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**ORIGINAL RESEARCH**

# Alarming signs of iron deficiency anemia in oral cavity: An original survey at a tertiary care centre in central India

Dr. Karuna Jindwani[1], Dr. Brindha Andal. M[2], Dr. Keshav Singh[3], Dr. Karan Saran Kapur[4]

[1]Professor, Department of Dentistry, Shyam Shah Medical College, Rewa, India
[2]PG 3[RD] year, [3]Professor, [4]Assistant Professor, Department of Medicine, Shyam Shah Medical College, Rewa, India

**Corresponding author**
Dr. Karuna Jindwani
Professor, Department of Dentistry, Shyam Shah Medical College, Rewa, India
**Email:** jindwanikaruna@yahoo.co.in

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## ABSTRACT

**Background:** Anemia is characterized by a decrease in the circulating mass of red blood cells (RBCs) below established normal thresholds. The oral symptoms associated with stomatitis and glossitis due to nutritional deficiencies have been well-documented. Hence; the present study was undertaken for assessing the occurrence of oral mucosal lesions among patients of microcytic anemia. **Materials & methods:** This study design was cross-sectional and analytical study. After getting approval from Institutional Ethics Committee, this study was conducted in the Department of Medicine, Shyam Shah Medical College and associated Sanjay Gandhi and Gandhi Memorial Hospital, Rewa, Madhya Pradesh from September 2022 to August 2023 on 333 patients of orofacial diseases. All the patients were explained about the study and a written consent were obtained from each of them. The sample of venous blood is collected by venipuncture and sample was analyzed for haemoglobin, complete blood count, RBC indices. Statistical analysis was done for all the recorded data. After compilation and tabulation of data, appropriate statistical tests were applied. P-value< 0.05 was considered statistically significant. **Results:** On oral cavity examination, the most common findings was mucosal pallor found in 323 patients (97%). The next most common finding on tongue was atrophic glossitis in 107 patients (32.13%) .Other significant oral cavity findings comprised of fissured tongue in 103 patients(30.93%) and angular chelitis in 74 patients (22.22%) , geographic tongue in 33patients (9.91%) , oral ulcers in 67 patients (20.12%), candidal infection, lichen planus etc. **Conclusion:** Since the oral cavity has been called the mirror of the human body because many systemic diseases have relatively early oral manifestations, it is imperative that iron deficiency and associated anemia be examined in children.

**Key words:** Microcytic anemia, Oral mucosal lesions.



## INTRODUCTION

Anemia is characterized by a decrease in the circulating mass of red blood cells (RBCs) below established normal thresholds. This condition is prevalent across the global population. Red blood cells are equipped with hemoglobin, a protein composed of four polypeptide chains and a heme group that contains iron in its reduced state. Iron serves as the primary element in hemoglobin and is essential for oxygen transport. A reduction in the body's iron stores adversely impacts hemoglobin synthesis, which in turn compromises the delivery of oxygen to various organ systems. Consequently, anemia diminishes the blood's oxygen-carrying capacity, resulting in tissue hypoxia.[1, 2] Diagnosis typically involves measuring hematocrit, which reflects the proportion of packed RBCs to total blood volume, alongside hemoglobin concentration. Microcytic, hypochromic anemia is characterized by the presence of smaller-than-normal RBCs (microcytic) that exhibit a paler color (hypochromic). The predominant cause of this anemia type is a deficiency in iron reserves, which can arise from several factors, including inadequate dietary iron intake, impaired intestinal absorption, acute or chronic blood loss, and increased iron requirements during conditions such as pregnancy or recovery from significant trauma or surgery. According to data from the World Health Organization (WHO), approximately 24.8% of the global population is affected by anemia, with a significant proportion attributed to iron deficiency. This form of anemia is particularly prevalent among premenopausal women, who experience blood loss during menstruation.

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Among pregnant women, nearly 41% are affected by anemia, while 30% of nonpregnant premenopausal women also face this condition. In contrast, males generally exhibit greater resistance to anemia, likely due to the influence of circulating testosterone levels.[3, 4]

The oral symptoms associated with stomatitis and glossitis due to nutritional deficiencies have been well-documented. Among these deficiencies, iron deficiency (ID) stands out as the most prevalent. It is responsible for nearly half of all anemia cases globally. In the United States, the prevalence of iron deficiency anemia (IDA) varies significantly across different demographics, with rates of 2% in adult males, 9-12% in white females, and approaching 20% in black females. In Taiwan, the incidence of ID is reported at 2.1% for males and 10.7% for females, while the prevalence of IDA is 0.2% in males and 2.1% in females. In summary, iron deficiency is notably common among females and represents a critical concern in the context of women's health. Nevertheless, a significant number of individuals with IDA or ID without anemia remain inadequately diagnosed and treated.[5- 8] Hence, the present study was undertaken for assessing the occurrence of oral mucosal lesions among patients of microcytic iron deficiency anemia.

## MATERIALS & METHODS

This study design was cross-sectional and analytical study. After getting approval from Institutional Ethics Committee, this study was conducted in the Department of Medicine, Shyam Shah Medical College and associated Sanjay Gandhi and Gandhi Memorial Hospital, Rewa, Madhya Pradesh from September 2022 to August 2023 on 333 patients of orofacial diseases.

**Inclusion criteria**

- All Patients presenting with orofacial manifestations and microcytic anemia
- Age >16 years
- Patient consenting for study

All the patients were explained about the study and a written consent were obtained from each of them. The sample of venous blood is collected by venipuncture and sample was analyzed for haemoglobin, complete blood count, RBC indices. Statistical analysis was done for all the recorded data. After compilation and tabulation of data, appropriate statistical tests were applied. P-value< 0.05 was considered statistically significant.

## RESULTS

Maximum number of cases were underweight with 228 (68.47%) cases, out of which males were 95 (66.90%) cases and females were 133 (69.63%) cases, followed by overweight status in 53 (15.92%) patients out of which males were 27 (19.01%) cases and females were 26 (13.61%) cases respectively. Mean BMI is 16.25±2.42 and p Value <0.0001 was found to be statistically significant.On oral cavity examination, the most common findings was mucosal pallor found in 323 patients (97%). The next most common finding on tongue was atrophic glossitis in 107 patients (32.13%).Other significant oral cavity findings comprised of fissured tongue in 103 patients(30.93%) and angular chelitis in 74 patients (22.22%) , geographic tongue in 33patients (9.91%) , oral ulcers in 67 patients (20.12%), candidal infection, lichen planus etc.

**Table 1: Correlation of BMI with gender**

| BMI | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | **No** | **%** | **No** | **%** | **No** | **%** |
| Underweight = <18.5 | 95 | 66.90 | 133 | 69.63 | 228 | 68.47 |
| Normal weight = 18.5–24.9 | 19 | 13.38 | 32 | 16.75 | 51 | 15.32 |
| Overweight = 25–29.9 | 27 | 19.01 | 26 | 13.61 | 53 | 15.92 |
| Obesity = >30 | 1 | 0.70 | - | - | 1 | 0.30 |
| **Total** | **142** | **100.0** | **191** | **100.0** | **333** | **100.0** |
| **Mean BMI = 16.25±2.42 unpaired t test =114.99 p Value <0.0001** | | | | | | |

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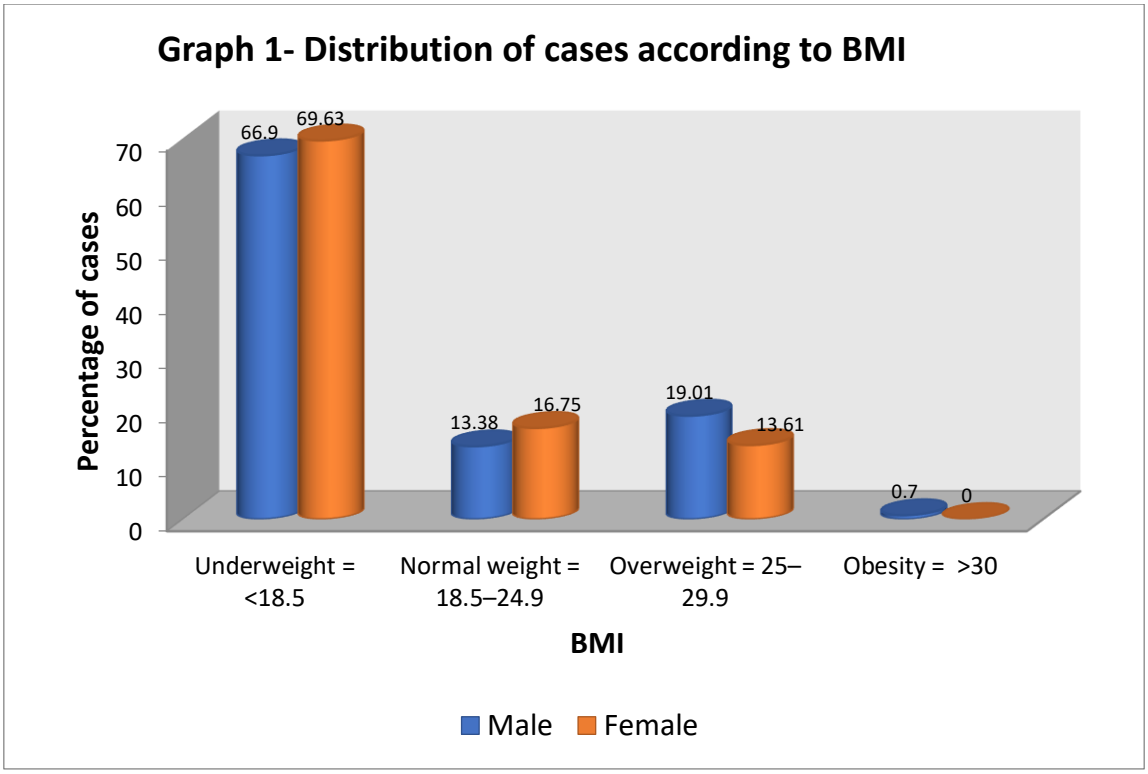


**Table 2: Oral examination**

| Oral cavity examination | | Total | |
|---|---|---|---|
| | | Number | Percentage |
| Oral Mucosal | Mucosal Pallor | 323 | 97.00 |
| | Erythematous Mucositis | 10 | 3.00 |
| | | | |
| Tongue | Atrophic glossitis | 107 | 32.13 |
| | Fissured tongue | 103 | 30.93 |
| | Geographic tongue | 33 | 9.91 |
| | | | |
| Others | Angular Chelitis | 74 | 22.22 |
| | | | |
| | Candidal infection | 10 | 3.00 |
| | Oral Pigmentation | 11 | 3.30 |
| | Periodontitis | 3 | 0.90 |
| | Oral ulcer | 67 | 20.12 |
| | Lichen planus | 2 | 0.6 |

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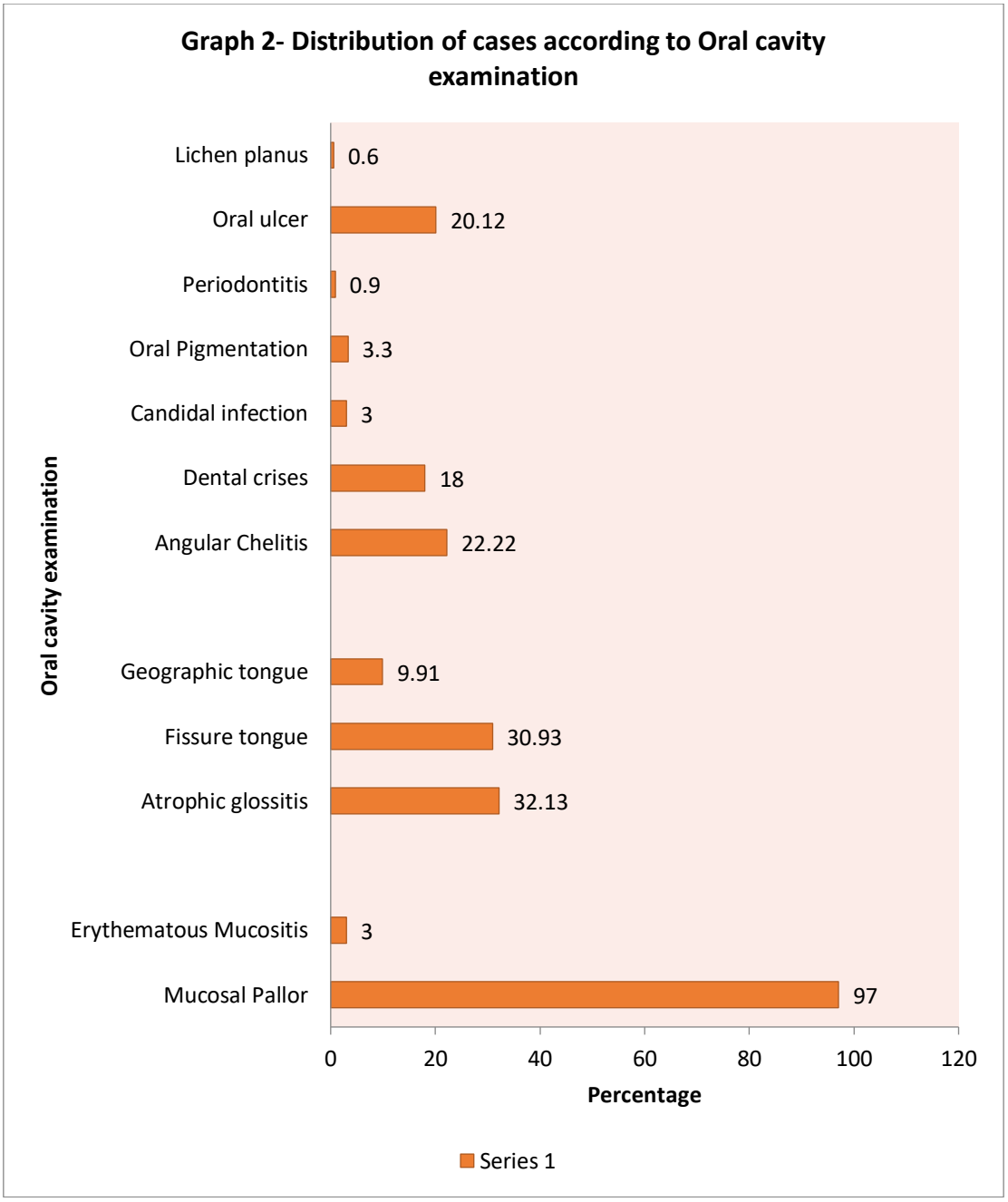


**Figure1. Geographic tongue with aphthous ulcer and pseudomembrane.**

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**Figure 2.** Atrophic glossitis in a patient with iron deficiency anemia. Mucosal atrophy appears as smooth, bald areas devoid of lingual papillae on the dorsal

## DISCUSSION

In the field of healthcare, the prompt identification of oral manifestations during examinations of the oral cavity has been shown to be crucial for the diagnosis of underlying systemic conditions. These manifestations can either precede or follow findings from other areas of the body, thus aiding in early diagnosis and timely intervention. Although numerous oral disorders are linked to plaque-related issues, the oral mucosa can also exhibit changes due to systemic diseases, often being the initial site to display symptoms of such conditions. It is essential for both primary care physicians and dentists to possess a thorough understanding of the oral manifestations associated with systemic diseases, which enables them to identify and effectively address these signs and symptoms. A thorough oral examination should include the evaluation of mucosal alterations, such as pallor and pigmentation; a detailed inspection of the mucosal surface and palate for lesions; an assessment of periodontal health, focusing on inflammation and bleeding; and an examination of the tongue, gingiva, and overall dental status. Oral indicators of iron deficiency anemia (IDA) may include significant dental caries, chronic periodontitis, candidiasis, sensations of burning and redness of the tongue, mucosal pallor, atrophy of the lingual papillae, atrophic glossitis, dysphagia, and an increased risk of oral cancer.[7- 10]Hence; the present study was undertaken for assessing the occurrence of oral mucosal lesions among patients with microcytic anemic patients.

Maximum number of cases were underweight with 228 (68.47%) cases, out of which males were 95 (66.90%) cases and females were 133 (69.63%) cases, followed by overweight status was found in 53 (15.92%) patients out of which males were 27 (19.01%) cases and females were 26 (13.61%) cases respectively. Mean BMI is 16.25±2.42 and p Value <0.0001 was found to be statistically significant.On oral cavity examination, the most common findings was mucosal pallor found in 323 patients (97%) as seen in Table 7. The next most common finding on tongue was atrophic glossitis in 107 patients (32.13%).Other significant oral cavity findings comprised of fissured tongue in 103 patients(30.93%) and angular chelitis in 74 patients (22.22%) , geographic tongue in 33 patients (9.91%), oral ulcers in 67 patients (20.12%), candidal infection in 10 patients and lichen planus in 2 patients.

Iron deficiency can result in oral infections and the accumulation of bacteria due to insufficient oxygen levels. The most prevalent form of low serum iron levels is iron deficiency anemia, which can present in the oral cavity through conditions such as angular cheilitis, atrophic glossitis, generalized atrophy of the oral mucosa, candidiasis, recurrent aphthous ulcers, pallor, and stomatitis. Atrophic glossitis is characterized by the atrophy of fungiform and filiform papillae, which typically progresses to the lateral borders and dorsum of the tongue. The affected tongue may exhibit bald patches or appear red, shiny, and smooth, often accompanied by soreness, burning sensations, and tenderness. Conversely, excessive iron in drinking water can lead to extrinsic staining of the teeth.[10- 12]

Moreover, iron deficiency has been linked to the presence of oral premalignant lesions. Research indicates a notable reduction in serum iron levels alongside an increase in total iron binding capacity in individuals diagnosed with oral submucous fibrosis. It has been observed that iron deficiency in oral tissues leads to reduced vascularity, which facilitates the percolation of arecoline, a compound derived from the areca nut. The areca nut, commonly known as betel nut, is prevalent in South and Southeast Asia and contains carcinogenic substances, including arecoline. Increased percolation of arecoline can harm the oral

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mucosa by promoting fibroblastic proliferation and collagen synthesis. A case study by Battacharya and colleagues highlighted that iron deficiency was a primary factor in the development of oral submucous fibrosis, which was effectively treated with iron supplements and antioxidants. Additionally, low serum iron levels have been observed in patients with oral leukoplakia. Furthermore, iron deficiency is associated with Plummer-Vinson syndrome, also referred to as Paterson-Brown-Kelly syndrome or sideropenic dysphagia, which carries a risk of progression to malignancy. A correlation has been established between iron deficiency and esophageal adenocarcinoma.[11, 13, 14]

## CONCLUSION

In conclusion, as the oral cavity reflects general health status of individual, oral manifestations may be the earliest feature of Iron deficiency anemia. Hence, since Oral physician may be the first person to recognize the presence of anemia, his role to diagnose any underlying condition & hence help the patient for proper referral & treatment. In women and children Iron deficiency anemia is a “silent killer” & as a dentist we should look at the clinical features & help in early diagnosis and prompt treatment by the physician. The effects of anemia on the oral cavity and the lesions and through it we can reach the correct diagnosis and treatment early for reducing the harmful events of anemia.

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