

## E-cigarettes: Intellect and understanding of young adult users in Pune City.

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Submitted: 25-11-2023

Accepted: 05-12-2023

**ABSTRACT: Introduction-**The use of electronic cigarettes (ECs) or vapes, also known as e-cigarette, electronic nicotine delivery system (ENDS) or vaping devices has increased over the past decade and is a timely and significant public health issue [1]. They are battery-operated devices, used to vaporize a liquid that may or may not contain nicotine. **Methodology-A**

cross-sectional questionnaire study was conducted to assess the knowledge, attitude and practices regarding the use of E-cigarettes among young adults in Pune city of Maharashtra. A pilot study was done on 21 subjects to check for the reliability and validity of the questionnaire, and to calculate the sample size. This close-ended, self-structured questionnaire was designed that complies the demographic details along with 28 questions that assessed the knowledge, attitude, awareness and practices with regards to the use of E-cigarettes. Questionnaire was circulated among E-cigarette users in Pune.

**Results-**A total of 310 participants were included in the study out of which 303 participants were aware of e-cigarettes. Among them 169 were males, while 134 were females. The majority of participants gained awareness about E-cigarettes from internet (n=125) and started the use of E-cigarettes at the age of 21. **Conclusion-**This study shows that although some users are aware of adverse effect of ECs, a good majority of users have a reduced awareness about the various side

effects and health hazards associated with smoking ECs.

### I. INTRODUCTION:

The use of electronic cigarettes (ECs) or vapes, also known as e-cigarette, electronic nicotine delivery system (ENDS) or vaping devices has increased over the past decade and is a timely and significant public health issue [1]. They are battery-operated devices, used to vaporize a liquid that may or may not contain nicotine. The main ingredients of liquids are propylene glycol, glycerol and several flavorings. A large variety of devices are available, from small cigarette-like devices consisting of a low-capacity disposable lithium battery and a prefilled atomizer (commonly called cartomizer) to new-generation high-capacity rechargeable batteries that can deliver adjustable voltage and atomizers that are able to store more liquid and can be refilled [2].

E-cigarettes were initially developed and marketed as a healthier alternative to smoking tobacco products, there is a growing body of evidence proving that their aerosols contain numerous toxicants, carcinogens, and other organic compounds produced through thermal decomposition of the solvents, although their quantity is generally lower than the ones found in conventional tobacco cigarettes[3]. In studies comparing e-cigs aerosol to tobacco smoke, lower levels (9- to 450-fold lower) of potentially toxic

compounds (e.g., formaldehyde, acetaldehyde, acrolein, and toluene)[4] but considerable levels of potential carcinogens including toxic metals (aluminum, cadmium, chromium, copper, lead, magnesium, manganese, nickel, and zinc), a number of organic compounds including carbonyls(e.g., acrolein from glycerol/glycerin), and potentially harmful compounds such as silicate beads, tin, and flavorings as well as propylene oxide (from propylene glycol) that are not present in traditional tobacco cigarettes are found in these aerosols[5,6,7,8]. Additionally, a general lack of standards in manufacturing and marketing of e-liquids has been reported [9]. Thus, a significant concern survives regarding varying purity, toxicity, and variety (e.g., flavor additives) of ingredients employed [10].

organizations like the World Health Organization and the US Food and Drug Administration prohibit the declaration of any therapeutic claims[2].The Indian Council of Medical Research, through its white paper on e-cigarettes, recommended that e-cigarettes should be completely prohibited in India; this recommendation was put forth in the interest of protecting public health and in accordance with the precautionary principle of preventing harm[11].

Therefore, the purpose of this study was to assess the characteristics of a sample of EC users in Pune City, by providing a questionnaire and by promoting the study through the internet. Since ECs are used by consumers as either partial or complete substitutes for smoking, for recreational purposes or at times due to peer pressure and need to fit in ,we sought to examine the differences in characteristics, patterns of use, side effect and effect on my ongoing systemic disease if any and awareness about the ban imposed among young adults population in Pune City.

## II. METHODOLOGY:

A cross-sectional questionnaire study was conducted to assess the knowledge, attitude and practices regarding the use of E-cigarettes among young adults in Pune city of Maharashtra. A pilot study was done on 21 subjects to check for the reliability and validity of the questionnaire, and to calculate the sample size. Reliability of questionnaire was assessed using Cronbach's alpha value that was 0.8. The sample size was calculated to be 300 using the formula  $n = Z_{\alpha/2} \times p \times (1-p) / d^2$ , where

$Z_{\alpha/2}$  - critical value of the normal distribution at  $\alpha/2$ . (at confidence level of 95%,  $\alpha$  is 0.05 and the critical value is 1.96)

d= margin of error which is 5% considered here

p= prevalence of 50% (prevalence of tobacco users among patients reporting to the outpatientdepartment)

Therefore, substituting the values in the formula,  
 $n = 1.96 \times 1.96 \times 0.50 \times 0.50 / 0.05 \times 0.05 = 270$

Considering 10% of non-responsiveness, sample size is calculated as

$N = n / 0.9 = 270 / 0.9 = 300$

This close-ended, self-structured questionnaire was designed that complies the demographic details along with 28 questions that assessed the knowledge, attitude, awareness and practices with regards to the use of E-cigarettes. Questionnaire was circulated among E-cigarette users in Pune. A brief introduction was given to the participants about the study followed by sharing the google forms via google form link. The data/ responses collected were entered in Excel spreadsheet. The data was analysed by means of statistical analysis using statistical product and service solution (SPSS) version 21 for windows. Chi square test was done to find out association of various factors with knowledge, attitude and awareness among E-cigarette smokers.

## III. RESULTS:

A total of 310 participants were included in the study out of which 303 participants were aware of e-cigarettes. Among them 169 were males, while 134 were females. The majority of participants gained awareness about E-cigarettes from internet (n=125) and started the use of E-cigarettes at the age of 21 (n=111). Most of the participants lacked awareness about the solid contents of E-cigarettes (n=212), but on the other hand were aware about the liquid composition of E-cigarettes being propylene glycol (n=125). A majority of the participants (n=101) are likely to smoke E-cigarettes after meals. 34.2 % (n=106) participants are aware about the various detrimental effects of E-cigarettes on various body systems. 57.1% (n=177) participants were aware that WHO has prohibited the declaration of any therapeutic claims with respect to E-cigarettes. The most popular tobacco product amongst the participants was considered to be conventional tobacco cigarettes or bidis (n=141). 89 (28.7%) participants considered liquid base with flavours to be the most common nicotine delivery system in use. Most of the participants (n=150) were aware about the use

of healthy vapes. Majority of the participants were aware about the ban imposed on E-cigarettes (n=170), and the punishment for violation of violation of E-cigarette law (n=167). A large proportion of the participants started smoking E-cigarettes to cope up with anxiety and stress (n=119), with conventional cigarette (n=126) like device being the most preferred mode of smoking E-cigarettes. 61.6% (n=191) participants have also reported the use of conventional cigarettes at least once in their life. 133 participants suffer from chronic health conditions, out of which 8.7% (n=27) participants reported that their condition improved after using E-cigarettes, whereas 34.2% (n=106) reported worsening of symptoms after the use of E-

cigarettes. The most common side effect associated with the use of E-cigarettes was disturbed and altered sleeping pattern (n=100). 32.6% (n=101) participants reported that they did not experience any accidents with the use of E-cigarettes, whereas 40.6% (n=123) participants reported exposure to battery. Majority of the participants last smoked an E-cigarette a month ago (n=109), with specific vape shops being the most common outlet to purchase E-cigarettes (n=129). The most effective method to quit E-cigarettes, according to the participants, were gradually decreasing its use over time (n=117) and using nicotine patches or chewing gums (n=116).

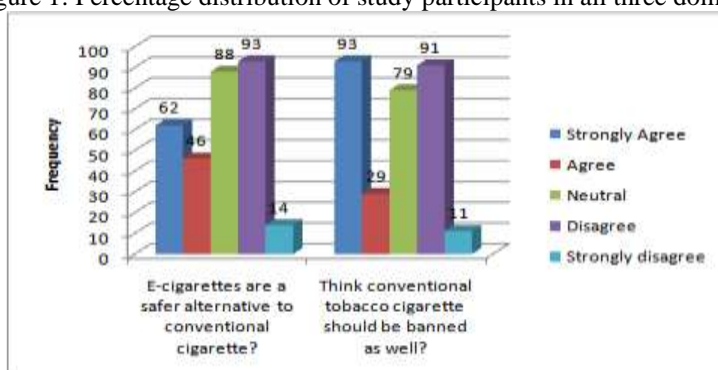
Table 1: Response analysis among participants (n=303;100%)

Item	Frequency	Percentage	
How did you come across E-cigarette or were exposed to information about it?	Family members	37	11.9
	Friends	47	15.2
	Internet/advertisement	125	40.3
	Social media	94	30.3
What are the Solid contents of E-cigarettes?	Both carcinogens and nicotine	91	29.4
	Carcinogens like propylene oxide	57	18.4
	Distilled water and flavours	58	18.7
	Only nicotine	97	31.3
What are the liquid contents of E-cigarettes?	Propylene glycol	125	40.3
	Alcohol	43	13.9
	Carbonated water	102	32.9
	None of the above	33	10.6
At what age did you start smoking E-cigarettes?	13-15 years	46	14.8
	16-18 years	93	30.0
	18-21 years	111	35.8
	Above 21 years of age	53	17.1
When are you most likely to smoke E-cigarettes?	After meals	101	32.6
	Early during the day	53	17.1
	No specific	91	29.4
	When I am with friends	58	18.7
Possible long-term consequences of using E-cigarettes?	Anxiety	63	20.3
	Asthma	82	26.5
	Cardiac	52	16.8
	All of the above	106	34.2
Are you aware that WHO has Prohibited the declaration of any therapeutic claims with respect to E-cigarettes?	Yes	177	57.1
Alternate nicotine delivery systems you are aware of?	Liquid base with flavours	89	28.7
	Pre filled cartridges	52	16.8
	Ready to use liquids	89	28.7
	All of the above	73	23.5
How many puffs of E-	03-04	59	19.0

cigarettes is equivalent to conventional tobacco cigarette?	10-12	129	41.6
	20-25	58	18.7
	Unaware	57	18.4
What is a healthy vape?	Has less nicotine content	40	12.9
	Has nicotine but no carcinogenic compound	64	20.6
	Contains vitamins or other nutrients	150	48.4
	Don't know	49	15.8
What according to you is the most popular or used tobacco products?	Cigars	74	23.9
	Conventional tobacco cigarette or bidis	141	45.5
	Dissolvable tobacco products	21	6.8
	E-cigarette	67	21.6
Aware about the ban imposed on E-cigarettes?	Yes	170	54.8
What is the Punishment for violation of E-cigarettes law?	Fine of 10,000 rupees	35	11.3
	Imprisonment of 5 years and fine up to 10 lakhs	64	20.6
	Imprisonment up to 1 year or a fine of up to 1 lakh or both for the first-time offender. Subsequent offender will attract imprisonment up to 3 years and fine up to 5 lakhs	167	53.9
	No dictated punishment	37	11.9
Which state in India was the first to ban E-cigarettes?	Gujarat	48	15.5
	Kerala	25	8.1
	Maharashtra	116	37.4
	Punjab	114	36.8
How many deaths are caused due to smoking every year?	1.35 million	91	29.4
	2 million	34	11.0
	2.5 mill	73	23.5
	4 million	105	33.9
What led you to use E-cigarettes?	For enjoyment / recreational purpose	52	16.8
	To cope with anxiety and stress	119	38.4
	To reduce or quit conventional tobacco cigarette	58	18.7
	Under peer pressure	74	23.9
Have you ever smoked conventional tobacco cigarette?	Yes	191	61.6
Preferred mode of smoking E-cigarettes?	Cigarette like device	126	40.6
	Do it yourself (buying base and refill)	42	13.5
	DTL kits (direct to lungs)	50	16.1
	Second and newer generation batteries	85	27.4

Do you suffer from any chronic illness and have seen changes in your condition after the use of E-cigarettes?	No, don't suffer from any chronic illness	135	43.5
	Unsure	35	11.3
	Yes, suffer from chronic condition and seen improvement after the use of ECs	27	8.7
	Yes, suffer from chronic condition which has become worse after the use of ECs	106	34.2
Have you experienced any side effects after using E-cigarettes?	Cough/chest pain	66	21.3
	No side effects	53	17.1
	Sleeping disorder	100	32.3
	Sore or dry throat	84	27.1
Have you experienced any accidents with the use of E-cigarettes?	No	101	32.6
	Sudden explosion of device	18	5.8
	Yes, exposed to battery explosion	123	40.6
	Yes, exposed to liquid	61	20.1
When was the last time you smoked an E-cigarette?	A month ago	109	35.2
	A week ago	93	30.0
	More than a year back	31	10.0
	Within the last week	70	22.6
According to you, which of the following is the most effective method to quit E-cigarettes?	Counselling or self-regulation	51	16.5
	Don't know	19	6.1
	Gradually decreasing its use	117	37.7
	Using nicotine patches or chewing gums	116	37.4
From where do you usually buy your E-cigarettes?	Friend/ dealer	74	23.9
	Online platform	82	26.5
	Other	18	5.8
	Specific vape shop	129	41.6
Ever noticed a warning label on E-cigarettes?	Always	33	10.6
	Never	66	21.3
	Rarely	82	26.5
	Sometimes	122	39.4

Figure 1: Percentage distribution of study participants in all three domains





A total of 310 study participants were included in the study out of which 172 were males, while 138 were females. [Table 1] Out of these 310 participants, 7 were unaware of e-cigarettes and 303 consumed and were aware of same and thus were included for further analysis. [Figure 1].

#### IV. DISCUSSION:

Electronic nicotine delivery systems (ENDS) or e-cigarettes or vape pens/vaping devices are battery powered devices which are used to smoke or 'vape'. It contains a flavored solution with varying concentrations of nicotine which is an addictive chemical found in cigarettes and other forms of tobacco products producing an aerosolized mixture of the flavored liquids and nicotine, which is inhaled by the user. Nicotine is considered as one of the most addictive substances. The potential risk of a person being addicted to it throughout life is determined by various factors like the rapidity at which it is introduced into the body, age of first exposure and the dosage administered. Nicotine addiction is established more strongly when the exposure occurs in adolescence [12].

This survey was conducted among young adults in Pune City and aims to assess the understanding and knowledge of its users.

In our study, Social media and Internet have been major contributors in popularity of E-cigarettes with 94 and 125 users claiming to have perceived about EC's through them respectively. Similarly, a study published by CDC (center for disease control and prevention) in US concluded that daily social media use was significantly associated with a higher likelihood of being susceptible to EC's use among US adolescent. Social media platforms have extensive e-cigarette-related content. This content may be user-generated, such as a person posting about e-cigarettes to their own social networking platforms, or the industry posting marketing content with themes that appeal to adolescents (eg, vape tricks) [12]. In general, e-cigarettes are portrayed positively on social media and internet as "glamorous," "healthy," and "safe".

A majority of users, 101 participants, were more likely to smoke after meals followed by 93 users who didn't adhere to any specific time for smoking. 111 participants started smoking E-cigarettes around the age of 18-21 and 93 users had started smoking as early as 16-18 years of age. A majority of participants, about 61.6% of EC users had previously or were currently smoking conventional tobacco cigarette. A small

minority, 38.4%, were subjects who were nonsmokers at the time of EC use initiation which is in contrast to the findings of a study conducted by Farsalinos et al where only 0.5% reported that they were nonsmokers at the time of EC use. [2]

Among the participants, 108 users believed EC's to be a safer alternative to conventional tobacco cigarette, 107 participants disagreed with this ideology and the rest believed both to be Equal. A similar study conducted in Manipal college of dental sciences showed that around 79.5% (31 of 39) of the participants felt that e-cigarette is safer and healthier and rather less harmful than the conventional cigarettes [13]. Out of the 307 users 170 were aware about a ban imposed on EC's and almost equal i.e. 177 participants were also aware about WHO guidelines that prohibited any therapeutic claims with respect to E-cigarettes.

The use of ENDS or e-cigarettes adversely affects almost all the human body system with impact across the life course. The cartridges used in these ENDS or e-cigarettes are filled with liquid nicotine, flavorings agents and other chemicals. A typical cartridge contains about as much nicotine as a pack of 20 regular cigarettes and can act as a source for nicotine addiction. Furthermore, the amount of nicotine and other chemicals in these products varies widely, and thus, the consumer remains unaware of the actual contents of these products they use. Studies on these nicotine solvents had shown a varied degree of release of potential carcinogens – which includes acetaldehyde, formaldehyde and acetone – depending on battery output voltage [13]. Our findings stated that a majority of users, about 97 participants think that E-cigarettes only contain nicotine followed by 91 participants who were aware that EC's contain nicotine as well as carcinogens. The liquid-vaporizing solutions also contain toxic chemicals and metals that have been demonstrated to be responsible for several serious adverse health effects, including cancers and diseases of the heart, lungs and brain. Users in this study believed only asthma (26.5%), anxiety (20.3%), cardiac (16.8%) and the rest users (34.2%) believed all the mentioned conditions to be a long-term consequence of ECs. Moreover, the flavoring agents used in e-cigarettes to attract consumers can also adversely affect the health of users due to cytotoxic effect of the flavorings in refill fluids as has been demonstrated by various studies [13].

In this study, sleeping disorder was the most common side effect experienced by users

(32.3%) followed by sore and dry throat (27.1%). This is in contrary to a study conducted in Italy by Farsalinos et al that reported that most common side effects were dry mouth and throat [2]. Additionally, a substantial number of participants, 34.2%, suffered from preexisting chronic conditions which worsened after the use of E-cigarettes whereas only 8.7% users reported that they had experienced improvement. This population is more likely to be of dual smokers (EC's as well as conventional tobacco cigarette). This finding is in contrast to the findings of Farsalinos et al which reported a substantial portion of participants (dual users) with pre-existing conditions (including respiratory diseases) that observed improvement after EC use [2]. Mishaps while vaping is also a common finding in our study where 202 participants out of 303 reported to have experience accidents with the use of E-cigarettes. Majority, 40.6%, were exposed to battery product and around 5.8% reported to have experienced sudden explosion of device. Similarly, a study conducted in Manipal college of dental sciences also reported accidents due to EC such as accidental consumption of liquid components, battery explosion leading to burns around mouth and electrical shocks from device and charger [13].

In this study, when asked about most effective method to quit or reduce the consumption of ECs, participants believed that using nicotine patches and gradually decreasing EC use overtime to be effective aids. WHO has created tools such as toll free quit lines and text messages program as support for individuals to quit ECs. Text-message based vaping cessation programs are effective in promoting abstinence among young adult e-cigarette users. A randomized control trial conducted by the Truth Initiative in the U.S. correlated 7-month quit rates (percentage of young adults who self-reported free of e-cigarettes in the last 30 days) between 1,304 participants who received the text message support and 1,284 participants who were assessment-only controls during the same period. The results showed that quit rates were 24.1% among intervention participants and 18.6% among control participants, which are statistically significantly different [14].

## V. CONCLUSION:

This study shows that although some users are aware of adverse effect of ECs, a good majority of users have a reduced awareness about the various side effects and health hazards associated with smoking ECs. Despite the Ban and healthcare

guidelines prohibition there is an increase in usage of EC's among adolescents. Lack of censoring of EC use and advertisement in social media and Internet adds to the popularity of ECs.

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