RESEARCH ARTICLE

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Social Determinants and the Prevalence of Paan Masala Use among Adults in India: Results from Global Adult Tobacco Survey, 2016-17

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Abstract

Background: Gutkha or Paan masala with tobacco is commonly used smokeless tobacco product in India. Given the restrictions on advertisement and promotion of Gutkha and the necessity of warning labels on tobacco products, the tobacco industry has popularised paan masala without tobacco as a surrogate product. Paan masala itself is harmful for health but remains beyond scope of current tobacco control policies. It was important to understand prevalence and determinants of its use (with or without tobacco). **Methods:** Data from the Global Adult Tobacco Survey (GATS)-2, India was used to estimate prevalence of paan masala use (with or without tobacco) in India. Multi-nominal regression and logistic regression were used to calculate risk ratios and odds ratios. **Results:** The prevalence of any form of paan masala was 12.1% among adults in India. Prevalence was higher among males (17.8%) than females (6.0%), aged 25-44 years (14.5%) than those aged 65 years or above (9.0%). Relative risk ratio (RRR) for Paan masala with tobacco was significantly high among those with no formal schooling (RRR:2.00) and among those in poorest wealth quintiles (RRR:1.26). While, RRR were lower for Paan masala use without tobacco among those with no formal schooling (RRR:0.95) and among poorest wealth quintiles (RRR:0.78). Region-wise AOR were highest for North-East (AOR:4.80) and Central regions (AOR:4.76) compared to South India. **Conclusion:** The prevalence of paan masala use is high in India. Persons belonging to lower socioeconomic status or having no formal schooling have higher risk of consuming paan masala with tobacco. However, persons from higher wealth quintiles or having formal schooling had higher risk of use of paan masala without tobacco. These findings need careful attention of policy makers and law enforcers as it indicates different marketing strategies might have adopted by industry to target these two mutually exclusive population groups.

Keywords: Paan masala- Gutkha- Tobacco- India

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Introduction

The tobacco epidemic in South-East Asia is characterized by preponderance of smokeless tobacco (SLT) use in chewable and orally applicable forms. The region has long standing custom of using betel quid with areca nut and lime and was integrated into daily life and culture-based rituals (Nair et al., 2004). A betel quid (paan) is usually prepared by stuffing a mixture of various ingredients, such as areca nut, slaked lime, spices, and seeds, into a quid of the betel leaf (Mukherjea et al., 2015; Niaz et al., 2017). Some of the ingredients such as condiments, sweetening agents, and spices are added according to individual preferences. The early years of colonization introduced tobacco to the subcontinent and soon tobacco became a common ingredient of the betel quid. Betel quid with tobacco soon became the predominant form of tobacco in India and South Asia (Nair et al., 2004).

Betel leaf is perishable and once prepared it needs to be consumed in a short period of time. This means that a consumer need to either visit a shop/kiosk where betel quid are freshly prepared and sold, or maintain an inventory of all essential ingredients and prepare a quid on one's own. Tobacco manufacturing companies in the subcontinent could foresee a potential market for a non-perishable version of the betel quid. Nearly three decades ago, the industry developed dry forms using similar ingredients and colouring and flavouring agents which could give similar experience to the consumer with an advantage of long shelf life. These products were sold as paan masala or gutkha and became instantly popular. Paan masala is a preparation of areca nut, catechu, cardamon, lime, and many natural and artificial perfuming and flavouring materials. Gutkha

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is a variant of paan masala which contains tobacco and is often sold as a single use package (Adhikari et al., 2020). It has a high concentration of nicotine, other addictive substances and have harmful effects on the oral cavity, heart, liver, kidney and reproductive organ (Garg et al., 2015). Previous evidence indicates that consumption of paan masala increase pulse rate, systolic and diastolic blood pressure (Archana et al., 2011). An epidemiological study also demonstrated risk or precancer associated with use of paan masala; prevalence of oral cancer was 3.2% among non-tobacco paan masala users and 12.2% among tobacco users (Mehrotra et al., 2017). Various reports and studies indicate the explosive growth of gutkha consumption among adults in India. It has become more popular (prevalence of 6.8% among adults) in India than the betel quid with tobacco (prevalence of 5.8% among adults) (TISS and MoHFW, 2018). Gutkha has become popular due to convenience usage, easy availability (Mukherjee and Hadaye, 2006), low cost, convenient packaging, long shelf life, lack of social stigma, and youth appeal (Niaz et al., 2017).

Gutkha induces specific biophysical and biochemical changes, including the development of oxidative stress and cardiovascular disease (Shaik et al., 2021). However, people believed that gutkha is harmless, has positive physiological effects, such as relaxation, increased concentration, heightened alertness, and diminished hunger (Tobacco Free Initiative, 2006), and acts as a mouth freshener (Niaz et al., 2017). The epidemic of gutkha use was soon followed by increasing numbers of oral submucous fibrosis among young adults in India. Around the same time, the Indian legal framework got a boost in the form of the Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Act (COTPA), 2003. Gutkha came under the scanner, and many states attempted to ban it with varying success. Despite the fact that twenty-four Indian states and three union territories have banned gutkha consumption due to its carcinogenic properties and other harmful effects, it continued to be actively sold in the black market as single-use packaged of areca nut pieces, tobacco, and condiments (Shah et al., 2012; Praveen et al., 2015; Adhikari et al., 2020). Also, manufacturers are supplying paan masala and tobacco in separate packets (Shetty, 2014). Paan masala has been marketed as a safe product and is not covered under the COTPA provisions. Smokeless tobacco users can easily purchase paan masala, add tobacco to it and prepare Gutkha (Adhikari et al., 2020; Shetty, 2014). While the harm associated with gutkha and tobacco is well known in India, paan masala without tobacco is viewed as a safe product, and little research has examined the pattern of paan masala use among the Indian population. However, it is well-established fact that paan masala is carcinogenic and has harmful effects on the oral cavity, heart, liver, kidney, and reproductive organ (Garg et al., 2015). For instance, an earlier study was conducted among healthy volunteers and found increasing pulse rate, systolic and diastolic blood pressure on consumption of paan masala (Archana et al., 2011). There are no anti-paan masala messages in the media or legal protections in spite of the harm potential. Popularising paan masala brands has been a surrogate way of marketing tobacco products. This study examines the prevalence of paan masala use with and without tobacco among adults in India. Paan Masala is available either as a readymade pouch of paan masala without tobacco, along with a pouch of paan masala a tobacco pouch is mostly provided as a complimentary, for a users to mixed both pouches and to make their own pouch of paan masala with tobacco (commonly known as gutkha) or as a loose preparations containing three chief ingredients of tobacco, lime, and areca nut such as mawa or kharra. This study also examines the socio-economic and demographic determinants of paan masala consumption with and without tobacco.

Materials and Methods

Data

This study used data from second round of the Global Adult Tobacco Survey (GATS) conducted by the Tata Institute of Social Sciences, Mumbai for the Ministry of Health and Family Welfare, Government of India. GATS was conducted two rounds; 1st round in 2009-10 and 2nd round in 2016-17. Both rounds of the survey are nationally representative, covering all states and two Union Territories (UTs). GATS is a global standard for systematically monitoring tobacco use (smoking and smokeless) among adults and tracking key tobacco control indicators of MPOWER. The inclusion criteria were all adults aged 15 and above, living in their household as a usual resident before the survey. Independent sampling was done for each state and UT. Multi-stage sampling technique was used for both urban and rural areas. Three stage sampling process was applied for urban areas, where wards for the city were selected at the first stage and Census Enumeration Blocks (CEB) were selected within the selected wards at the second stage; both stages used probability proportional to size (PPS) technique. In the third stage, households from each CEB were selected. Two-stage sampling procedures was applied for rural areas. At the first stage, villages were selected as primary sampling units (PSUs) by PPS sampling and stratification based upon geographic region, proportion of scheduled caste and scheduled tribe population and female literacy. The required number of households from each PSU were selected in the second stage. A detailed methodology, sampling design, household and individual selection, data collection, management and monitoring procedures could be found in the GATS-2 report (Tata Institute of Social Sciences and Ministry of Health and Family Welfare, 2018). Also, data of GATs are available in public and could be found from the Global Tobacco Surveillance System Data (GTSS data). GATS 2 collected information from representative samples of 74037 adults aged 15 or above. This study utilized the complete sample size.

Outcome variables

Use of paan masala assessed based on the information collected about consumption of smokeless tobacco products (Section C) and non-tobacco products (Section CC) in GATS 2. The two smokeless tobacco products

considered for the analysis were paan masala with tobacco, and gutkha or areca nut-tobacco lime mixture or mawa. We constructed a new nominal variable "any paan masala use" and sub-categorised the paan masala users into three categories: 'user of paan masala without tobacco', 'paan masala user always with tobacco', 'dual user of paan masala (paan masala without tobacco as well as paan masala with tobacco)'. After preliminary analysis, we found that only 1% of the adults were dual users of paan masala (with as well as without tobacco); hence, this category was combined with consumer of 'Paan masala user always with tobacco'. We created two outcome variables; first a nominal variable with three categories; namely 'User of paan masala without tobacco', 'User of paan masala with tobacco', 'non-user of paan masala'. Second variable was binomial with two categories of user and non-user of paan masala. The variables' descriptions and coding are presented in Table 1.

Independent variables

A set of demographics variables include gender (male/female) and age (groped as 15-24, 25-44, 45-64, and 65 or above) and socioeconomic status was measured in terms of place of residence (urban/rural), education (no formal schooling, less than primary school completed, primary completed but not secondary, and secondary or above). Economic status was measured based on ownership of household assets using principal component analysis (PCA). Individuals were divided into five economic quintiles based on their household scores ranges from 1 being the poorest to 5 being the richest. The social group was measured based on combination of religion and caste and categorized as Hindu upper caste, Hindu other backward caste, Hindu scheduled caste, Muslim, Other religion, and Scheduled tribe. All states were grouped geographically into six regions: North, Central, East, Northeast, West, and South.

Statistical analysis

Descriptive statistics was used to examine the use of paan masala among adults. Prevalence rates were estimated separately for 'use of paan masala without tobacco', 'use of paan masala always with tobacco', 'use of dual form of paan masala (with and without tobacco)'. A multinomial logistic regression was applied to investigate social determinants of two types of paan masala use; with and without tobacco. Multinomial logistic regression was used for outcome variable of Paan masala-nominal and codes were 0 for 'non-user of any form of paan masala,' 1 for 'user of paan masala without tobacco ', and 2 for 'user of paan masala with tobacco.' Lastly, multivariate logistic regression analysis was used to calculate odds ratios of consuming any form of paan masala. The logistics regression applied 'paan masala-binomial' as a dichotomous variable, 0 for 'non- user of paan masala' and 1 for' user of paan masala.' The results of the multinomial logistics regression were presented in the form of relative risk ratio (RRR), and results of the logistics regression were presented in the form of adjusted odds ratio (AOR) along with 95% confidence interval.

Results

Socioeconomic and demographic differentials in the use of paan masala

Table 2 presents the prevalence of paan masala among adults aged 15 or above in India. Overall, 12% of adults used any form of paan masala in India, 8% used paan masala always with tobacco, and 3% used paan masala without tobacco whereas only about 1% consumed both varieties of paan masala (with and without tobacco). Thus, a total of 9% (8% and 1%) use paan masala with tobacco. There were substantial differences in use of paan masala in any form according to socioeconomic and demographic characteristics. For instance, males (18%) were more likely to use any form of paan masala than females (6%). A higher percentage of adults aged 25-44 years (15%) used any form of paan masala than those aged 65 years or above (9%). The prevalence of any form of paan masala use was highest in the Northeast region (19%), followed by Central (18%), West (16%), East (12%), and lowest in North and South region (4% in each region). Around 15% adults with lowest economic status (1st quintile) consumed any form of paan masala; prevalence declined with increase in economic status with only 8% prevalence among persons in highest quintile. A highest percentage of Muslims (15%) and scheduled tribes (14%) reported use of paan masala in any form, while the corresponding percentage was 11% among upper caste Hindus.

Table 2 also shows differentials in the use of paan masala with and without tobacco among adults. The percentage of paan masala use with tobacco was more common in rural whereas that of without tobacco was more common in urban areas. Prevalence of paan masala with tobacco was least (5%) in the highest education category but that of paan masala without tobacco was highest (4%) in the same category. The prevalence of paan masala with tobacco had a declining pattern from poorest (11%) to richest (4%) but that of paan masala without tobacco increased from poorest (2.8%) to richest (3.8%). Scheduled tribes and scheduled caste had higher prevalence of paan masala with tobacco of about 10% each whereas the prevalence of paan masala without tobacco was highest among Muslims (4.7%).

Geographical disparity in the use of paan masala

Geographical differences in use of paan masala in any form (with and without tobacco) among males are presented in Figure 1. Results show considerable variation in any form of paan masala use among males across states and UTs in India. Any form of paan masala was largely being used by men in Arunachal Pradesh (35%), followed by Madhya Pradesh (32%), Uttar Pradesh, Odisha, and Nagaland (31% in each state). In five states such as Gujarat, Chhattisgarh, Assam, Jharkhand, and Maharashtra, 20% to 25% of males reported using any form of paan masala. Figure 2 presents differences in prevalence of paan masala use in any form among females across states and UTs. Result shows that any form of paan masala was largely being used by females in Nagaland (29%), followed by Arunachal Pradesh (23%), Tripura

Table 1. Description of Outcome Variables: coding and questions captured in GATS 2

Name of the variable	Category	Conditions
Paan masala use – Nominal	User of Paan masala without tobacco (1)	CC1 (Do you consume paan masala without tobacco?) = 1 (Yes) & any one of the following "
		a. C01 = 3 (not a current smokeless tobacco user)
		b. C06C = 0 (not users of gutkha, areca nut-tobacco lime mixture, or mawa) & C06E = 0 (non-users of paan masala with tobacco)
		c. C10C = 0 (not users of gutkha, areca nut-tobacco lime mixture, or mawa) & C10E = 0 (non-users of paan masala with tobacco)
	User of Paan masala with tobacco (2)	Any one of the following:
		a. C06C > 0 (exclude 999) (users of gutkha, areca nut-tobacco lime mixture, or mawa), & C06E > 0 (exclude 999) (users of paan masala with tobacco)
		b. C10 C >0 (exclude 999), (users of gutkha, areca nut-tobacco lime mixture, or mawa), & C10E > 0 (exclude 999) (users of paan masala with tobacco)
	Non-user of Paan masala (0)	CC1 (Do you consume paan masala without tobacco?) = 2 (No) & any one of the following "
		a. C01 = 3 (not a current smokeless tobacco user)
		b. C06C = 0 (not users of gutkha, areca nut-tobacco lime mixture, or mawa) & C06E = 0 (non-users of paan masala with tobacco)
		c. C10C = 0 (not users of gutkha, areca nut-tobacco lime mixture, or mawa) & C10E = 0 (non-users of paan masala with tobacco)
Paan masala use - binomial	User of any form of paan masala (with or without tobacco)	Any one or more of the following:
		a. CC1 (Do you consume paan masala without tobacco?) = 1 (Yes)
		b. C06C > 0 (exclude 999) (users of gutkha, areca nut-tobacco lime mixture, or mawa), & C06E > 0 (exclude 999) (users of paan masala with tobacco)
		c. C10 C >0 (exclude 999), (users of gutkha, areca nut-tobacco lime mixture, or mawa), & C10E > 0 (exclude 999) (users of paan masala with tobacco)
	Non-user of Paan masala	CC1 (Do you consume paan masala without tobacco?) = 2 (No) & any one of the following "
		a. C01 = 3 (not a current smokeless tobacco user)
		b. C06C = 0 (not users of gutkha, areca nut-tobacco lime mixture, or mawa) & C06E = 0 (non-users of paan masala with tobacco)
		c. C10C = 0 (not users of gutkha, areca nut-tobacco lime mixture, or mawa) & C10E = 0 (non-users of paan masala with tobacco)

(19%), Odisha (16%), Assam and Meghalaya (14% in each state). A substantial proportion of females in many states, such as Manipur and West Bengal (10% in each state), Maharashtra, Jharkhand, and Mizoram (9% in each state), use any form of paan masala.

Determinants of paan masala use

Table 3 presents result of multinomial regression estimate to examine the association between selected socioeconomic demographic variables and use of paan masala with and without tobacco. The relative risk ratios

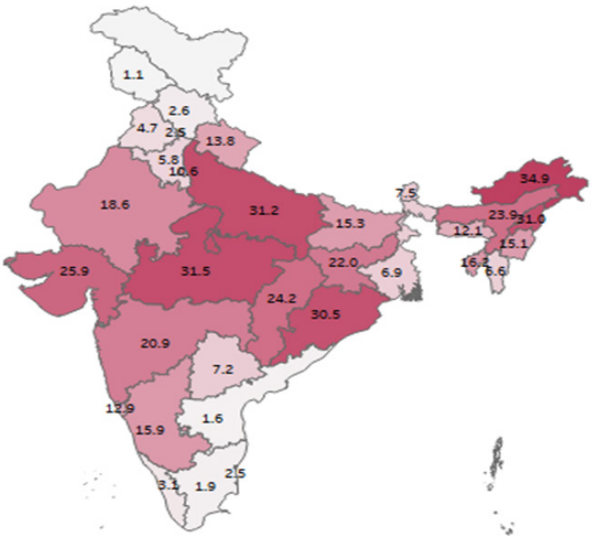

Figure 1. Geographical Variation in Use of Any form of Paan Masala among Males in India, 2016-2017

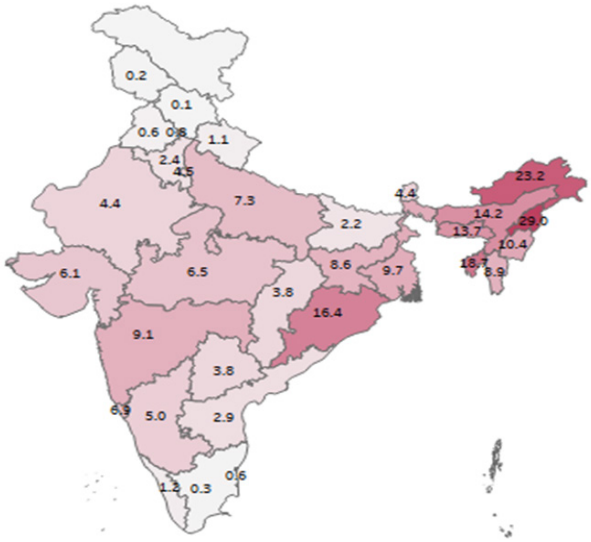

Figure 2. Geographical Variation in Use of Any form of Paan Masala among Females in India, 2016-2017

Table 2. Prevalence of Use of Paan Masala by Socio-Demographic Variables, India (GATS-2, 2016-17)

Background Characteristics	User of Paan masala without tobacco	User of Paan masala always with tobacco	Dual user of Paan masala (paan masala without tobacco as well as paan masala with tobacco)	Any form of paan masala	N
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	
Overall	3.1 (2.9-3.3)	8.0 (7.6-8.3)	1.0 (0.9-1.2)	12.1 (11.7-12.5)	74,037
Residence					
Rural	2.8 (2.6-3.0)	8.6 (8.2-9.0)	1.0 (0.8-1.2)	12.4 (11.9-12.9)	47,549
Urban	3.7 (3.3-4.1)	6.7 (6.2-7.3)	1.1 (0.8-1.4)	11.5 (10.8-12.2)	26,488
Sex					
Female	2.3 (2.1-2.6)	3.1 (2.9-3.4)	0.6 (0.5-0.7)	6.0 (5.7-6.4)	40,265
Male	3.8 (3.5-4.2)	12.6 (12.0-13.2)	1.5 (1.2-1.7)	17.8 (17.1-18.5)	33,772
Age					
15-24	3.7 (3.2-4.3)	6.0 (5.3-6.7)	1.1 (0.8-1.5)	10.8 (9.9-11.7)	13,329
25-44	3.2 (2.9-3.5)	10.2 (9.7-10.8)	1.1 (1.0-1.3)	14.5 (13.9-15.2)	35,564
45-64	2.6 (2.2-3.0)	7.1 (6.5-7.7)	0.8 (0.6-1.0)	10.5 (9.8-11.2)	19,132
65 or more	2.0 (1.5-2.6)	5.6 (4.7-6.6)	1.0 (0.6-1.5)	8.5 (7.4-9.7)	6,012
Education					
No formal schooling	2.0 (1.8-2.4)	8.3 (7.6-9.0)	0.8 (0.6-1.0)	11.1 (10.4-11.9)	18,532
Less than primary school completed	3.0 (2.4-3.8)	10.2 (9.2-11.3)	1.0 (0.7-1.5)	14.2 (13.0-15.5)	7,510
Primary completed but not secondary	3.1 (2.7-3.5)	10.7 (10.0-11.5)	1.2 (0.9-1.5)	15.0 (14.1-15.9)	20,967
Secondary completed	3.9 (3.5-4.3)	5.0 (4.6-5.5)	1.0 (0.8-1.3)	9.9 (9.3-10.6)	27,028
Region					
North	1.4 (1.1-1.6)	2.5 (2.1-3.0)	0.3 (0.2-0.4)	4.1 (3.7-4.7)	17,128
Central	3.1 (2.6-3.6)	12.8 (11.9-13.7)	1.9 (1.5-2.3)	17.7 (16.7-18.8)	11,518
East	4.1 (3.6-4.6)	6.7 (6.2-7.3)	1.0 (0.8-1.3)	11.8 (11.1-12.6)	9,834
Northeast	6.1 (5.3-6.9)	10.8 (9.9-11.7)	1.7 (1.4-2.2)	18.5 (17.4-19.8)	13,574
West	4.5 (3.8-5.3)	10.4 (9.4-11.4)	0.7 (0.5-1.1)	15.6 (14.4-16.8)	7,901
South	1.4 (1.1-1.6)	2.7 (2.4-3.1)	0.2 (0.2-0.3)	4.3 (3.9-4.8)	14,082
Economic status					
1st quintile	2.8 (2.4-3.2)	11.0 (10.2-11.7)	1.3 (1.0-1.7)	15.0 (14.2-15.9)	15,547
2nd quintile	2.6 (2.2-3.1)	9.5 (8.7-10.4)	0.8 (0.6-1.1)	12.9 (12.0-13.9)	12,073
3rd quintile	2.8 (2.4-3.3)	8.5 (7.7-9.3)	0.8 (0.6-1.0)	12.1 (11.3-13.0)	15,627
4th quintile	3.7 (3.1-4.4)	6.3 (5.6-7.1)	1.4 (1.0-2.0)	11.4 (10.4-12.5)	12,260
5th quintile	3.8 (3.2-4.3)	3.8 (3.2-4.4)	0.9 (0.6-1.2)	8.4 (7.6-9.2)	18,530
Social Group					
Hindu Upper caste	3.1 (2.6-3.6)	6.5 (5.9-7.2)	1.0 (0.7-1.4)	10.6 (9.8-11.5)	15,200
Hindu other backward class	3.1 (2.7-3.5)	7.9 (7.3-8.4)	0.9 (0.7-1.1)	11.8 (11.1-12.5)	22,174
Hindu scheduled caste	2.3 (1.9-2.7)	9.6 (8.8-10.6)	0.9 (0.7-1.2)	12.8 (11.9-13.8)	11,469
Muslims	4.7 (4.0-5.4)	8.3 (7.3-9.5)	1.5 (1.1-2.1)	14.6 (13.3-15.9)	8,642
Other religions	2.0 (1.4-3.0)	3.1 (2.3-4.2)	0.9 (0.4-2.3)	6.1 (4.8-7.7)	4,424
Scheduled tribes (all religions)	2.8 (2.3-3.3)	9.9 (8.9-11.0)	1.1 (0.8-1.5)	13.7 (12.6-15.0)	12,128

of age, sex, residence and religion followed similar pattern for both types of paan masala (with and without tobacco). The RRRs for both types were significantly higher among urban residents (1.2 (1.09-1.31) and 1.15 (1.07-1.23) respectively for without and with tobacco types). Men were more at risk with RRR of 2.07(1.90-2.25) for paan masala without tobacco and 5.06(1.07-1.23) for with tobacco. As compared to the higher age group (65+), the risk of both types of paan masala use was highest in the 25-44 year age group (RRR: 1.51, CI: 1.27-1.79 and 2.12, CI 1.88-2.38 respectively). Risk of paan masala without tobacco was highest in the North-East region (RRR: 6.35 (5.23-7.71) and that of paan masala with tobacco was highest in the central region (RRR: 5.80 (5.21-6.45).

Compared to those with the richest economic status, the likelihood of paan masala use without tobacco was lower across all other economic status categories. On the other hand, the likelihood of paan masala use with tobacco was higher across all economic status groups than those who belong to the richest (5th quintile). RRRs of paan masala use with tobacco were significantly higher for lower education categories compared to those with secondary education completed. There was no difference in risk for paan masala use without tobacco. Risk of paan

Table 3. Social Determinants of Use of Paan Masala without Tobacco, Paan Masala with Tobacco, and Any form of Paan Masala Compared with Non-Users of Paan Masala, India, (GATS, 2016-17)

Background Characteristics	Multi-nominal regression		Multivariate logistic regression
	Use of Paan masala without tobacco	User of Paan masala with tobacco	Use of any form of paan masala
	RRR (95% CI)	RRR (95% CI)	AOR (95% CI)
Residence			
Rural®			
Urban	1.20 (1.09-1.31)*	1.15 (1.07-1.23)*	1.16 (1.10-1.23)*
Sex			
Female®			
Male	2.07 (1.90-2.25)*	5.06 (4.72-5.41)*	3.68 (3.49-3.88)*
Age			
65 or more®			
15-24	1.42 (1.19-1.71)*	1.21 (1.06-1.38)*	1.29 (1.16-1.44)*
25-44	1.51 (1.27-1.79)*	2.12 (1.88-2.38)*	1.91 (1.72-2.11)*
45-64	1.23 (1.03-1.47)*	1.25 (1.10-1.42)*	1.24 (1.12-1.38)*
Education			
No formal schooling	0.95 (0.84-1.08)	2.00 (1.83-2.19)*	1.53 (1.42-1.65)*
Less than primary school completed	1.00 (0.86-1.16)	1.90 (1.71-2.11)*	1.51 (1.38-1.65)*
Primary completed but not secondary	0.92 (0.83-1.02)	1.93 (1.79-2.08)*	1.50 (1.41-1.59)*
Secondary completed®			
Region			
North	0.91 (0.71-1.15)	1.04 (0.86-1.25)	0.98 (0.85-1.14)
Central	2.97 (2.56-3.43)*	5.80 (5.21-6.45)*	4.76 (4.36-5.20)*
East	4.03 (3.48-4.68)*	2.37 (2.10-2.66)*	2.88 (2.62-3.17)*
Northeast	6.35 (5.23-7.71)*	4.04 (3.43-4.76)*	4.80 (4.22-5.47)*
West	3.57 (3.07-4.17)*	4.62 (4.11-5.19)*	4.21 (3.83-4.63)*
South®			
Economic status			
1st quintile (poorest)	0.78 (0.68-0.89)*	1.26 (1.14-1.40)*	1.08 (0.99-1.17)
2nd quintile	0.69 (0.60-0.80)*	1.22 (1.10-1.35)*	1.01 (0.93-1.10)
3rd quintile	0.87 (0.76-0.99)*	1.22 (1.10-1.35)*	1.08 (0.99-1.17)
4th quintile	0.95 (0.84-1.07)	1.12 (1.01-1.25)*	1.05 (0.97-1.14)
5th quintile (Richest) ®			
Social Group			
Hindu Upper caste	1.10 (0.93-1.30)	0.79 (0.70-0.88)*	0.86 (0.78-0.95)*
Hindu other backward class	1.25 (1.07-1.46)*	0.86 (0.78-0.94)*	0.95 (0.88-1.04)
Hindu scheduled caste	1.05 (0.88-1.5)	1.03 (0.93-1.14)	1.04 (0.95-1.14)
Muslims	1.91 (1.63-2.25)*	0.88 (0.79-0.98)*	1.13 (1.03-1.24)*
Other religions	0.98 (0.73-1.30)	0.71 (0.57-0.87)*	0.77 (0.65-0.92)*
Scheduled tribes (all religions) ®			

R, Reference; *p≤0.001; #, dual users are included in paan masala with tobacco / Gutkha category as the numbers were too small for independent analysis

masala use without tobacco was higher among Muslims (RRR: 1.91, CI: 1.63-2.25) than Scheduled tribes who belong to any religion. Probability of paan masala use with tobacco was lower across all social groups except Hindu scheduled castes than Scheduled tribes.

Results of multivariate analysis using logistic regression for the dependent variable "paan masala use in any form" are presented in Table 3. The likelihood of paan masala use in any form was higher in urban areas (AOR: 1.16, CI: 1.10-1.23) than in their rural counterparts. Odds were 3.68 (3.49-3.88) for males; odds were also higher for age groups younger than 65 and for educational categories who had not completed secondary education. Region-wise AOR were highest for North-East (AOR 4.80, CI: 4.22-5.47) and Central regions (AOR 4.76, CI: 4.36-5.20) times more likely to use any form of paan masala than females. Muslims had higher (AOR 1.13, CI 1.03-1.24) whereas Hindu upper caste had lower odds (AOR 0.86, CI: 0.78-0.95) of paan masala use.

Discussion

The analysis presented above shows that 12% of adults used any form of paan masala in India, and 9% use paan masala with tobacco. Among all the smokeless tobacco products, only khaini (tobacco-lime) mixture is more commonly used. Prevalence of use of betel quid is much less and this analysis of GATS-2 data confirms that the new avatar of the betel quid in the form of paan masala with tobacco has become more dominant. Gutkha was earlier avatar but was taken off the shelf with stringent legal measures. The industry responded to this in two ways. The manufacturers of gutkha have shifted to production of paan masala which has all the ingredients of gutkha except tobacco. However, the usual fact is that paan masala is often bought but gets consumed by adding a complementary tobacco pouch given to the buyer without even asking by a buyer. The second way is small-to-medium scale production of products commonly known as kharra, mawa or gutkha which are a combination of tobacco, areca nut, lime and other condiments. Such circumvention is being reported over past ten years whereby individuals were purchasing tobacco and mixing it with a pocket of paan masala adversely affecting the impact of ban (Saraf et al., 2018).

Moreover, a study was done for the impact evaluation of gutkha ban found that the financial and social cost of selling gutka as well as public penalties affected reducing, but the ban could also be contributing to increased profits and promotional activities associated with the sale of other tobacco products and increased use as well as initiation of other types of smokeless tobacco products (Nair et al., 2012). For instance, study suggested that paan masala, tobacco in loose form, tobacco pouches and mouth fresheners are not banned (Shetty, 2014) and are easily available in the market. Many paan masala brands marketed as tobacco-free contains, but these paan masalas contain high level of nicotine magnesium carbonate, which leads to hyper magnesia (Shetty, 2014). It is important to note that large number of local brands are being sold and many studies have highlighted that these brands have no pictorial waning or not following display rules (Shetty, 2013); 16 brands tested did not reveal the presence of content of nicotine in the label (Sharma et al., 2015).

The pattern of use of both tobacco and non-tobacco forms of paan masala is similar according to place of residence, gender, age, and region. But the pattern is different across education and economic class. There is no relationship between educational status and use of paan masala without tobacco. On the other hand, for tobacco products, lower education is risk factor. The pattern with economic quintile is on the same lines, with poverty being a risk factor for use of paan masala with tobacco. However, higher income level is associated higher use of paan masala without tobacco, a finding which parallels in literature with cigarette smoking (Agrawal et al., 2013). This is similar to the previous research, where it was observed that a positive association with betel quid with tobacco with decreasing level of education and wealth, while use of betel quid without tobacco is more common among individual with moderate level of education and does not shows a linear gradient with wealth quintiles (Arora et al., 2020). This implies that where education has been shown to be protective in tobacco use, the same has not been seen with paan masala without tobacco. This could be due to two factors; i) paan masala without tobacco is not considered as harmful even by educated class and ii) marketing by the paan masala manufacturers have been able to project the product as safe and desirable. Manufacturers used various marketing strategies, such as surrogate advertisements and use descriptions on paan masala, such as 'saffron blended' or 'brings freshness', 'superb flavour' to influence the potential users. This type of massage diverts users' attention away from the dangerous carcinogens in paan masala and instead creates the illusion that it is a higher quality product that provides pleasure and may be beneficial to the body.

As far as other determinants are concerned, this study revealed that region and social group are principal determinants of paan masala use without tobacco, whereas gender, age, and region are major determining factors for use of paan masala with tobacco. We found that those live in the Northeast region are more likely to use paan masala without tobacco. Some states, including Mizoram, Arunachal Pradesh, Manipur, and Nagaland share international border with Myanmar, and the wide availability of cheap tobacco products, smuggled from Myanmar could be a primary reason for the high consumption of paan masala use in North East region. Muslims are more likely to use paan masala without tobacco than schedule tribes who belong to all religions. This finding is supported by the argument or researchers that some religion prohibits substance use. For instance, Sikhism prohibits tobacco use (Bhatt et al., 2020) and Islam prohibits alcohol use (Michalak et al., 2009), while there is no explicit prohibition on tobacco use (Ghouri et al., 2006), this could be the reason for the highest prevalence of paan masala use among Muslims.

Males are significantly more likely to use paan masala with tobacco than females. This finding is consistent with another study where it was found that prevalence of gutkha usage was higher among males than females (Dongre et al., 2008). Consumption of paan masala with tobacco is nearly six times higher in the Central region than in the South region. This finding is consistent with an earlier study carried out using data from National Family Health Survey-4 and suggests that consumption of paan masala with tobacco in the district of Central region is nearly double than the national average (Karuppusamy et al., 2021). This finding also provides strong evidence that despite the ban on gutkha and its new avatar of paan masala and its variants are widely available and used in this region.

The use of chewing tobacco is reaching dangerous endemic levels in India (Neki and Jain, 2016). Excessive use of paan masala and paan masala with tobacco (Gutkha) leads to loss of appetite, promote unusual sleeping patterns, and loss of concentration. Long-term use can cause oral submucous and can lead to precancerous lesions, and increase risk of other mouth cancer as well as cancers of the liver, cervix, stomach, prostate and

lung (Neki and Jain, 2016). However, paan masala is not considered as harmful; its advertisement and/ or promotion is not restricted by the COTPA regulations. These products themselves are harmful. Moreover, they are combined with tobacco. As can be seen from this study, all those who use paan masala products (12%), nearly three-fourths (9%) are using it in combination with tobacco.

Our study has some limitations. The data is self-reported consumption of tobacco and related products; the actual use of tobacco could be possibly more. However, the prevalence of more than 12% in general population of paan masala use is significant. For India, this means a large population size especially young adults are exposed to carcinogens.

Author Contribution Statement

SK contributed to the planning of the study, carried out statistical analysis and drafted the manuscript. NG contributed to the design of the study, carrying out statistical analysis, reviewed the manuscript. MSP contributed to the design of the study and reviewed the manuscript. All authors have read and approved the final manuscript.

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Approval

This study was used secondary data and no primary data collection was involved. Hence there is no approval required from the institutional review board.

Ethics statement

The GATS India data set is available in the public domain from CDC and are de-identified. All the Global Adult Tobacco Surveys were approved by ethical boards of survey countries and CDC, Atlanta. Study protocols and survey materials for GATS 1 were approved by the Ethics Review Committee and Institutional Review Board (IRB) of the International Institute for Population Sciences, Mumbai. Study protocols and survey materials for GATS 2 were approved by the Ethics Review Committee and IRB of Tata Institute of Social Sciences, Mumbai. Consent was obtained from all participants. Parent or guardian consent was obtained for interviews of minors aged 15–17 years.

Data Availability

The dataset is available in public and could be found from the Global Tobacco Surveillance System Data (GTSSData) at https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DataReports.aspx?Country=180&CAID=2&Surve=4&WHORegion=2&Site=38400020.

Conflict of Interest

The authors declare that they have no conflict of interest.

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