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Awareness and Knowledge of Oral Signs and Symptoms of Vitamin B12 Deficiency among Students of Krishna Vishwa Vidyapeeth: A Cross-sectional Study

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ABSTRACT

Background: Vitamin B12 deficiency is frequently seen in populations with limited intake of animal-based foods. Early oral changes such as glossitis, burning sensations, and ulceration, can offer important diagnostic clues, however, these oral indicators are often overlooked during routine practice.

Material and Methods: A cross-sectional questionnaire was administered to 150 undergraduate learners from the fields of Medicine, Dentistry, Nursing, Pharmacy, and Physiotherapy at Krishna Vishwa Vidyapeeth. A pre-validated survey assessed knowledge regarding Vitamin B12, including dietary sources, recommended intake, systemic effects, and oral manifestations. Responses were obtained through a Google Form and evaluated using descriptive statistical methods.

Results: Nearly all participants (98.7%) were aware of Vitamin B12 deficiency; however, only a minority correctly identified daily requirements, natural dietary sources, and storage methods. A majority (90.7%) recognized oral signs as potential indicators, with glossitis, burning sensations, and oral ulcers most frequently reported. These findings demonstrate strong baseline awareness but highlight gaps in detailed clinical knowledge.

Conclusion: Healthcare students exhibit high general awareness of Vitamin B12 deficiency, yet detailed understanding of dietary intake and storage remains limited. Their ability to recognize oral manifestations underscores a potential role in early detection. Focused educational initiatives and interdisciplinary training may help bridge knowledge gaps and enhance timely patient care.

Keywords: Vitamin B12 deficiency; Oral manifestations; Glossitis; Healthcare students; Awareness; Cross-sectional study

INTRODUCTION

Vitamin B12, or Cobalamin, plays a crucial role in maintaining healthy nerve function, supporting red blood cell production, and enabling normal DNA synthesis.[1] As humans cannot synthesize this vitamin, it must be obtained from dietary sources or supplementation. A lack of Vitamin B12 may contribute to a wide range of numerous systemic complications, and early warning signs frequently first present in the oral cavity.

Typical oral changes linked to inadequate Vitamin B12 levels may involve glossitis, burning sensations, oral ulcers, and pallor of the mucosa.[3,4,5] Such symptoms can significantly affect comfort and may appear before more serious systemic conditions such as fatigue, neuropathy, and megaloblastic anemia.[2,6] Due to their nonspecific nature, oral signs are often overlooked or misdiagnosed unless healthcare providers are adequately informed.[3]

Healthcare professionals in dentistry, medicine, nursing, pharmacy, and physiotherapy are future providers who can detect early signs. Prior studies indicate knowledge gaps exists even among these students.[7,8]

Considering the high prevalence of B12 deficiency in India, especially among vegetarians, assessing awareness is critical.[9] The present study seeks to evaluate how well students understand the oral indicators and symptoms related to Vitamin B12 deficiency.

MATERIALS AND METHODS

Study Design and Setting

A descriptive cross-sectional survey was conducted at Krishna Vishwa Vidyapeeth, Karad, to evaluate the level of awareness among undergraduate students regarding Vitamin B12 deficiency, with particular attention to its oral manifestations. Ethical approval for the study was granted by the Institutional Ethical Committee (Ref. No. KVV/IEC/06/2025).

Study Population

The study enrolled 150 undergraduates students drawn from Medicine (MBBS), Dentistry, Nursing, Pharmacy, and Physiotherapy. Participants represented different academic years, ranging from first-year students to interns, and included both male and female students.

Inclusion Criteria

Undergraduate students enrolled in any academic year who voluntarily consented and completed the questionnaire.

Exclusion Criteria

Incomplete or duplicate questionnaire submissions were excluded.

Sampling Technique and Sampling Size

Participants were selected using a convenience sampling method to ensure representation across different faculties and year levels.

Sample size(N)=$Z^2P.Q/L^2$

P = 88% (participants aware of Vitamin B12 deficiency)

Q = 100 – P = 12

L = allowable error = 5.2%

Z = 1.96 (95% confidence)

Therefore,

N=$(1.96)^2(88)(12)/(5.2)^2$

N=150

Questionnaire Design

A self-administered Google Form was used, structured into three sections:

1. Demographics: Name, gender, field of study, academic year.

The questionnaire was modified from established, validated instruments, including nutrient-related food frequency questionnaires and structured symptom-based surveys. Content validity was reviewed by academic experts, and a pilot test ensured clarity and comprehensibility before distribution.

1.Have you heard of vitamin B12 deficiency before?
a)Yes
b)No
2.Do you know the recommended daily intake of vitamin B12 for adults?
a)1-2mcg
b)2.4mcg
c)10mcg
d)Not sure
3.Can vitamin B12 deficiency occur despite a healthy diet?
a)Yes
b)No
4.Which group is more commonly affected by vitamin B12 deficiency?
a)Vegetarian
b)Elderly individual
c)Pregnant women
d)All of the above
5.Which of the following foods, naturally contain vitamin B12?
a)Fish
b)Meat

c)Cheese
d)Spinach
6.Do you think vitamin deficiency can be present with oral signs and symptoms?
a)Yes
b)No
7.Which of the following oral symptoms are commonly linked to vitamin B12 deficiency?
a)Glossitis
b)Burning mouth syndrome
c)Oral ulcers
d)All of the above
8.Do you think oral signs can help in the early detection of vitamin B12 deficiency?
a)Yes
b)No
c)Not sure
9.Which systemic signs are commonly seen in vitamin B12 deficiency?
a)Fatigue
b)Tingling or numbness in extremities
c)Memory disturbances
d)All of the above
10.Which diagnostic test is commonly used to confirm vitamin B12 deficiency?
a)Serum vitamin B12 level
b)Hemoglobin
c)Blood sugar level
d)Urine analysis
11.Can Vitamin B12 deficiency be corrected with timely supplementation?
a)Yes
b)No
12.How long does the body typically store vitamin B12
a)A few days
b)A few weeks
c)A few months
d)Several years
13.In your opinion, is awareness about nutritional deficiencies emphasized enough in health education?
a)Yes
b)No
14.Have you ever personally experienced or known someone with oral someone with oral issues due to nutritional deficiencies?
a)Yes
b)No
15.Would you be interested in attending educational workshops or seminars about nutritional deficiencies and their oral signs?
a)Yes
b)No

Data Collection Process

Students were briefed about the purpose of the study and provided their consent. The link to the questionnaire was shared online through the college networks using Google Forms. The data were organized in Google Sheets, analyzed in Microsoft Excel, and summarized using descriptive statistics.

RESULTS

Demographic Characteristics

A total of 150 students from Krishna Vishwa Vidyapeeth took part in the study.The participants represented different health science programs and academic years, providing a broad and balanced view of their awareness of Vitamin B12 deficiency (Table 1).

Table 1: Demographic characteristics of the study participants (n=150)

Variable	Category	n(%)
Faculty	Medical	27(18.0)
	Dental	35(23.3)
	Physiotherapy	30(20.0)
	Nursing	30(20.0)
	Pharmacy	28(18.7)
Gender	Male	73(48.7)
	Female	77(51.3)
Year of Study	First year	28(18.7)
	Second year	28(18.7)
	Third year	29(19.3)
	Fourth year	29(19.3)
	Intern	36(24.0)

Vitamin B12 Deficiency Awareness

Almost all students (98.7%) knew about Vitamin B12 deficiency; only 20% were aware of the recommended daily intake (2.2 mcg). Recognition of at-risk groups and dietary sources varied (Table 2, Figure 1-2).

Table 2: Student's Knowledge About Vitamin B12 deficiency

Questions	Options	n(%)
Awareness about Vitamin B12 deficiency	Yes	148(98.7)
	No	2(1.3)
Knowledge of recommended daily intake	1-2mcg	30(20)
	2.4mcg	108(72)
	10mcg	1(0.7)
	Not sure	11(7.3)
Awareness that deficiency can occur despite healthy diet	Yes	126(84)
	No	24(16)
Group commonly affected by B12 deficiency	Vegetarian	16(10.7)
	Elderly individuals	8(5.3)
	Pregnant women	5(3.3)
	All of the above	121(80.7)
Correct natural sources	Fish	70(18.4)
	Meat	95(25)
	Cheese	108(28.4)
	Spinach	107(28.2)

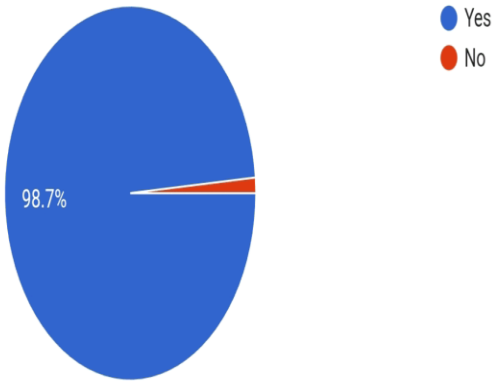

Figure 1: Awareness About Vitamin B12 Deficiency

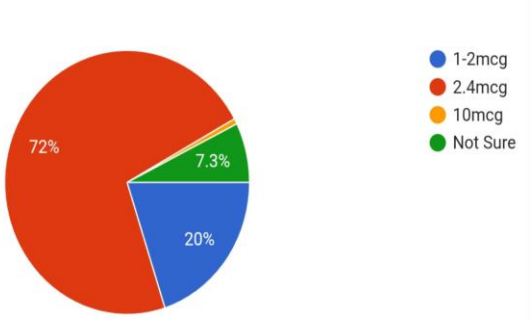

Figure 2: Knowledge of Recommended daily Vitamin B12 intake

Knowledge of Oral and Systemic Manifestations

A large majority of students (93.3%) felt that Vitamin B12 deficiency can cause oral signs and symptoms. Glossitis (82.7%) and burning mouth syndrome (72.7%) were most frequently recognized, while only 16.7% identified oral ulceration. Importantly, 83.3% agreed that oral signs can aid in early detection.Regarding systemic features, fatigue (82.7%), tingling (81%), and memory disturbance (77.3%) were commonly reported, with 81.3% acknowledging all systemic manifestations (Table 3, Figure 3-4).

Table 3: Knowledge of oral and systemic manifestations

Questions	Options	n(%)
Are Oral signs and other symptoms observed in Vitamin B12 deficiency?	Yes	136(90.7)
	No	14(9.3)
Which of the following are oral signs linked to vitamin B12 deficiency?	Glossitis	1(0.7)
	Burning mouth syndrome	4(2.7)
	Oral ulcers	25(16.7)
	All of the above	120(80)
Can oral signs be useful in identifying Vitamin B12 deficiency?	Yes	122(81.3)
	No	25(16.7)
	Not sure	3(2)
Which of the following are systemic signs linked to Vitamin 12 deficiency?	Fatigue	4(2.7)
	Tingling or numbness in extremities	12(8)
	Memory disturbances	12(8)
	All of these signs	81.3

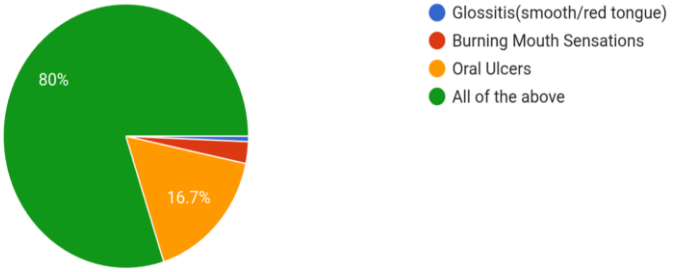

Figure 3: Awareness of Oral Clinical Features in Vitamin B12 deficiency

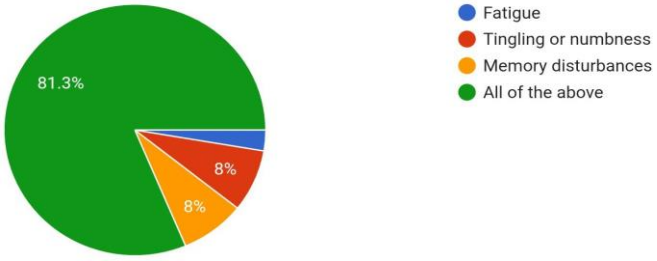

Figure 4: Awareness of Systemic Clinical Features in Vitamin B12 deficiency

Diagnostic Methods and Preventive Perceptions

Most students (97.3%) correctly identified a blood test for Vitamin B12 levels as the confirmatory diagnostic method. About 63.3% stated that the deficiency can be reversed and emphasized the importance of nutritional guidance and early screening by dentists. 92.7% supported conducting awareness programs to educate healthcare students about nutritional deficiencies (Table 4, Figure 5).

Table 4: Diagnostic methods and preventive perceptions

Questions	Options	n(%)
Which test is used to confirm Vitamin B12 deficiency?	Serum Vitamin B12 level	146(97.3)
	Haemoglobin level	4(2.7)
	Blood sugar test	-
	Urine analysis	-
Can it be reversed with timely supplementation?	Yes	143(95.3)
	No	7(4.7)
How long does the body typically store vitamin B12 ?	A few days	10(6.7)
	A few weeks	136(90.7)
	A few months	3(2)
	Few years	1(0.7)
Awareness about nutritional deficiencies in health education	Yes	99(66)
	No	51(34)
Personal experienced/known someone with nutritional deficiencies	Yes	55(36.7)
	No	95(63.3)
Interested in workshops or seminars	Yes	139(92.7)
	No	11(7.3)

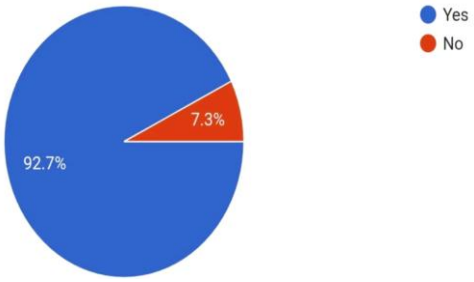

Figure 5: Interested in attending workshops or seminar

DISCUSSION

The present study evaluated student's awareness of B-12 deficiency and its related oral signs. The result showed that while overall awareness about Vitamin B12 deficiency was generally good, detailed knowledge regarding dietary sources, recommended daily intake, and systemic as well as oral manifestations was inadequate.

Nearly all participants (98.7%) had heard of Vitamin B12 deficiency, which is consistent with earlier surveys highlighting a relatively good baseline awareness of nutritional deficiencies among healthcare students.[1] However, only 20% of respondents correctly identified the recommended daily intake, indicating a lack of clarity regarding precise nutritional requirements. Similar observations were reported by Green et al., who emphasized that despite widespread awareness, knowledge of dietary recommendations often remains poor.[2]

The recognition of oral manifestations such as glossitis and burning mouth syndrome was encouraging, with more than 70% of students identifying these signs. This finding is important because oral changes are often among the earliest indicators of a systemic Vitamin B12 deficiency.[3] Nevertheless, the fact that less than one-fifth of participants identified oral ulceration underscores the gaps in comprehensive understanding. González-Moles et al. Highlighted the need to recognize subtle oral findings for timely diagnosis.[4] Comparable findings have been noted in other Asian research, where limited emphasis on oral health led to delayed identification of vitamin deficiencies.[8]

Most students were aware of the systemic effect of Vitamin B12 deficiency, reporting symptoms such as fatigue, neuropathy, and cognitive disturbances-findings that align with earlier research describing these features as common clinical outcomes.[5] The study also revealed that 83.3% of the participants recognized that oral signs can assist in early diagnosis, supporting the concept that the oral cavity often reflects underlying systemic conditions.[6] This link between nutritional deficits and conditions affecting the oral mucosa is well supported by prior research.[9]

Awareness about diagnostic methods was relatively strong, with 97.3% correctly identifying serum Vitamin B12 estimation as the confirmatory test. However, their understanding of prevention and long-term management appeared limited. Only one-third knew that body can retain Vitamin B12 for several years, even though supplementation is highly effective in correcting the deficiency.[7] Reports from other community-based studies have shown comparable patterns particularly regarding inadequate awareness of Vitamin B12 storage and bioavailability.[10]

From an educational standpoint, over 90% of the students showed interest in attending workshops on Vitamin B12 deficiency, indicating their willingness to improve their understanding through structured learning programs. Collaborative teaching that includes the faculties of medicine, dentistry, nursing, pharmacy, and physiotherapy may serve as a practical approach to reducing current knowledge gaps. These academic initiatives could help support early diagnosis while also encouraging coordinated patient care. Evidence from other developing nations has shown that incorporating similar curriculum-based strategies can enhance nutritional awareness and improve patient counseling outcomes.[11]

The clinical relevance of these findings is considerable. In India, where vegetarian dietary patterns are widespread, the likelihood of Vitamin B12 deficiency is especially elevated.[5] Early identification of oral changes by dentists and other healthcare professionals can therefore be crucial in preventing severe systemic outcomes such as megaloblastic anemia and neuropathy.

Although overall awareness regarding Vitamin B12 deficiency among healthcare students appeared reasonably good, their detailed understanding—especially regarding oral manifestations and long-term prevention—was inadequate. Educational strategies, including seminars, workshops, and curriculum integration, are urgently required to bridge this knowledge gap and ensure early recognition of oral signs for timely intervention.

CONCLUSION

With foundational knowledge about Vitamin B12 deficiency was satisfactory,, important gaps remain in understanding its dietary sources, requirements, and body storage. Recognition of oral manifestations underscores the potential for early detection. Focused interdisciplinary education and workshops are recommended to bridge knowledge gaps and improve patient care out comes.

Ethical approval
Ethical authorization for conducting the study was granted by the Institutional Ethical Committee (Ref. No. KVV/IEC/06/2025).

Patient Consent
The authors confirm that all necessary patient consent was obtained.

Financial Support and sponsorship
None

Conflict of Interest
There were no conflicts of interest associated with this study.

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