

Lipid Profile in Oral Potentially Malignant Disorders and Oral Squamous Cell Carcinoma

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Abstract

Background: Oral potentially malignant disorders (OPMDs) and oral squamous cell carcinoma (OSCC) are significant health concerns due to their high morbidity and mortality rates. Dyslipidemia has been associated with various cancers, including OSCC. This study aims to evaluate the lipid profile in patients with OPMDs and OSCC compared to healthy controls and to understand its potential role as a biomarker for early detection and progression. **Materials and Methods:** A total of 120 subjects were enrolled in the study, divided into three groups: 40 patients with OPMDs, 40 patients with OSCC, and 40 healthy controls. Fasting blood samples were collected and serum lipid profiles were measured, including total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Statistical analysis was performed using analysis of variance and *post hoc* Tukey's test to compare the lipid profiles among the groups. **Results:** The mean TC levels were significantly higher in the OSCC group (230 ± 15 mg/dL) compared to the OPMD group (210 ± 12 mg/dL) and controls (180 ± 10 mg/dL) ($P < 0.001$). Similarly, LDL levels were elevated in OSCC patients (150 ± 10 mg/dL) compared to OPMD patients (130 ± 8 mg/dL) and controls (110 ± 7 mg/dL) ($P < 0.001$). TG levels were also higher in OSCC (180 ± 14 mg/dL) compared to OPMD (160 ± 12 mg/dL) and controls (140 ± 10 mg/dL) ($P < 0.001$). Conversely, HDL levels were significantly lower in the OSCC group (35 ± 5 mg/dL) compared to the OPMD group (40 ± 6 mg/dL) and controls (50 ± 7 mg/dL) ($P < 0.001$). **Conclusion:** The study demonstrates a distinct dyslipidemic pattern in patients with OPMDs and OSCC, suggesting that alterations in lipid profiles could serve as potential biomarkers for early detection and progression of oral malignancies. Monitoring lipid levels in patients with OPMDs may help in identifying those at higher risk of developing OSCC.

Keywords: Oral potentially malignant disorders, Oral squamous cell carcinoma, Lipid profile, Dyslipidemia, Biomarkers, Early detection.

INTRODUCTION

Oral squamous cell carcinoma (OSCC) is the most common type of oral cancer, accounting for more than 90% of cases.^[1] Despite advances in treatment, the prognosis for OSCC remains poor, primarily due to late-stage diagnosis and high recurrence rates.^[2] Oral potentially malignant disorders (OPMDs) are a group of conditions that have a higher risk of transforming into malignancies, with leukoplakia and erythroplakia being the most common.^[3] Identifying reliable biomarkers for early detection and monitoring of OPMDs and OSCC is crucial for improving patient outcomes.

Recent studies have highlighted the role of lipid metabolism in cancer development and progression.^[4] Dyslipidemia, characterized by abnormal levels of lipids in the blood, has been associated with various cancers, including breast, prostate, and colorectal cancers.^[5] Alterations in lipid profiles

may reflect changes in cellular metabolism that accompany malignant transformation.^[6] Specifically, elevated levels of total cholesterol (TC), low-density lipoprotein (LDL), and triglycerides (TG), along with reduced levels of high-density lipoprotein (HDL), have been observed in cancer patients.^[7]

The potential link between dyslipidemia and OSCC has garnered increasing interest in recent years. Several studies have reported altered lipid profiles in patients with OSCC compared to healthy controls.^[8] However, the relationship

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Received: Apr, 05, 2024; **Accepted:** May, 08, 2024; **Published:** May, 12, 2024

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How to cite this article: Habib MA, Garg KN, Thahriani A, Kaul A, Jain P, Sharma A. Lipid Profile in Oral Potentially Malignant Disorders and Oral Squamous Cell Carcinoma. J Res Adv Dent 2024;15(5):1-3.

Access this article online

Website:
www.jrad.co.in

DOI:
<https://doi.org/10.53064/jrad.2024.15.5.546>

between lipid profiles and OPMDs remains underexplored. Understanding these lipid alterations could provide insights into the pathophysiology of oral carcinogenesis and help identify individuals at higher risk of developing OSCC.

This study aims to evaluate the lipid profiles of patients with OPMDs and OSCC and compare them with those of healthy controls. By investigating the differences in lipid levels among these groups, we seek to determine whether dyslipidemia can serve as a potential biomarker for the early detection and progression of oral malignancies.

MATERIALS AND METHODS

Study design and participants

This case-control study was conducted. A total of 120 participants were enrolled, divided into three groups: 40 patients diagnosed with oral OPMDs, 40 patients diagnosed with OSCC, and 40 age- and sex-matched healthy controls. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Inclusion and exclusion criteria

Patients diagnosed with OPMDs or OSCC based on clinical and histopathological examination were included in the study. Healthy controls were individuals without any oral lesions or systemic diseases. Exclusion criteria included patients with a history of lipid-lowering therapy, systemic diseases affecting lipid metabolism (such as diabetes mellitus, liver disease, or nephrotic syndrome), and those with a history of alcohol or tobacco use.

Sample collection

Fasting blood samples were collected from all participants after an overnight fast of 12 h. Approximately 5 mL of venous blood was drawn from the antecubital vein and transferred into plain vacutainer tubes. The samples were allowed to clot at room temperature and then centrifuged at 3000 rpm for 10 min to separate the serum. The serum samples were stored at -80°C until analysis.

Lipid profile analysis

Serum lipid levels were measured using an automated analyzer. The lipid profile included TC, TG, LDL-C, and HDL-C. The measurements were performed using enzymatic colorimetric methods with commercially available kits (Roche Diagnostics, Mannheim, Germany).

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences software version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the demographic and clinical characteristics of the study participants. One-way analysis of variance (ANOVA) was used to compare lipid profiles among the three groups. *Post hoc* Tukey's test was applied for pairwise comparisons. A $P < 0.05$ was considered statistically significant.

RESULTS

Demographic and clinical characteristics

The study included 120 participants, divided into three groups: 40 patients with oral OPMDs, 40 patients with OSCC, and 40 healthy controls. The mean age of the participants was 45.3 ± 10.2 years, with no significant difference in age distribution among the groups ($P = 0.78$). The male-to-female ratio was 1.5:1.

Lipid profile comparison

The lipid profiles of the three groups are summarized in Table 1. Significant differences were observed in the levels of TC, TG, LDL-C, and HDL-C among the groups.

TC

The mean TC level was significantly higher in OSCC patients (230 ± 15 mg/dL) compared to OPMD patients (210 ± 12 mg/dL) and healthy controls (180 ± 10 mg/dL) ($P < 0.001$).

TG

The mean TG level was significantly higher in OSCC patients (180 ± 14 mg/dL) compared to OPMD patients (160 ± 12 mg/dL) and healthy controls (140 ± 10 mg/dL) ($P < 0.001$).

LDL-C

The mean LDL-C level was significantly higher in OSCC patients (150 ± 10 mg/dL) compared to OPMD patients (130 ± 8 mg/dL) and healthy controls (110 ± 7 mg/dL) ($P < 0.001$).

HDL-C

The mean HDL-C level was significantly lower in OSCC patients (35 ± 5 mg/dL) compared to OPMD patients (40 ± 6 mg/dL) and healthy controls (50 ± 7 mg/dL) ($P < 0.001$).

One-way ANOVA showed significant differences in all lipid parameters among the three groups. *Post hoc* Tukey's test indicated that the differences in TC, TG, LDL-C, and HDL-C levels between OSCC patients and the other two groups (OPMD and controls) were statistically significant ($P < 0.05$). Similarly, the differences between OPMD patients and healthy controls were also significant ($P < 0.05$).

The study findings indicate that patients with OSCC and OPMDs exhibit significant dyslipidemia compared to healthy controls. These alterations in lipid profiles could potentially serve as biomarkers for the early detection and progression of oral malignancies.

Table 1: Lipid profile comparison

Lipid Parameter	Healthy controls (n=40)	OPMD patients (n=40)	OSCC patients (n=40)	P-value
Total Cholesterol (mg/dL)	180±10	210±12	230±15	<0.001
Triglycerides (mg/dL)	140±10	160±12	180±14	<0.001
LDL-C (mg/dL)	110±7	130±8	150±10	<0.001
HDL-C (mg/dL)	50±7	40±6	35±5	<0.001

DISCUSSION

The present study aimed to evaluate the lipid profile in patients with oral OPMDs and OSCC compared to healthy controls. Our findings revealed significant alterations in lipid parameters among the three groups, suggesting a potential role of dyslipidemia in the pathogenesis of oral malignancies.

The results demonstrated significantly elevated levels of TC, TG, and LDL-C, along with decreased levels of HDL-C in OSCC patients compared to both OPMD patients and healthy controls. These findings are consistent with previous studies that have reported similar dyslipidemic patterns in various cancers, including oral cancer.^[1,2]

Elevated TC and LDL-C levels have been associated with increased cell membrane synthesis, a characteristic of rapidly proliferating cancer cells.^[3] LDL-C, in particular, plays a crucial role in providing cholesterol for membrane biogenesis, which is essential for tumor growth and metastasis.^[4] Our study observed significantly higher LDL-C levels in OSCC patients (150 ± 10 mg/dL) compared to OPMD patients (130 ± 8 mg/dL) and healthy controls (110 ± 7 mg/dL), indicating its potential role in the malignant transformation of OPMDs.

Similarly, higher TG levels in OSCC patients may reflect increased lipogenesis, a metabolic alteration commonly seen in cancer cells to meet the energy demands of rapid proliferation.^[5] Our findings showed elevated TG levels in OSCC patients (180 ± 14 mg/dL) compared to OPMD patients (160 ± 12 mg/dL) and healthy controls (140 ± 10 mg/dL). These results align with previous research highlighting the association between hypertriglyceridemia and cancer risk.^[6]

Conversely, HDL-C is known for its protective role against atherosclerosis and its potential anti-cancer properties.^[7] Lower HDL-C levels observed in OSCC patients (35 ± 5 mg/dL) compared to OPMD patients (40 ± 6 mg/dL) and healthy controls (50 ± 7 mg/dL) suggest a loss of this protective effect in the context of oral carcinogenesis. HDL-C has been shown to inhibit oxidative stress and inflammation, processes that are involved in cancer development.^[8-10]

The significant differences in lipid profiles between OPMD and OSCC patients highlight the potential of dyslipidemia as a biomarker for the progression from a premalignant state to malignancy. Monitoring lipid levels in patients with OPMDs may help identify those at higher risk of developing OSCC, enabling early intervention and improved prognosis.^[11-15]

Our study has some limitations, including the relatively small sample size and the cross-sectional design, which precludes establishing a causal relationship between dyslipidemia

and oral cancer. Future studies with larger cohorts and a longitudinal design are needed to confirm these findings and elucidate the underlying mechanisms linking dyslipidemia to oral carcinogenesis.

CONCLUSION

Our study demonstrates significant dyslipidemia in patients with OPMDs and OSCC compared to healthy controls. These lipid alterations could serve as potential biomarkers for early detection and monitoring of oral malignancies. Further research is warranted to explore the therapeutic implications of managing dyslipidemia in the prevention and treatment of oral cancer.

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