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Assessment of the Oral Health Impacts of Vaping Compared to Traditional Tobacco Use among adolescent population visiting a teaching hospital in Lucknow city, Uttar Pradesh

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ABSTRACT

Introduction: E-cigarettes deliver nicotine through aerosolized vapor, which users inhale. This method of nicotine delivery has led to perceptions of reduced harm compared to conventional smoking, and many individuals have turned to vaping as a means to quit smoking or as a perceived healthier alternative.

Aims & Objectives: The aim of this study is to assess and compare the oral health impacts of e-cigarette use (vaping) and traditional tobacco use among adolescents visiting a teaching hospital in Lucknow city, Uttar Pradesh**.**

Materials & Methods: A cross-sectional study was conducted among the participantswhich were categorized into three groups: those who used electronic cigarettes (vapers), those who used traditional tobacco products (smokers), and those who did not use any tobacco or vaping products (control group).

Results: This cross-sectional study provided comprehensive evidence that both traditional cigarette smoking and electronic cigarette use are associated with adverse oral health outcomes, although the severity is greater in traditional cigarette smokers. The analysis showed that both vapers (OR = 2.10, 95% CI = 1.45-3.03, p < 0.001) and smokers (OR = 2.45, 95% CI = 1.72-3.50, p < 0.001) had significantly higher odds of periodontal disease compared to non-users.

Conclusion: In summary, this study highlights the significant impact of smoking and vaping on periodontal health and oral mucosal lesions.

Keywords: *Vaping, Tobacco, Traditional, Oral, Health*

1. INTRODUCTION

Oral health is a crucial component of overall health and well-being, encompassing not only the prevention of oral diseases but also the maintenance of functional, aesthetic, and psychosocial aspects of the mouth and its related structures. Traditional tobacco use has long been recognized as a significant risk factor for a variety of oral health issues, including periodontal disease, oral cancer, tooth loss, and delayed wound healing.[1, 2]

In recent years, electronic cigarettes (e-cigarettes) and vaping devices have emerged as popular alternatives to traditional tobacco products. Marketed as a safer option, these devices have gained substantial traction, particularly among younger demographics.[3] E-cigarettes deliver nicotine through aerosolized vapor, which users inhale. This method of nicotine delivery

has led to perceptions of reduced harm compared to conventional smoking, and many individuals have turned to vaping as a means to quit smoking or as a perceived healthier alternative.[4]

Vaping devices come in various forms, including vape pens, mods, and pod systems, all of which function by heating a liquid (e-liquid) containing nicotine, flavorings, and other chemicals to create an aerosol. The rapid proliferation of vaping devices and the variety of flavors available have contributed to their popularity, especially among adolescents and young adults.[5]

The increasing prevalence of vaping, particularly among younger populations, has prompted public health officials and researchers to scrutinize its potential health impacts. Adolescents and young adults are particularly susceptible to the appeal of vaping due to the variety of available flavors and the perception of reduced harm compared to traditional smoking.[6] Health claims and perceptions surrounding vaping have contributed to its widespread adoption. Many users perceive e-cigarettes as a safer alternative to smoking, driven by marketing messages and anecdotal reports of reduced harm.[7]

The need for this study is underscored by several factors. Firstly, the increasing prevalence of e-cigarette use, especially among adolescents and young adults, has raised concerns about potential health consequences. Understanding the oral health impacts of vaping is essential for developing targeted public health interventions.

2. MATERIALS & METHODS

This cross-sectional study was designed to assess and compare the oral health impacts of vaping and traditional tobacco use among adolescents.The study population consisted of adults above 18 years visiting Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow, Uttar Pradesh. Participants were categorized into three groups: those who used electronic cigarettes (vapers), those who used traditional tobacco products (smokers), and those who did not use any tobacco or vaping products (control group).

Adults were classified as vapers if they reported using electronic cigarettes at least once per week for the past six months. They were considered smokers if they reported smoking traditional tobacco products (e.g., cigarettes, cigars) at least once per week for the past six months. The control group consisted of adolescents who had never used electronic cigarettes or traditional tobacco products.

Participants were asked to provide detailed information on the dosage and duration of their vaping or smoking habits. Dosage for vapers was measured by the number of puffs per session and the number of sessions per day, as well as the nicotine concentration in their e-liquids. For smokers, dosage was measured by the number of cigarettes smoked per day. Duration was recorded as the number of months or years the participant had been using either electronic cigarettes or traditional tobacco products.

Based on previous studies, the estimated p1 to be 0.40 and p2 to be 0.60. Substituting these values into the formula, the study included a sample size of approximately 200 participants per group. To account for potential non-response and incomplete data, the sample size was increased by 20%, resulting in a total of 720 participants (240 in each group).

Adults aged above 18 years& current users of either electronic cigarettes or traditional tobacco products, or non-users for the control group were included in the study. Adults with systemic diseases affecting oral health, former users of either vaping or traditional tobacco products as well as adults using both vaping and traditional tobacco products concurrently were excluded from the study.

Participants were allocated into three groups:

1. Vapers: Adults using electronic cigarettes at least once per week for the past six months.
2. Smokers: Adults using traditional tobacco products at least once per week for the past six months.
3. Control: Adults who had never used electronic cigarettes or traditional tobacco products.

Data was collected using a structured questionnaire and clinical oral examinations. The questionnaire covered demographic information, vaping or smoking habits, frequency and duration of use, oral hygiene practices, and self-reported oral health problems. Clinical oral examinations included gingival health using the Gingival Index, bleeding on probing (BoP), plaque index (PI), probing depth, attachment loss, marginal bone loss (MBL), tooth loss, and oral mucosal lesions according to the WHO 2013 Basic Oral Health Surveys. Convenience sampling method was employed for collection of data and the participation in the study was voluntary and anonymous. The collected data were analyzed using SPSS (Statistical Package for the Social Sciences) software 25.0 version.

3. RESULTS

A total of 720 participants were recruited for the study, divided equally among the three groups: 240 electronic cigarette users (vapers), 240 traditional tobacco users (smokers), and 240 non-users (control group).

In the present study, the mean age of the vaper's population was 22.5 years, with a slightly higher representation of males

(55%) than females.Among smoker's population, the mean age recorded were 23.1 SD 4.7 years with higher prevalence of males (58%) compared to females (42%). Also, non users populations have mean age of 21.9 years with higher gender predilection was seen in males (52%) than females (48%).

In terms of oral hygiene practices, a majority of participants brushed twice a day and used manual toothbrushes. Half of the participants used mouthwash regularly. However, only 40% reported regular dental visits.

The mean Gingival Index (GI) scores were compared among the three groups using One-Way ANOVA. The results indicated significant differences in gingival health among the groups(F = 25.46, p < 0.001). Post hoc tests (Tukey's HSD) revealed that both vapers (mean GI = 1.78) and smokers (mean GI = 2.03) had significantly higher GI scores compared to the control group (mean GI = 1.12), with smokers showing the highest levels of gingival inflammation. The percentage of sites with Bleeding on Probing was highest among smokers (56.2%), followed by vapers (48.7%), and lowest among non-users (29.3%).

Table 1 illustrates the mean plaque index of different groups. The mean Plaque Index (PI) scores were compared using One-Way ANOVA. The analysis showed significant differences among the groups (F - value = 30.61, p < 0.001). Post hoc tests indicated that smokers (mean PI = 2.42) had the highest plaque accumulation, followed by vapers (mean PI = 2.15), while the control group had the lowest PI scores (mean PI = 1.45).

Table 1: Plaque Index (PI)

Group	Mean PI (SD)	F-value (ANOVA)	p-value
Vapers	2.15 (0.61)		
Smokers	2.42 (0.68)	30.61	<0.001
Non-Users	1.45 (0.44)		

Table 2 showed comparison of mean probing depth among different population. The results revealed that smokers had significantly greater probing depths (mean PD = 3.87 mm) compared to both vapers (mean PD = 3.54 mm) and non-users (mean PD = 2.89 mm with p-value <0.001).

Table 2: Probing Depth

Group	Mean Probing Depth (mm, SD)	F-value (ANOVA)	p-value
Vapers	3.54 (0.82)		
Smokers	3.87 (0.91)	18.24	<0.001
Non-Users	2.89 (0.67)		

The analysis showed significant differences among the groups (F- value = 22.85, p < 0.001). Post hoc tests indicated that smokers (mean CAL = 4.32 mm) had the highest attachment loss, followed by vapers (mean CAL = 3.98 mm), and the control group had the lowest CAL (mean CAL = 3.11 mm).

Tooth loss was recorded and compared using chi-square tests. The results indicated a significant association between smoking status and tooth loss (χ^2 = 15.82, p < 0.001). Smokers had the highest prevalence of tooth loss (23.4%), followed by vapers (18.9%), and non-users (8.6%).

Table 3: Tooth Loss

Group	Percentage with Tooth Loss	Chi-square	p-value
Vapers	18.9%		
Smokers	23.4%	15.82	<0.001
Non-Users	8.6%		

The results showed a significant association between smoking status and the presence of oral mucosal lesions (χ^2 = 29.45, p < 0.001). Smokers had the highest prevalence of lesions (19.2%), followed by vapers (15.8%), and non-users (6.7%). The analysis showed that both vapers (OR = 2.10, 95% CI = 1.45-3.03, p < 0.001) and smokers (OR = 2.45, 95% CI = 1.72-3.50, p < 0.001) had significantly higher odds of periodontal disease compared to non-users.

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4. DISCUSSION

Smoking significantly impacts the oral mucosa, leading to various lesions and conditions. The chemicals in tobacco smoke, including tar, nicotine, and polycyclic aromatic hydrocarbons, act as direct irritants to the oral mucosa. Chronic exposure to these irritants causes cellular damage and promotes the development of lesions such as leukoplakia, erythroplakia, and smoker's palate. Tobacco smoke contains numerous carcinogens that can induce genetic mutations in the epithelial cells of the oral mucosa.

The mean Gingival Index scores indicated that both vapers (mean GI = 1.78) and smokers (mean GI = 2.03) had significantly higher levels of gingival inflammation compared to non-users (mean GI = 1.12). Similar findings were reported by Vora et al. who found that cigarette smokers had higher GI scores compared to non-smokers and e-cigarette users, indicating greater gingival inflammation in smokers.[8] Another study by Wadia R et al corroborated these results, showing that traditional smokers exhibited more severe gingival inflammation compared to e-cigarette users and non-smokers.[9]

The prevalence of bleeding on probing was significantly higher among smokers (56.2%) and vapers (48.7%) compared to non-users (29.3%). This aligns with the study by Lee et al., which found higher BoP percentages in cigarette smokers compared to non-smokers and e-cigarette users.[10] Similarly, Chambrone et al. reported increased BoP in smokers compared to non-smokers, indicating higher levels of periodontal inflammation in smokers.[11]

Smokers had significantly greater probing depths (mean PD = 3.87 mm) compared to both vapers (mean PD = 3.54 mm) and non-users (mean PD = 2.89 mm). These results are similar to those reported by Nociti et al., who found deeper probing depths in smokers compared to non-smokers.[12] Another study by Heasman et al. also indicated that smoking exacerbates periodontal pocket depth, leading to more severe periodontal disease.[13] The prevalence of tooth loss was highest among smokers (23.4%), followed by vapers (18.9%), and lowest in non-users (8.6%). These findings are consistent with the study by Albandar et al., which showed higher rates of tooth loss in smokers compared to non-smokers. [14] Another study by Palmer et al. also reported increased tooth loss in smokers, emphasizing the negative impact of smoking on oral health.[15]

The prevalence of oral mucosal lesions was highest in smokers (19.2%), followed by vapers (15.8%), and non-users (6.7%). This aligns with the study by Warnakulasuriya, which found a higher prevalence of oral mucosal lesions in smokers compared to non-smokers.[16] Scully and Porter also reported that smoking is a significant risk factor for the development of oral mucosal lesions.[17]

5. CONCLUSION

The results revealed that traditional cigarette smokers had the highest levels of gingival inflammation, periodontal destruction, and oral mucosal abnormalities, followed by electronic cigarette users. Smokers exhibited significantly greater probing depths, attachment loss, and marginal bone loss, reflecting more severe periodontal disease progression. The logistic regression analysis confirmed that both smokers and vapers had higher odds of periodontal disease compared to non-users, with smokers at a greater risk.

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