

Tobacco Use and Oral Health Status: A Cross-sectional Study among Commercial Motorcycle Riders in a Suburban Community in Nigeria

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ABSTRACT

Background: This study profiled the tobacco use habits among a vulnerable population, commercial motorcycle riders in Nigeria and assessed the association with their oral health status as a piece of vital information to facilitate the planning of a context-appropriate cessation program for this population.

Materials and methods: The study design was cross-sectional analytical. Multistage sampling technique was used to select 255 participants. Oral status was assessed with the simplified oral hygiene index (OHI-S), community periodontal index and treatment needs (CPITN), and gingival index. Descriptive statistics were used to summarize the participants' demographic, riding, and tobacco use behavior. Chi-square test was used to compare oral health status between the current and non-smokers. Multivariable binomial logistic regression was used to assess the oral health status associated with smoking while adjusting for demographic factors. Analysis of data was done using STATA version 17.0/SE. Statistics were done at $p < 0.05$ significance level.

Results: About 24.7% of the commercial motorcyclists were current smokers. After controlling for age and level of education, commercial motorcyclists who are current smokers are more likely to have worse CPITN scores (aOR = 3.45, $p < 0.001$), have mild gingivitis (aOR = 3.07, $p < 0.01$), have poor oral hygiene (aOR = 2.29, $p < 0.01$), and have extrinsic teeth discoloration (aOR = 6.12, $p < 0.001$) compared with non-current smokers.

Conclusion: Motorcycle riders who currently smoke have worse oral health than those who do not smoke. As a result, smoking cessation interventions should target this population in order to improve their oral health.

Keywords: Dental, Motorcycle, Oral health, Riding, Smoking, Tobacco.

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INTRODUCTION

The usage of tobacco poses one of the biggest risks to public health in history, and tobacco use is an epidemic that is rapidly spreading.¹ With the tobacco pandemic killing over 8 million people every year worldwide, it is one of the biggest threats to public health that the world has ever faced.² More than 7 million of those deaths result from direct tobacco use, while around 1.2 million are from non-smokers exposed to second-hand smoke.² About 16,100 tobacco-related deaths occur in Nigeria annually.³ Due to the nation's inadequate monitoring and surveillance systems, these numbers may be greatly underestimated.⁴

Approximately, 5.6% (4.7 million) of adult Nigerians use tobacco products currently, and 3.9% (3.1 million) smoke cigarettes.⁵ Tobacco products' increased use in Nigeria can be attributed to the fact that they serve a variety of functions, including being a surrogate currency, a means of social control, a stress reliever, and a social lubricant.⁶ Furthermore, in most of the Nigeria's rural and urban communities, smokeless tobacco is consumed in unknown amounts as part of a social gathering custom, for recreational purposes, as a "cure" for specific illnesses, and for other reasons without consideration for the possible health risks.⁷

Motorcycles and tricycles are becoming increasingly popular modes of transportation among Nigerians, particularly in recent years. The use of motorcycles as a means of public transport became famous in 1992 due to the dearth of other means of public transportation.⁸ The country's sociopolitical situation,

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which includes widespread poverty, unemployment, and political exploitation, has resulted in a dramatic increase in the need for commercial motorcycle riders.⁷ Most motorcyclists (locally known as "Okada Riders") are young, male, low-to-medium-income earners with a low educational status.⁷ According to a study conducted among commercial motorcycle riders in Southern Nigeria, a significant percentage (15.30%) consumed tobacco, with approximately 14.70% smoking cigarettes.⁹ Commercial motorcycle

riders have increasingly used tobacco products to improve their riding performance, making them a vulnerable population to tobacco use. As a result, there have been detrimental effects on people's health, endangering drivers, passengers, and other road users and creating a serious public health issue in developing countries.

Tobacco use is associated with several harmful effects that most users are unaware of.¹⁰ Tobacco use has several negative effects on oral health, including tooth and dental restoration staining, hyposmia, and the development of oral diseases, such as smokers' palate, smokers' melanosis, and coated tongue.¹¹ Tobacco use has also been linked to oral pre-cancerous lesions, oral cancer, oral candidiasis, periodontal disease, implant failure, and dental caries.^{11,12} For example, it has been implicated in the etiology of various forms of cancer, such as lung, bladder, and esophageal cancers. Moreover, it is a prevalent risk factor for a number of chronic illnesses, such as diabetes, heart disease, and respiratory issues.¹³

Despite evidence from various parts of the world showing that tobacco users generally have poor oral health,^{14–20} the effects of tobacco use on the oral health of commercial motorcycle riders, a tobacco-vulnerable population in Nigeria, have never been studied to the best of our knowledge. This cross-sectional study aimed to assess the possible relationship between tobacco use and oral health among a disproportionate tobacco population, commercial motorcyclists, in a Nigerian suburban community as a piece of vital information to facilitate planning a context-appropriate cessation program for this population. This study's objectives were to examine the possible relationship between cigarette smoking and (1) periodontal health, (2) oral hygiene status, (3) gingival health, and extrinsic teeth discoloration among commercial motorcycle riders.

MATERIALS AND METHODS

Sampling Frame, Sampling, and Sample Size

The sampling frame was from the seventeen (17) commercial motorcycle parks in the Igbo-Ora community that agreed and consented to collaborate with the study. Each frame included all the commercial motorcyclists of the respective motorcycle park. Two-stage sampling was used to select nine motorcycle parks (first stage) and 32 commercial motorcycle riders from each selected park (second stage) using simple random sampling at each stage. The sample size was calculated using Kish-Leslie Formula (1965) formula (z^2pq/e^2). We encountered an 11% non-response rate. A pilot study was done among commercial motorcycle riders in the Idere community (a neighboring community) to assess the feasibility of the study.

Study Design and Participants

This cross-sectional study was conducted among 255 commercial motorcyclists residing in the Igbo-Ora community, Ibarapa-central local government area's headquarters in Oyo State, Nigeria. Eligible participants were commercial motorcyclists aged 18 and above who lived in the community, while motorcyclists who had received any form of dental care within the last month were excluded from the study.

Ethical Approval

The study was approved by the University College Hospital/University of Ibadan Nigeria (UCH/UI) ethics committee. Permission

to conduct the study was obtained verbally from the community leaders, Local Government, and Motorcycle Park Authorities after explaining the study's objectives to them. The willing participants were educated about the research and were requested to sign the consent form.

Participation was entirely voluntary, and responses were de-identified and anonymous. Participants were compensated for their time through incentives, oral education, and referrals for free scaling and polishing.

Data Collection Procedures

Demographic and tobacco-related data were collected using the in-person interviewer-based questionnaire extracted and modified from the global adult tobacco survey (GATS), which the WHO developed for assessing tobacco use in adults.²¹ The data collection lasted 2 months. The survey questionnaire comprised 48 closed-ended questions and 5 open-ended questions. It contained demographic information, such as age, gender, level of education, religion, tribe, etc., information on tobacco use, attitude toward smoking, knowledge about tobacco, tobacco cessation, tobacco advertisement, and promotion.

An intraoral examination was conducted by four final-year dental students at the University of Ibadan, Nigeria Dental School, who have been trained and calibrated using the WHO Adult Oral Assessment Form²² to determine the oral hygiene, caries, and periodontal statuses of the participants. The participants were seated in chairs during the examination, which was conducted in daylight. The simplified oral hygiene index (OHI-S) by Greene and Vermillion,²³ gingival index by Loe and Silness,²⁴ teeth discoloration, and community periodontal index and treatment needs (CPITN) score by Ainamo²⁵ were measured and recorded for each consented participant.

Measures

The primary independent variable was smoking status. The participants were classified into two groups: Current smokers and non-smokers. A participant who has smoked 100 cigarettes in their lifetime and who smokes cigarettes daily or some days is considered a current smoker.²⁶ A non-smoker is a participant who has either not smoked up to 100 cigarettes in his or her lifetime or has smoked 100 cigarettes but quit smoking at least 30 days before our assessment.²⁶

The oral health status was the dependent variable of interest and was assessed using the OHI-S, gingival index, CPITN score, and external teeth discoloration.

Other covariates included age, gender, marital status, level of education, possession of a rider's permit, safety helmet use, and years of riding experience.

Statistical Analysis

The participants' demographic, riding, and tobacco use behavior were summarized using descriptive statistics. The Chi-square test was used to compare oral health status between the current and non-smokers. Multivariable binomial logistic regression was used to assess the association between cigarette smoking and oral health status (Model I – CPITN, Model II – Gingival score, Model III – OHI-S, and Model IV – Extrinsic Discoloration) while adjusting for age and level of education.

Analyses were done with STATA, Version 17.0 (Stata Statistical Software: College Station, TX: Stata Corp LP), and the significance level was determined using a two-sided p -value < 0.05 .

Table 1: Sociodemographic and riding characteristics of the commercial motorcycle riders

Characteristics	(n = 255)
Age (Years)	37.3 (± 9.77)
Gender	
Male	255 (100%)
Female	0 (0%)
Highest level of education	
Primary school and below	135 (53.0%)
Secondary school and higher	120 (47.1%)
Marital status	
Single/Separated/Divorce	26 (10.2%)
Married/Living with significant other	229 (89.8%)
Rider's permit or license	
Yes	130 (51.0%)
No	125 (49.0%)
Riding experience (Years)	10.34 (± 8.55)
Safety helmet	
No	158 (62.0%)
Once in a while/sometimes	89 (35.0%)
Always	8 (3.0)

RESULTS

Demographic and Riding Characteristics

We recruited 255 male commercial motorcyclists in Igbo-Ora community, Nigeria. The mean age of the commercial motorcyclists was 37.3 years (± 9.77). Around 53% of our population had a maximum of primary school education, while 47% had above primary school education, as shown in Table 1. The majority of the commercial motorcyclists (89.8%) were either married or living with significant other. About half of the participants (51.0%) had a governmental motorcycle riding license. The average recruited motorcyclist has been riding a motorcycle for 10.4 years (± 8.55). Around 62.0% of them never won a safety helmet while riding their motorcycles.

Tobacco Use

Among the participants, 24.7% were current smokers, 29.4% were former smokers, and 45.9% had never smoked cigarettes, as shown in Table 2. The participant's average age at first cigarette was 11.0 years (± 11.12), while the current smokers have been smoking for an average of 8.81 years. About 35% of commercial motorcycle riders currently take other forms of tobacco besides cigarettes, such as chewing tobacco, cigars, pipe, and snuff. Around 15.3% of the participants were dual users of tobacco.

Oral Health Status

One-third (33.3%) had a CPITN score greater than three. About 46.7% had moderate to severe gingivitis. More than 50% (51.8%) had poor OHI-S. Two-thirds (66.7%) had extrinsic discoloration of their teeth (Table 3).

Smoking and Oral Health Status

There were statistically significant differences in CPITN score, gingival index, OHI-S, and extrinsic discoloration between the current smokers and non-smokers (Table 3).

After controlling for age and level of education, commercial motorcyclists who are current smokers are more likely to have worse CPITN scores (aOR = 3.45, 95% CI = 1.84–6.45, $p < 0.001$),

Table 2: Behavioral characteristics of the commercial motorcycle riders

Characteristics	(n = 255)
Smoking prevalence	
Current smokers	63 (24.7%)
Former smokers	75 (29.4%)
Never smokers	117 (45.9%)
Current smoking status	
Current smokers	63 (24.7%)
Non-smokers	192 (75.3%)
Age at first smoke (Years)	11.0 (± 11.12)
Years since smoking (Years)	8.8 (± 11.27)
Other forms of tobacco, for example, Jedi, chewing tobacco, pipe, cigar, snuff	
Yes	88 (34.5%)
No	167 (65.5%)
Dual users ¹	39 (15.29%)

¹Dual users – Those who smoke cigarettes and also take at least one other form of tobacco

have mild gingivitis (aOR = 3.07, 95% CI = 1.62–5.79, $p < 0.01$), have poor oral hygiene (aOR = 2.29, 95% CI = 1.21–4.31, $p < 0.01$), and have extrinsic teeth discoloration (aOR = 6.12, 95% CI = 2.61–14.30, $p < 0.001$) compared with non-current smokers (Models I–IV on Table 4).

DISCUSSION

The current study found that the prevalence of smoking among commercial motorcycle riders was 24.7%, which is at least 6.5 times higher than the general population (3.6%).²⁷ This demonstrates that commercial motorcycle riders are a population who are more predisposed to smoking cigarettes and using other tobacco products due to the nature of their job. Increased biking performance and stress relief could be why this population uses tobacco more than the general population.²⁸ Furthermore, our participants' smoking rates were approximately 1.7 times higher than those reported in a similar population in another part of Nigeria in 2015.⁹ This population should receive special attention in terms of smoking cessation education and services.

The results of this study showed that smokers had periodontal disease at a higher severity than did non-smokers. About half (50.8%) of the smokers scored CPITN maximum codes 3 and 4, signifying shallow and deep periodontal pockets. Our finding was in keeping with other studies where smokers are likelier to have worse periodontal health than non-smokers.^{18–20,29–31} Smoking affects the immune response and impairs the periodontal tissue's healing capability.¹⁷ Tobacco use slows the rate at which polymorphonuclear leukocytes move, reducing the ability of oral tissues to defend against bacterial attack, resulting in poor healing and periodontal disease.¹⁷ Nicotine can also change fibroblasts' structure, preventing them from firmly attaching to the tooth root surface, resulting in attachment loss and alveolar bone loss.^{15,16}

More than 70% of the smokers in our study had mild gingivitis, keeping with the current knowledge of tobacco on the gingiva. Cigarette smoking causes nicotine-induced vasoconstriction, which can exhibit decreased vascular angiogenesis and thus masks clinical features that can be used to monitor periodontal health.^{30–32}

This study showed that current smokers are more likely to have poor oral hygiene than non-smokers. This finding mirrors that of

Table 3: Oral health status between smokers and non-smokers

Characteristics	All n = 255 (100%)	Current smokers n = 63 (24.7%)	Non-smokers n = 192 (75.3%)	p-value
CPITN score				0.001
0–2 ¹	170 (66.7%)	31 (49.21%)	139 (72.40%)	
>3 ²	85 (33.3%)	32 (50.79%)	53 (27.60%)	
Gingival index ³				0.001
Mild gingivitis (0.1–1.0)	136 (53.3%)	45 (71.43%)	91 (47.40%)	
Moderate to severe gingivitis (1.1–3.0)	119 (46.7%)	18 (28.57%)	101 (52.60%)	
OHI-S ⁴				0.015
Good/Fair (0.1–3.0)	123 (48.2%)	22 (34.92%)	101 (52.60%)	
Poor (3.1–6.0)	132 (51.8%)	41 (65.08%)	91 (47.40%)	
Extrinsic discoloration				<0.001
Present	169 (66.3%)	56 (88.89%)	113 (58.85%)	
Absent	86 (33.7%)	7 (11.11%)	79 (41.15%)	

CPITN, community periodontal index and treatment needs by ainamo; OHI-S, simplified oral hygiene index; ¹0, healthy periodontium, 1, bleeding after gentle probing, 2, calculus felt on probing or defective margin of filling or crown; ²3, pocket depth between 3.5 and 5.5 mm, 4, pocket depth more than 5.5 mm; ³by Loe and Silness; ⁴by Greene and vermillion

Table 4: Demographic and smoking status associated with oral health status among the commercial motorcyclists

Characteristics	Model I CPITN ^a	Model II gingival score ^b	Model III OHI-S ^c	Model IV extrinsic discoloration ^d
Model I				
Age (Years)	1.05 (1.02–1.09)**	1.04 (1.30–4.03)**	0.97 (0.94–1.00)	1.02 (0.99–1.05)
Highest level of education				
Primary school and below (Ref)				
Secondary school and higher	1.05 (0.57–1.91)	2.29 (0.55–2.40)	0.21 (0.11–0.38)***	0.95 (0.53–1.70)
Smoking status				
Non-current smokers (Ref)				
Current smokers	3.45 (1.84–6.45)***	3.07 (1.62–5.79)**	2.29 (1.21–4.31)**	6.12 (2.62–14.30)***

*<0.05; **<0.01; ***<0.001; aOR, adjusted odds ratio; 95% CI, 95% confidence interval; ^aReference category, 0–2 CPITN score; ^bReference category, Moderate-severe gingivitis; ^cReference category, Good/Fair OHI-S; ^dReference category, Presence of extrinsic discoloration

previous studies,^{14,33,34} where it was reported that smokers had an average OHI score that was greater than non-smokers. This can be explained by the fact that cigarette smoking causes tooth staining, which roughens the surface of the teeth and promotes faster plaque accumulation.^{35,36}

In our study, current smokers were about four times more likely than non-smokers to have externally discolored teeth. Tobacco smoke contains compounds (nicotine and tar) that can be deposited on the teeth' surface, penetrate the teeth' hard tissues, and cause tooth discoloration.³⁷ Many studies have shown a 2–4 times increase in teeth discoloration in smokers compared with non-smokers; however, an eight times increase in our population may indicate that commercial motorcycle riders consume a lot more cigarettes than the general population.^{38,39}

Our study findings are novel in terms of tobacco use and habits, as well as the associated oral health status among commercial motorcycle riders in Nigeria. The results can be used to help plan a context-appropriate cessation program for this population, as well as to improve their oral health.

Because of the cross-sectional nature of our study, establishing a cause–effect relationship between smoking and oral health status is impossible. We encountered difficulty in getting the riders to complete the questionnaires and oral examination due to the busy nature of their job. However, we overcame this by repeatedly visiting the motorcycle parks. Tobacco use was based on respondents'

self-reporting, and it is not impossible that some tobacco users may deny they consume tobacco. Thus, there might be possibility of under-reporting of smoking status which might mask the true strength of the positive relationship we observed between smoking and oral health status. Due to the quick pace of data collection and the participants' pressure to complete the oral assessments fast, there is the possibility that the oral examinations conducted for this study might not be as thorough as those conducted at dental clinics.

Further research into a large sample of commercial motorcyclists in Nigeria and different parts of the country is recommended.

CONCLUSION

Commercial motorcycle riders in Nigeria are more likely to use tobacco, particularly cigarette smoking. Motorcycle riders who currently smoke have worse oral health than those who do not smoke. As a result, smoking cessation interventions should target this population in order to improve their oral health.

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