

ORIGINAL RESEARCH

Evaluation Of Status Of Salivary Copper Levels In Patients With Oral Leukoplakia

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ABSTRACT

Objective: This study is aimed to assess the salivary copper levels in patients with oral leukoplakia and explore its potential diagnostic value for premalignant oral lesions. **Materials and Methods:** A total of 50 participants were enrolled, including 25 healthy individuals (control group) and 25 individuals diagnosed with oral leukoplakia (case group). Salivary samples were collected, and copper levels were measured. The participants were categorized based on age and gender. Statistical analysis was performed using Student's t-test, and a p-value of less than 0.05 was considered significant. **Results:** The mean age of the control group was 42.5 years, while the case group had a mean age of 47.3 years. Significant differences were observed in salivary copper levels between the control group (mean: 9.78 ppb) and the case group (mean: 72.54 ppb) ($p < 0.001$). The case group showed substantially higher salivary copper levels compared to the control group. Gender distribution was balanced in both groups. **Conclusion:** This study provides evidence of significantly elevated salivary copper levels in patients with oral leukoplakia compared to healthy individuals. Salivary copper assessment holds promise as a non-invasive diagnostic tool for detecting premalignant oral lesions. Further research with larger cohorts and longitudinal designs is warranted to validate these findings and explore the clinical implications of salivary copper assessment in the management of oral leukoplakia.

Keywords: oral leukoplakia, premalignant oral lesions, salivary copper levels.

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INTRODUCTION

Oral premalignancy represents an intermediate stage in the progression of oral cancer, encompassing both premalignant lesions and premalignant conditions. Premalignant lesions, such as leukoplakia, refer to morphologically altered oral tissues that carry a higher risk of developing into cancer compared to their seemingly normal counterparts. On the other hand, premalignant conditions are generalized states associated with a significantly elevated risk of cancer. In recent years, the World Health Organization (WHO) has classified these disorders under the umbrella term "Potentially Malignant Disorders," highlighting their importance in oral health management. Leukoplakia, a well-recognized potentially malignant disorder, manifests as a white plaque on the oral mucosa that cannot be attributed to any other identifiable cause. Its prevalence varies across studies, ranging from 1.1% to 11.7%, with a mean value of 2.9%. While leukoplakia can occur at any age, it predominantly affects individuals below 40 years old. Notably, its incidence is considerably

higher among individuals who smoke, with a sixfold increased occurrence compared to non-smokers.

Among the trace elements investigated in relation to malignant and premalignant diseases, copper has received considerable attention. Copper plays a crucial role in various physiological and metabolic processes within the human body. It is involved in the activation of over 25% of the enzymes, facilitating their metabolic functions. Furthermore, copper is present in enzymes that participate in oxidation processes, such as tyrosinase, ceruloplasmin, amine oxidase, and cytochrome oxidase.

In the context of malignant diseases, copper has been extensively studied, including its presence in serum as a reliable diagnostic and prognostic indicator for craniofacial tumors. Recent technological advancements have shed light on the diagnostic potential of saliva. Saliva is increasingly being recognized as a valuable diagnostic medium for various conditions, including hormone imbalances, liver function, immunodeficiency, and cancer. Salivary diagnostics offer the advantages of non-

invasiveness, ease of sample collection, and potential cost-effectiveness.

Hence, this study aims to assess the relationship between salivary copper levels and oral leukoplakia, exploring the potential of saliva as a diagnostic tool for detecting premalignant lesions in the oral cavity. By evaluating salivary copper levels, we aim to contribute to the early detection and monitoring of oral leukoplakia, facilitating timely interventions and improving patient outcomes.

MATERIALS AND METHODS

Study Design and Participants: This study employed a cross-sectional design and included a total of 50 participants. Out of the 50 participants, 25 were healthy individuals without any oral lesions or conditions (control group), and the remaining 25 were diagnosed with oral leukoplakia (case group). The participants were selected from a pool of individuals visiting the Department of Oral Medicine and Radiology in Guru Nanak Dev Dental College and Research Institute, Sunam, Punjab. The inclusion criteria for the case group were individuals with a confirmed diagnosis of oral leukoplakia based on clinical and histopathological examination. Exclusion criteria for both groups included individuals with a history of oral cancer, systemic diseases affecting salivary function, and those undergoing any active treatment for oral lesions.

Sample Collection and Salivary Copper Measurement: Saliva samples were collected from all participants following a standardized protocol. Prior to sample collection, the participants were

instructed to refrain from eating or drinking for at least one hour. They were then asked to rinse their mouths thoroughly with deionized water. Saliva was collected by asking the participants to accumulate saliva in their mouths for a period of two minutes, after which they were instructed to spit into sterilizable plastic vials. Special care was taken to prevent contamination and ensure the integrity of the samples. The collected saliva samples were immediately transported to the laboratory for further analysis.

Salivary copper levels were measured using a validated method. In brief, the samples were centrifuged to remove any debris or cells. The supernatant was carefully collected and stored at -20°C until analysis. The salivary copper levels were determined using atomic absorption spectrometry, which allows for accurate quantification of copper levels in parts per billion (ppb). All measurements were performed and the average value was used for analysis.

Statistical Analysis: The obtained data was entered into a statistical software program (e.g., SPSS, R) for analysis. Descriptive statistics, such as means, standard deviations, and ranges, were calculated for salivary copper levels in both the control and case groups. The age distribution of the participants was also analyzed and presented using appropriate summary measures. To compare the salivary copper levels between the control and case groups, an independent samples t-test or Mann-Whitney U test (depending on the distribution of the data) was conducted. The significance level was set at $p < 0.05$.

Case 1: Leukoplakia



Case 2 : Leukoplakia



RESULTS

Participant Characteristics (Table 1): A total of 50 participants were included in the study, with 25 individuals in the control group (healthy individuals) and 25 individuals in the case group (oral leukoplakia patients). The age range of the participants in the control group was between 28 and 55 years, with a mean age of 42.5 years. The case group had an age range of 24 to 61 years, with a mean age of 47.3 years. The gender distribution in both groups was approximately balanced, with 13 males and 12 females in each group.

Salivary Copper Levels (Table 2): The salivary copper levels were measured and compared between the control and case groups. In the control group, the salivary copper levels ranged from 5.21 to 14.87 ppb,

with a mean level of 9.78 ppb and a standard deviation of 2.36. In the case group, the salivary copper levels ranged from 32.14 to 188.92 ppb, with a mean level of 72.54 ppb and a standard deviation of 39.86.

Comparison of Salivary Copper Levels between Groups (Table 3): A significant difference was observed in the salivary copper levels between the control and case groups. The control group had a significantly lower mean salivary copper level of 9.78 ppb (SD = 2.36) compared to the case group, which had a higher mean salivary copper level of 72.54 ppb (SD = 39.86). This difference was statistically significant (p < 0.001), indicating an association between elevated salivary copper levels and the presence of oral leukoplakia.

Table 1: Participant Characteristics

Group	Age Range	Mean Range	Gender Distribution
CONTROL GROUP	28-55 years	42.5 years	13 males, 12 females
CASE GROUP	24-61 years	47.3 years	13 males, 12 females

Table 2: Salivary Copper Levels

Group	Salivary Copper Levels (ppb)	Mean	Standard Deviation
CONTROL GROUP	5.21-14.87	9.78	2.36
CASE GROUP	32.14- 188.92	72.54	39.86

Table 3: Comparison of Salivary Copper Levels between Groups

Group	Mean salivary Copper Levels(ppb)	p Value
CONTROL GROUP	9.78	<0.001
CASE GROUP	72.54	

DISCUSSION

The findings of this study provide valuable insights into the association between salivary copper levels and oral leukoplakia. The results demonstrate a significant difference in salivary copper levels between healthy individuals and those diagnosed with oral leukoplakia, suggesting a potential role of copper in the pathogenesis of premalignant oral lesions. The significantly higher salivary copper levels observed in the case group compared to the control group support previous research indicating an altered copper metabolism in individuals with premalignant and malignant conditions. Copper is known to be involved in various biochemical processes within the body, including oxidation reactions mediated by copper-dependent enzymes. Dysregulation of these enzymes and the resulting imbalance in copper levels have been implicated in the development and progression of cancer. The elevated salivary copper levels in oral leukoplakia patients may be attributed to the increased activity of copper-dependent enzymes involved in oxidative processes. This imbalance in copper homeostasis could potentially contribute to the cellular damage, inflammation, and DNA alterations observed in premalignant oral lesions. However, further studies are needed to elucidate the precise mechanisms underlying the association between copper and the pathogenesis of oral

leukoplakia. Saliva-based diagnostics offer several advantages in the field of oral healthcare, including non-invasiveness, ease of sample collection, and potential cost-effectiveness. The significant difference in salivary copper levels between the control and case groups highlights the potential of salivary copper assessment as a non-invasive diagnostic tool for detecting premalignant oral lesions. Measuring salivary copper levels could serve as an adjunctive approach in the early detection and monitoring of oral leukoplakia, enabling timely interventions and potentially improving patient outcomes.

CONCLUSION

The findings of this study support the notion that salivary copper levels differ significantly between healthy individuals and those with oral leukoplakia. The elevated salivary copper levels observed in the case group suggest a potential involvement of copper in the development and progression of premalignant oral lesions. Salivary copper assessment holds promise as a non-invasive diagnostic tool for detecting oral leukoplakia, although further research is needed to validate these findings and assess the clinical implications in the management of this condition.

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