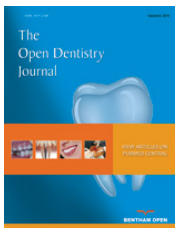

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RESEARCH ARTICLE

Association between Self-perceptions of Periodontal Health and Electronic Cigarette use in Young Adults

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Abstract:

Background:

The present study aimed to determine the association between self-perceptions of periodontal health and electronic cigarette use.

Material and Methods:

The study used an observational, analytical and cross-sectional design. 189 young adults aged 18 to 29 from the Metropolitan area of Lima, Peru, were recruited. In order to evaluate self-reported periodontal health, a questionnaire conceived by Quiroz *et al.* (2017) was used. This includes 13 questions divided into two dimensions (habits and self-perceived periodontal health). Poisson regression with robust variance was used to examine associations between qualitative variables and calculate raw and adjusted prevalence ratios.

Results:

59.46% of participants using electronic cigarettes were found to have a poor perception of gum health. Statistically significant associations were produced between poor perceptions of gum health and vaping, regarding both raw data (PR=0.81; 95% CI: 0.69-0.95; p=0.011) and data adjusted to consider covariates (PR=0.82; 95% CI: 0.69-0.97; p=0.021). No associations were observed for the dimensions of bleeding during brushing, reddish, and/or swollen gums.

Conclusion:

A relationship was found between poor perceptions of gum health and electronic cigarette use.

Keywords: Periodontal disease, Electronic cigarette, Self-report, Young adult, Vaping, Brushing.

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1. INTRODUCTION

According to the American Academy of Periodontology and the European Federation of Periodontology, good periodontal status is defined as: "The absence of inflammation of the gums and bleeding as well as the presence of a periodontium with normal or stable support without active bone resorption with physiological immunity" [1]. According to the 2016 Global Burden of Disease Study [2], periodontal disease was the eleventh most prevalent condition in the world. Likewise, 50% of adolescents and 44% of adults have calcified dental plaque, which could be a risk factor for developing gingivitis and/ or periodontitis.

Periodontal disease can be assessed clinically or through self-report questionnaires. These instruments have become valid and important tools for determining the prevalence of this condition in large populations. Additionally, self-report is often used as a screening method to detect certain diseases in individuals without signs or symptoms of the disease. Gum self-assessment and individual awareness of periodontal disease are the main issues when identifying periodontal disease [3 - 5].

Many habits can damage periodontal status. For example, it has been shown that exposure to electronic cigarette smoke can damage or induce apoptosis of epithelial cells which form

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the first line of defense. Damage can also occur to fibroblasts in the periodontal ligament, inducing increased oxidative activity within cells, which could damage DNA and harm oral health [6]. The electronic cigarette or vape is a device that contains a liquid that is first heated, then vaporized and, finally, inhaled by the user [7]. Nicotine is one of the components of electronic cigarettes. This is highly addictive and has been shown to alter the cytoskeleton and induce remodeling of the extracellular matrix in the gingival fibroblast [8, 9]. Further, it may contain flavorings and the base or additive propylene glycol is oxidized by the increase in temperature to form large concentrations of formaldehyde that irritate the periodontal tissue.

A study carried out in the United States concluded that young adults use electronic cigarettes more than other age groups, with men also being more likely to have tried electronic cigarettes on at least one occasion [10]. Currently, one in five young adults use electronic cigarettes and current consumption is projected to more than double by 2025 [11]. In Peru, the prevalence of electronic cigarette use in young adults is 12.6%, with trends also showing a constant increase [12].

Some research links vape use with the presence of periodontal disease. In 2019, an investigation using data from the Korean National Health and Nutrition Examination Survey (KHANES) gathered from 13.551 individuals concluded e-cigarette users were more likely to have periodontal disease [13].

However, an experimental *in vitro* study reported that flavorless e-cigarette aerosols are less harmful to the survival and growth of oral bacteria compared to conventional cigarette smoke, given that fewer colony-forming units are formed and biofilm formation is lower [14]. Thus, it is possible that e-cigarettes are not related to the presence of periodontal disease [6]. Controversy currently abounds due to the lack of scientific articles to have conducted in-depth evaluations. Given that discussed above, the aim of the present study was to determine the association between self-perceived periodontal health and electronic cigarette use in young adults from the Metropolitan area of Lima, Peru.

2. MATERIALS AND METHODS

2.1. Study Design

An observational, analytical and cross-sectional study design was used. The study was carried out among young adults from Metropolitan Lima in 2021.

2.2. Participants

In order to calculate sample size, proportions were compared within data gathered from a pilot test, with data pertaining to the perception of dimensions corresponding to reddish and/or swollen gums and electronic cigarette use. 17.65% of non-vaping participants stated that they never had reddish or swollen gums, whereas 42.86% of vapers reported sometimes presenting this alteration. Statistical analysis was carried out using the Epidat® version 4.2 program with a confidence level of 95%, power of 80% and a ratio of 1. The minimum required sample corresponded to 144 individuals. The final sample comprised 189 young adults aged 18 to 29. Participants were recruited *via* convenience sampling.

2.3. Inclusion and Exclusion Criteria

Young men and women aged between 18 and 29 years old who resided in Metropolitan Lima were recruited for the present study. Participants were required to be regular electronic cigarette users for at least 12 months prior to starting the research. Participants who stopped smoking during the execution of the investigation were excluded from the study. Participants had to report smoking at least one cigarette a month to be included in the study.

2.4. Ethical Considerations

The research project was approved by a research ethics subcommittee at Universidad Peruana de Ciencias Aplicadas, Lima, Peru (PI440-20). Participation was voluntary, with informed consent being provided by all participants.

2.5. Evaluation of the Periodontal Self-report Questionnaire

Self-perception of periodontal health was evaluated using the questionnaire conceived by Quiroz, *et al.* [15]. A Cronbach's alpha of 0.76 has been reported for this instrument, with this suggesting that it is acceptably reliable. Questions are divided into two dimensions (habits and periodontal health perceptions). Items pertaining to questions are either dichotomous or polytomous.

2.6. Evaluation of Electronic Cigarette use and Frequency

In order to identify electronic cigarette users, the following question was posed: "Do you use electronic cigarettes?" Yes or no responses were possible. In the case of an affirmative response, participants were posed the question: "How many times do you use an electronic cigarette each moth?". Response options were: every day, some days and never.

2.7. Covariate Evaluation

Covariates, including age, sex, place of residence, educational level, occupation, income and alcohol consumption, were recorded in line with previous research [13, 16 - 18].

2.8. Internal Validation of the Questionnaire

Internal validation of the questionnaire was carried out by an expert panel made up of five dentists from different specialties, all with at least 5 years of experience. (Appendix 2). Inter-rater agreement between the experts was calculated using Aiken's V statistic, obtaining a value of 0.99. This suggests that the questionnaire has acceptable validity.

A pilot test was carried out with 20 young adults from Metropolitan Lima to confirm that the questionnaire was easy to understand, as already suggested by the expert panel. A Cronbach's alpha of 0.68 was produced for the self-reporting of periodontal health and 0.73 for the question pertaining to "electronic cigarette use". This suggests the good reliability of the instrument. Likewise, a "test-retest" technique was

performed by calculating a Cohen's Kappa statistic for both self-reported periodontal health and cigarette use, producing values of 0.79 and 0.70, respectively. This indicates good agreement between questionnaire responses in both cases.

With regards to the selection of participants, the survey was published on different Facebook® groups open to electronic cigarette users and participants could access a link to the questionnaire using Google Forms®.

2.9. Data Analysis

Data were recorded in a Microsoft Excel®, version 2021, spreadsheet, with collected information being examined and verified. For data analysis, the statistical program Stata®. Version 16.00 was used. Descriptive measures were calculated, specifically, absolute and relative frequencies for all qualitative study variables and median and interquartile range for all quantitative variables, given that the latter were not normally distributed. In order to determine associations between qualitative variables and electronic cigarette consumption, the Chi-square test and Fisher's Exact test were conducted, where relevant. For multivariate analysis, Poisson regression with robust variance was performed for qualitative self-reported periodontal health variables, calculating prevalence ratios (PR) for crude and adjusted data (95% CI).

3. RESULTS

The present study aimed to determine the association between self-perceived periodontal health and electronic cigarette use in young adults from Metropolitan Lima in 2021. 189 individuals who met previously established inclusion and exclusion criteria were evaluated. A statistically significant association was found between electronic cigarette use and perceptions of gum health (p=0.005).

Table **1** presents the general characteristics, oral health habits and self-perceptions of periodontal health reported by participants. Regarding the overall sample, median age was 22 (24-21) years and 59.79% were male. 74 respondents of those surveyed reported electronic cigarette use (39.15%), whilst 115 reported no such use (60.85%). The majority of participants had higher education or held university degrees. With regards to habits, all respondents reported brushing their teeth and using toothpaste for oral hygiene, however, 36.92% had not visited the dentist in recent years. On the other hand, 93.3% of those surveyed had a good perception of tooth brushing. With regards to self-reported periodontal health, 80.42% of those surveyed were found to have good or very good perceptions of the state of health of their gums. 91.53% of participants stated that they "never or sometimes" presented bleeding during brushing and only 6.36% reported that their gums appeared reddish and/or swollen.

Table 1. General characteristics, oral health habits and self-perception of periodontal health (n=189).

Variable	n	%
Age*	22	(24-21)
Gender	-	-
Male	113	(59.79)
Female	76	(40.21)
Residence	-	-
South Lima	35	(18.52)
Downtown lima	127	(67.20)
North Lima	14	(7.41)
East Lima	13	(6.88)
Education level	-	-
High school	19	(10.05)
Undergraduate	26	(13.76)
University	135	(71.43)
Postgraduate	9	(4.76)
Monthly income*	7750	(13000-3000)
Alcohol status	-	-
Never	3	(1.59)
Ever	186	(98.41)
Occupation	-	-
Employer	9	(4.76)
Independent worker	52	(27.41)
Employee	36	(19.05)
Others Ψ	92	(48.68)
Electronic cigarette use	-	-
Use	-	-
Yes	74	(39.15)
No	115	(60.85)

(Table 1) contd.....

Variable	n	%
Frequency	-	-
Non-use	115	(60.85)
Some days	55	(29.10)
Everyday	19	(10.05)
Misaligned / crooked teeth	-	-
No or I don't know	115	(60.85)
Yes	74	(39.15)
Toothbrush use	-	-
Yes	189	(100)
Toothpaste use	-	-
Yes	189	(100)
Dental floss use	-	-
No	69	(36.51)
Yes	120	(63.49)
Mouthwash	-	-
No	63	(33.33)
Yes	126	(66.67)
Dental cleaning by the dentist	-	-
No or I don't know	7	(3.70)
Yes	182	(96.30)
Daily tooth brushing	-	-
Less than twice a day	12	(6.35)
Two or more times a day	177	(93.65)
Daily flossing	-	-
I don't use it or only once a week	94	(49.74)
Once a day or every time I brush	95	(50.26)
Visit to the dentist in the last year	-	-
No	66	(34.92)
Yes	123	(65.08)
Perception of tooth brushing	-	-
Regular / Bad	12	(6.35)
Good / Very good	177	(93.65)
Periodontal Health Self-Report	-	-
Perception of the state of the gums	-	-
Regular / Bad	37	(19.58)
Good / Very good	152	(80.42)
Gum bleeding during brushing	-	-
Never / Sometimes	173	(91.53)
Often / Always	16	(8.47)
Appearance of reddish and/or swollen gums	-	-
Never / Sometimes	177	(93.65)
Often / Always	12	(6.35)

Note: *Median (interquartile range)

Ψ Others: Work hand, unpaid family worker, the domestic worker

Table **2** presents general characteristics, habits and self-perceived periodontal health according to electronic cigarette use. A statistically significant difference in electronic cigarette use is observed according to gender, with 73.68% of women not engaging in such use (p=0.003). It was also found that the majority of those surveyed with postgraduate studies did not vape. Likewise, of those participants who used dental floss "once a day or every time they brushed", 65.83% were not vapers compared to 34.17% who were, although this difference was not statistically significant. As for those who had a "regular or bad" perception of tooth brushing, 58% vaped, whilst the majority of those who had visited the dentist in the last year were non-vapers (59.35%). With regards to self-reported periodontal health, of those who reported regular or poor perceptions of the state of their gums, 59.46% were smokers, who were significantly more likely to report this outcome than non-smokers (p=0.005). The majority of respondents who reported having bleeding gums "sometimes or never" during toothbrushing and having reddish and/or swollen gums did not use electronic cigarettes.

Table 2. General characteristics, habits and self-perception of periodontal health, according to electronic cigarette use in young people from Metropolitan Lima during 2021 (n=189).

Electronic Cigarette Use		**Yes N (%)**	**No N (%)**	**P-value***
General Characteristics		-	-	-
Age[β]		22 (25-21)	22 (24-21)	0.758 [u]
Gender		-	-	0.003
-	Male	54 (47.79)	59 (52.21)	-
-	Female	20 (26.32)	56 (73.68)	-
Residence		-	-	0.8028
-	South Lima	14 (40.00)	21 (60.00)	-
-	Downtown lima	48 (37.80)	79 (62.20)	-
-	North Lima	7 (50.00)	7 (50.00)	-
-	East Lima	5 (61.54)	8 (61.54)	-
Education		-	-	-
-	High school	9 (47.37)	10 (52.63)	0.830
-	Non-university higher	11 (42.31)	15 (57.69)	-
-	University higher	51 (37.78)	84 (62.22)	-
-	Postgraduate	3 (33.33)	6 (66.67)	-
Income[β]		7500(14000-2900)	7500 (12000-3500)	0.789 [u]
Occupation		-	-	0.505
-	Employer	4 (3.5)	5 (5.5)	-
-	Self-employed	24 (20.4)	28 (31.6)	-
-	Employee	11 (14.1)	25 (21.9)	-
-	Other Ψ	35 (36.0)	57 (56.0)	-
Alcohol Status				
Never consumed	0 (0.00)	3 (100.00)	0.281 [F]	-
Consumed on at least one occasion	74 (39.15)	112 (60.22)	-	-
Dental floss use				
Yes	41 (34.17)	79 (65.83)	0.064	-
-	No	33 (47.83)	36 (52.17)	-
Mouthwash use		-	-	-
-	Yes	50 (39.68)	76 (60.32)	0.833
-	No	24 (38.10)	39 (61.90)	-
Daily tooth brushing		-	-	0.372 [F]
Less than twice a day	3 (25.00)	9 (75.00)	-	-
Two or more times a day	71 (40.11)	106 (59.89)	-	-
Daily dental floss use		-	-	0.121
-	I don't use it or only once a week	42 (44.68)	52 (55.32)	-
-	Once a day or every time I brush	32 (33.68)	63 (66.32)	-
General characteristics		-	-	-
Misaligned / crooked teeth		-	-	0.547
-	No or I don't know	47 (40.87)	68 (59.13)	-
-	Yes	27 (36.49)	47 (63.51)	-
Perception of toothbrushing		-	-	0.160
-	Regular / Bad	7 (58.33)	5 (41.67)	-
-	Good / Very good	67 (37.85)	110 (62.15)	-
Professional dental cleaning		-	-	0.707 [F]
-	No or I don't know	2 (28.57)	5 (71.43)	-
-	Yes	72 (39.36)	110 (60.44)	-
Visit to the dentist in the last year		-	-	0.565
-	No or I don't know	24 (36.36)	42 (63.64)	-
-	Yes	50 (40.65)	73 (59.35)	-
Periodontal Health Self-Report		-	-	-

(Table 2) contd.....

Electronic Cigarette Use		Yes N (%)	No N (%)	P-value*
Perception of the state of the gums		-	-	0.005
-	Regular or bad	22 (59.46)	15 (40.54)	-
-	Good or very good	52 (34.21)	100 (65.79)	-
Gum bleeding during brushing		-	-	0.353
-	Never / Sometimes	66 (38.15)	107 (61.85)	-
-	Often / Always	8 (50.00)	8 (50.00)	-
Appearance of reddish and/or swollen gums		-	-	0.854
-	Never / Sometimes	69 (38.98)	108 (61.02)	-
-	Often / Always	5 (41.67)	7 (58.33)	-

Note: [F]: Fisher's exact test

*: Chi-square test

[u]: U de Mann Whitney test

[β]: Median and interquartile range

Table 3. Association of dimensions of self-perceptions of periodontal health with electronic cigarette use in young people from Metropolitan Lima during 2021 (n=189).

Poor Perception of the State of the Gums								
Crude Model[α]			**Adjusted Model[β]**					
PR	[95% CI]	p	PR	[95% CI]	p	-	-	-
Electronic cigarette use								
Yes	0.81	[0.69-0.95]	0.011	0.82	[0.69 – 0.97]	0.021	-	-
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	-	-
Gum bleeding during tooth brushing								
Electronic cigarette use								
Yes		1.55	[0.60-3.97]	0.357	1.66	[0.66-4.15]	0.273	-
No		Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	-
Appearance of reddish and/or swollen gums								
Electronic cigarette use								
Yes		1.11	[0.36-3.38]	0.854	1.05	[0.24-4.55]	0.939	-
No		Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	-

Note: [α]: Prevalence ratios (PR) produced from Poisson regression with robust variance estimator. Crude model only includes exposure variable.

[β:] Adjusted model includes the following variables: age, gender, place of residence, education, occupation, income, alcohol status, toothbrush use, toothpaste use, dental floss use, mouthwash use, prophylaxis with the dentist, daily tooth brushing, daily flossing and dentist visit in the last year.

CI: Confidence interval

Statistical significance level p<0.05

Finally, Table **3** evaluates the association of dimensions of self-perceived periodontal health electronic cigarette use. Outcomes of the Poisson regression model with robust variance reveal a statistically significant association between perceived gum health and vaping, with regards to both raw data (PR = 0.81; 95% CI: 0.69 – 0.95; p=0.011) and adjusted data (PR = 0.82; 95% CI 0.69-0.97; p = 0.021). However, no statistically significant associations were found between gum bleeding during brushing and the appearance of reddish and/or swollen gums.

4. DISCUSSION

The aim of the present study was to determine the association between self-perceptions of periodontal health and electronic cigarette use. A statistically significant association was found between poor perceptions of gum health and the use of electronic cigarettes in the young adults surveyed.

In the present study, most young people were observed to have good oral health habits. All respondents brushed their teeth and used toothpaste daily and 62% reported flossing. This is in accordance with a study carried out in Portugal in 2017 [19], which reported that 100% of young people brushed their teeth every day and the majority used dental floss, revealing good oral health habits. This may be because the young people surveyed mostly had a stable socioeconomic status and belonged to the middle class, meaning that they likely had greater purchasing power to buy oral hygiene instruments, whilst they were probably also exposed to a culture of prevention regarding general health [20. 21].

The present investigation was carried out during the COVID-19 pandemic. The frequency of electronic cigarette use corresponding to on "some days" was reported by 29% of the sample, whilst 10% reported "everyday" use. This is similar to that observed in the first confinement phase during the Italy pandemic [22]. This study showed an increase in the prevalence of electronic cigarette use due to anxiety surrounding the uncertainty caused by the state of emergency. Individuals with depression and anxiety disorders are more

likely to use electronic cigarettes since engaging in this habit provides a feeling of relief from symptoms of anguish [23]. Further, it is worth noting that there is currently a social campaign underway against conventional tobacco, potentially leading young people to replace it with vaping devices [24].

Self-report periodontal health questionnaires have been used in different populations as valid tools to assess the prevalence of periodontal disease. In 1994, self-reports used pertained to a simple questionnaire for detecting signs or symptoms of gum disease with questions such as "do your gums bleed during brushing?" or "do you have inflammation in the gums?" Authors at the time highlighted that the questionnaire could be useful in terms of monitoring gingival health [25]. Over recent years, new questionnaires have been created such as the 12-item "Periodontal Screening Score" or "PESS" which is considered a useful and accurate tool for identifying people at risk of periodontal disease [26]. Similarly, Quiroz, *et al.* [15] developed a periodontal health self-report tool in Chile for population surveillance of periodontal status. This has been validated in Spanish and cataloged as reliable with acceptable internal consistency. For this reason, it was the chosen tool in the present study.

In the present research, good perceptions of periodontal health were found in young people. This is similar to that described in the United States, where self-reported periodontal status has been associated with hygiene, probing depth and alveolar bone level in young people and adults. Here, findings were further verified using clinical and radiographic examination alongside the questionnaire [3]. In response to the present questionnaire, the majority rated their periodontal status as between 5 and 8 along a 10-point scale, with this corresponding to moderate or good perceptions of periodontal status. This may be due to the age groups evaluated as periodontal disease is related to increasing age, being a common disease in adults aged 35 to 44 and people older than 65 to 74 [27].

Only 26.32% of women used electronic cigarettes, which is comparable to that found in a study conducted by Lee, *et al.* [28]. This previous research showed that women are less likely to use electronic cigarettes compared to men. In Peru, only 6.2% of young women are smokers [29]. It should be noted that more than half of conventional smokers migrate to using electronic cigarettes to reduce harmful tobacco habits. Thus, since there is a low prevalence of women using conventional cigarettes, the prevalence is even lower when it comes to electronic cigarette use [12].

With regards to self-reported periodontal health and vape use, 59.4% used electronic cigarettes and reported having regular or poor perceptions of the health of their gums. This is in accordance with findings reported in a study conducted by Irusa *et al.* [30], which indicated that the effect of electronic cigarettes on periodontal tissue is similar to that of conventional cigarettes. This may be due to the composition of the liquid contained by electronic cigarettes. Although these devices come in many shapes, sizes and colors, all share three common components, which are a base, nicotine and flavoring. The base of the device consists of a combination of propylene glycol or glycerin which promote an acidic environment in the oral cavity and increase microbial adhesion. This is a cause for concern because much of this vapor is retained in the oral tissues causing periodontal damage. Dentists should, therefore, routinely ask patients about e-cigarette use to prevent negative consequences to oral health [31].

When evaluating gum bleeding during brushing, it was observed that the majority of both vapers (38.1%) and non-vapers (61.8%) report presenting this symptom never or sometimes. Gingiva bleeding is reduced in people who smoke conventional cigarettes because it influences the cellular, molecular and microbiological scope of periodontal tissue [32]. The presence of nicotine in electronic cigarettes and the vasoconstrictor effect it exerts in the gingival blood vessels reduces bleeding and cellular scarring, in this way, obscuring the first signs of gingivitis. For this reason, vapers may not experience bleeding and so may not present with symptoms to warn them of these changes [33].

When examining the dimensions of self-reported periodontal health and electronic cigarette use, a statistically significant relationship was found between poor perceptions of gum health and vaping, both in relation to raw data and adjusted data considering covariates. This is in accordance with previous findings that when conventional smokers migrate to the use of electronic cigarettes they experience a significant increase in inflammation, which could be reflected in poor perceptions of gum health [34]. On the other hand, the association with perceptions of reddish and/ or swollen gums was not statistically significant. This finding is in contrast with that of an experimental *in vitro* study [35], which showed that electronic cigarettes increased oxidative stress and the level of pro-inflammatory cytokines in the periodontal ligament and the gums. From this, it was concluded that electronic cigarette use could generate periodontal damage [36].The difference in outcomes could be because surveyed individuals may not have an accurate awareness of good oral health or may have incomplete perceptions of their own periodontal health. Additionally, as outcomes come from self-report measures, it is also possible that respondents misinterpret terms or experience confusion when responding to questionnaires [37]. Dental professionals need to stay informed of new evidence to advise patients of potential implications for their oral and dental health [38].

CONCLUSION

The outcomes of the present research establish the importance of recording the frequency of electronic cigarette use in patients' clinical history, as well as the need for health professionals to implement educational strategies to reduce electronic cigarette use and prevent harmful effects on general health. Likewise, it is recommended that future studies be conducted to evaluate the progression of periodontal status with prolonged electronic cigarette use and compare outcomes from self-report data with clinical evaluations.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research project was approved by a research ethics subcommittee at Universidad Peruana de Ciencias Aplicadas, Lima, Peru (PI440-20).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

All participants were involved voluntarily after providing informed consent.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the "Repositorio Académico UPC" at http://hdl.handle.net/10757/661942.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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REFERENCES

[1] Lang NP, Bartold PM. Periodontal health. J Periodontol 2018; 89(S1): S9-S16. [http://dx.doi.org/10.1002/JPER.16-0517] [PMID: 29926938]

[2] Vos T, Abajobir AA, Abate KH, *et al.* Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017; 390(10100): 1211-59. [http://dx.doi.org/10.1016/S0140-6736(17)32154-2] [PMID: 28919117]

[3] Levin L, Bechor R, Sandler V, Samorodnitzky G. Association of self-perceived periodontal status with oral hygiene, probing depth and alveolar bone level among young adults. N Y State Dent J 2011; 77(1): 29-32.

[4] Demetriou C, Ozer BU, Essau CA. Self-report questionnaires. In: Cautin RL, Lilienfeld SO, Eds. The Encyclopedia of Clinical Psychology. 1-6.

[5] Abbood HM, Hinz J, Cherukara G, Macfarlane TV, Macfarlane T. Validity of self-reported periodontal disease: A systematic review and meta-analysis. J Periodontol 2016; 87(12): 1474-83. [http://dx.doi.org/10.1902/jop.2016.160196] [PMID: 27523519]

[6] Javed F, Abduljabbar T, Vohra F, Malmstrom H, Rahman I, Romanos GE. Comparison of periodontal parameters and self-perceived oral symptoms among cigarette smokers, individuals vaping electronic cigarettes, and never-smokers. J Periodontol 2017; 88(10): 1059-65. [http://dx.doi.org/10.1902/jop.2017.170197] [PMID: 28644108]

[7] Rouabhia M. Impact of electronic cigarettes on oral health: A review. J Can Dent Assoc 2020; 86: k7. [PMID: 32543367]

[8] Robayo-González CX, Becerra N, Castro-Goyes DF. Health effects of electronic cigarettes. A review of the literature. Rev Public Health 2019; 21(1): 115-21. [http://dx.doi.org/10.15446/rsap.v21n1.77032] [PMID: 33206918]

[9] Chen IL, Todd I, Fairclough LC. Immunological and pathological effects of electronic cigarettes. Basic Clin Pharmacol Toxicol 2019; 125(3): 237-52. [http://dx.doi.org/10.1111/bcpt.13225] [PMID: 30861614]

[10] Schoenborn CA, Gindi RM. Electronic cigarette use among adults: United States, 2014. NCHS Data Brief 2015; (217): 1-8. [PMID: 26555932]

[11] Park-Lee E, Chunfeng R. Cigarette Use Among Middle and High School Students — National Youth Tobacco Survey, United States, 2021. US Department of Health and Human Services/Centers for Disease Control and Prevention 2021.

[12] Accinelli RA, Lam J, Tafur KB. The electronic cigarette: an emerging public health problem. Rev Peru Med Exp Salud Publica 2020; 37(1): 122-8. [http://dx.doi.org/10.17843/rpmesp.2020.371.4780] [PMID: 32520174]

[13] Jeong W, Choi DW, Kim YK, *et al.* Associations of electronic and conventional cigarette use with periodontal disease in South Korean adults. J Periodontol 2020; 91(1): 55-64. [http://dx.doi.org/10.1002/JPER.19-0060] [PMID: 31355936]

[14] Cuadra GA, Smith MT, Nelson JM, Loh EK, Palazzolo DL. A comparison of flavorless electronic cigarette-generated aerosol and conventional cigarette smoke on the survival and growth of common oral commensal *Streptococci.* Int J Environ Res Public Health 2019; 16(10): 1669. [http://dx.doi.org/10.3390/ijerph16101669] [PMID: 31091650]

[15] Quiroz V, Reinero D, Hernández P, Contreras J, Vernal R, Carvajal P. Development of a self-report questionnaire designed for population-based surveillance of gingivitis in adolescents: Assessment of content validity and reliability. J Appl Oral Sci 2017; 25(4): 404-11. [http://dx.doi.org/10.1590/1678-7757-2016-0511] [PMID: 28877279]

[16] ENAHO P. National Household Survey on Living Conditions and Poverty 2017. In: Household Survey, Peru. 2017.

[17] ENAHO. Permanent Employment Survey in Metropolitan Lima Mobile Quarter.

[18] ENAHO. Peru: National Household Survey 2019.

[19] Melo P, Marques S, Silva OM. Portuguese self-reported oral-hygiene habits and oral status. Int Dent J 2017; 67(3): 139-47. [http://dx.doi.org/10.1111/idj.12273] [PMID: 27981568]

[20] Hakeberg M, Wide Boman U. Self-reported oral and general health in relation to socioeconomic position. BMC Public Health 2018; 18(1): 63. [http://dx.doi.org/10.1186/s12889-017-4609-9] [PMID: 28747180]

[21] Wang L, Cheng L, Yuan B, Hong X, Hu T, Hu T. Association between socio-economic status and dental caries in elderly people in Sichuan Province, China: A cross-sectional study. BMJ Open 2017; 7(9): e016557. [http://dx.doi.org/10.1136/bmjopen-2017-016557] [PMID: 28947446]

[22] Odone A, Lugo A, Amerio A, *et al.* COVID-19 lockdown impact on lifestyle habits of Italian adults. Acta Biomed 2020; 91(9-S): 87-9. [PMID: 32701921]

[23] Li L, Borland R, O'Connor RJ, *et al.* How are self-reported physical and mental health conditions related to vaping activities among smokers and quitters: Findings from the ITC four country smoking and vaping wave 1 survey. Int J Environ Res Public Health 2019; 16(8): 1412. [http://dx.doi.org/10.3390/ijerph16081412] [PMID: 31010185]

[24] Chadi N, Hadland SE, Harris SK. Understanding the implications of the "vaping epidemic" among adolescents and young adults: A call for action. Subst Abus 2019; 40(1): 7-10. [http://dx.doi.org/10.1080/08897077.2019.1580241] [PMID: 30883295]

[25] Kailio P, Nordblad A, Croucher R, Ainamo J. Self-reported gingivitis and bleeding gums among adolescents in Helsinki. Community Dent Oral Epidemiol 1994; 22(5PT1): 277-82. [http://dx.doi.org/10.1111/j.1600-0528.1994.tb02050.x] [PMID: 7813175]

[26] Carra MC, Gueguen A, Thomas F, *et al.* Self-report assessment of severe periodontitis: Periodontal screening score development. J Clin Periodontol 2018; 45(7): 818-31. [http://dx.doi.org/10.1111/jcpe.12899] [PMID: 29611224]

[27] Nazir M, Al-Ansari A, Al-Khalifa K, Alhareky M, Gaffar B, Almas K. Global prevalence of periodontal disease and lack of its surveillance. ScientificWorldJournal 2020; 2020: 1-8. [http://dx.doi.org/10.1155/2020/2146160] [PMID: 32549797]

[28] Lee YH, Chiang T, Kwon E, Baik S, Chang YC, Chang Y. Trends and sociodemographic factors of e□cigarette use among adult daily smokers in South Korea. Int J Health Plann Manage 2020; 35(4): 960-9.

[http://dx.doi.org/10.1002/hpm.2932] [PMID: 31879984]
[29] Rojas M, Muñoz WC. Global Adolescent Tobacco Survey (GATS) 2014- Final Report. Peru: Ministry of Health of Peru 2014.
[30] Irusa KF, Vence B, Donovan T. Potential oral health effects of e□ cigarettes and vaping: A review and case reports. J Esthet Restor Dent 2020; 32(3): 260-4.
[http://dx.doi.org/10.1111/jerd.12583] [PMID: 32243711]
[31] Alvear T G, Santibáñez S L, Ramírez S V, Sepúlveda M R, Sepúlveda R. Electronic cigarettes. Can we recommend its use? Rev Chil Enferm Respir 2017; 33(2): 118-30.
[http://dx.doi.org/10.4067/s0717-73482017000200118]
[32] Rojas JP, Rojas LA, Hidalgo R. Smoking and its effect on periodontal tissues. Rev Clinic Implant periodontics rehab Oral 2014; 7(2): 108-13.
[http://dx.doi.org/10.4067/S0719-01072014000200010]
[33] Figueredo CA, Abdelhay N, Figueredo CM, Catunda R, Gibson MP. The impact of vaping on periodontitis: A systematic review. Clin Exp Dent Res 2021; 7(3): 376-84.
[http://dx.doi.org/10.1002/cre2.360] [PMID: 33274850]
[34] Wadia R, Booth V, Yap HF, Moyes DL. A pilot study of the gingival response when smokers switch from smoking to vaping. Br Dent J 2016; 221(11): 722-6.
[http://dx.doi.org/10.1038/sj.bdj.2016.914] [PMID: 27932811]
[35] Sundar IK, Javed F, Romanos GE, Rahman I. E-cigarettes and flavorings induce inflammatory and pro-senescence responses in oral epithelial cells and periodontal fibroblasts. Oncotarget 2016; 7(47): 77196-204.
[http://dx.doi.org/10.18632/oncotarget.12857] [PMID: 27791204]
[36] Atuegwu N, Perez M, Oncken C, *et al.* Association between regular electronic nicotine product use and self-reported periodontal disease status: Population assessment of tobacco and health survey. Int J Environ Res Public Health 2019; 16(7): 1263.
[http://dx.doi.org/10.3390/ijerph16071263] [PMID: 30970567]
[37] Pollock NW. Managing Bias in Research. Wilderness Environ Med 2020; 31(1): 1-2.
[http://dx.doi.org/10.1016/j.wem.2020.01.001] [PMID: 32044214]
[38] Briggs K, Bell C, Breik O. What should every dental health professional know about electronic cigarettes? Aust Dent J 2021; 66(3): 224-33.
[http://dx.doi.org/10.1111/adj.12818] [PMID: 33428774]