Original Research Article

Rising trend of vaping products use amongst university students of urban setting in Pakistan: a cross-sectional survey

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ABSTRACT

Background: Owing to the global rise in prevalence, influencing factors and the health risks of vaping among youth, the current research delves into the concerning surge of vaping in university students. We aim to determine the frequency of the use of vaping products (VPs), their influencing factors and effects on general health and life style among university students of Pakistan.
Methods: This cross-sectional study was conducted among 389 university students aged 18 and 35 years using non-probability convenient sampling. A self-administered, structured questionnaire was designed after through literature search.
Results: The frequency of vaping was 68.4% (266) among 389 participants. Mean age was 22.40±2.44 while 78.4% were males. Out of those 266 individuals, 60.9% were vaping for more than a year, 35.5% vape daily while 73.7% used vaping pod for vaping. 32.3% reported to feel unhealthy change after starting vaping, 55.3% had no change in sleep pattern, 25.6% admitted having breathing problems after vaping while 57.1% experienced positive effect on their mood with vaping. The students from non-medical discipline tend to vape more than medical students (p-value 0.005). Highest source of information about smoking products was friends (77.4%) followed by social media and other internet sources (58.10%).
Conclusions: VPs use is prevailing and rapidly escalating. Our finding may contribute to a better understanding of the prevalence, compelling factors and effects and may provide insight into the future interventions to combat this rising trend to ensure the well-being of young adults in Karachi, Pakistan.

Keywords: Electronic cigarettes, University students, Vaping, Vaping products, Young adults

INTRODUCTION

Vaping is the use of handheld electronic devices to vaporize heated aerosols containing a mixture of nicotine and /or glycerol, propylene glycol and flavorings which inhaled by users.[1] The national institute of drug abuse (NIDA) defines vaping related electronic products as battery-operated devices, also known as electronic cigarettes (ECs), vaping products (VPs) or electronic nicotine delivery system (ENDS) that are common use for recreational activities.[2] An increasing trend of using vaping products (VPs) among young adults nowadays, particularly university students since their emergence in 2004.[3] These VPs are generally perceived and advertised as safer alternatives for traditional combustion cigarettes (TCC) as well as to quit smoking.[3] However, most of the users are unaware of the fact that devices contains potential harmful chemicals and metals that may have adverse health outcomes.[4] Moreover, the VPs deliver nicotine at higher levels in comparison of TCC, which can elicit more addiction and consequently causing long-lasting health issues, particularly, behavioral, respiratory, cardiovascular and neurological problems.[4,5]

Globally, a number of cross-sectional surveys estimated the prevalence of vaping among university students that is imperative in order to combat this public health issue. Western countries exhibited varying levels of VPs use, ranging from 17% to 62%.[6] In Eastern European countries, studies reported 33.4%, 34.4% and 55.6% prevalence of VPs use among university students in Russia, Slovakia and Lithuania respectively.[3,7] Habib E et al. revealed 27.7% prevalence levels in a study conducted in Saudi Arabia among medical university students.[8] The global VPs market is experiencing tremendous growth in the west and southeast Asian countries India, Nepal, Bangladesh and Pakistan.[9] Pakistan is now emerging as a major VPs business hub and will reach the projected revenue of approximately 77.2 million United states Dollars (USD) by the year 2024.[9] Resent studies conducted in Pakistan on the prevalence of VPs revealed a consistent increase in use among university students aged 18 years and above and conclude 6.2%-10.1% prevalence among participants.[10,11] However, majority of the participants were not fully aware regarding the contents and their associated detrimental health effects.[9]

In Pakistan, the popularity of VPs has been on the rise since last decade. Reasons for the popularity of VPs among university students are related to their awareness level and beliefs about the associated risks. Consumers of VPs considered these devices as less additive than TCC and a helpful tool quit smoking.[3] However, the major influencing factors for initiating the VPs remains friends, social media and advertisements in most of the studies participants.[3,12] According to the Food and Drug Administration in the United States, VPs are still classified as tobacco product as it contains tobacco derived nicotine.[6] Despite the restriction from World Health Organization (WHO) for advertising and selling the VPs as minimal as possible, there is no ban on selling at government level in Pakistan.[1] Also, a lack of scientific policies at national level regarding VPs use and regulations in Pakistan at present further deteriorate the situation at public health level.[1]

The current research delves into the concerning surge of young adults vaping in Pakistan with a specific emphasis on the prevalence, the associated overall health risks and the influencing factors contributing to the rise in vaping among university students. Hence, the purpose of this research is to determine the frequency of the use of vaping products (VPs) among university level students of Pakistan, especially focusing on individuals of 18-35 years of age. Additionally, the study aims to identify the influencing factors of VPs use and their effects on general health, mood and sleep. By achieving these objectives, the research intends to contribute to a better understanding of the prevalence, compelling factors and effects of the rising trends of VPs use in this specific population group, which can inform future interventions and measures to combat the rising trend and improve the well-being of young adults in Karachi, Pakistan.

METHODS

Study design and sampling

This was a cross-sectional study conducted between 1st January and 30th June 2023 amongst university students of Karachi, Pakistan. Undergraduate (n=299) and post-graduate (n=99) university students attending two large universities (one public and private sector each) in the metropolitan city of Pakistan were recruited. Currently enrolled full-time undergraduate and post-graduate students were eligible to participate if they were: between the ages of 18 and 35 and whether they were VPs users or not. Both males and females within the specified age range were eligible. Students who were current TCC users, non-Pakistani nationals (overseas students), had part-time enrolment and who had not given written informed consent were not included in the study.

Utilizing power analysis with a desired statistical power of 0.80, a significance level of 0.05 and 50% prevalence, we calculated a sample size of 389. Furthermore, 95% confidence interval was computed to provide a range of values within which the true population parameter is likely to fall, adding an additional layer of precision to our sample size determination. The study adopted a non-probability convenient sampling technique.

Study tools

The data was collected through a self-administered, structured questionnaire consisting of mainly of closed ended questions. The questionnaire was piloted among 20 individuals and modified based on feedback. The final version was then distributed through printed materials to the targeted population. Potential participants were initially briefed about the topic beforehand and written informed consent was obtained from all study participants prior to completing the survey. A brief sociodemographic section in the questionnaire contained participant's age, gender, residence status, marital Status, household earning, study discipline and level/year of study. The subsequent questions gathered details regarding participants' self-reported vaping status, concomitant use of any other substance, sleep habits, daily activity and physical exercise status. All the collected data were de-identified in order to maintain the confidentiality of study participants and the anonymity of their data at all times.

Statistical analysis

The analysis was performed on Statistical Package for Social Sciences (SPSS) version 25. Descriptive analysis was utilized for demographic characteristics. Quantitative data were presented as mean±SD while categorical data were expressed as frequencies and percentages. The normality of continuous variable was assessed using the Kolmogorov-Smirnov test. The differences between opinion among participants was assessed using the non-parametric one sample test for all the categories.

RESULTS

A total of 389 university students participated in the study with the mean age of 22.40±2.44. After categorizing the age in equal class intervals, there was a significant difference among the groups with 73.5% aged between 21 to 25 years followed by 17.2% between 15 to 20 years (p value <0.001).

Among these 389, 78.4% were males, 56.3% were hostilites and 92.0% were unmarried. Islam was the most prevalent religion (97.4%) whereas majority (86.9%) belonged to urban areas of the country. Significant difference was observed among study disciplines and level of study, as 69.2% belonged to medical discipline while 76.9% were undergraduate students (Table 1).

Table 1: Demographics and basic characteristics of the participants (n=389).

Variables		N (%)	P value
Age (Mean±SD)	22.40±2.44		
Age (grouped) (years)	15-20	69 (17.2)	<0.001
	21-25	286 (73.5)	
	26-30	33 (8.5)	
	31-35	3 (0.8)	
Gender	Male	305 (78.4)	<0.001
	Female	84 (21.6)	
Residence	Day scholar	170 (43.7)	<0.015
	Hostelite	219 (56.3)	
Marital status	Unmarried	358 (92.0)	<0.001
	Married	29 (7.5)	
	Separated/divorced	2 (0.5)	
Religion	Islam	379 (97.4)	<0.001
	Christianity	10 (2.6)	
Household income	<100,000	157 (40.4)	<0.001
	>100,000	232 (59.6)	
Residential area	Urban	338 (86.9)	<0.001
	Rural	51 (13.1)	
Study discipline	Medical	269 (69.2)	<0.001
	Non-medical	120 (30.8)	
Level of study	Undergraduate	299 (76.9)	<0.001
	Post-graduate	90 (23.1)	

Table 2: Life style and personal habits of university students (n=389).

Variables		N (%)	P value
Sleep habits (hours)	<6	90 (23.1)	<0.001
	6-8	197 (50.6)	
	>8	102 (26.2)	
Daily activity status	Sedentary	98 (25.2)	<0.001
	Moderately active	197 (50.6)	
	Active	94 (24.2)	
Physical exercise	Never/rarely	115 (29.6)	<0.001
	Often (<4 days/week)	184 (47.3)	
	Daily	90 (23.1)	
Any addiction for substances	No	300 (77.1)	<0.001
	Yes	89 (22.9)	
Use of vaping devices	No	123 (31.6)	<0.001
	Yes	266 (68.4)	
Daily tea intake	No	199 (51.2)	0.685
	Yes	190 (48.8)	
Daily coffee intake	No	225 (57.8)	0.002
	Yes	164 (42.2)	

Table 2 explains the daily life style of participants. Half of them were used to have 6 to 8 hours of sleep and moderately active daily routine (5.06% and 50.6% respectively). 47.3% claimed to do physical exercise often (<4 days/week) as compared to never and daily categories (29.6% and 23.1%). When asked about any addiction for substance, 300 participants denied. However, 266 out of 389 (68.4%) used to vape.

Attitude and practices towards vaping is described in table 3. The results are calculated from 266 vaping positive individuals, out of whom 60.9% were vaping since more than a year while similar results were generated regarding the frequency of vaping (p value 0.710). Deemed to the vaping devices, vaping pod was the most common device to be used (n=196). However, the participants were allowed to fill more than one device. 40.6% used pens while 17.3% used heated tobacco and similar number of individuals used cigarette like device for vaping.

Those who vape, were asked about the effects of vaping. Among those 266 recipients, 57.9% declared no change in health followed by 32.3% who felt unhealthy change after starting vaping. 55.3 had a no change in sleep pattern. 25.6 said that they are experiencing breathing problems after vaping. Nevertheless, 57.1% believed that they had positive effect on their mood with vaping (Table 4). The association of vaping was also analyzed with the socio-demographic profile of the participants using chi-square test. However, no significant association was seen with any of the variables except the study discipline as students from non-medical discipline tend to vape more (78.3%; p value 0.005).

The source of information about smoking products is given in figure 1. Highest source of information was friends (77.4%) followed by social media and other internet sources (58.10%). Family, celebrity/role model influence, electronic and print media were found 33.2%, 29.89%, 28.6% and 12.6% respectively as source of information for different types of vaping products. Vape shops (5.9%) of smoking products were found least attraction that influence the participants.

Table 3: Vaping products use pattern and product preferences of the participants (n=266).

Variables		N (%)	P value
Vaping duration (year)	<1	104 (39.1)	<0.001
	>1	162 (60.9)	
Frequency of vaping	Occasionally	89 (35.5)	0.710
	Often	83 (31.2)	
	Daily	94 (35.5)	
Use of pods for vaping	No	70 (26.3)	<0.001
	Yes	196 (73.7)	
Use of pen for vaping	No	158 (59.4)	0.003
	Yes	108 (40.6)	
Use of heated tobacco	No	220 (82.7)	<0.001
	Yes	46 (17.3)	
Use of cig-like devices	No	220 (82.7)	<0.001
	Yes	46 (17.3)	
Use of other products	No	250 (94.0)	<0.001
	Yes	16 (6.0)	

Table 4: Vaping associated behavioral and health effects among participants (n=266).

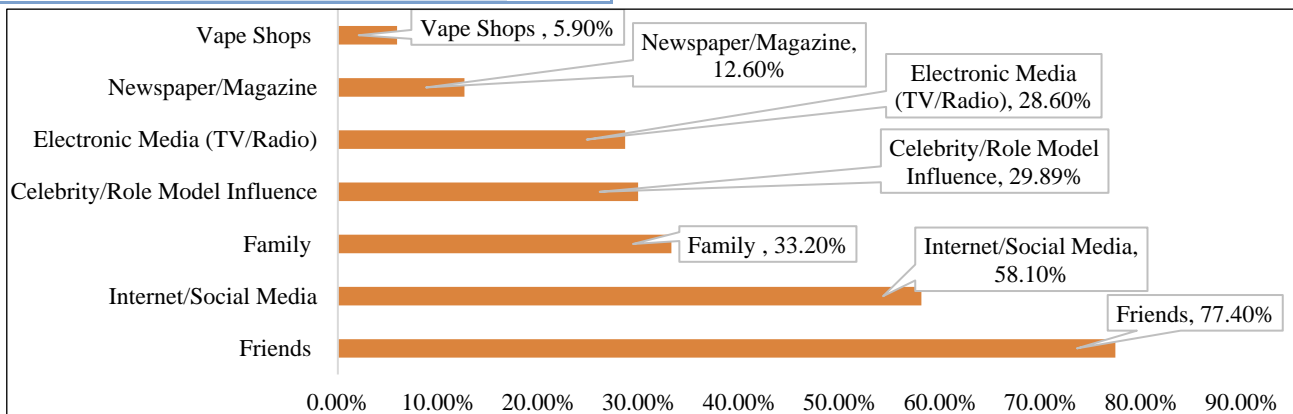| Variables		N (%)	P value
Change in health after vaping	No change	154 (57.9)	<0.001
	Healthy change	26 (9.8)	
	Unhealthy change	86 (32.3)	
Change in sleep pattern after vaping	No	147 (55.3)	<0.001
	Yes	119 (44.8)	
Breathing problems/cough	No	198 (74.4)	<0.001
	Yes	68 (25.6)	
Positive effect on mood after vaping	No	114 (42.9)	0.023
	Yes	152 (57.1)	

Figure 1: Source of vaping products information among study participants (n=398).

DISCUSSION

The use of VPs and the increasing prevalence among young university level adults presents a challenge to achieving the goal of a tobacco free generation. The current research is a leading one among few related previous studies that studied the prevalence of VPs use among university students of Pakistan. Our study provides evidence on prevalence of VPs use in Karachi; the largest city of Pakistan, that can serve as the baseline data for surveillance and evaluation activities in the country. The data shows that prevalence of current VPs use among Pakistani university students is 64.8%. This prevalence is considerably higher than what was reported in prior Pakistani study which was 6.2%.[10] On the other hand, our results are close to what was reported from a recent study conducted on a larger sample of Pakistani students that was conducted in private university in which the prevalence of VPs use was 50.4%.[11] These discrepancies in prevalence could be attributed to the difference in sample size, sampling methodology and sociodemographic characteristics. It is worth mentioning that, out of these two later studies, one was conducted among students from a single private university [11] and the second one selected 500 participants from five universities of two cities of Sindh province.[10] However, our study included students from public and private sector universities in an urban setting of a single city.

The prevalence of VPs use in our study was significantly higher than what was reported in the neighboring countries including India (23%), and China 5.8%).[13,14] Ghanim et al revealed 18.1% prevalence of VPs use among Palestinian university students.[15] This result is similar to another recent study of Palestine in which the prevalence of VPs use was 19.7%.[16] On the contrary, Awan et al reported 33.8% prevalence of VPs use in university students of Saudia Arabia.[17] Data from the other middle east countries showed lower prevalence including Qatar (14%) and Jordan (11%) than the finding of Saudian's researh.[3,18,17] However, the higher prevalence of VPs use is the remarkable findings of our study which supports the notion that VPs use is rapidly growing and gaining more popularity among the Pakistani university students.

Medical students are future doctors who will influence the health behaviors of patients and play an important role in smoking control decision-making of community by cessation counselling. Therefore, their habits and beliefs about use of VPs is heavily influenced the provision of prevention counselling. Researches have shown that medical professionals who personally smoke are less likely to provide prevention counselling to patients.[19] In the current study, 69.2% participants belong to the discipline of medicine. A study conducted in Saudia Arabia revealed 12.2% prevalence among medical students in account of vaping.[8] Turkistani et al mentioned 16.2% prevalence of VPs use in medical students.[19] Similarly, a multinational survey in medical students conducted by Degani-Costa et al found 20%, 11%, and <1% vaping prevalence in Brazil, United States and India respectively.[20] This diversity in findings could be attributed due to cultural aspects and national and public health policies among countries. Addressing the problems of vaping in this specific population is relevant to avoid the renormalization of vaping.

The different forms of VPs available in Pakistan, including pods pen device, heated tobacco, cig-alike devices, have bought more choices for vapers along with more ways for VPs manufacturers to advertise false understanding and present a greater threat to vaper's health. The most common VP our study participants used was pod (74%) followed by pen device (40.6%), heating device (17.3%) and cig-alike device (17.3%). However, Sun y et al, listed the latest top brands with the highest VPs sales were Vuse, JUUL, Elf Bars, NJOY and Breez Smoke.[21] Among all top brands, products from SMOK were classified as third-generation VPs (also referred as mods, a highly customizable aerosol-generating devices that use electronic-liquids), while other products were fourth-generation VPs (pod mods; a type of modifiable pod cartridge that use nicotine salts and available in different shapes.[21]

The rising trend of the VPs use has wide-reaching public health implications in young adults. We investigated the risk factors in terms of unhealthy change in health (2.3%) and changes in sleep pattern (44.8%) associated with the VPs use among participants which might affect their mental health and sleep quality in a long run. Whereas, the short- and long-term consequences of VPs use remain largely understudied, few researches have elucidated the association between VPs and sleep problems in young adults and linked to the mental health problems.[22] As the trend of VPs use increases, it is important to consider the potential impact on multiple domains including sufficient sleep that has been linked to optimal health and academic outcomes among university students.

In line with some previous studies showing respiratory tract problems amongst VPs users, 25.6% study participants of our study reported cough with associated breathing problems. Besides the well-known toxicities specific to nicotine, there are several harmful effects of almost all the components in VPs especially propylene glycol, vegetable glycerin.[21] Although the presence of many chemicals in abundance, VPs are potentially less harmful than TCC due to absence of inhaled carbon monoxide and less nitric oxide, aldehydes and oxidants, however, VPs are not as safe as expected.[21] Further, researches that reported less toxic effects for VPs mostly focused on short-term effects, however, the long-term effects on health of VPs remains unclear.[21,23]

Environmental factors, including friends, family, and VPs marketing through social and electronic media can influence VPs use behavior among university students. Having friends (77.4%) who use VPs were the most

significant influencing factor followed by social media (58.10%) and family (33.20%) in our study participants. This highlights the importance of social context in determining the VPs use. In line with our findings, Hrywna et al stated that VPs users were more prevalent among students who had friend using VPs compared with those who did not.[24] Family and friends' behavior significantly influence VPs use, with higher chances of usage if one's parents or friend is a vapor.[16] The risk of vaping initiation among young adults especially university students increases with the increasing popularity of social media platforms where vape shops and VPs companies aggressively marketed their products.[21] Besides marketing and promotional activities of vaping companies, vapers also uses social media platforms to share their experiences and opinions on VPs that further supports the initiation of vaping.[21]

This study has few limitations. This study targeting specific group of students and confined to one geographical region, whose vaping habits might be different from the general population and may not apply to the group who are not students. The data collected are self-reported in nature, so reporting bias may exist. Lastly, the study was cross-sectional and could not dynamically observe changes in VPs use, it was not possible to assess causal relationship.

CONCLUSION

This study concluded that VPs use is prevalent and rapidly rising among university students in Pakistan. The negative influence of friends, family members and social media was highlighted as a significant explanation of for the spread of VPs use. These findings are crucial for stakeholders like public health experts and policy makers to work beyond the scope of simply intensifying efforts to improve the young adult's awareness level about VPs use, in addition to establishing regulations on VPs availability and policies regarding its use. Also, strategies to address vaping among university students should be multifaceted, considering social and environmental factors, vaping manufacturers marketing tactics and the role of academic institutions in promoting healthy behaviors.

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