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RESEARCH ARTICLE

Evaluation of Salivary C-Reactive Protein in Smokers with Periodontitis in Khartoum state

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Abstract

Objectives: Smoking widely affects oral health, including its role in the development of periodontitis. C - reactive protein (CRP) is an inflammatory biomarker that can be easily determined in saliva. This study was designed to assess Salivary C-Reactive protein in smokers with periodontitis.

Material and Methods: The study was a prospective cross-sectional study, conducted in Khartoum during the period from January to April 2023. One hundred participants were enrolled in this study, 50of them were cases (cigarette smokers with periodontitis), and the remaining 50 nonsmokers with healthy periodontium as the control group, saliva samples were collected for the assessment of the C reactive protein levels

Results: Smokers with periodontitis had significantly higher levels of CRP compared to the control group (7.99 ± 0.44 vs 2.38±0.07 mg/L, p=0.000). Additionally, there was no correlation between the level of CRP and the age of the patients (p=0.9, r=0.018). also, no correlation was found between the level of CRP and the duration of smoking (p=0.611, r=0.074).

Conclusion: There were significant increase in salivary C reactive protein levels among study group, no correlation between age and duration with C reactive protein level

Keywords: C-reactive protein, periodontitis, saliva, smoking

Introduction

Periodontitis, an inflammatory condition, causes the degradation of periodontal tissue, supportive structures, tooth ligament, and alveolar bone. Consequently, periodontal pockets are formed, followed by gum recession and ultimately tooth loss. This condition can impact individuals across all age groups but is particularly prevalent among adults.[1]

Smoking is widely recognized as a significant risk factor for the development and progression of periodontitis.[2] It is an unsafe behavior that has adverse impacts on oral health through multiple mechanisms. It plays a role in the onset of periodontal disease, as well as the development of cancerous and pre-cancerous lesions. Cigarette smoke contains detrimental compounds including aldehydes, carbon monoxide, oxygen, benzopyrene, and hydrogen cyanide radicals.[3]

Tobacco use leads to the death of up to 50% of smokers, resulting in an annual death count exceeding 8 million. The World Health Organization Framework Convention on Tobacco Control (WHO FCTC), endorsed by 182 nations in 2003, aims to combat the widespread tobacco epidemic.[4] Africa faces significant obstacles when it comes to tackling tobacco consumption, including diverse practices such as cigarette smoking; and other hybridized forms that are prevalent in Sudan.[5]

Saliva serves as a protective agent for the soft and hard tissues within the mouth. It is a fluid with characteristics of both liquidity and viscosity, comprising primarily of 99% water and 1% enzymes, hormones, antibodies, antimicrobial substances, and growth factors with low molecular weight. These constituents are transported from the bloodstream via diffusion mechanisms, involving active transportation. Certain substances are synthesized within the salivary glands themselves, whereas others are acquired through ultrafiltration. The composition of saliva mirrors diverse physiological processes occurring in the body.[6]

C-reactive protein (CRP) is a hepatically-produced acute-phase protein that is synthesized in response to infection and tissue injury. Its association with periodontal disease and other systemic diseases has been well-established.[7]

Saliva has emerged as a valuable biomarker for diagnosing oral health conditions, including the inflammatory condition periodontitis.[8] Inflammation is an integral component of the immune response and triggers the release of CRP into the bloodstream. Serum CRP serves as the gold standard for detecting mild inflammation.[9]

Traditionally, the diagnosis of periodontitis has relied on clinical examination and radiographic evaluation, yet these approaches may yield imprecise measurements.[10,11] Nevertheless, alterations in particular biomarkers detected in saliva can serve as valuable diagnostic instruments for evaluating periodontitis, consequently salivary CRP levels can serve as a diagnostic tool for early detection of periodontitis in smokers could lead to improved personalized treatment plans accordingly.[12]

Material and Methods

This prospective analytical cross-sectional study was conducted at the Khartoum Dental Teaching Hospital in Khartoum, Sudan, from January to April 2023.

The aim of this study was to compare the Level of salivary C Reactive Protein between smokers with periodontitis and nonsmokers without periodontitis. This research consisted of both clinical and laboratory investigations. A total of 100 participants who met the inclusion criteria and expressed interest in participating were selected from the pool of individuals.

Fifty individuals were smokers and had periodontitis (case group), whereas the control group consisted of 50 participants who had a healthy periodontium and were non-smokers. Individuals with concurrent chronic conditions such as hypertension or diabetes mellitus, as well as those taking medications, currently undergoing antimicrobial therapy, or who had received periodontal treatment within the past six months, were excluded from the study.

The study was approved by UMST Ethical committee, and before the clinical examination, participants were provided with a verbal explanation of the study's objectives and procedures. They were then requested to sign a formal consent form.

Periodontitis was characterized by a probing pocket depth ≥4 mm and a clinical attachment level of ≥2 mm. The disease stage was not factored into the analysis.

The participants received specific instructions prior to collecting unstimulated whole saliva for analysis. They were instructed to wait for at least 30 minutes after consuming food, beverages, tobacco, or chewing gum. Following this waiting period, they were instructed to rinse their mouth with water multiple times and wait for 1-2 minutes until the water became clear before proceeding with saliva collection (between 8.00 a.m. and 11.00 a.m.). In order to remove any cellular debris, the samples were centrifuged

at 3000 rpm for 5 minutes. The resulting supernatant was cautiously transferred into a new Eppendorf tube, properly labeled, and then stored at a temperature of -20°C until CRP analysis was performed.

Salivary CRP analysis was conducted on an automated analyzer (TOSHIBA, TBA-120FR) using reagent kits provided by AGAPPE. The analysis procedure strictly adhered to the instructions provided by the manufacturer.

The data was entered and organized in a Microsoft Office Excel 2010 spreadsheet. The Statistical Package for the Social Sciences software (version 22.0; IBM SPSS Inc.) was used for analysis. The information collected from the questionnaire was coded as variables. The normality of the data was tested using the Kolmogorov-Smirnov test. Descriptive and inferential statistics, including analysis of independent variables, were then conducted.

Results

A total of 100 participants were included in the study, with a mean age of (36±7.9) years for the case group and (35±8) years for the control group. **Table 1**

The mean salivary C- Reactive Protein was significantly higher in the cases group (7.99 ±0.04 mg/L) compared to the control group (2.38±0.07 mg/L), with a p<0.001. **Table 2**

There was a weak positive correlation between the salivary CRP level and the age of the participants (r=-0.018). However, this correlation was found to be statistically insignificant (p=0.9). **Table 3**

Also, there was a weak positive correlation between salivary CRP level and duration of use (r=0.074). However, the correlation was not statistically insignificant (p=0.611) as presented in **Table 3**

Table 1. Distribution of the study group according to age (case vs. control), n=100

Age	Mean ± SD	Minimum	Maximum	p
Case (n=50)	36 ± 7.9	22	52	0.207
Control (n=50)	35 ± 8.0	19	49	

Table 2. Mean difference of CRP level among case and control group, Independent t-test, n=100

Study population	CRP (mg/L)		p
	Mean	SD	
Case group (n=50)	7.99	0.04	<0.001
Control group (n=50)	2.38	0.07	

Table 3. Correlations between CRP level and Age, duration, Pearson's correlation, n=50

Correlation		Age	Duration
CRP	N	50	50
	Correlation coefficient (r)	0.018	0.074
	P	0.9	0.611
	Strength	Weak	Weak
	Direction	Positive	Positive

Discussion

Proteins present in saliva play a critical role in the body's natural defense mechanisms against diseases.[13]

Cigarette Smoking is widely recognized as major risk factor for periodontal disease.[14] The concept that saliva can offer valuable information regarding the general well-being of the body remains substantiated. The evaluation of salivary CRP levels in smokers with periodontitis provides direct evidence regarding the association between systemic inflammation (as indicated by CRP) and oral health conditions. This highlights the importance of considering systemic factors when diagnosing and managing periodontal diseases in smokers.[15] Therefore, the aim of study was to explore a potential biomarker for assessing inflammation and disease in Smokers with Periodontitis.

The current study revealed a significant increase in salivary C Reactive Protein level in case group when compared to control group (7.99 ±0.04 mg/L, 2.38±0.07 mg/L) with p value <0.001. This finding supports the conclusions of a previous study by Hadžić Z,[8] who concluded that salivary CRP can serve as a reliable alternative to plasma CRP for diagnosing periodontitis. Additionally, this finding aligns with the study conducted by Aghila.[16]

Smoking initiates the early stages of inflammation in the body. it is likely related to the absorption of nicotine and the effects of reactive oxygen species present in cigarettes, which attract and activate neutrophils. and the rise in inflammatory biomarkers is attributed to modifications in redox homeostasis, metabolic pathways, and the antioxidant system.[17,18]

Moreover, the study revealed that there is weak positive, but statistically not significant, correlation between salivary C reactive protein levels and age of patients, confirming the findings of a study conducted by Hussein B.[1]

Also, the study showed insignificant weak positive correlation between salivary c reactive protein and or the duration of smoking. This finding corresponds with a study conducted by Hussein B.[1]

The study has limitations, such as a short duration, and the absence some data as stage of periodontitis, frequency of smoking/day. We suggest developing programs to educate the community about the impact of smoking on oral health. Additionally, it is important to manipulate salivary biomarkers for the early detection and monitoring of chronic periodontitis. Furthermore, it is recommended to conduct additional studies that assess a broader range of salivary biomarkers.

Conclusion

In conclusion, the study revealed a significant increase in salivary C Reactive Protein Levels in individuals who smoke and have periodontitis. Neither duration of smoking, nor the age of patients were found to be linked to salivary CRP levels.

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Conflicts of Interest

The authors have no conflicts of interest to declare.

Authors' Contributions

Conceptualization, H.A. and A.S.; Methodology, A.S.; Software, H.A.; Validation, H.A., and A.S.; Formal Analysis, H.A.; Investigation, H.A.; Resources, A.S.; Data Curation, H.A.; Writing – Original Draft Preparation, A.S.; Writing – Review & Editing, H.A.; Visualization, H.A.; Supervision, H.A.; Project Administration, H.A.; Funding Acquisition, A.S.

Ethics statement

The study was approved by the ethical committees of the University of Medical Sciences and Technology (UMST) (No. UMST/EG23/12/2022). Informed consents were obtained from all participants, and approval was granted by the hospital administration through the office of the medical director. Participants were verbally approved

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