



## Original Research Article

# AN EPIDEMIOLOGICAL ASSESSMENT OF EFFECT OF TOBACCO CONSUMPTION AMONGST SCHOOL-GOING ADOLESCENTS WITH EMPHASIS ON PHYSICAL-GROWTH IMPACT AT AHMEDABAD CITY

Khushi Patel<sup>1</sup>, Kamlesh Kumar Jain<sup>2</sup>, Kush Alkeshkumar Patel<sup>1</sup>, Vasu G. Rathod<sup>3</sup>, Margi Sheth<sup>4</sup>, Aryan Mehul Panchal<sup>5</sup>

<sup>1</sup>Final year Medical Student, GCS Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.

<sup>2</sup>Professor & HOD, Community Medicine Department, GCS Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.

<sup>3</sup>Statistician cum Tutor, Community Medicine Department, GCS Medical College, Hospital and Research Centre, Ahmedabad, Gujarat, India.

<sup>4</sup>Assistant Professor, Community Medicine Department, GMERS Medical College, Rajpipla, Gujarat, India.

<sup>5</sup>Intern Doctor, GCS Medical College Hospital and Research Centre, Ahmedabad, Gujarat, India.

Received : 28/01/2025  
Received in revised form : 10/02/2026  
Accepted : 25/02/2026

**Corresponding Author:**

**Dr. Kamlesh Kumar Jain,**  
Professor & HOD, Community  
Medicine Department, GCS Medical  
College, Hospital and Research Centre,  
Ahmedabad, Gujarat, India.  
Email: medico\_22981@yahoo.com

DOI: 10.70034/ijmedph.2026.1.401

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Med Pub Health  
2026; 16 (1); 2315-2320

**ABSTRACT**

**Background:** Today, adolescent tobacco use and its health problems are worrisome. About 90% of oral cancers in South East Asia are related to chewing or smoking tobacco. This study tries to find out how common tobacco use is, explain how it's used, and learn what things are related to it among students in Ahmedabad, Gujarat. The objective is to assess the prevalence, epidemiological pattern, and factors associated with tobacco consumption among the adolescents and to compare the nutritional status among the adolescents consuming the tobacco with those who are not consuming tobacco.

**Materials and Methods:** A sample size of 240 adolescents was determined based on an estimated tobacco use prevalence of 18% from previous studies in Gujarat. Using the standard formula ( $4pq/l^2$ ) with a 5% margin of error, the minimum required sample was calculated to be 236. To account for potential non response and ensure adequate representation the sample size was rounded to 240. Therefore a cross sectional study was conducted among 240 adolescents aged 14-19 years in selected Ahmedabad Municipal Corporation (AMC) schools. Sampling Technique: A multi stage sampling technique was employed to select study participants: Zone selection: Ahmedabad Municipal Corporation (AMC) comprises seven administrative zones. Three zones were randomly selected using a lottery method. Ward Selection: within each selected zone, one ward was chosen at random. School selection: Two schools from each selected ward were randomly selected. Participant Selection: In each selected school students from classes 9 to 12 were included using probability proportionate sampling. Within classes, simple random sampling was used based on the master attendance list to achieve the targeted sample size. Henceforth, a pre tested questionnaire was used to collect data on socio demographics, tobacco use patterns and awareness. Anthropometric measurements were taken to determine nutritional status based on Body Mass Index (BMI). Statistical analysis was performed using descriptive statistics and the Chi-square test to assess associations.

**Results:** The overall prevalence of tobacco consumption was 12.1%. The mean age of initiation was 14.3 years. Chewable tobacco was the most common form used. Tobacco use was significantly associated with gender, with 17.2% (n=25 out of 145) males using tobacco compared to 4.2% (n=4 out of 95) females (p value=0.002,  $X^2=9.17$ ). Adolescent with at least one parent who used tobacco were more likely to be users themselves (p value=0.0001). Awareness of health impacts was also significantly higher among non users (p value=0.0001). No

statistically significant association was found between tobacco use and the adolescents nutritional status ( $p$  value  $<0.0001$ ).

**Conclusion:** In summary, this study shows that tobacco use among students in Ahmedabad is still a serious public health problem. About 12.1% said they had tried tobacco, mostly in smokeless forms. Being male and having parents who use tobacco were strong factors, but there was no clear link between tobacco use and nutrition. Because kids are starting to use tobacco early and are influenced by family and friends, it's important to have thorough prevention and education plans in schools and families. These plans should start in early adolescence to stop young people from starting to use tobacco.

**Keywords:** Adolescents, Prevalence, Smoking, Tobacco chewing.

---

---

## INTRODUCTION

The World Health Organization reports that tobacco use is still a major global health concern, leading to millions of deaths each year.<sup>[1,2]</sup> Young people are especially susceptible to becoming addicted to tobacco, often starting without fully understanding the health risks. This can make it harder to quit later on. Several things can lead to tobacco use in teens, such as pressure from friends, genes, parental actions, financial status, and school stress.<sup>[3]</sup> In India, tobacco use is widespread, with 48% of men older than 15 using it.<sup>[4]</sup> In Gujarat, 14.61% of people smoke and 66.23% chew tobacco, with the worst addiction rates among 17 to 19-year-olds at 36.36%.<sup>[4]</sup>

Tobacco, whether smoked or chewed, includes more than 70 known carcinogens and presents serious health risks, such as various cancers and respiratory illnesses.<sup>[5]</sup> Though the cancer-causing and respiratory impacts are well-documented, there is growing interest in understanding tobacco's impact on adolescent nutrition and physical growth. Studies have shown different results; some tie tobacco use to higher BMI, while others tie it to poor nutrition. This study adds to the current knowledge by analyzing tobacco use among teens in Ahmedabad. Its aims are to learn how common tobacco use is, describe its patterns, and spot the social and demographic factors tied to it. By looking at how tobacco use and nutrition relate, this research seeks to advise educational programs and policies for a healthier future without tobacco.

## MATERIALS AND METHODS

**Study Design and Participants:** A cross-sectional study was conducted among school-going adolescents aged 14-19 years in Ahmedabad. The study setting comprised six selected secondary and higher secondary schools managed by the Ahmedabad Municipal Corporation (AMC). Sample size is calculated by the formula  $4pq/l^2$ , where  $p$ = prevalence of tobacco consumption,  $q$ =  $100-p$ ,  $l$ = allowable error(5%). Considering the prevalence of tobacco consumption among adolescent 18% in Kahar P et al,<sup>[6]</sup> study in Gujarat, sample size came out to be 236. Therefore, approximately 240 adolescents will be included in the study

**Data Collection and Tools:** A self administered pre tested, structured, close ended questionnaire was used for data collection. The questionnaire covered socio-demographic details, tobacco consumption patterns, sources of influence, and awareness of health impacts. Anthropometric measurements, including height and weight, were confidentially recorded to calculate BMI.

### Multi Stage Sampling Technique:

Stage 1	There are seven zones in Ahmedabad Corporation for administrative purpose in Education department. Zone wise list was taken from the Corporate Education Officer. Randomly 3 zones will be selected through lottery method.
Stage 2	From each zone, randomly one ward will be selected.
Stage 3	From each selected ward, two school will be selected.
Stage 4	From each selected school, students will be selected through Probability Proportionate sampling
Stage 5	Students will be selected from each class (Class 9 to Class 12) through Simple random sampling by collecting their master attendance list.

A pilot run was conducted before finalizing the questionnaire. A detailed description about the study was given to the participants. Students who were present at the time of administration of the questionnaire and willing to participate in the study were included. The study was conducted over a period of six months. Anonymity of the participants was maintained by avoiding any information revealing the identity of the participants in the questionnaire.

Permission was obtained from the corporate Education Officer and the Institutional Ethics Committee and consent was obtained from the school principals and class teachers and also was obtained from all participating adolescents.

Data was analysed using descriptive statistics (mean, Standard deviation, frequencies and percentages). To identify factors associated with tobacco consumption, the Chi square test was applied. A  $p$  value of less than 0.05 was considered statistically significant.

### Operational definition:

1. Nutritional Status: Nutritional status will be calculated through WHO criteria for Body Mass Index for age. The cut offs for BMI will be interpreted as following.<sup>[7]</sup>
2. Pubertal changes-

- Growth Spurt: Rapid increase in height and weight.<sup>[8]</sup>  
<https://carta.anthropogeny.org/moca/topics/adolescent-growth-spurt>
- Secondary Sexual Characteristics: physical feature related to the sex of an organism that emerges during puberty, or the phase of sexual maturity. Examples of secondary sex characters in humans include the development of breasts in females and pigmented facial hair in males.<sup>[9]</sup>
- Menarche: Menarche is defined as the first menstrual period in a female adolescent. Menarche typically occurs between the ages of 10 and 16, with the average age of onset being 12.4 years.<sup>[10]</sup>
- Changes in Body Composition: Increase in muscle mass in males and changes in body fat distribution in females.

3. Tobacco products- All the products containing the nicotine like Cigarettes, Bidis, Cigars, Chuttas, hukkas, pan masala, Gutka, E-cigarrattes will be taken as product.<sup>[11]</sup>

## RESULTS

A This study included 240 adolescent students, with 145 (60.4%) males and 95 (39.6%) females. Most students (46.7%) were between 14 and 16 years old. The grade distribution was as follows: 50 (20.8%) in 9th grade, 70 (29.2%) in 10th grade, and 45 (18.8%) in 12th grade. Data on parental education show that 62.5% of mothers and 34.2% of fathers had only primary education, while 8.8% of mothers and 21.7% of fathers had graduate degrees. [Table 1] presents the detailed socio- demographic traits of the participants.

**Table 1: Socio demographic characteristics of School going Adolescents in Ahmedabad(n=240)**

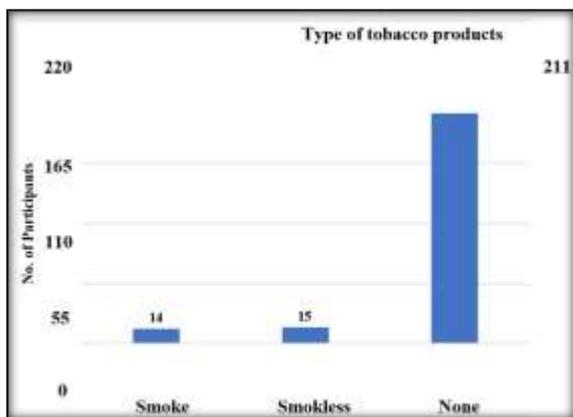
Variable	Frequency	Percentage
Age		
<14	34	14.2
14-16	112	46.7
≥17	94	39.1
Mean (SD)	15.97 (1.27)	
Gender		
Male	145	60.4
Female	95	39.6
Student's Grade		
9th Standard	50	20.8
10th Standard	70	29.2
11th Standard	75	31.3
12th Standard	45	18.8
Mother's Education		
Primary	150	62.5
Secondary/ Higher Secondary	69	28.7
Graduate	21	8.8
Father's Education		
Primary	82	34.2
Secondary/ Higher Secondary	106	44.2
Graduate	52	21.7

[Table 2] shows the nutritional status of the students in our study. Out of 240 adolescents, 10.4% (25 students) were underweight, while 32.5% (78 students) had a standard weight. A little more than a third of the participants, 34.6% (83 students), were

overweight, and 22.5% (54 students) were considered obese. It appears that most students were either overweight or of normal weight, with fewer students being underweight or obese.

**Table 2: Distribution of Nutritional Status among School going Adolescents in Ahmedabad (n=240).**

Nutritional Status	Frequency	Percentage
Underweight	25	10.4
Normal	78	32.5
Overweight	83	34.6
Obese	54	22.5



**Figure 1: Distribution of types of Tobacco Products tried among School going Adolescents (n=240)**

**Prevalence of tobacco products usage:** Out of 240 surveyed adolescents, 29(12.1%) reported having

ever tried using any tobacco products, whereas the majority, 211(87.9%) indicated they had never tried tobacco. This finding highlights that while most students have not experimented with tobacco, a notable minority have been exposed at least once. Among the study participants only a small proportion reported current tobacco use and out of them only 4(1.7%) consumed tobacco daily, 6(2.5%) consumed monthly, 7(2.9%) of them consumed weekly and 12(5%) occasionally, whereas the majority 211(87.9%) reported not using tobacco at all. Out of all the sources, Shops were the most common source of tobacco (10%), followed by friends and family members (5.4%). Major influences for trying tobacco included curiosity (7.9%), media or advertisements (5.8%). Notably, 47.9% of the adolescents had fathers who used tobacco, and 7.1% had both parents consuming it.

**Table 3: Patterns, Sources and Influences of Tobacco Consumption among School going Adolescents in Ahmedabad (n=240)**

Variable	Frequency	Percentage
Frequency of Tobacco Consumption		
Daily	4	1.7
Monthly	6	2.5
Weekly	7	2.9
Occasionally	12	5
Not at all	211	87.9
Source for getting the Tobacco		
Stores/Shop	24	10
Others (Friends & family members)	13	5.4
Influence for Consuming the Tobacco		
Media/ Advertisement	14	5.8
Curiosity	19	7.9
Family members using Tobacco	14	5.8
Parents Consumption of Tobacco		
Father	115	47.9
Both of them (Mother & Father)	17	7.1
None of them	95	39.6
Don't Aware	13	5.4

**Table 4: Association of Tobacco use with Socio demographic and Familial factors among school going adolescents in Ahmedabad**

Variable	Tobacco Consumption		Total	-square/p- value	Cramer's V
	Yes	No			
Age					
<14	4 (11.76%)	30 (88.24%)	34	2.38 (0.304)	0.09
15-16	10(8.93%)	102(91.07%)	112		
≥17	15 (15.96%)	79(84.04%)	94		
Gender					
Male	25(17.24%)	120 (82.76%)	145	9.17 (0.002)	0.19
Female	4(4.21%)	91(95.79%)	95		
Nutritional Status					
Underweight	15(60%)	10(40%)	25	63.22 (<0.0001)	0.51
Normal	9(11.54%)	69(88.46%)	78		
Overweight	3(3.61%)	80(96.39%)	83		
Obese	2(%)	52(96.30%)	54		
Student's Grade					
9th Standard	7(14%)	43(86%)	50	2.40 (0.493)	0.1
10th Standard	5(7.14%)	65(92.86%)	70		
11th Standard	10(13.33%)	65(86.67%)	75		
12th Standard	7(15.56%)	38(84.44%)	45		
Mother's Education					
Primary	19(12.67%)	131(87.33%)	150	1.75 (0.416)	0.08
Secondary/ Higher	6(8.70%)	63(91.30%)	69		
Secondary	17(80.95%)	4(19.05%)	21		
Father's Education					
Primary	14(17.07%)	68 (82.93%)	82		

Secondary/ Higher	7(6.60%)	99(91.30%)	106	5.45 (0.066)	0.15
Secondary Graduate	8(15.38%)	44(84.62%)	52		
Parents Consumption of Tobacco					
Father	16(13.91%)	99(86.09%)	115	27.16 (<0.0001)	0.33
Both of them (Mother & Father)	8(47.06%)	9(52.94%)	17		
None of them	3(3.16%)	92(96.84%)	95		
Don't Aware	2(15.38%)	11(84.62%)	13		
Awareness regarding Potential Impact of Tobacco Consumption					
Yes	11(35.48%)	20(64.52%)	31	18.34 (<0.0001)	0.27
No	18(8.61%)	191(91.39%)	209		

A clear gender differential was observed, with males reporting a significantly higher prevalence of tobacco use (17.24%) than females (4.21%) ( $\chi^2 = 9.17$ ,  $p = 0.002$ ; Cramer's  $V = 0.19$ ). Nutritional status showed a strong and statistically significant association with tobacco consumption ( $\chi^2 = 63.22$ ,  $p < 0.0001$ ; Cramer's  $V = 0.51$ ), with underweight adolescents demonstrating substantially higher use (60%) compared to normal-weight and overweight/obese groups. Parental tobacco consumption was also a major predictor of adolescent use ( $\chi^2 = 27.16$ ,  $p < 0.0001$ ; Cramer's  $V = 0.33$ ), with nearly half (47.06%) of those whose both parents consumed tobacco also reporting use, indicating strong familial and environmental influence. Awareness regarding the harmful effects of tobacco showed a significant association ( $\chi^2 = 18.34$ ,  $p < 0.0001$ ; Cramer's  $V = 0.27$ ); however, use was paradoxically higher among those who were aware (35.48%), suggesting that awareness alone may not translate into preventive behavior.

## DISCUSSION

This study provides crucial insights into the prevalence, patterns, and socio-demographic factors associated with tobacco consumption among school-going adolescents in Ahmedabad. The findings highlight that tobacco use is a significant public health issue within this young population, driven by specific and identifiable factors.

The overall prevalence of tobacco consumption was found to be 12.1%. This figure is remarkably less compared with the 18% prevalence reported by Kahar P et al study conducted in rural Gujarat, suggesting that the burden of adolescent tobacco use differs across both urban and rural settings within the state.<sup>[6]</sup> Moreover, this finding is broadly consistent with the results reported by Prajapati et al.(2017), who observed a similar tobacco prevalence of 12.3% among adolescents in Himmatnagar city, Gujarat.<sup>[12]</sup> Furthermore, this aligns with broader national trends identified by the Global Youth Tobacco Survey (GYTS), which confirms that a substantial portion of Indian youth are exposed to and use tobacco products.<sup>[13]</sup>

This research found that the average age people start using tobacco is 14.3 years. This agrees with Prajapati et al.'s study. A study in the Gandhidham slums (Dave et al., 2025) shows a worrying trend:

43% of users started before age 10.<sup>[14]</sup> This shows that adolescence is when people are most likely to start this risky habit. Starting early makes quitting harder later on. It also shows that we urgently need strong intervention programs in schools, starting in middle school, before these habits become hard to break.

Analysis of related elements showed that gender and parents' tobacco use are the strongest predictors of tobacco use. Studies have shown that male teens are more likely to use tobacco than female teens in India. This is often because of social norms that allow men to use tobacco more freely. This study and the Prajapati et al study found that boys used tobacco 4-5 times more than girls. The Gandhidham study reported 22.5% of boys and 14.8% of girls used tobacco (rates are still higher in boys, but with worrying rates among girls).<sup>[12,14]</sup> This difference shows that health education programs that consider gender differences are needed.

A key finding is how much parents' actions matter. Teens with a parent who uses tobacco are much more apt to use it too. This lines up with social learning theory. Parents who use tobacco might unintentionally become role models, making the behavior seem normal and making their children think addiction isn't so risky. This strong link suggests that anti-tobacco programs for young people should involve educating parents.

One of the secondary objectives of this study was to explore the link between tobacco use and nutritional status. Our analysis found no statistically significant association between an adolescent's tobacco use and their Body Mass Index (BMI). This contributes to a field with conflicting evidence; while some studies suggest a link, others do not. It is possible that the duration or intensity of tobacco use within this young cohort was not yet sufficient to cause a measurable physiological impact on their BMI. Longitudinal studies that follow adolescents over a longer period are needed to fully understand the long-term effects of tobacco on physical growth.

Across contexts, awareness of tobacco's health risks was poor among users and most students had not received targeted tobacco health education. The Gandhidham study uniquely reported that minors were rarely refused sales, highlighting weak enforcement of child protection laws and calling attention to environmental and systemic failure.<sup>[14]</sup>

## CONCLUSION

In summary, this study shows that tobacco use among students in Ahmedabad is still a serious public health problem. About 12.1% said they had tried tobacco, mostly in smokeless forms. Being male and having parents who use tobacco were strong factors, but there was no clear link between tobacco use and nutrition. Because kids are starting to use tobacco early and are influenced by family and friends, it's important to have thorough prevention and education plans in schools and families. These plans should start in early adolescence to stop young people from starting to use tobacco.

**Limitations:** Although this study used a self-administered anonymous questionnaire in order to maintain the anonymity and confidentiality of the study participants, there may have been some under reporting due to social desirability bias and reporting bias.

## REFERENCES

1. Petersen PE. Tobacco and oral health—The role of the World Health Organization. *Oral Health Prev Dent.* 2003;1(4):309–15.
2. World Health Organization. Tobacco [Internet]. WHO; [cited 2025 Dec 12]. Available from: <https://www.who.int/news-room/fact-sheets/detail/tobacco>
3. The GATS Collaborative Group; Centers for Disease Control and Prevention (CDC). The Global Adult Tobacco Survey (GATS) Atlas [Internet]. Atlanta (GA): CDC; 2015 [cited 2025 Dec 12]. Available from: [https://www.cdc.gov/tobacco/global/gtss/tobacco\\_atlas/index.htm](https://www.cdc.gov/tobacco/global/gtss/tobacco_atlas/index.htm)
4. Makwana NR, Shah VR, Yadav S. A study on prevalence of smoking and tobacco chewing among adolescents in rural areas of Jamnagar district, Gujarat state. *Subst Abus.* 2017;1(1):47–50.
5. International Agency for Research on Cancer. Tobacco Smoke and Involuntary Smoking. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Vol. 83. Lyon: World Health Organization, International Agency for Research on Cancer; 2004.
6. Kahar P, Misra R, Patel TG. Sociodemographic Correlates of Tobacco Consumption in Rural Gujarat, India. *Biomed Res Int.* 2016;2016:5856740.
7. World Health Organization (WHO). BMI-for-age (5–19 years) [Internet]. [cited 2024 Jul 24]. Available from: <https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age>
8. Bogin B. Adolescent Growth Spurt. In: Center for Academic Research and Training in Anthropogeny (CARTA) MOCA [Internet]. [cited 2025 Dec 12]. Available from: <https://carta.anthropogeny.org/moca/topics/adolescent-growth-spurt> (carta.anthropogeny.org) carta.anthropogeny.org
9. The Editors of Encyclopædia Britannica. Secondary sex character. *Encyclopædia Britannica* [Internet]. [cited 2025 Dec 12]. Available from: <https://www.britannica.com/science/secondary-sex-character>
10. Lacroix AE, Gondal H, Shumway KR, Langaker MD. Physiology, menarche. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan–. [cited 2025 Dec 12]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470216/>
11. Michigan Department of Health & Human Services. Types of Tobacco Products. Michigan.gov [Internet]. [cited 2025 Dec 12]. Available from: <https://www.michigan.gov/mdhhs/keep-mi-healthy/chronicdiseases/tobacco/types-of-tobacco-products>
12. Varma, A., Damke, S., Meshram, R., Vagha, J., Kher, A., & Vagha, K. (2017). Prediction of mortality by pediatric risk of mortality (PRISM III) score in tertiary care rural hospital in India. *International Journal of Contemporary Pediatrics*, 4(2), 322–327. <https://doi.org/10.18203/2349-3291.ijcp20170003>
13. Ministry of Health & Family Welfare (MoHFW), Government of India, and International Institute for Population Sciences (IIPS). Global Youth Tobacco Survey (GYTS-4), India 2019: Final Report. New Delhi/Mumbai: MoHFW & IIPS; 2021 [cited 2025 Dec 12]. Available from: <https://ntcp.mohfw.gov.in/assets/document/surveys-reports-publications/GYTS%204%20Final%20Report.pdf>
14. Dave A, Pushkarna B, George S, Shah K, Vora K, Thacker N. A cross-sectional mixed method study to assess the prevalence of tobacco consumption among school going early adolescents of the slum population in Gandhidham, a city in India. *BMC Public Health.* 2025 Aug 5;25(1).
15. Prajapati, N., Chaudhari, C. C., Dixit, G. T., Gadhavi, R., Bhatt, A. A., & Thakor, N. (2017). Tobacco and betel nut use among school going adolescents of government high school of Himmatnagar city, Gujarat, India: a cross sectional study. *International Journal of Contemporary Pediatrics*, 4(2), 306–309. <https://doi.org/10.18203/2349-3291.ijcp20170363>.