

Inhale the Truth: Knowledge, Attitude, and Usage Patterns of Cigarette and E-Cigarette (Vape) Users among Young Adults Aged 18–27 Years: A Cross-Sectional Study from Maharashtra, India

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Abstract

Background: The co-occurring use of e-cigarettes and combustible cigarettes among young adults is a growing public health concern. Differences in knowledge, attitude, and usage patterns between cigarette smokers and vape users are critical to informing targeted interventions.

Objective: To evaluate and compare knowledge, attitude, and usage patterns among cigarette smokers and vape users aged 18–27 years, and to assess nicotine dependence using the Penn State Cigarette Dependence Scale (PSCDS).

Methods: A cross-sectional study was conducted using a structured, validated questionnaire administered to 812 young adults in a city in Maharashtra, India. A total of 812 participants (406 cigarette smokers and 406 vape users) completed both the Knowledge-Attitude-Practice questionnaire and the Penn State Cigarette Dependence Scale. Demographic data, health risk knowledge, attitudes, usage patterns, and nicotine dependence were collected. Descriptive statistics, Independent Samples t-test, and Chi-square test were used for statistical analysis.

Results: The majority of participants were male (81.3%) and aged 18–22 years (56.7%). Mean PSCDS scores were 7.94 ± 2.93 for vape users and 7.31 ± 2.90 for cigarette smokers (Table 5). Over 33% of participants initiated use before the age of 17 years (Table 2). Peer influence and curiosity were the primary reasons for initiation (34.5% each). While 70.2% correctly identified the government ban, significant misconceptions persisted — 26.4% believed vaping has no long-term health effects, and 16% considered vaping less harmful than smoking (Table 3). Attitudes toward vaping were largely divided across all five Likert-scale statements (Table 4).

Conclusion: Although both groups demonstrated substantial nicotine dependence, vape users exhibited significantly higher dependence scores than cigarette smokers and similar misconceptions regarding health

risks. Early initiation, peer influence, and widespread product availability despite a government ban highlight the need for targeted public health interventions among young adults in India.

Keywords: Attitude, cigarette smoking, cross-sectional study, E-cigarettes, India, knowledge, Maharashtra, nicotine dependence, Penn State Cigarette Dependence Scale, vaping, young adults.

Introduction

The e-cigarette, commonly known as the "vape," was introduced by Hon Lik in China in 2003 as a supposedly less harmful alternative to combustible cigarettes and a more effective nicotine delivery system.[1] E-cigarettes operate through an atomizer that heats a liquid — typically containing glycerol, propylene glycol, flavouring agents, nicotine, formaldehyde, and other chemicals — into an aerosol that is inhaled by the user.[2-4] Available in disposable, rechargeable, and reusable formats, and offered in a wide range of flavours, these devices have gained considerable popularity among young adults and Generation Z populations.[5-6] In India, approximately 27% of the population uses tobacco in some form.[7] Despite a nationwide ban on the sale, import, manufacture, and advertisement of e-cigarettes enforced since September 2019 under the Prohibition of Electronic Cigarettes Act, these products remain widely accessible through retail outlets and online platforms.[8-9] Vaping is generally perceived as less harmful than smoking; however, evidence indicates that e-cigarette aerosols contain numerous harmful chemicals, and their long-term health effects — including pulmonary dysfunction and oxidative stress — are increasingly documented.[10]

Young adults aged 18–27 years constitute the primary user group for both cigarettes and e-cigarettes in India. The dual use of these products is associated with compounded health risks and riskier behavioural patterns compared to single-product use.[11] Despite this, there is a paucity of Indian studies comparing knowledge, attitudes, usage patterns, and nicotine dependence between cigarette smokers and vape users in this age group. The present study was conducted to address this gap.

To our knowledge, very few Indian studies have simultaneously compared knowledge, attitudes, behavioural practices and nicotine dependence between exclusive cigarette smokers and exclusive vape users using a validated multidimensional dependence scale.

Aim

To assess knowledge, attitude, and practice, and to evaluate nicotine dependence among vape users and cigarette smokers aged 18–27 years in Maharashtra, India.

Objectives

1. To assess and compare knowledge, attitudes, and usage patterns among vape users and cigarette smokers aged 18–27 years.
2. To assess and compare nicotine dependence using the Penn State Cigarette Dependence Scale (PSCDS) between the two groups.

Materials and Methods

Study Design and Setting

A cross-sectional study was conducted among young adults aged 18–27 years residing in a city in Maharashtra, India. Data were collected between February to May 2026.

Study Population and Sample Size

The sample size was calculated using the single population proportion formula:

Formula:

$$n = (Z^2 \times p \times q) / d^2$$

Where:

- **n** = Required sample size
- **Z** = Standard normal deviate at 95% confidence level = **1.96**
- **p** = Expected prevalence = **50% (0.50)**
- **q** = $1 - p$ = **0.50**
- **d** = Absolute precision (margin of error) = **5% (0.05)**

Calculation:

$$n = (1.96^2 \times 0.50 \times 0.50) / (0.05^2)$$

$$n = (3.8416 \times 0.25) / 0.0025$$

$$n = 0.9604 / 0.0025$$

$$n = 384.16$$

The minimum required sample size was 384 participants. To facilitate balanced comparisons, 406 participants were recruited in each study group.

A prevalence of 50% was assumed because no previous Indian study had reported the prevalence of knowledge, attitudes, and usage patterns regarding cigarette and e-cigarette use among young adults in the study population. This assumption provides the maximum sample size for a cross-sectional study. To improve the precision of the estimates, enhance statistical power, and compensate for incomplete responses, recruitment continued beyond the minimum required sample size. Consequently, **812 eligible participants** completed the questionnaire and were included in the final analysis, comprising **406 cigarette smokers and 406 vape users**.

Data Collection Tools

Two structured, validated instruments were used:

1. Knowledge, Attitude, and Practice Questionnaire (n=812): Comprised sections on knowledge of health risks of vaping and smoking, attitudes toward vaping (five Likert-scale statements), and usage patterns including age of initiation, frequency of use, reasons for initiation, and health effects experienced. The questionnaire was developed after a literature review and reviewed by experts in Public Health Dentistry for content validity. A pilot study was conducted before the main survey to assess clarity and feasibility, and necessary modifications were incorporated.
2. Penn State Cigarette Dependence Scale (PSCDS) (n=812): A validated multi-dimensional tool measuring nicotine dependence including dimensions of craving, loss of control, automaticity, and withdrawal. Nine

items were scored using ordinal and binary response options. The scale was adapted for application to vape users.

Inclusion criteria

- Age 18–27 years
- Current cigarette smoker or vape user
- Resident of Maharashtra
- Willing to participate

Exclusion criteria

- Incomplete questionnaires
- Duplicate responses
- Non-consenting participants

Recruitment

Participants were recruited using convenience sampling through Facebook, WhatsApp, Telegram, and face-to-face interviews. To minimize selection bias, participants were recruited through multiple online and offline platforms. Duplicate and incomplete questionnaires were excluded before analysis. Anonymous data collection and a standardized questionnaire were used to reduce information bias.

Statistical Analysis

Data were analyzed using SPSS version 21. Descriptive statistics included frequencies, percentages, means, and standard deviations. Shapiro-Wilk testing demonstrated normal distribution of knowledge and PSCDS scores ($p > 0.05$), justifying parametric analysis. Comparisons between cigarette smokers and vape users for continuous variables (knowledge score, and PSCDS score) were performed using Independent Samples t-test as appropriate. Associations between categorical variables were analysed using Chi-square test. A p-value < 0.05 was considered statistically significant. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee of Sinhgad Dental College Ethical Approval Number: SDCH/IEC/OUT/2026/35. Informed consent was obtained from all participants. Participant anonymity and data confidentiality were maintained throughout.

Results

A total of 812 young adults aged 18–27 years participated in the study, comprising 406 vape users and 406 cigarette smokers. The demographic characteristics of the participants are presented in Table 1. The majority were males (81.3%, $n=660$), while females constituted 18.7% ($n=152$) of the study population. More than half of the participants belonged to the 18–22 years age group (56.7%, $n=460$).

Usage patterns of cigarettes and e-cigarettes are shown in Table 2. More than half of the participants (57.4%, $n=466$) initiated smoking or vaping between 18 and 22 years of age, while 33.5% ($n=272$) reported initiation before the age of 17 years. Curiosity and introduction by friends were the most common reasons for initiation (34.5% each), followed by peer pressure (21.4%). The majority of participants (56.4%, $n=458$) reported using their preferred nicotine product more than ten times daily.

Knowledge regarding cigarettes and e-cigarettes was assessed using six items (Table 3). Awareness regarding the legal status of vaping in India was relatively high, with 70.2% of participants correctly identifying that e-cigarettes are banned. However, substantial misconceptions persisted. Only 53.0% recognized that vaping has long-term adverse health effects, while 26.4% believed it did not. Similarly, 16.0% perceived vaping to be less harmful than conventional cigarette smoking. Among the knowledge variables, a statistically significant difference between vape users and cigarette smokers was observed only for perceptions regarding the relative harmfulness of vaping and smoking ($\chi^2=8.57$, $p=0.036$).

Comparison of overall knowledge scores between the two groups revealed significantly higher scores among vape users (3.76 ± 1.13) compared with cigarette smokers (3.60 ± 1.17) ($t=-2.018$, $p=0.044$), indicating better overall knowledge among vape users (Table 4).

Participants' attitudes toward vaping are summarized in Table 5. Participants demonstrated heterogeneous attitudes toward vaping, indicating substantial variability in perceptions regarding smoking cessation, social acceptance, and public use of e-cigarettes. Nearly half of the participants (45.8%) agreed or strongly agreed that vaping helps individuals quit smoking, whereas 32.0% disagreed or strongly disagreed. Approximately 49.3% supported allowing vaping in public spaces, while 32.5% remained uncertain. Furthermore, 61.8% considered vaping a lifestyle choice, and 58.1% believed vaping should receive social acceptance comparable to cigarette smoking.

Nicotine dependence was assessed using the Penn State Cigarette Dependence Scale (PSCDS) (Table 6). High levels of dependence were observed in both groups. More than 84% of participants reported difficulty quitting, approximately 73% experienced nervousness or anxiety during abstinence, and over 85% reported moderate to very strong cravings in the preceding week. Vape users consistently demonstrated slightly higher dependence indicators than cigarette smokers.

Comparison of mean PSCDS scores demonstrated significantly greater nicotine dependence among vape users (7.94 ± 2.93) compared with cigarette smokers (7.31 ± 2.90) ($t=-2.117$, $p=0.035$) (Table 7).

Health effects and withdrawal symptoms associated with nicotine use are presented in Table 8. Overall, 63.5% of participants reported experiencing health-related problems attributable to smoking or vaping. A greater proportion of vape users reported health issues (66.5%) compared with cigarette smokers (60.6%); however, the difference was not statistically significant ($\chi^2=2.81$, $p=0.094$). Restlessness was the most commonly reported withdrawal symptom among both vape users (45.6%) and cigarette smokers (41.1%), followed by mood swings and anxiety. No statistically significant difference was observed between the two groups with respect to withdrawal symptoms ($\chi^2=2.59$, $p=0.460$).

Overall, the findings indicate that although vape users demonstrated significantly higher knowledge scores and nicotine dependence scores than cigarette smokers, both groups exhibited substantial misconceptions regarding vaping-related harms, high levels of nicotine dependence, and comparable patterns of health-related symptoms.

Tables

Table 1: Demographic Characteristics

Variable	Category	n	%
Age Groups	18–22 years	460	56.7
	23–27 years	346	42.6
	Other	6	0.7
Gender	Male	660	81.3
	Female	152	18.7
Substance Type	Vape Users	406	50.1
	Cigarette Smokers	406	49.9

Table 2: Usage Patterns Among Participants

Variable	Category	n	%
Age of Initiation	<17 years	272	33.5
	18–22 years	466	57.4
	23–27 years	66	8.1
	>27 years	8	1.0
Reason for Initiation	Curiosity	280	34.5
	Friend Offered	280	34.5
	Peer Pressure	174	21.4
	To Quit Smoking	78	9.6
Frequency of Use	Once Daily	29	3.5
	2–5 Times Daily	156	19.2
	6–10 Times Daily	169	20.8
	>10 Times Daily	458	56.4

Table 3: Knowledge Regarding Cigarettes and E-Cigarettes

Knowledge Variable	Correct Response (%)	χ^2	p-value
Addictive substances in vaping devices	67.5	1.54	0.464
Long-term health effects of vaping	53.0	4.23	0.123
Relative harm of vaping vs smoking	66.0	8.57	0.036*
Government regulation in India	70.2	2.91	0.405
Chemicals in vape liquids	61.3	6.44	0.092
Heavy metals in vaping devices	50.0	7.82	0.050

Statistically significant at $p < 0.05$.

Table 4: Comparison of Knowledge Scores Between Groups

Group	Mean $\pm$ SD	t-value	p-value
Cigarette Smokers (n=406)	3.60 $\pm$ 1.17		

Vape Users (n=406)	3.76 ± 1.13	-2.018	0.044*
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Statistically significant at $p < 0.05$.

Table 5: Attitude Towards Vaping

Statement	Strongly Agree (%) 1	Agree (%) 2	Uncertain (%) 3	Disagree (%) 4	Strongly Disagree (%) 5
Vaping helps quit smoking	190 (23.4)	182 (22.4)	180 (22.2)	194 (23.9)	66 (8.1)
Allowed in public spaces	162 (20.0)	238 (29.3)	264 (32.5)	116 (14.3)	32 (3.9)
Over-promoted to youth	164 (20.2)	186 (22.9)	236 (29.1)	156 (19.2)	70 (8.6)
Vaping is a lifestyle choice	280 (34.5)	222 (27.3)	188 (23.2)	86 (10.6)	36 (4.4)
Vaping should be socially accepted	272 (33.5)	200 (24.6)	148 (18.2)	114 (14.0)	78 (9.6)

Table 6: Nicotine Dependence (PSCDS) Among Study Participants

Variable	Vape Users	Cigarette Smokers
Hard to Quit	84.3%	84.2%
Strong Cravings	64.2%	63.1%
Hard to Refrain in Restricted Places	67.2%	66.5%
Irritable When Unable to Use	53.4%	53.2%
Nervous/Anxious During Abstinence	73.5%	73.4%
Woke at Night to Use	31.9%	31.5%
Moderate–Very Strong Urges	85.8%	84.7%
Mean PSCDS Score ± SD	7.94 ± 2.93	7.31 ± 2.90

Table 7: Comparison of Mean PSCDS Scores

Group	Mean ± SD	t-value	p-value
Cigarette Smokers	7.31 ± 2.90	-2.117	0.035*
Vape Users	7.94 ± 2.93		

Statistically significant at $p < 0.05$.

Table 8: Comparison of Health Issues and Withdrawal Symptoms Between Vape Users and Cigarette Smoker

Variable	Category	Vape Users n (%)	Cigarette Smokers n (%)	χ^2	p-value
Health Issues Due to Product Use	Yes	270 (66.5)	246 (60.6)	2.81	0.094
	No	136 (33.5)	160 (39.4)		
Withdrawal Symptoms	Restlessness	185 (45.6)	167 (41.1)	2.59	0.460

	Mood Swings	118 (29.1)	113 (27.8)		
	Anxiety	96 (23.6)	109 (26.8)		
	Tremors	7 (1.7)	17 (4.2)		

Statistically significant at $p < 0.05$.

Figure Legends

Figure 1 : Demographic profiles of study participants.

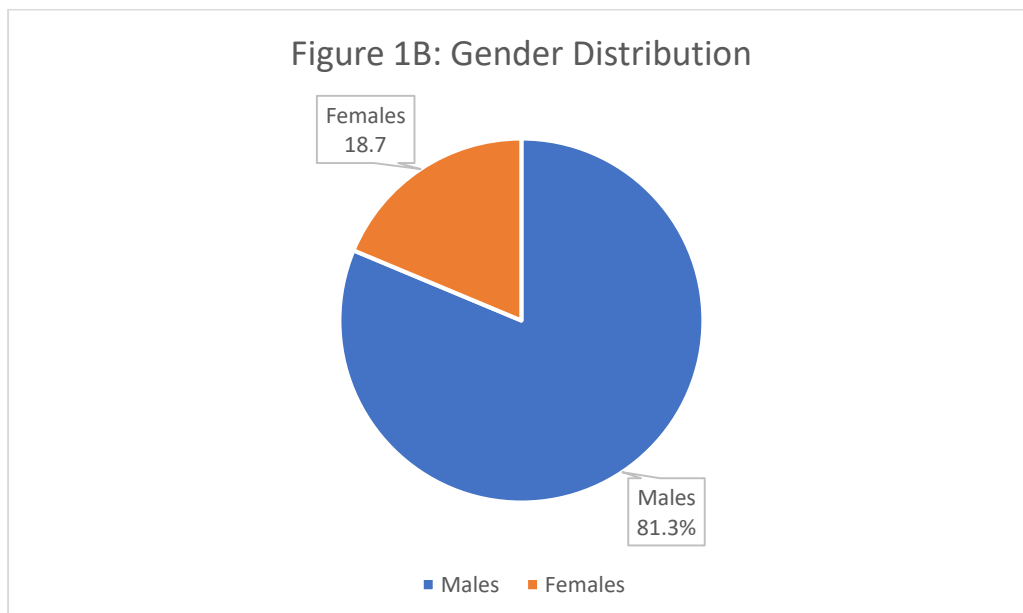
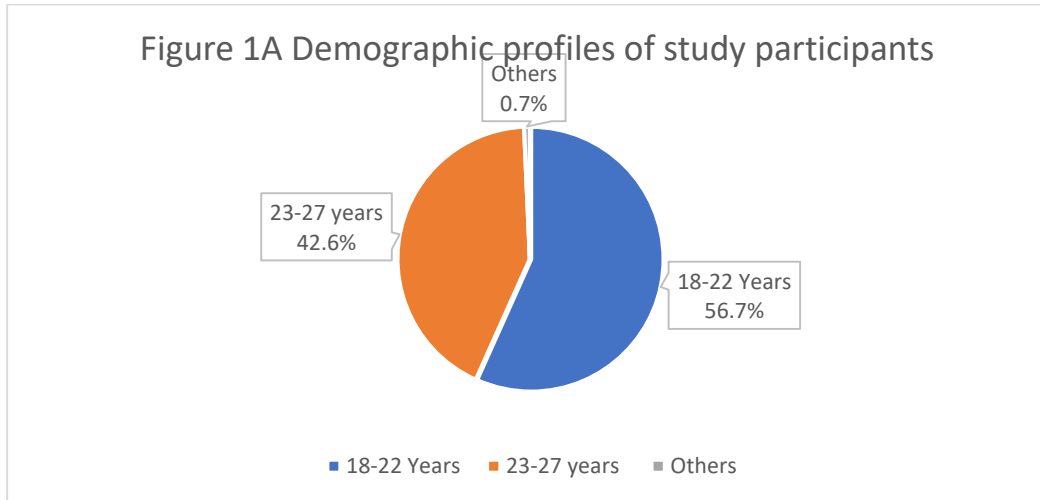


Figure 2: Substance Preference and frequency of use.

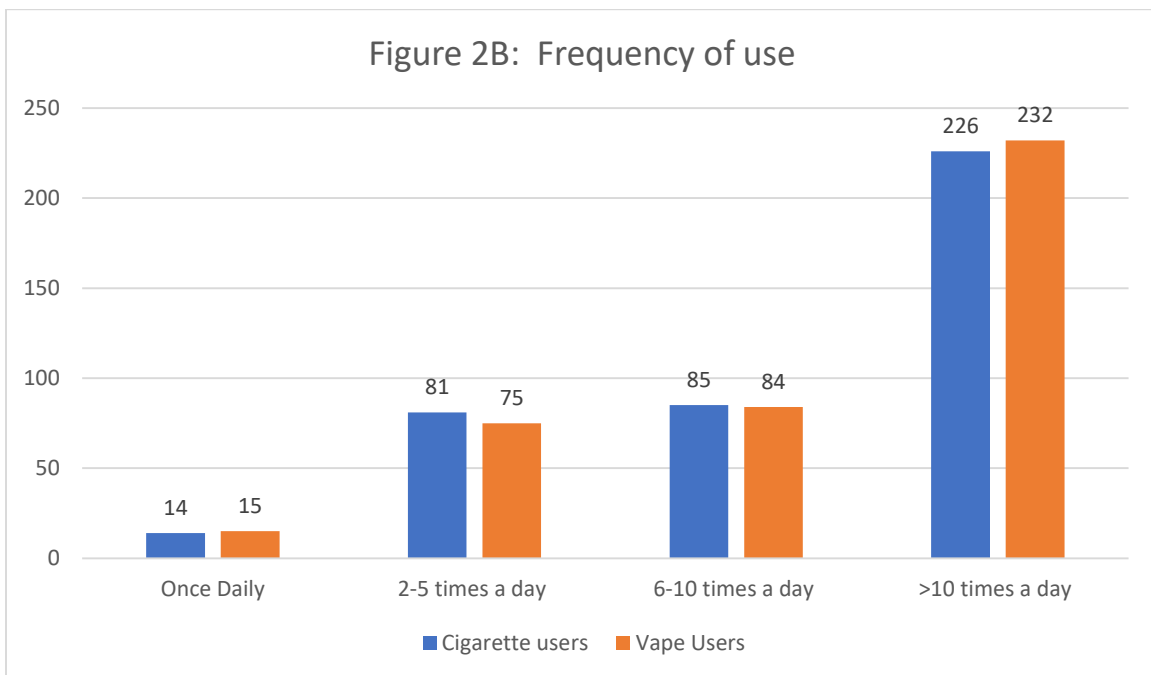
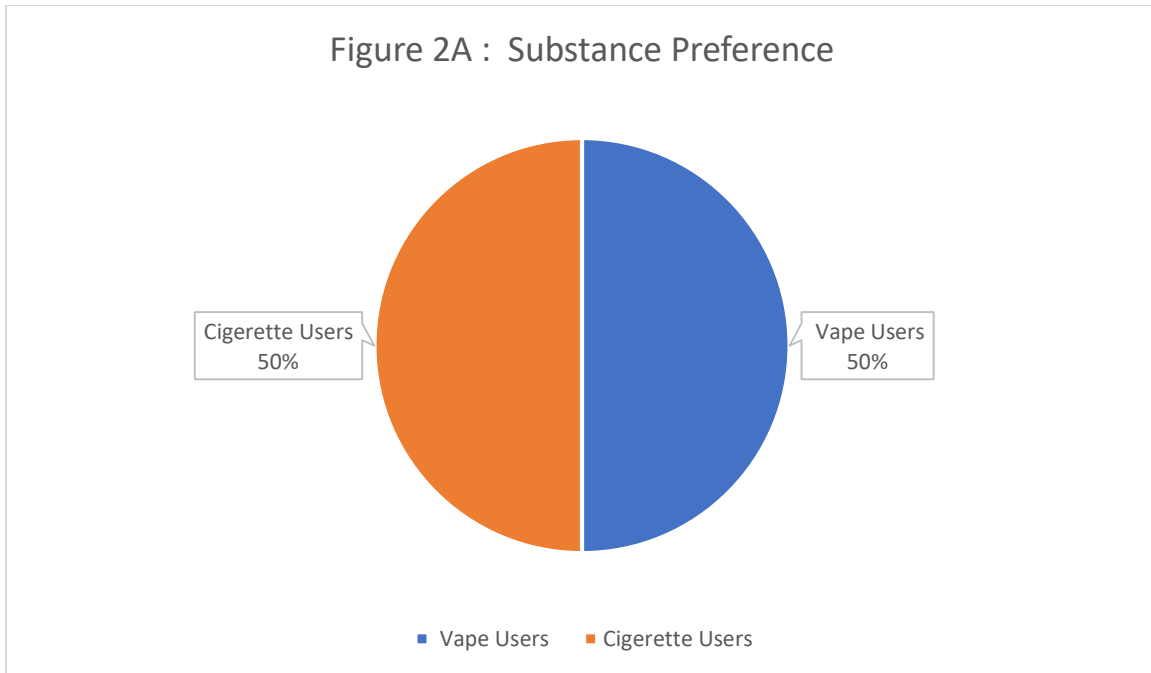


Figure 3: Initiation patterns

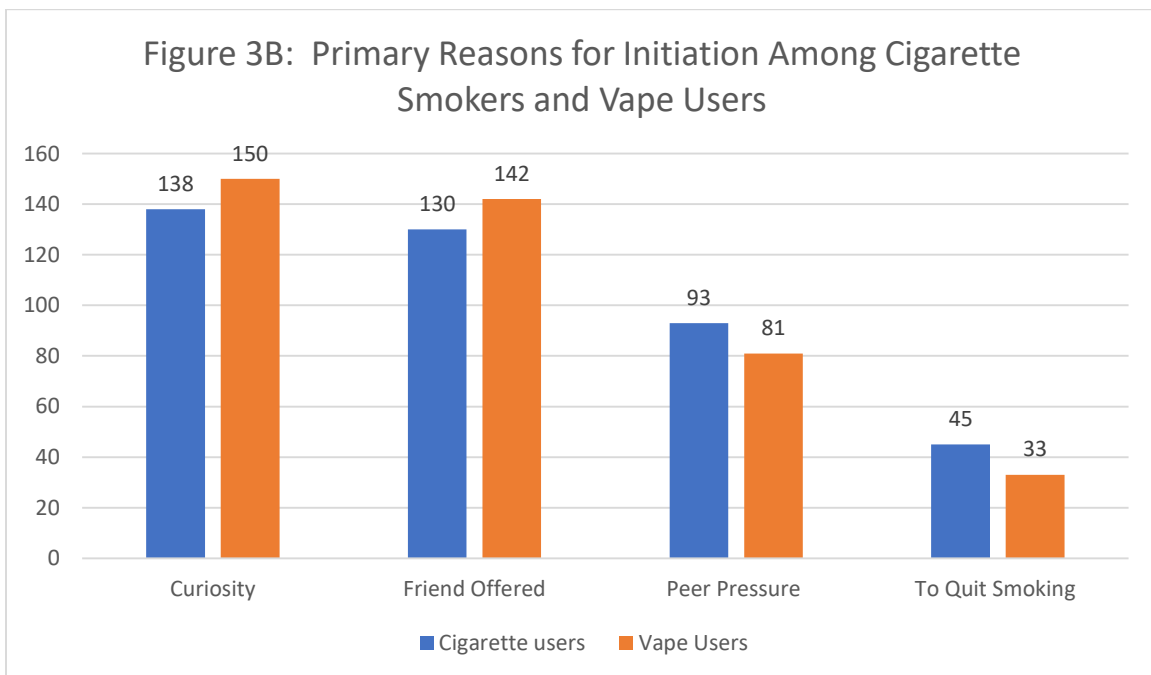
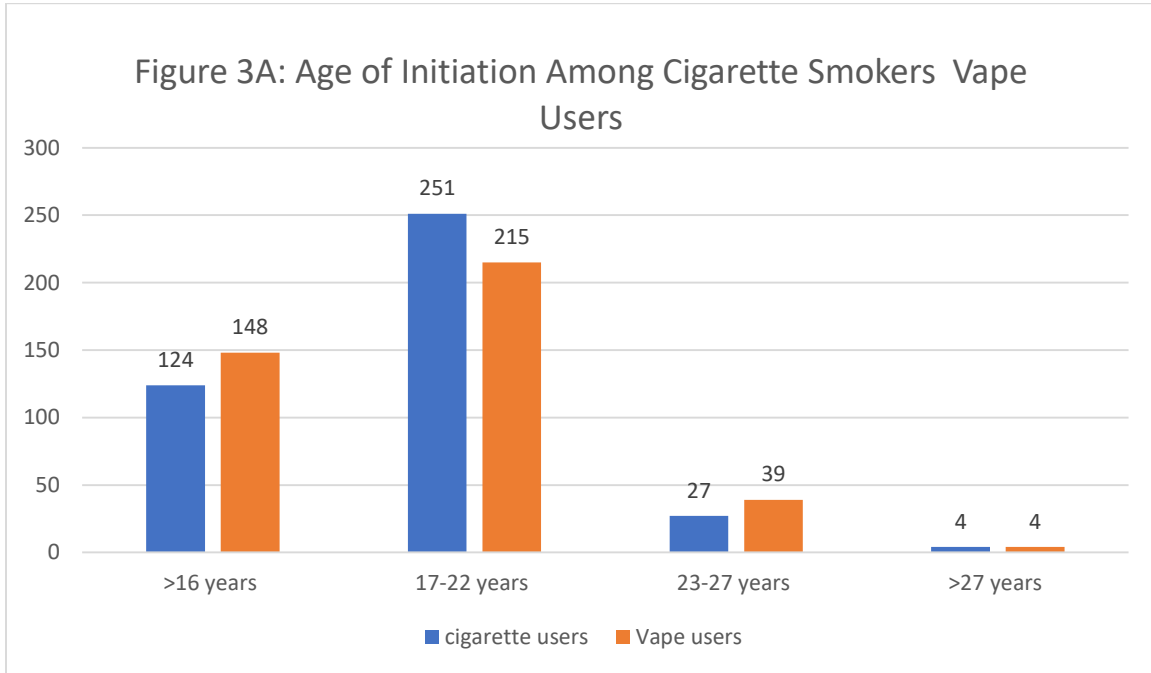


Figure 4: Knowledge about vaping and smoking

Figure 4A: Does vaping have long term Adverse side effects

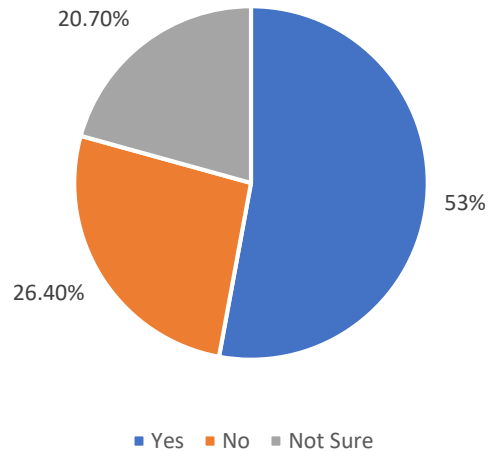


Figure 4B: Vaping vs Smoking harm Comparison

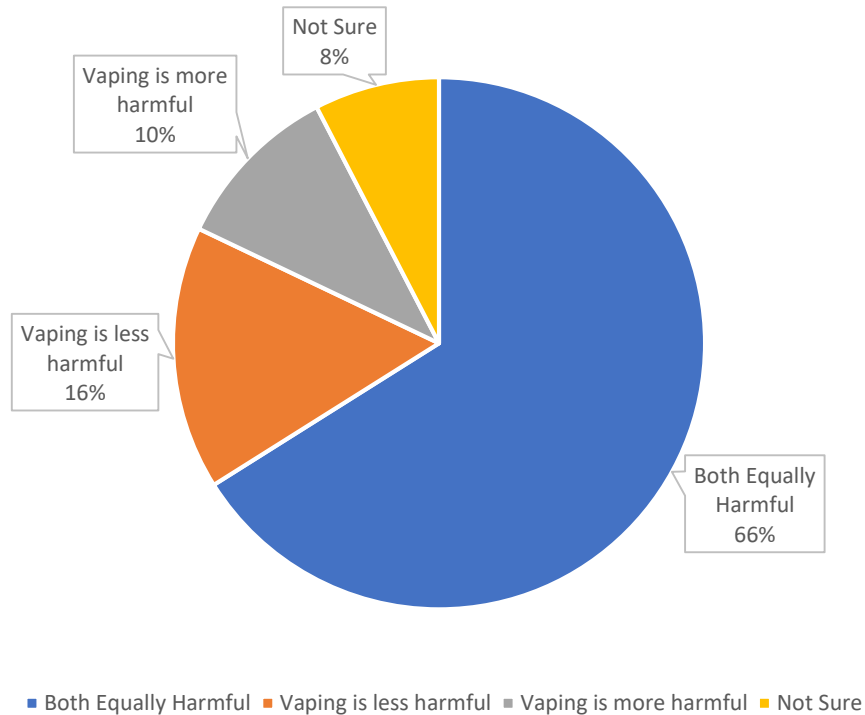


Figure 4C: Awareness of Government Regulation

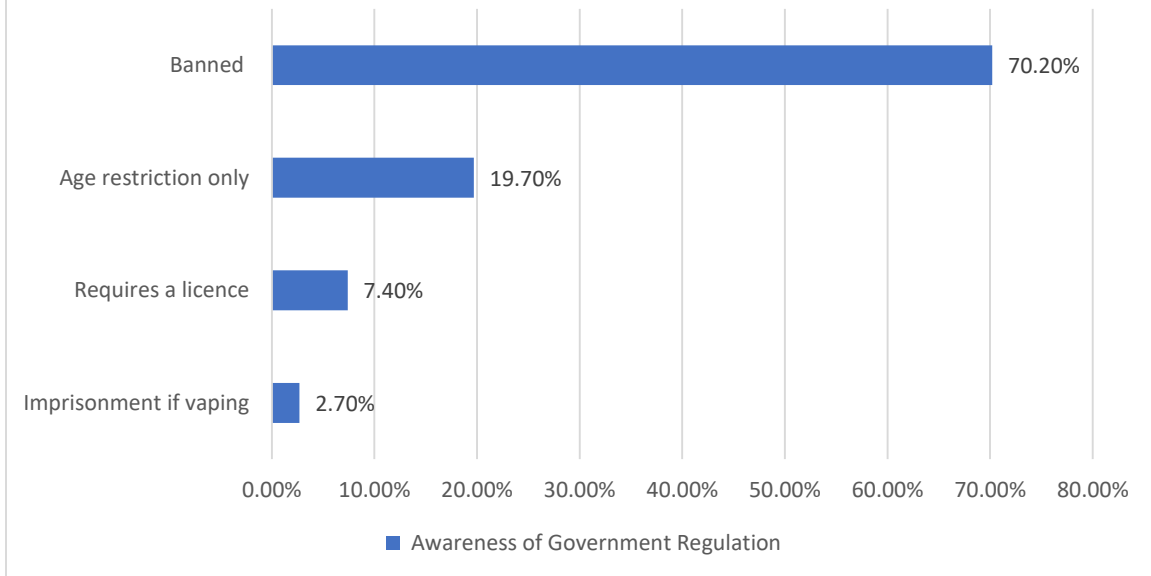


Figure 5: Attitude towards vaping

Figure 5. Attitudes Toward Vaping Among Study Participants

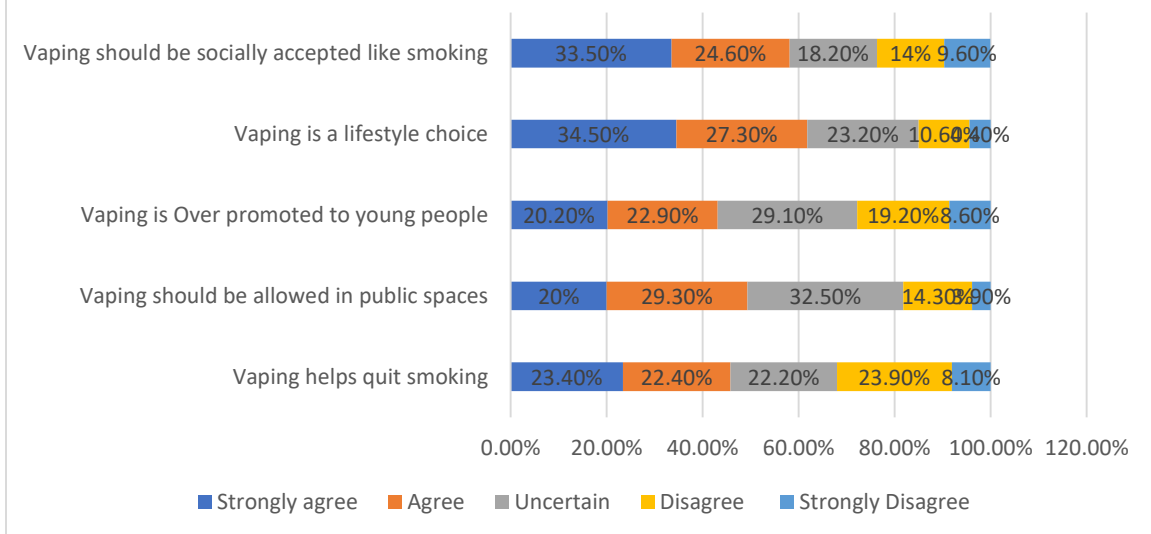


Figure 6: Health effects and withdrawal symptoms

Figure 6A:- Health issues due to smoking and vaping

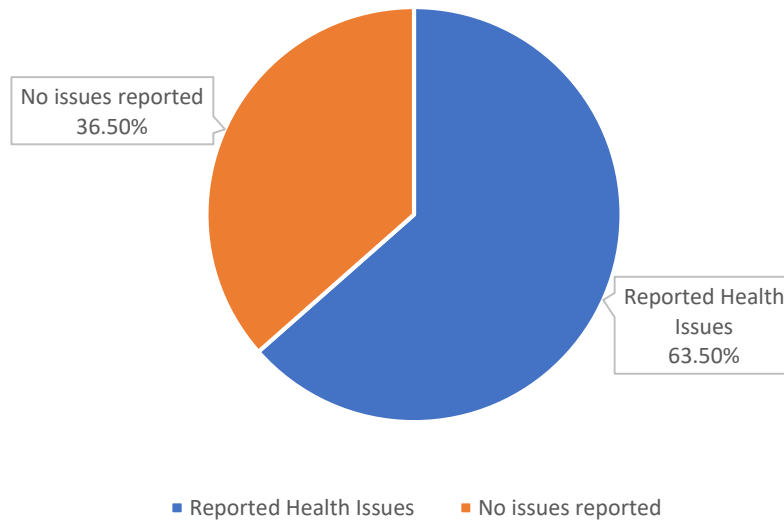


Figure 6B: Withdrawal Symptoms on abstinence

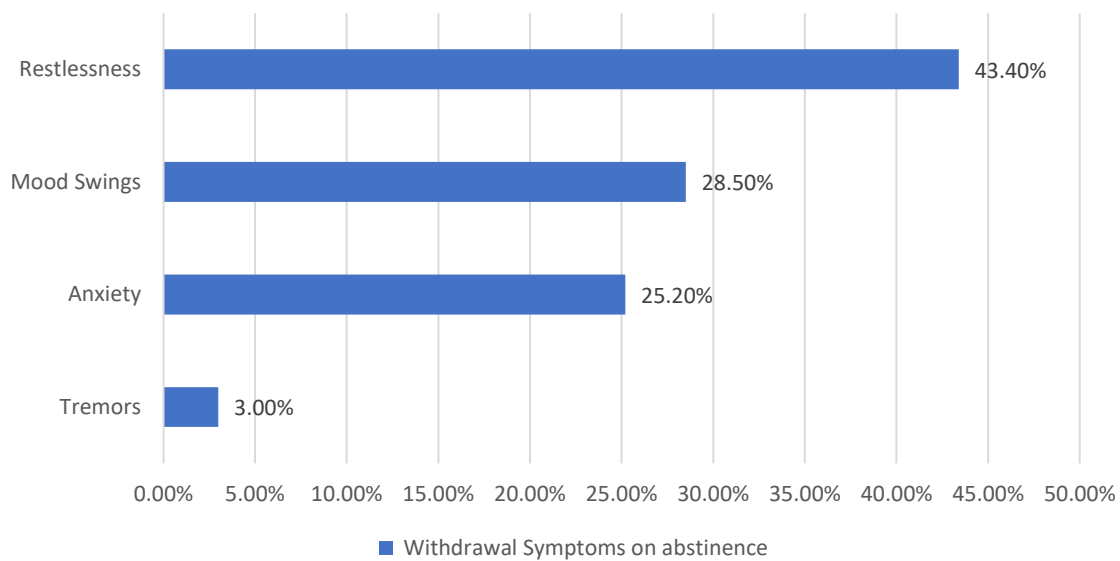
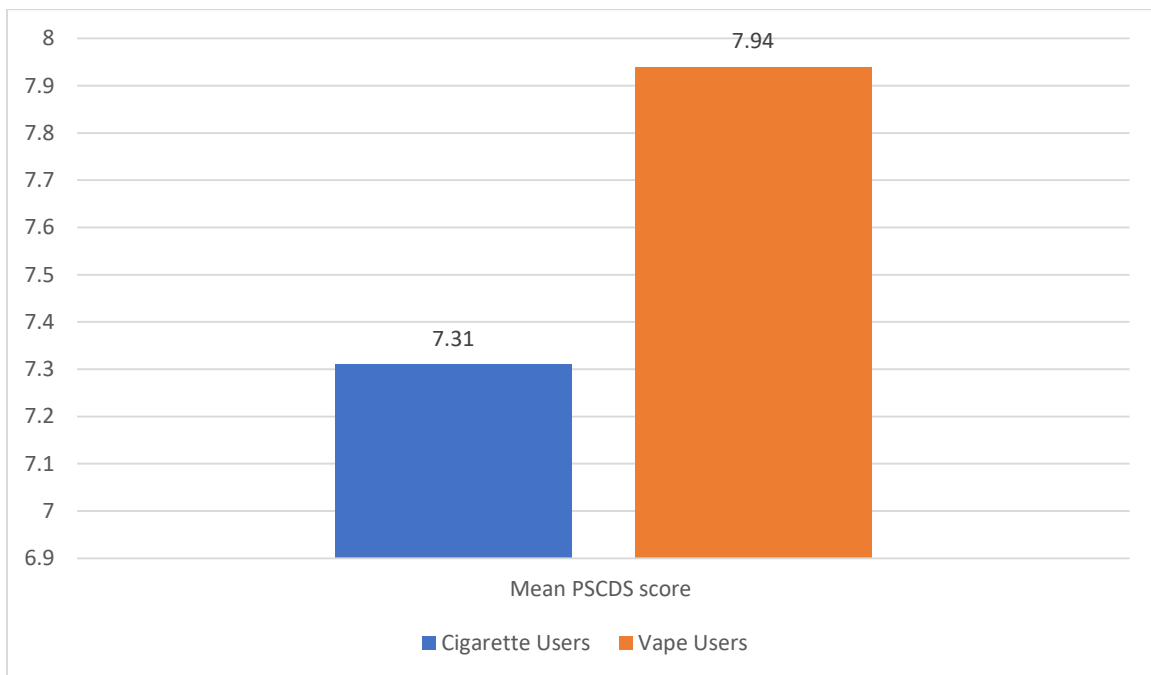
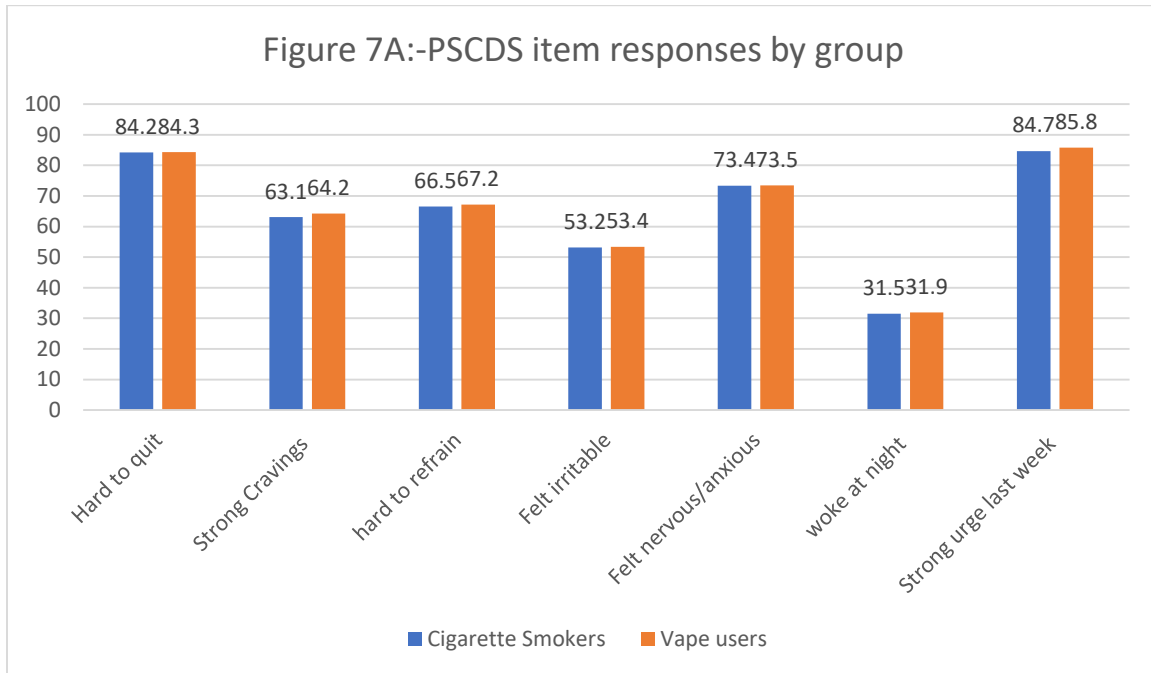


Figure 7 : Nicotine Dependence



Discussion

The present cross-sectional study assessed and compared knowledge, attitudes, usage patterns, and nicotine dependence among cigarette smokers and vape users aged 18–27 years in Maharashtra, India. The findings revealed significantly higher knowledge scores and nicotine dependence among vape users compared with cigarette smokers. Participants demonstrated mixed attitudes toward vaping across the assessed statements.

Despite relatively high awareness regarding certain aspects of vaping, substantial misconceptions regarding health risks and addiction persisted among participants.

The demographic profile of the study population demonstrated a predominance of males and young adults aged 18–22 years. These findings are consistent with previous studies reporting higher prevalence of tobacco and e-cigarette use among young males, particularly during late adolescence and early adulthood, a period characterized by experimentation and increased susceptibility to nicotine dependence.[12-14] The high proportion of participants within this age group highlights the importance of targeting young adults through tobacco-control and nicotine-prevention strategies.

One of the most concerning findings of the study was the early initiation of nicotine use. Approximately one-third of participants reported initiating smoking or vaping before the age of 17 years. Early exposure to nicotine is associated with long-term neurodevelopmental consequences and an increased risk of persistent addiction later in life. [15,16] The finding is particularly alarming given the existing prohibition on e-cigarettes in India and suggests continued accessibility of nicotine products among adolescents and young adults.

Curiosity and peer influence were identified as the primary reasons for initiation. Similar observations have been reported in previous studies, where social acceptance, peer networks, and exposure to vaping-related content on social media significantly influenced experimentation and continued use of e-cigarettes. [17,18] The growing role of digital media in shaping perceptions of vaping may contribute to normalization of nicotine use among young individuals and warrants greater regulatory attention.

Knowledge regarding vaping and smoking was variable among participants. Although a majority correctly identified that vaping is prohibited in India, misconceptions regarding long-term health effects and relative harmfulness were common. More than one-quarter of participants believed that vaping does not cause long-term adverse health effects, while a notable proportion perceived vaping as less harmful than conventional cigarette smoking. These findings are consistent with previous studies that have demonstrated widespread underestimation of the risks associated with e-cigarette use.[19,20] Such misconceptions may encourage initiation and continued use, particularly among young adults seeking alternatives to conventional cigarettes. Interestingly, vape users demonstrated significantly higher overall knowledge scores than cigarette smokers. This may be attributable to greater exposure to vaping-related information through online communities, product marketing, and social media platforms. However, higher knowledge scores did not necessarily translate into accurate risk perception, as misconceptions remained prevalent among both groups. Similar findings have been reported in previous research, indicating that awareness of e-cigarettes may coexist with inaccurate beliefs regarding their safety and addictive potential.[20,21]

Attitudes toward vaping were highly heterogeneous. Nearly half of the participants believed that vaping could assist smoking cessation, whereas others disagreed or remained uncertain. The role of e-cigarettes as smoking cessation aids remains controversial, with evidence suggesting potential benefits in specific contexts but insufficient support for widespread recommendation among young adults.[22] Furthermore, a substantial proportion of participants considered vaping a lifestyle choice and supported its social acceptance. These findings suggest increasing normalization of vaping behaviour, which may undermine ongoing tobacco-control efforts.

A key finding of the study was the significantly higher nicotine dependence observed among vape users compared with cigarette smokers. Vape users demonstrated higher mean PSCDS scores and reported greater levels of cravings and difficulty quitting. These findings challenge the common perception that vaping is less addictive than smoking. Previous studies have demonstrated that modern e-cigarette devices can deliver nicotine efficiently, producing dependence levels comparable to or even exceeding those associated with conventional cigarettes.[23,24] The high prevalence of withdrawal symptoms, including restlessness, mood swings, and anxiety, further supports the presence of substantial nicotine dependence among both groups. More than sixty percent of participants reported experiencing health-related problems associated with smoking or vaping. Although the difference between groups was not statistically significant, vape users reported slightly higher rates of health-related issues. Emerging evidence suggests that e-cigarette aerosols may adversely affect respiratory, cardiovascular, and oral health through inflammatory and oxidative mechanisms.[25] From a dental public health perspective, vaping has been associated with periodontal inflammation, disruption of the oral microbiome, and impaired oral tissue health.[26]

This study included a relatively large sample size of 812 participants, exceeding the minimum required sample size and thereby improving the precision of the findings. The inclusion of equal numbers of cigarette smokers and vape users enabled a balanced comparison between the two groups. Additionally, the use of a validated nicotine dependence instrument (Penn State Cigarette Dependence Scale) alongside a structured questionnaire provided a comprehensive assessment of knowledge, attitudes, usage patterns, and nicotine dependence among young adults, generating valuable evidence to support future tobacco-control and oral health promotion strategies in India.

The study has certain limitations. Its cross-sectional design prevents establishment of causal relationships, and the use of self-reported data may introduce reporting bias. Additionally, the study was conducted within a single geographic region using convenience sampling, which may limit generalizability. Nevertheless, the study provides valuable evidence regarding vaping and smoking behaviours among young adults in India.

Overall, the findings indicate that despite relatively higher knowledge levels among vape users, misconceptions regarding vaping remain widespread, and nicotine dependence is substantial in both groups. These results highlight the need for evidence-based educational interventions, stronger enforcement of existing regulations, and comprehensive cessation programmes targeting young adults to reduce the burden of nicotine addiction and its associated health consequences. These findings emphasize the need for strengthened enforcement of tobacco-control legislation, school- and college-based educational programmes, and targeted cessation interventions focusing on young adults.

Conclusion

This cross-sectional study of 812 young adults in Maharashtra demonstrates that vape users and cigarette smokers display comparable levels of nicotine dependence, similar knowledge gaps, and divided attitudes toward vaping. The mean PSCDS scores (vape: 7.94 ± 2.93 ; cigarettes: 7.31 ± 2.90) refute the perception of vaping as a less addictive alternative. One-third of participants initiated use before the age of 17 years, primarily due to peer influence and curiosity. Despite the national ban on e-cigarettes, these findings suggest inadequate implementation of existing regulations or continued accessibility of these products.

Persistent misconceptions about the safety of vaping, normalisation of vaping as a lifestyle choice, and high

reported rates of health-related symptoms collectively highlight the urgency of public health action. Evidence-based educational programmes targeting specific knowledge deficits, stricter enforcement of the e-cigarette ban, and accessible cessation support for young adults are essential to curbing the rising burden of nicotine-related morbidity in this vulnerable age group.

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