0.44	6.84	1.17
<i>Pearson chi2(3) = 110000 Pr = 0.000</i>			

A vast majority of females (98.13%) do not consume alcohol, whereas 74.57% of males do not consume it. This suggests that alcohol consumption is much more common among males. Light alcohol consumption is more

common among males (10.4%) than females (1.06%). Hard alcohol consumption is predominantly a male behavior, with 8.18% of males consuming hard alcohol compared with only 0.37% of females. The chi-square

test indicates that the differences in alcohol consumption by gender are statistically significant, with a p value of 0.000. In summary, across all categories (tobacco, alcohol, and any substance use), males consistently had higher consumption rates than females did. The urban–rural divide shows that substance use is generally greater in rural areas, but the male–female disparity remains significant in both settings.

Table 4 details the frequency of both healthy and unhealthy behaviors by gender, offering a deeper analysis of behavioral patterns by gender.

A vast majority of females (99.77%) do not smoke bidis, compared to 90.74% of males. A very small percentage of females (0.20%) are moderate bidi smokers, while this percentage was significantly greater among males (6.87%). Overall, 0.96% of the population are moderate smokers. Heavy bidi smoking is almost nonexistent among females (0.03%), but 2.39% of males fall into this category. Overall, 0.3% of the total population are heavy smokers. In the case of cigarette smoking, almost all females (99.83%) did not smoke cigarettes, compared to 87.97% of males. Only 0.15% of females are moderate cigarette smokers, whereas 11.28% of males fell into this category. Heavy cigarette smoking is rare among females (0.02%) and slightly more common among males (0.74%). Overall, 0.1% of the population are heavy smokers.

In terms of alcohol consumption, 1.62% of females and 21.4% of males drink alcohol. High frequency drinking is rare among females (0.25%) but more prevalent among males (4.02%). Overall, 0.68% of the population drinks alcohol daily.

In the terms of healthy eating habits, 31.28% of the population eats healthy food regularly. Approximately 30.36% of females and 38.37% of males regularly consumed healthy food. A total of 34.32% of females and 33.93% of males moderately consumed healthy food. Overall, 34.27% of the population falls into this category; approximately 35.32% of females and 27.7% of males occasionally eat healthy food. In terms of unhealthy eating habits, 56.97% of the population reported unhealthy habits, approximately 57.31% of females and 54.33% of males occasionally consumed unhealthy food. Approximately 24.61% of females and 21.76% of males moderately consumed unhealthy food. Overall, 24.28% of the population moderately eats unhealthy food. Approximately 18.08% of females and 23.91% of males regularly consumed unhealthy food. Overall, 18.74% of the population regularly eats unhealthy food.

These results show that males are significantly more likely to smoke both bidis and cigarettes and alcohol than females are. The disparity is evident in both the moderate and heavy smoking categories. Males are much more likely to consume alcohol than females are, both moderately and daily. The gender gap is stark, with nearly a quarter of males drinking alcohol compared with a very small percentage of females. Interestingly, males are slightly more likely than females to regularly consume healthy food. Females are more likely to occasionally consume unhealthy food, whereas males are more likely to regularly consume unhealthy food. The significant p values ($Pr = 0.000$) across all categories suggest that these differences are statistically significant.

Table 4 Gender distribution (in percentages) of the frequency of healthy and unhealthy behavior among adults (15-49) in India, NFHS 5 (2019-21)

INDICATORS	NFHS 5 (2019-21)		
	Female	Male	Total
TOBACCO			
Bidi			
None	99.77	90.74	98.74
Moderate Smoker	0.20	6.87	0.96
Heavy Smoker	0.03	2.39	0.3
	<i>Pearson chi2(2) = 55000 Pr = 0.000</i>		
Cigarette			
None	99.83	87.97	98.48
Moderate Smoker	0.15	11.28	1.42
Heavy Smoker	0.02	0.74	0.1
	<i>Pearson chi2(2) = 91000, Pr = 0.000</i>		
ALCOHOL			
None	98.13	74.57	95.44
Moderate frequency Drinker	1.62	21.4	3.88
High frequency (Daily) Drinker	0.25	4.02	0.68
	<i>Pearson chi2(2) = 110000, Pr = 0.000</i>		
Frequency of eating healthy food			
Regular Eater (Better)	30.36	38.37	31.28
Moderate Eater	34.32	33.93	34.27
Occasional Eater (Worse)	35.32	27.7	34.45
	<i>Pearson chi2(2) = 3100, Pr = 0.000</i>		
Frequency of eating unhealthy food			
Occasional Eater (Better)	57.31	54.33	56.97
Moderate Eater	24.61	21.76	24.28
Regular Eater (Worse)	18.08	23.91	18.74
	<i>Pearson chi2(2) = 1900 Pr = 0.000</i>		

Table 5 Diversified Diet Index by gender and place of residence for adults (15-49 years) India, NFHS - 5 (2019-21).

DIET INDEX	NFHS 2019-21		
	Female	Male	Total
<u>OVERALL</u>			
Less diversified diet (Unhealthy)	40.49	32.73	39.6
Moderately diversified diet (Moderate)	35.85	39.03	36.22
Diversified diet (Healthy)	23.66	28.25	24.18
	<i>Pearson chi2(2) = 2200, Pr = 0.000</i>		
<u>URBAN</u>			
Less diversified diet (Unhealthy)	33.58	27.87	32.9
Moderately diversified diet (Moderate)	35.68	36.5	35.78
Diversified diet (Healthy)	30.74	35.63	31.32
	<i>Pearson chi2(2) = 378.7148 Pr = 0.000</i>		
<u>RURAL</u>			
Less diversified diet (Unhealthy)	42.76	34.43	41.83
Moderately diversified diet (Moderate)	35.91	39.91	36.36
Diversified diet (Healthy)	21.32	25.66	21.81
	<i>Pearson chi2(2) = 1800 Pr = 0.000</i>		

Table 5 presents the Diversified Diet Index by gender and place of residence. A greater percentage of females followed a less diversified (unhealthy) diet than did males (40.49% of females and 32.73% of males). While 35.85% of females had a moderately diversified diet, 39.03% of males were in this category. Approximately 28.25% of the males were on a diverse diet (healthy), whereas only 23.66% of the females were on a healthy, diversified diet. In urban areas, females are more likely to have unhealthy diets than males are (33.58% of urban female's vs 27.87% of urban males). The pattern of having a diversified diet by gender is the same in both rural and urban areas. Overall, females, both in urban and rural areas, are more likely to have a less diversified, unhealthy diet than males. Conversely, males are more likely to have a moderately diversified or diversified (healthy) diet. The gender gap in diet diversification is consistent across urban and rural areas, with females generally having lower diet diversity. Urban residents tend to have better diet diversification than rural

residents do, but within each area, males consistently have diversified healthier diets than females do.

Overall, a large proportion of men consume a moderate diet, whereas a large proportion of women consume a less diversified diet; however, notably, rural women have a disadvantage in consuming a diversified diet.

Results from regression analysis

Table 6 displays the likelihood of engaging in the consumption of any selected substance-based or diversified diet based on the NFHS-5 data. Men are approximately 25 times more likely than women to engage in alcohol and tobacco consumption after other background variables, such as age, place of residence, education, marital status, working status, religion, caste, and wealth index, are adjusted for. Similarly, men are more likely to have a diversified diet (OR: 1.34; CI: 1.31 1.37) than women are after controlling for background variables.

Table 6 Odds ratios of binary logistic regression for the use of any selected substance and having a diversified diet by background characteristics in Indian adults (15--49), NFHS 5 (2019--21)

Background Characteristics	NFHS 5 (2019-21)				NFHS 5 (2019-21)			
	Use of any selected substance				Diversified Diet			
	Odds Ratio	Std. Err.	95% CI		Odds Ratio	Std. Err.	95% CI	
Sex								
Female ^R								
Male	25.19***	0.466	24.29	26.12	1.34***	0.013	1.31	1.37

The dependent variable was the use of any of the above-mentioned substances, including smoking bidi or cigarettes and drinking alcohol.

Dependent variable: Diversified diet includes daily consumption of vegetable and animal proteins and minimal or occasional consumption of unhealthy foods.

*^R: Reference category; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. This model is adjusted for age, place of residence, education, marital status, working status, religion, caste, and wealth index. The full table can be found in Appendix 8.*

Discussion

This study underscores significant gender disparities in selected substance use and dietary diversity among Indian adults (15-

49), as evidenced by the National Family Health Survey (NFHS-5) data. The findings revealed that males are consistently more likely than females to engage in higher consumption of substances such as tobacco

and alcohol, irrespective of the urban or rural setting. Conversely, males also tend to consume a more diversified and healthier diet than females do, although this does not offset the health risks posed by their higher substance use. However, rural areas are disadvantaged in terms of a higher prevalence of consuming these substances, especially men (34.38%), and a lower percentage of people, especially women (42.76%), eat diverse diets.

The persistence of these disparities aligns with the literature that highlights men's greater propensity for substance use and the consequent negative impacts on their health. Earlier studies revealed that men are more likely to engage in high-substance consumption, whereas women are more inclined toward low-moderate consumption, contributing to poorer survival rates among men (Pampel, 2002; Saikia & Bhat, 2008, Dhakad & Saikia, 2023). The study's results reaffirm that substance use among men, particularly in rural areas, contributes significantly to the gender gap in mortality rates. This gap is further exacerbated by cultural norms that permit or even encourage substance use among men while restricting women's access to the same substances. In rural areas, a greater proportion of women engage in moderate-risk behaviors, possibly due to cultural acceptance of bidi smoking and smokeless tobacco such as 'Misri' (A Pratinidhi et al., 2010). Meta-analyses confirm that substance abuse is more prevalent among men and in rural areas (Reddy & Chandrasekhar, 1998; Mohan et al., 1978; Varma et al., 1980; Chakravarthy, 1990; Mohan et al., 2001), driving premature male mortality—a trend observed in Europe as well (Waldron, 1995; McCartney, 2011).

The excessive consumption of alcohol and tobacco plays a significant role in widening the survival gap between male-female particularly in adulthood. Dhakad and Saikia (2023) reported that Indian men experience a greater probability of death than Indian women do during adulthood. This disparity in substance use may be a more pronounced factor influencing survival differences across both genders.

Interestingly, the study also highlights the paradox where despite their higher substance use, men in India generally report better dietary diversity than women do. This could be attributed to socioeconomic factors that favor men's access to a wider variety of food, as well as the cultural practices that prioritize men's nutritional needs over those of women. The gendered nature of dietary patterns, as indicated by this study, reflects deep-rooted societal norms that continue to influence health outcomes across different regions of India. The study revealed that men are more likely to consume a diversified diet than women are (OR: 1.34; CI: 1.31 1.37). In low-income countries, women's nutritional status is often compromised by their subordinate decision-making roles (Hindin, 2000; Miller, 1997). Cultural norms and patriarchy influence dietary choices, leading to undernourishment among women (Jensen & Holm, 1999; Sen, 1998; Natrajan & Jacob, 2018). Women often consume less nutritious food, reinforcing gender dynamics within households (Hathi et al., 2021). Interestingly, Indian women from higher socioeconomic backgrounds also prefer vegetarian food because of their religious beliefs.

While this study briefly explored the relationship between the consumption of selected substances and diverse dietary

patterns, correlation analysis revealed a moderate association (0.492) between them, among women (0.534) and men (0.362). This reflects the complex interplay of factors influencing both diversified diets and selected substance consumption beyond simple correlation.

Gender-based and urban–rural differences follow relatively similar patterns in both the NFHS-4 and the NFHS-5, although there is an overall decline in alcohol and tobacco consumption from the NFHS-4 (2015-16) to the NFHS-5 (2019-21) (Tables of NFHS-4 (2015-16) are attached in appendix 2 to appendix 7). Possible reasons for the declining trends in alcohol, tobacco, and dietary diversity from NFHS-4 to NFHS-5 can be attributed primarily to the impact of the COVID-19 pandemic because the resulting lockdowns limited the availability of tobacco, alcohol, and a variety of food items. The pandemic's socioeconomic effects, including emotional stress, not only affected the data collected from the NFHS-5 but also affected health, behavioral, and dietary outcomes.

Strengths and limitations of this study

Limited research has examined gender disparities in health behaviors, which contribute to differences in life expectancy and health outcomes. This study addresses that gap using recent NFHS data and rigorous statistical methods. The findings underscore elevated risks among adult males and provide timely evidence to inform policies aimed at reducing gender-based health inequalities and enhancing population well-being. Secondly, our study is based on nationally representative data, providing a comprehensive overview of gender disparities in health behaviors across India.

However, the reliance on self-reported data for dietary diversity and selected substance use introduces the potential for recall bias, which may affect the accuracy of the findings. Additionally, the NFHS data lack detailed information on portion sizes, which limits the ability to assess the nutritional adequacy of the reported diets. In India, the predominant population's adherence to religious and cultural beliefs often leads to a preference for vegetarianism, resulting in a reduced diversity of food options. This may also affect our diet diversity indicator analyzed in the present study. Despite these limitations, the study provides valuable insights into the gender-specific health behaviors that contribute to the disparities in health outcomes observed in India.

Policy Recommendations

Public health strategies should strengthen tobacco and alcohol regulation, expand preventive infrastructure, and offer accessible behavioral support. Targeted interventions are essential, especially for men, who exhibit significantly higher substance use. Although Article 47 supports alcohol prohibition, only Gujarat and Bihar have implemented it. States without prohibition report substantially higher male alcohol use 18 times more than women (Appendix 1) indicating potential policy effectiveness despite economic concerns. Elevated GST on alcohol and tobacco has shown limited impact (Bapat et al., 2020), highlighting the need for stronger regulatory measures.

Informational, Educational and Communication (IEC) campaigns must address male substance use, while gender-sensitive policies are needed to reduce smokeless tobacco use among women.

Rising oral cancer rates (IHME, 2017) and cultural stigma suggest possible underreporting, especially among women. Nutrition programs should expand beyond early childhood and pregnancy to include adult women, focusing on dietary diversity especially in rural areas. Hence this study emphasizes the urgency of gender-responsive health policies addressing substance use and nutrition. Promoting healthier lifestyles among men and improving women's access to diverse diets are critical to reducing gender-based health disparities.

Future research should explore the complex interactions of socio-economic and cultural factors underlying gender disparities in substance use and nutrition to better understand and address gaps in health outcomes and survival. Longitudinal studies are essential to evaluate the long-term health consequences of these behaviors. Moreover, there is a critical need to assess gender-responsive health and nutrition interventions, which can inform the design of more effective, targeted strategies to reduce health gender inequities in health.

Conclusion

This study highlights significant gender disparities in substance use and dietary diversity among Indian adults. While men exhibit higher rates of tobacco and alcohol use, women face greater nutritional vulnerabilities, including reliance on smokeless tobacco and limited dietary diversity. These patterns reflect broader structural inequities that shape health risks differently by gender. Addressing these gaps requires integrating gender-responsive strategies into national health and nutrition initiatives. Continued research is essential to

inform targeted interventions that promote equitable health outcomes and reduce gender-based disparities across the life course.

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Appendix 1 Odds ratios of binary logistic regression for alcohol consumption by background characteristics in Indian adults, NFHS-4 (2015-16) and NFHS-5 (2019-21)

Background Characteristics	Alcohol Consumption							
	NFHS 4 (2015-16)				NFHS 5 (2019-21)			
	Odds Ratio	Std. Err.	95% CI		Odds Ratio	Std. Err.	95% CI	
Alcohol Prohibition Status								
Alcohol prohibition in states (Gujarat and Bihar) ^R								
No alcohol prohibition in states (Rest of the states)	2.52***	0.058	2.41	2.64	4.07***	0.128	3.82	4.32
Sex								
Female ^R								
Male	18.88***	0.334	18.23	19.55	18.82***	0.376	18.09	19.57
Age group								
Young (15-24) ^R								
middle (25-39)	2.03***	0.036	1.96	2.10	2.38***	0.051	2.28	2.48
older (40+)	2.21***	0.045	2.13	2.30	2.72***	0.065	2.59	2.85
Place of residence								
Urban ^R								
Rural	0.85***	0.012	0.83	0.87	0.88***	0.015	0.85	0.91
Education								
No education ^R								
Up to Secondary	0.68***	0.009	0.66	0.7	0.62***	0.009	0.61	0.64
Higher	0.67***	0.015	0.64	0.7	0.54***	0.013	0.52	0.58
Religion								
Hindu ^R								
Muslim	0.15***	0.004	0.14	0.16	0.13***	0.005	0.12	0.15
Others	1.47***	0.022	1.42	1.51	1.33***	0.022	1.29	1.37
Caste								
SC ^R								
ST	3.32***	0.057	3.21	3.43	2.80***	0.052	2.70	2.9
OBC	0.90***	0.014	0.87	0.93	0.90***	0.016	0.88	0.94
Others	0.87**	0.017	0.84	0.9	0.81***	0.017	0.78	0.85
Marital status								
Never Married ^R								
Married	1.11***	0.019	1.07	1.15	1.29***	0.026	1.24	1.35
Widowed/Divorced/Separated	1.34***	0.043	1.26	1.43	1.77***	0.061	1.66	1.90
Wealth Index								
Poorest ^R								
Poorer	0.70***	0.011	0.68	0.72	0.71***	0.012	0.69	0.74
Middle	0.65***	0.011	0.63	0.67	0.65***	0.012	0.62	0.67
Richer	0.59***	0.011	0.56	0.61	0.53***	0.011	0.51	0.56
Richest	0.48***	0.011	0.46	0.51	0.49***	0.012	0.47	0.52
cons	0.008	0.000	0.007	0.008	0.003	0.000	0.002	0.003

Appendix 2 Percentages of tobacco and alcohol consumption by gender and type of residence (rural/urban) among adults (15-49), India, NFHS-4 (2015-16)

Indicator	NFHS 4 (2015-16)		
	Female	Male	Total
Overall			
Tobacco	10.44	48.35	15.32
			<i>Pearson chi2 = 100000 Pr = 0.000</i>
Alcohol	2.47	31.13	6.17
			<i>Pearson chi2 = 130000 Pr = 0.000</i>
Urban			
Tobacco	8.73	42.91	13.45
			<i>Pearson chi2 = 28000 Pr = 0.000</i>
Alcohol	1.47	29.64	5.36
			<i>Pearson chi2 = 44000 Pr = 0.000</i>
Rural			
Tobacco	11.14	50.86	16.11
			<i>Pearson chi2 = 72000 Pr = 0.000</i>
Alcohol	2.89	31.82	6.51
			<i>Pearson chi2 = 85000 Pr = 0.000</i>
Overall			
Use of any selected Substance	3.2	41.51	8.14
			<i>Pearson chi2(2) = 180000, Pr = 0.000</i>
Urban			
Use of any selected Substance	2	38.92	7.1
			<i>Pearson chi2(2) = 58000, Pr = 0.000</i>
Rural			
Use of any selected Substance	3.69	42.72	8.57
			<i>Pearson chi2(2) = 120000, Pr = 0.000</i>

Appendix 3 Gender distribution of the consumption of different forms of tobacco and alcohol among adults (15-49), India, NFHS-4 (2015-16)

INDICATORS	NFHS 4 (2015-16)		
	Female	Male	Total
TOBACCO			
None	93.21	54.48	87.56
With Smoke Only	0.67	16.09	2.88
With Smokeless Only	5.49	20.61	7.66
Both Smoke and Smokeless	0.73	8.82	1.89
	<i>Pearson chi2(3) = 140000 Pr = 0.000</i>		
ALCOHOL			
None	98.74	70.49	94.68
Light Alcohol	0.93	13.27	2.71
Hard Alcohol	0.2	10.8	1.72
Both Light and Hard Alcohol	0.12	5.44	0.89
	<i>Pearson chi2 (3) = 130000 Pr = 0.000</i>		

Appendix 4 Rural–urban distribution of the consumption of different forms of tobacco and alcohol among adults (15-49), India, NFHS-4 ((2015-16) and NFHS 5 (2019-21)

	NFHS 4 (2015-16)			NFHS 5 (2019-21)		
	Rural	Urban	Total	Rural	Urban	Total
TOBACCO						
None	83.39	86.12	84.2	88.65	91.78	89.43
With Smoke Only	3.03	2.69	2.93	2.64	2.49	2.6
With Smokeless Only	10.8	8.97	10.26	7.9	5.37	7.27
Both Smoke and Smokeless	2.77	2.22	2.61	0.81	0.36	0.7
	<i>Pearson chi2(3) = 968.0196 Pr = 0.000</i>			<i>Pearson chi2(3) = 2000 Pr = 0.000</i>		
ALCOHOL						
None	93.18	94.33	93.18	95.14	96.37	95.44
Light Alcohol	3.45	2.98	3.31	2.2	1.91	2.13
Hard Alcohol	2.03	1.72	1.94	1.36	0.94	1.26
Both Light and Hard Alcohol	1.33	0.97	1.23	1.3	0.78	1.17
	<i>Pearson chi2(3) = 401.8179 Pr = 0.000</i>			<i>Pearson chi2(3) = 654.8218 Pr = 0.000</i>		

Appendix 5 Gender distribution (in percentages) of the frequency of healthy and unhealthy behavior among adults (15-49) India, NFHS-4 (2015-16)

INDICATORS	NFHS 4 (2015-16)		Total
	Female	Male	
TOBACCO			
Bidi			
None	99.44	86.28	97.74
Moderate Smoker	0.45	7.95	1.42
Heavy Smoker	0.12	5.77	0.85
	<i>Pearson chi2(2) = 72000 Pr = 0.000</i>		
Cigarette			
None	99.66	86.67	97.99
Moderate Smoker	0.32	11.89	1.81
Heavy Smoker	0.02	1.43	0.2
	<i>Pearson chi2(2) = 78000, Pr = 0.000</i>		
ALCOHOL			
None	97.53	68.87	93.83
Moderate frequency Drinker	2.16	27.05	5.37
High frequency (Daily) Drinker	0.32	4.08	0.8
	<i>Pearson chi2(2) = 130000, Pr = 0.000</i>		
Frequency of eating healthy food			
Regular Eater (Better)	24.41	32.89	25.5
Moderate Eater	31.96	33.28	32.13
Occasional Eater (Worse)	43.62	33.83	42.36
	<i>Pearson chi2(2) = 4600, Pr = 0.000</i>		
Frequency of eating unhealthy food			
Occasional Eater (Better)	52.06	47.88	51.53
Moderate Eater	24.9	23.54	24.73
Regular Eater (Worse)	23.04	28.58	23.75
	<i>Pearson chi2(2) = 1500 Pr = 0.000</i>		

Appendix 6 Diversified Diet Index by gender and place of residence for adults (15-49 years) India, NFHS-4 (2015-16)

DIET INDEX	NFHS 4 (2015-16)		
	Female	Male	Total
<u>OVERALL</u>			
Less diversified diet (Unhealthy)	38.50	30.16	37.42
Moderately diversified diet (Moderate)	34.91	35.91	35.04
Diversified diet (Healthy)	26.59	33.93	27.53
<i>Pearson chi2(2) = 3500, Pr = 0.000</i>			
<u>URBAN</u>			
Less diversified diet (Unhealthy)	32.67	26.39	31.8
Moderately diversified diet (Moderate)	34.72	34.07	34.63
Diversified diet (Healthy)	32.62	39.54	33.57
<i>Pearson chi2(2) = 757.7349 Pr = 0.000</i>			
<u>RURAL</u>			
Less diversified diet (Unhealthy)	40.91	31.91	39.78
Moderately diversified diet (Moderate)	35.00	36.77	35.22
Diversified diet (Healthy)	24.09	31.32	25.00
<i>Pearson chi2(2) = 2600 Pr = 0.000</i>			

Appendix 7 Odds ratios of binary logistic regression for selected substance use and for diversified diets by background characteristics in Indian adults (15-49), NFHS-4 (2015-16).

Background Characteristics	NFHS 4 (2015-16)				NFHS 4 (2015-16)			
	Use of any selected substance				Diversified Diet			
	Odds Ratio	Std. Err.	95% CI		Odds Ratio	Std. Err.	95% CI	
Sex								
Female ^R								
Male	24.29***	0.395	23.53	25.08	1.39***	0.013	1.37	1.42
Age group								
Young (15-24) ^R								
Middle (25-39)	2.15***	0.035	2.08	2.22	1.17***	0.007	1.16	1.19
Older (40+)	2.8***	0.052	2.7	2.9	1.22***	0.01	1.2	1.24
Residence								
Urban ^R								
Rural	0.90***	0.011	0.88	0.92	0.8***	0.004	0.79	0.81
Education								
No education ^R								
Up to Secondary	0.622***	0.008	0.61	0.64	1.40***	0.008	1.39	1.42
Higher	0.535***	0.011	0.51	0.56	1.78***	0.017	1.74	1.81
Marital Status								
Never Married ^R								
Married	1.15***	0.018	1.11	1.18	1.15***	0.008	1.13	1.16
Widowed/Divorced/Separated	1.48***	0.042	1.4	1.57	1.04***	0.015	1.01	1.07
Working Status								
Not Working ^R								
Working	1.81***	0.027	1.76	1.86	0.98***	0.009	0.96	1
Religion								
Hindu ^R								
Muslim	0.57***	0.01	0.55	0.59	2.24***	0.015	2.21	2.27
Others	1.92***	0.028	1.86	1.97	1.0***	0.008	0.99	1.02
Caste								
SC ^R								
ST	3.05***	0.049	2.96	3.15	1.15***	0.009	1.13	1.17
OBC	0.85***	0.012	0.82	0.87	0.84***	0.005	0.83	0.86
Others	0.88***	0.015	0.85	0.9	0.85***	0.006	0.84	0.87
Wealth Index								
Poorest ^R								
Poorer	0.77***	0.011	0.74	0.79	1.35***	0.01	1.32	1.37
Middle	0.71***	0.011	0.69	0.74	1.59***	0.012	1.57	1.62
Richer	0.63***	0.011	0.62	0.66	1.65***	0.014	1.62	1.68
Richest	0.5***	0.01	0.49	0.52	1.29***	0.012	1.26	1.31
_cons	0.019	0	0.019	0.02	0.298	0.003	0.291	0.304

^R: Reference category; ***p<0.01; **p<0.05; * p<0.1

Appendix 8 Odds ratios of binary logistic regression for selected substance use and for diversified diets by background characteristics in Indian adults (15-49), NFHS-5 (2019-21).

Background Characteristics	NFHS 5 (2019-21)				NFHS 5 (2019-21)			
	Use of any selected substance				Diversified Diet			
	Odds Ratio	Std. Err.	95% CI		Odds Ratio	Std. Err.	95% CI	
Sex								
Female ^R								
Male	25.19***	0.466	24.29	26.12	1.34***	0.013	1.31	1.37
Age group								
Young (15-24) ^R								
Middle (25-39)	2.43***	0.048	2.34	2.53	1.08***	0.007	1.07	1.1
Older (40+)	3.12***	0.069	2.98	3.26	1.10***	0.008	1.09	1.12
Residence								
Urban ^R								
Rural	0.88***	0.013	0.85	0.9	0.69***	0.004	0.68	0.7
Education								
No education ^R								
Up to Secondary	0.60***	0.008	0.58	0.62	1.24***	0.007	1.22	1.25
Higher	0.49***	0.011	0.47	0.51	1.56***	0.014	1.53	1.58
Marital Status								
Never Married ^R								
Married	1.26***	0.24	1.21	1.31	1.22***	0.008	1.2	1.23
Widowed/Divorced/Separated	1.76***	0.057	1.65	1.88	1.14***	0.015	1.11	1.17
Working Status								
Not Working ^R								
Working	1.68***	0.029	1.62	1.74	1.01*	0.009	0.99	1.03
Religion								
Hindu ^R								
Muslim	0.53***	0.012	0.51	0.56	2.70***	0.02	2.66	2.74
Others	1.64***	0.026	1.59	1.69	1.02***	0.007	1.01	1.03
Caste								
SC ^R								
ST	2.63***	0.046	2.54	2.72	1.07***	0.008	1.05	1.08
OBC	0.85***	0.014	0.82	0.87	0.86***	0.005	0.85	0.87
Others	0.88***	0.017	0.85	0.91	0.75***	0.005	0.74	0.76
Wealth Index								
Poorest ^R								
Poorer	0.75***	0.012	0.73	0.77	1.20***	0.008	1.18	1.21
Middle	0.67***	0.016	0.65	0.69	1.32***	0.009	1.3	1.34
Richer	0.55***	0.011	0.53	0.59	1.24***	0.009	1.23	1.27
Richest	0.48***	0.016	0.46	0.5	0.975**	0.008	0.95	0.99
_cons	0.013	0	0.012	0.013	0.665	0.007	0.65	0.68

^R: Reference category; ***p<0.01; **p<0.05; * p<0.1