## **Original Research**

# Serum fucose level in oral cancer and leukoplakia: A biochemical study

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#### Abstract

**Aim:** To evaluate and compare serum fucose levels in patients with oral cancer and oral leukoplakia, and to assess its potential role as a biochemical marker for early detection and progression of oral malignancies.

**Materials and methods:** The study comprised 60 participants divided into four groups. Group I included 20 age- and gender-matched healthy individuals, selected from patient attendants, who served as controls. Groups II and III each consisted of 20 patients clinically and histologically diagnosed with leukoplakia, and oral cancer (OC), respectively. All subjects were aged between 18 and 60 years. Informed consent was obtained from both patients and healthy controls. Inclusion criteria involved patients with confirmed diagnoses of leukoplakia, OC, and healthy individuals free from any systemic or localized illnesses, such as allergies, renal disease, hypertension, or diabetes, were selected as controls. Data analysis was done sing SSPS software.

**Results:** The mean age of participants was  $42.12 \pm 3.53$  years in the normal group,  $44.34 \pm 2.12$  years in the oral leukoplakia group, and  $33.45 \pm 4.13$  years in the oral cancer group, with all participants aged between 18 and 60 years. Regarding serum fucose levels, the normal group had a mean of  $6.23 \pm 0.05$  mg/dL (range 2.1-9.5 mg/dL), while the oral leukoplakia group had a significantly higher mean of  $24.34 \pm 5.11$  mg/dL (range 9.4-63.8 mg/dL). The oral cancer group exhibited the highest mean serum fucose level at  $39.52 \pm 5.23$  mg/dL (range 14-62.5 mg/dL).

**Conclusion:** Our study found a progressive increase in serum fucose levels from normal individuals to those with oral leukoplakia and oral cancer, although age differences among the groups were not statistically significant.

Keywords- Cancer, Fructose, Biochemical

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#### Introduction

The overproduction of certain biochemical substances in body fluids, such as serum glycoproteins, by malignant cells holds significant diagnostic and prognostic value. Research indicates that glycoconjugate molecules present on the plasma membranes of mammalian cells are closely linked to tumor progression, metastasis, and cell-to-cell interactions. Among the limited variety of monosaccharides forming the carbohydrate portion of glycoproteins, L-fucose is a terminal sugar of particular importance. This sugar plays a crucial role in cell signaling and communication and is also recognized as a potent immune modulator due to its abundance in immune cells like macrophages.<sup>1,2,3</sup>

Under normal physiological conditions, fucose is present in serum at low concentrations; however, its levels increase notably in pathological states such as cancer. Tumor cells are known to mask their abnormal features—such as reduced adhesion and unchecked proliferation—by enhancing the fucosylation of their surface molecules. Although this fucosylation mechanism is not yet fully characterized in oral cancers, several studies have proposed monitoring serum or tissue fucose levels as a valuable tool for the early detection, diagnosis, and prognosis of various malignancies, including oral carcinoma.<sup>4,5</sup>

Oral premalignant states are viewed as transitional phases that may progress to oral cancer. They are broadly divided into two categories: premalignant lesions and premalignant conditions. A premalignant lesion, such as leukoplakia, refers to a visibly altered area of tissue that carries a higher risk for developing cancer than normal tissue. In contrast, a premalignant condition, like oral submucous fibrosis, involves a more widespread susceptibility to cancer. The World Health Organization (WHO) has recently grouped both categories under a unified term—Potentially Malignant Disorders. Among these, oral leukoplakia is a notable white lesion affecting the oral lining, defined as a white patch that cannot be clinically or pathologically identified as any other condition. It is often strongly associated with smoking and other forms of tobacco use.6,7,8

Therefore in our study we aimedto evaluate and compare serum fucose levels in patients with oral cancer and oral leukoplakia, and to assess its potential role as a biochemical marker for early detection and progression of oral malignancies.

#### Materials and methods

The study comprised 60 participants divided into four groups. Group I included 20 age- and gender-matched healthy individuals, selected from patient attendants, who served as controls. Groups II and III each consisted of 20 patients clinically and histologically diagnosed with leukoplakia, and oral cancer (OC), respectively. All subjects were aged between 18 and 60 years. Informed consent was obtained from both patients and healthy controls. Inclusion criteria involved patients with confirmed diagnoses of

leukoplakia, OC, and healthy individuals free from any systemic or localized illnesses, such as allergies, renal disease, hypertension, or diabetes, were selected as controls.

Participants were excluded if they had systemic illnesses like diabetes, hypertension, liver disease, infections, or were pregnant, or had multiple premalignant oral lesions. Healthy controls who consumed tobacco or alcohol were also excluded. The biochemical analysis involved measuring fucose levels using the Dische and Shettles method, as modified by Winzler. Materials used for the assay included 95% ethanol, a sulphuric acid-water mixture, 3% cysteine reagent, 0.2 N sodium hydroxide, distilled water, and a working standard fucose solution (20 µg/mL). Datsa analysis was done using SSPS software.

#### Results

Table	1:	Age	(Mean	± SE,	n=20	) of (	3 groups
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Normal	Oral leukoplakia	Oral Cancer	F	Р					
42.12 ± 3.53 (18-60)	44.34 ± 2.12 (18-60)	33.45 ± 4.13 (18-60)	0.97	0.821					

The mean age of participants in the normal group was  $42.12 \pm 3.53$  years, in the oral leukoplakia group it was  $44.34 \pm 2.12$  years, and in the oral cancer group it was  $33.45 \pm 4.13$  years. All participants across the three groups were within the age range of 18 to 60 years. Statistical analysis using ANOVA yielded an F-value of 0.97 and a P-value of 0.821, indicating that the differences in mean age among the groups were not statistically significant. 7

l'able 2: Fucose levels (Mean±SE, n=20) of 3 gr
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Normal	Oral leukoplakia	Oral Cancer
6.23 ± 0.05 (2.1-9.5)	24.34 ± 5.11 (9.4-63.8)	39.52 ± 5.23 (14-62.5)

The mean serum fucose level in the normal group was  $6.23 \pm 0.05$  mg/dL, with a range of 2.1 to 9.5 mg/dL. In contrast, the oral leukoplakia group showed a significantly higher mean fucose level of  $24.34 \pm 5.11$ mg/dL, ranging from 9.4 to 63.8 mg/dL. The oral cancer group demonstrated the highest mean serum fucose level at 39.52 ± 5.23 mg/dL, with values ranging from 14 to 62.5 mg/dL.

### Discussion

Oral cancer is a major global health concern, particularly in developing countries where tobacco and betel nut consumption are prevalent risk factors. Among the various biomarkers explored for early detection and disease monitoring, serum fucose has gained attention due to its role in cellular adhesion, immune response, and tumor progression.9 Fucose, a hexose deoxy sugar, is a key component of glycoproteins and glycolipids, and its levels tend to increase in malignancies due to altered glycosylation patterns in cancerous cells. Leukoplakia, considered a potentially malignant disorder, also demonstrates biochemical changes that may reflect early neoplastic transformation.10,11 Evaluating serum fucose levels in patients with oral cancer and leukoplakia may help in understanding the progression from premalignant to

malignant stages and serve as a supportive tool in diagnosis and prognosis.

In our study, the mean age of participants was  $42.12 \pm$ 3.53 years in the normal group,  $44.34 \pm 2.12$  years in the oral leukoplakia group, and  $33.45 \pm 4.13$  years in the oral cancer group, with all participants aged between 18 and 60 years. Statistical analysis using ANOVA revealed no significant age differences among the groups (F = 0.97, P = 0.821). Regarding serum fucose levels, the normal group had a mean of  $6.23 \pm 0.05 \text{ mg/dL}$  (range 2.1–9.5 mg/dL), while the oral leukoplakia group had a significantly higher mean of  $24.34 \pm 5.11$  mg/dL (range 9.4–63.8 mg/dL). The oral cancer group exhibited the highest mean serum fucose level at  $39.52 \pm 5.23$  mg/dL (range 14– 62.5 mg/dL), indicating a progressive increase in serum fucose levels from normal individuals to those with leukoplakia and oral cancer.

In the study by Kumar S et al.,<sup>12</sup> the aim was to determine the role of serum fucose as a reliable biomarker for the early detection of malignant transformation in potentially malignant lesions and conditions, as well as to predict the biological behavior of malignant lesions. The study included 100 participants, divided into four groups: 25 cases each of oral leukoplakia, oral submucous fibrosis, and oral cancer, along with a control group. Fucose levels were

measured using the method of Dische and Shettles as adopted by Winzler. The results revealed that the ageand gender-matched subjects across the four groups did not influence the study's outcome on fucose levels. The study concluded that serum L-fucose levels could be helpful in detecting early malignant changes, improving the accuracy of clinical diagnoses, and assessing the spread and invasiveness of oral cancer, oral submucous fibrosis, and leukoplakia.

In the study by Rai NP et al.<sup>13</sup>, the aim was to evaluate the role of serum fucose as a biomarker for the early detection of oral cancer and to compare serum fucose levels among healthy controls, leukoplakia patients, and oral cancer patients. The study included 60 subjects, divided into three groups: 20 healthy controls, 20 patients with squamous cell carcinoma (OSCC), and 20 patients with leukoplakia. Fucose levels were measured using UV-visible spectrophotometry based on the method adopted by Winzler, using a cysteine reagent. Statistical analysis was performed using ANOVA with Bonferroni post hoc tests. The results revealed a significant increase in serum fucose levels in both OSCC and leukoplakia patients compared to normal controls, with levels rising progressively from controls to leukoplakia and further to OSCC. The study concluded that serum fucose estimation could serve as a reliable diagnostic biomarker for oral squamous cell carcinoma.

Bhairavi et al.<sup>14</sup> reported that serum L-fucosidase activity was significantly higher in patients with oral precancer (OPC) and oral cancer (OC) compared to the control group. The mean serum fucose level in OC patients was found to be  $46.63 \pm 5.29$  mg%. Similarly, elevated serum fucose levels compared to controls were also observed in studies by Solanki et al.<sup>15</sup> and Agarwal et al.<sup>16</sup>

A limitation of our study is the small sample size, which may affect the reliability and generalizability of the results. A larger sample size could lead to different outcomes and provide a more comprehensive understanding of serum fucose levels across diverse patient populations. This underscores the need for future studies with a larger cohort to confirm our findings and enhance the validity of the conclusions.

#### Conclusion

Our study found a progressive increase in serum fucose levels from normal individuals to those with oral leukoplakia and oral cancer, although age differences among the groups were not statistically significant.

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