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Awareness of Vitamin B12 Deficiency Among Undergraduate Student

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ABSTRACT:

Vitamin B12 (cobalamin) deficiency is one of the most common deficiency and it is caused due to limited dietary intake of animal foods or food-bound cobalamin malabsorption. Additionally, vegetarians with restrictive diets are particularly at risk due to reduced consumption of animal source. Vitamin B12 essential for DNA synthesis and cellular energy production. It is an essential cofactor involved in methylation processes that support DNA synthesis and cellular metabolism. Therefore, its deficiency can disrupt these functions and lead to serious clinical effects. Prevalence of Vitamin B12 deficiency is **more than 47% in the Indian population** and **only 26% of the population is Vitamin B12 sufficient.** Vitamin B12 deficiency can affect individuals at all age, but mostly affect to the elderly individuals. Vitamin B12 deficiency can lead to serious health problems, most serious cause is megaloblastic anaemia. It is also associated with symptoms such as fatigue, weakness, numbness or tingling in the hands, tiredness and feet (neuropathy), and memory loss. A structured questionnaire was distributed to undergraduate student (age 17-30). The survey collected data on dietary habits, clinical symptoms, disease condition and awareness regarding vitamin B12 sources and deficiency-related complications. The importance of the study is increased public awareness, nutritional education, and early screening strategies to prevent complications associated with vitamin B12 deficiency and helping high-risk people eat different kinds of foods and take supplements can reduce vitamin B12 deficiency.

Keywords: Vitamin B12 Deficiency, Undergraduate Student, awareness

INTRODUCTION

Vitamins are organic compounds that required by the human body and they are consider as a vital nutrients essential for overall health condition. Since the body cannot produce enough of them by own, they must be obtained from dietary source. There are thirteen types of vitamins, each classified based on their chemical structure and biological function, and each plays a important role in maintaining body condition. Out of which Vitamin B12 has a vital role in cell growth and development through many reactions and processes that occur in the body. When the level becomes elevated or lower than the normal, the whole process will collapse because each process is interconnected with other. Deficiencies can be treated by increasing their consumption in diet or by supplement intake.

In the United States, studies have shown that the prevalence of vitamin B12 deficiency differs across age group. It affects approximately 3% of individuals aged 20-39 years, 4% of those between 40-59 years, and about 6% of people aged 60 years and above.

1.1 What is Vitamin B12?

Vitamin B12 is a water-soluble vitamin, also called cobalamin. Vitamin B12 is an important nutrient that helps your body keep your nerve cells and red blood cells healthy. It also helps your body make DNA. The human body cannot produce it, so it must be obtained from animal based foods such as meat, egg, fish, milk and nutritional yeast. Daily intake of **2.4 mcg** is recommended for adults.

1.2 Sources of Vitamin B12:

✓ Food

Vitamin B12 is present in foods of animal origin, including meat, fish, chicken, eggs and dairy products. However, fortified breakfast cereals, Banana, Spinach and fortified nutritional yeasts are readily available source of vitamin B12 with high bioavailability.

✓ Dietary supplements

Vitamin B12 is commonly included in dietary supplements, most often in the form of cyanocobalamin, although other forms such as methylcobalamin, adenosylcobalamin, and hydroxycobalamin are also used.

✓ Prescription medications

Vitamin B12 in the form of cyanocobalamin and hydroxycobalamin, can be given as a prescription medication through parenteral routes like intramuscular injection. This method is generally used to manage vitamin B12 deficiency, specially in cases of megaloblastic anemia and oancreatic insufficiency that causes malabsorbtion and lead to sever deficiency.

1.3 Synthesis of Vitamin B12:

Vitamin B12 is made only by certain bacteria and archaea through a complex fermentation process. For industrial production, it is produced on a large scale by using bacteria such *as Propionibacterium shermanii* or *Pseudomonas denitrificans.* Then it is purified and processed into supplements forms like cynocobalamine.

1.4 Absorption of Vitamin B12:

Vitamin B12 is absorbed by two mechanisms,

1. Absorption of protein bound vitamin B12.

Dietary vitamin B12 is bound to proteins present in food and is released in the stomach due to it's acidic nature, which helps prepare it for absorption in the small intestine. Once released, it binds to a carrier protein called haptocorrin (transcobalamin I) and stays attached until it reaches the duodenum, where enzymes break the complex. The free vitamin B12 then binds to intrinsic factor (IF), a protein produced by stomach cells, which is essential for its absorption in the terminal ileum.

After absorption, vitamin B12 separates from intrinsic factor and enters the bloodstream, where it attaches to transport proteins like transcobalamin II and haptocorrin. These proteins help deliver vitamin B12 to body tissues and the liver for storage and use.

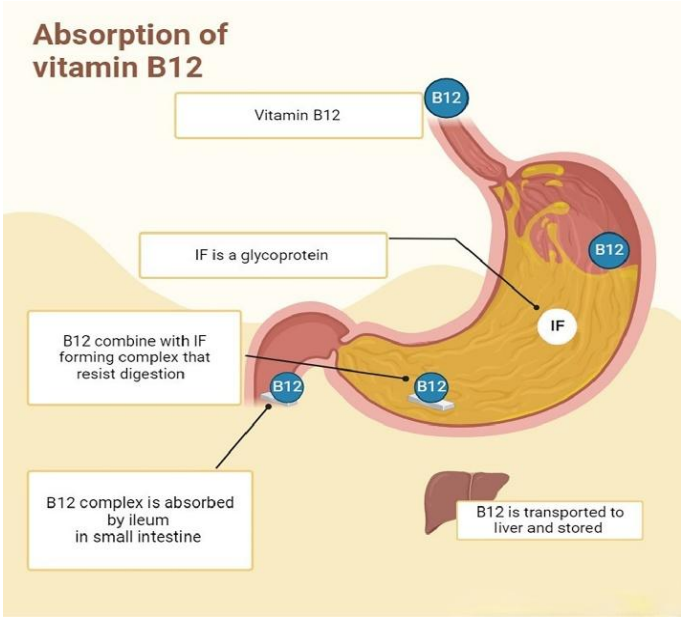


Fig.1. Absorption of Vitamin B12

2. Absorption of unbound protein

In supplements, vitamin B12 is present in a unbound form, so it does not require stomach acid or digestive enzymes to be released from proteins. However, stomach acid needed to properly dissolve certain tablets, especially if they are not chewed. When taken in large enough doses, unbound B12 can overcome intrinsic factor defects because so much can be absorbed through passive diffusion.

1.5 Vitamin B12 deficiency:

Vitamin B12 deficiency, also known as cobalamin deficiency, occurs when the body either does not receive enough vitamin B12 or is unable to absorb it properly from food. This vitamin is essential for the production of red blood cells and DNA, which is the genetic material in all cells. It plays a crucial role in maintaining normal body functions. If left untreated, vitamin B12 deficiency can lead to physical, neurological, and psychological complications.

1.6 Symptoms of vitamin B12 deficiency:

The symptoms of vitamin B12 deficiency can develop slowly. In some cases, individuals may not show any symptoms even if their vitamin B12 levels are low. This deficiency can lead to a range of physical, neurological, and psychological problems.

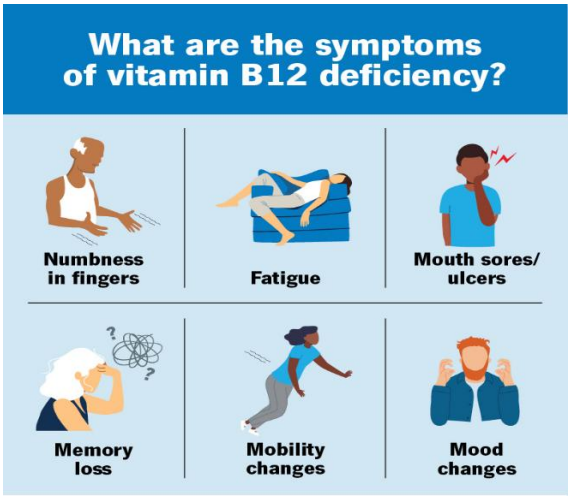


Fig.2. Symptoms of vitamin B12

✓ Physical symptoms

fatigue and weakness, nausea, vomiting or diarrhoea, reduced appetite, sore mouth or tongue ulcers and pale skin.

✓ Neurological symptoms

Tingling in hands and feet, vision problem, confusion, fumbling while speaking.

✓ Psychological symptoms

Depression, feeling irritable and change in behaviour

1.7 Causes of vitamin B12 deficiency:

Vitamin B12 deficiency occurs when a person either does not consume enough vitamin B12 in their diet or their body is unable to properly absorb it. Various conditions and situations can lead to this deficiency, including:

✓ Low vitamin B12 intake; vegetarianism, chronic alcoholism and older.

✓ Gastrointestinal disorders; Ulcer, Crohn's disease

✓ Pernicious anemia; People with pernicious anemia do not produce intrinsic factor, a protein that is essential for the absorption of vitamin B12. Without intrinsic factor, the body cannot properly absorb this vitamin, leading to a vitamin B12 deficiency.

✓ Transcobalamin II deficiency

✓ Drugs; Metformin, proton pump inhibitors and H_2 receptor antagonist.

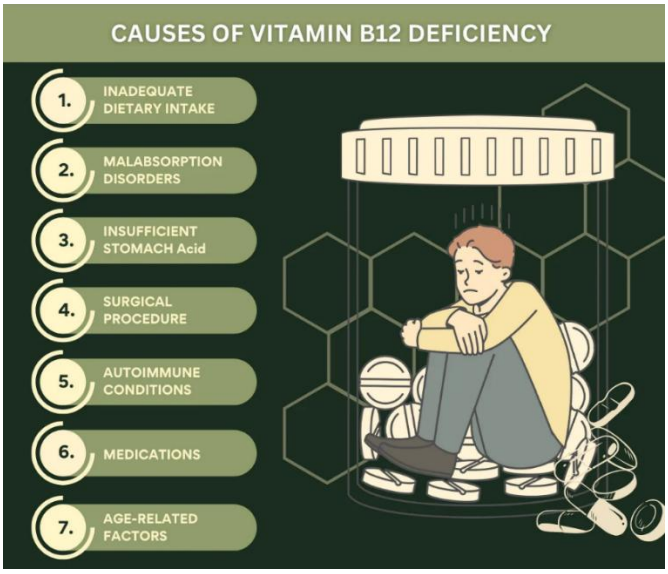


Fig. 3. Causes of vitmain B12.

1.8 Treatment and Management:

- Most individuals can avoid vitamin B12 deficiency by consuming sufficient amounts of meat, poultry, seafood, dairy, and eggs.
- If individuals have pernicious anemia or malabsorption then treatment gives these patient such as Vitamin B12 injection, high dose supplements or nasal vit. B12 administration.
- Vegetarian peoples can follow diet such as banana, Vitamin B12-fortified cereals, supplements etc.
- Eating foods that having rich vitamin B12 like meat, fish, eggs and dairy products.

1.9 Diagnostic test for Vitamin B12 deficiency:

Common tests used to detect vitamin B12 deficiency include:

- Complete blood count (CBC)
- Serum vitamin B12 level test
- Methylmalonic acid (MMA) test
- Homocysteine test

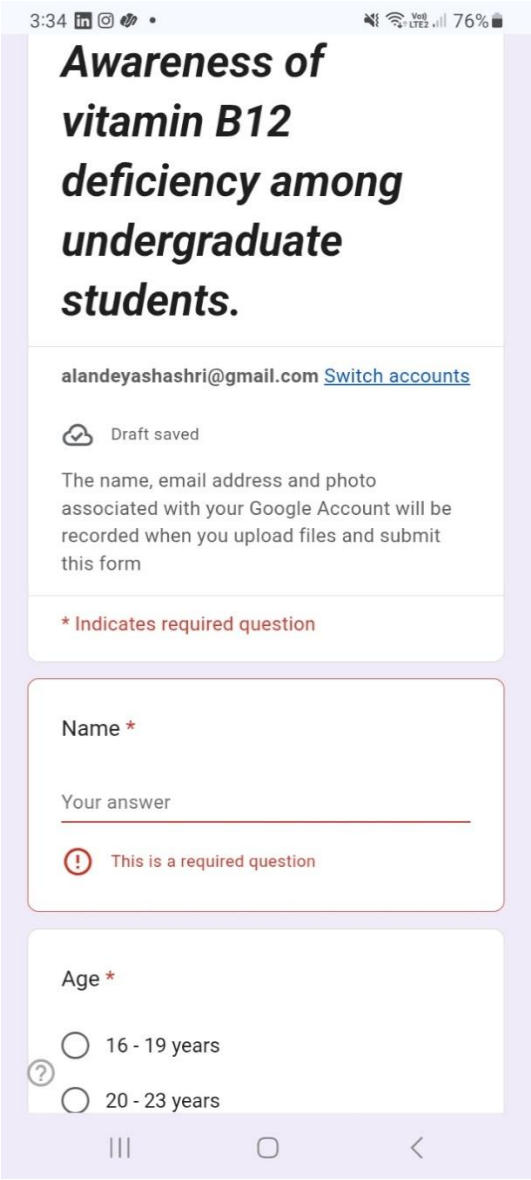
1.0 Importance of Awareness in Vitamin B12 Deficiency prevention:

Vitamin B12 deficiency awareness is particularly important among today's youth because of modern lifestyle habits such as irregular eating patterns, frequent fast-food consumption, skipping meals, and the taking of restrictive diets like vegan or poorly planned vegetarian diets. Many young people are not aware that Vitamin B12 plays a vital role in red blood cell production, nervous system function, and DNA synthesis. Due to this lack of awareness, early signs such as tiredness, difficulty in concentrating, weakness, mood changes, and memory problems are often overlooked or mistaken for stress, academic workload, or inadequate sleep. If not addressed in time, this deficiency can lead to serious health problems such as megaloblastic anemia, neurological complications, and reduced cognitive abilities, ultimately affecting academic performance and productivity. Awareness initiatives help young individuals understand the importance of a balanced diet, timely health check-ups, and proper supplementation when required. Hence, improving awareness among youth is essential for early prevention, better health outcomes, and enhanced academic and lifestyle efficiency.

1) Survey Methodology

2.1 Study design:

This study is based on a descriptive, quantitative approach using a cross- sectional survey design. This design was considered appropriate for assessing the level of awareness, knowledge, attitude and symptoms monitoring relevant to vitamin B12 deficiency among undergraduate students.



2.2 Targeted population and sampling:

- **Target Population:** The study targeted undergraduate students currently studying in colleges or universities.
- **Sample size:** A total 95 completed responses were included in the final data analysis.
- **Sampling Method:** The survey was conducted through Google Forms. The Google Forms was distributed through online platforms such as WhatsApp, email, and other social media apps to reach the target population.

Data collection Method:

The data was collecting using a structured, self-administered questionnaire titled **'Awareness of Vitamin B12 deficiency among undergraduate students.'** The survey made by using Google Form and was distributed electronically.

The survey consist approximately 20 questions divided into sections such as Demographics, Diet, general awareness, symptoms monitoring, prevention and diseased condition of participants. The questionnaire contains of both close-ended and multiple-choice questions to gather relevant information.

Data Collection Procedure:

A survey link was provided to the students electronically via their official whatsApp group of college along with a message as follows "Hello, we are conducting a survey on 'Awareness of vitamin B12 deficiency among Undergraduate student' for my final year project. Your participation is greatly appreciated. Please fill out the Google Form because your response will grateful for us. Thank you." Participation in the survey was completely voluntary and confidentially of the respondents was ensured. The data collection was conducted over a period of three weeks to obtain quantitative analysis of responses. All responses were automatically recorded and stored in Google Sheets for further analysis.

2.3 Data Analysis

The collected data was analyzed using Excel sheet. Responses obtained from Google Forms they were automatically recorded on a spreadsheet and checked for accuracy and completeness.

Then data analysis was done by using graphical representations, including bar charts and pie charts for clarity. The analysis is based on awareness, dietary habits, diseased condition and symptoms monitoring of vitamin B12 deficiency of this targeted population.

This approach guided for meaningful conclusions and appropriate results.

2) Survey Demographics:

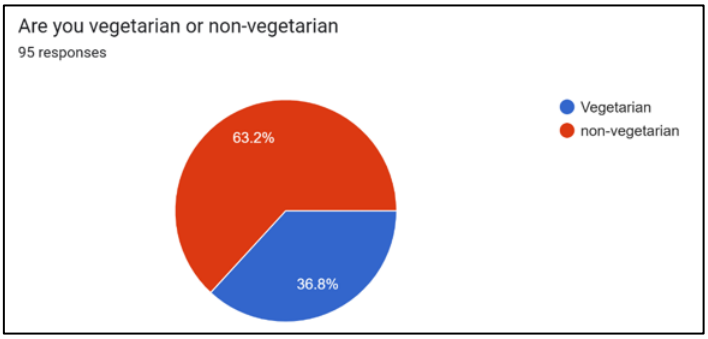
The survey gathered responses from 95 undergraduate student, most of which were female with 20-23 years age criteria.

Category	Group	Total response (%)
Gender	Male	24.2 %
	Female	75.8 %
Age Criteria	16-19 years	15.8 %
	20-23 years	77.9 %
	24-27 years	3.2 %
	28-30 years	0 %

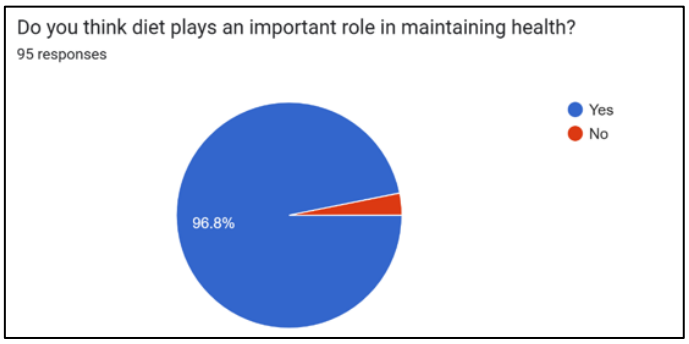
3) Key Findings

4.1 Dietary habits

- The respondents are categorized into vegetarian and non-vegetarian groups. In which 63.2 % are non-vegetarians and 36.8% are vegetarians.

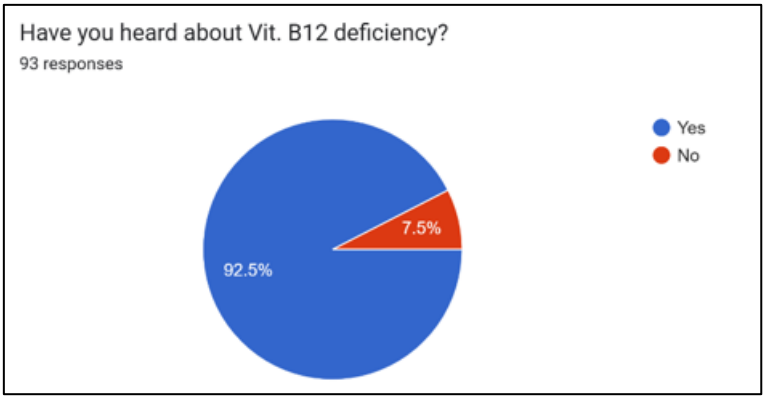


- Importance of diet: 96.8% responders think diet plays an important role in maintenance of vitamin B12.

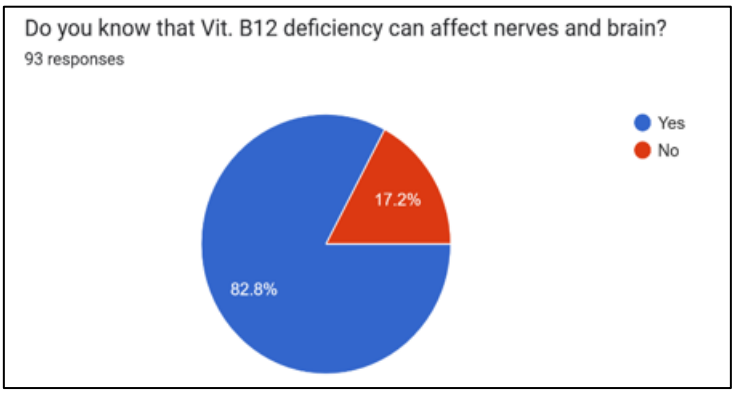


4.2 Awareness of vitamin B12 deficiency

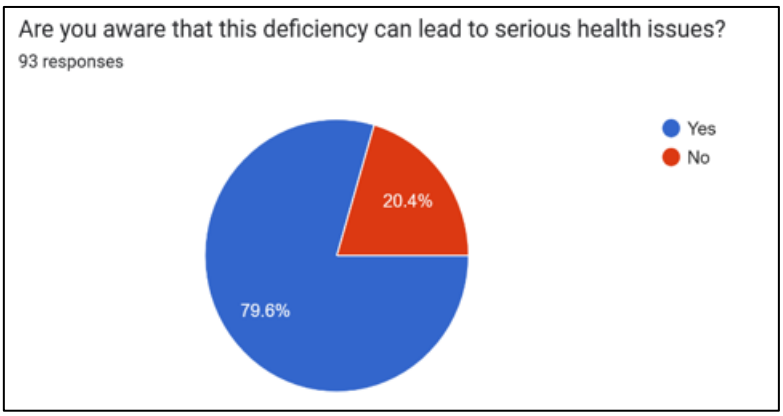
- **92.5%** participants heard about vitamin B12 deficiency. Hence majority of responders are aware about this deficiency. Only 7.5% participants not aware about this.



- **82.85** responders known the serious cause vitamin B12 deficiency that is nerve damage and brain dysfunction.



79.6% responders are aware about vitamin B12 deficiency can cause serious health issue and only 20.4% responders are not aware about this.

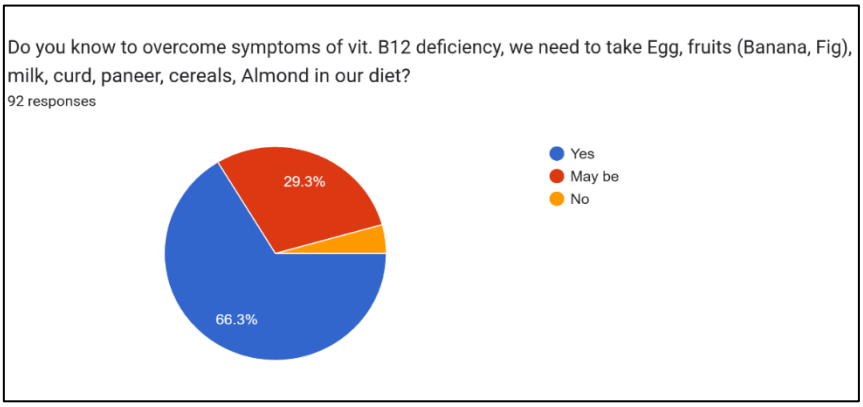


- To overcome the symptoms of vitamin B12 deficiency we need to take proper meal include Egg, fruits (Banana, Fig), milk, curd, paneer, cereals, Almond in our diet. The collected Data obtain;

66.3% = Yes

29.3% = May be

4.3 % = No

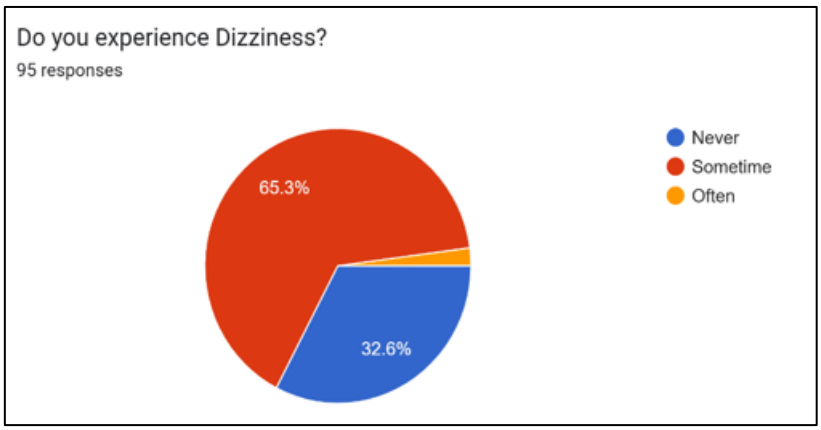


4.3 Symptoms Monitoring

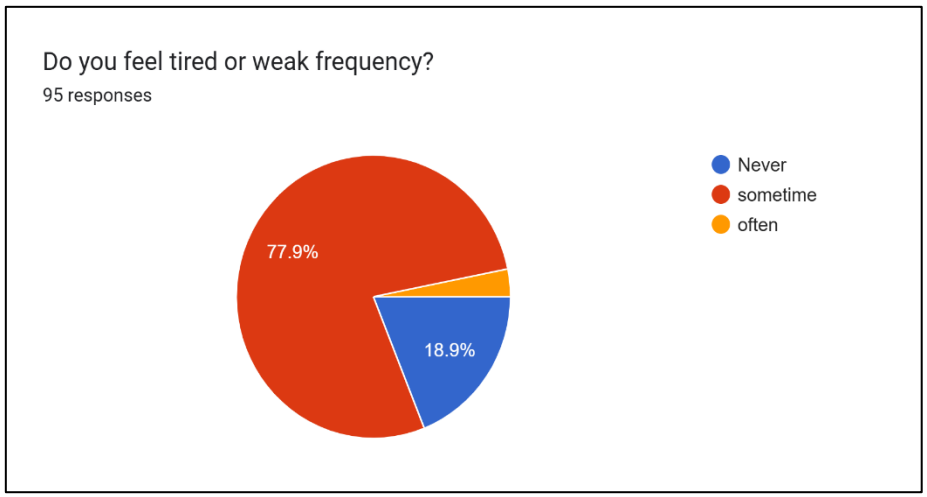
- In this survey include questions to assess most commonly symptoms of vitamin B12 deficiency are monitored; such as dizziness, tiredness, confusion, tingling in hands or feet, pale skin, headache, mouth ulcers and shortness of breath.

- Monitoring these symptoms helps in understanding the awareness and possibility of risk of vitamin B12 deficiency among study population.

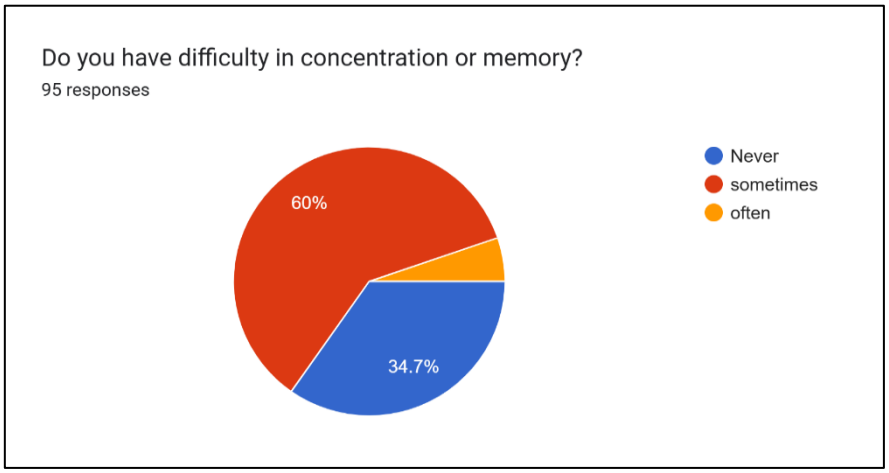
- Dizziness = **65.3%** (62 responses) answered **Sometime,32.6%** (31 responses) answered **Never, 2.1%** (2 responses) answered **Often.**



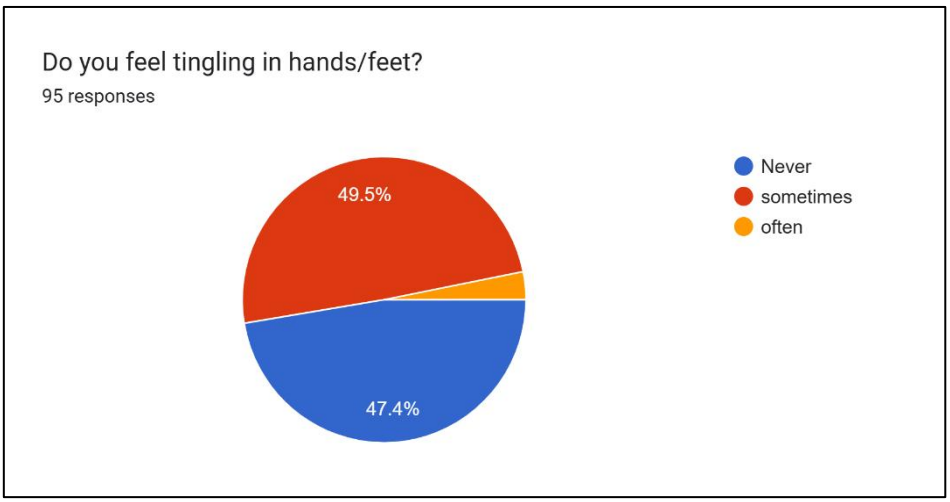
- Tiredness = **74** responses **Sometimes, 18** responses **Never** and **3** responses **Often.**



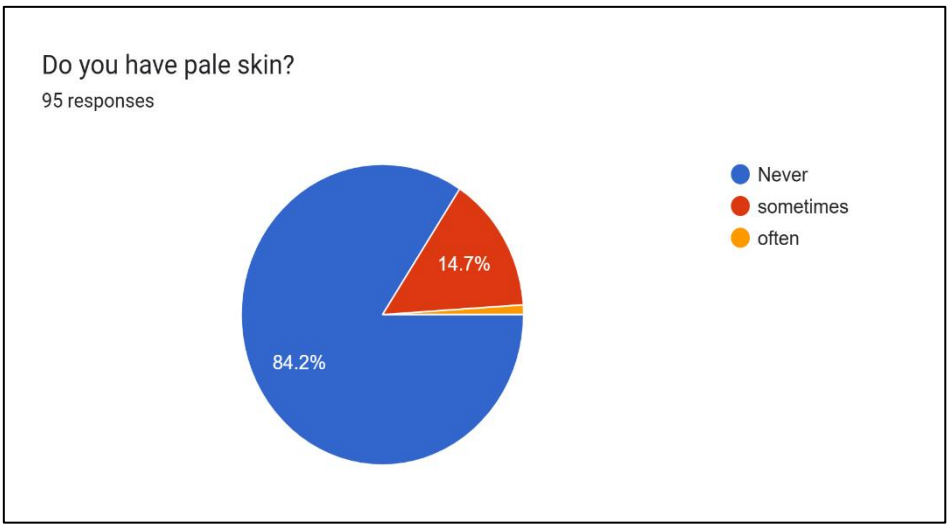
- Confusion = **60%-Sometimes, 34.7%- Never, 5.3% - Often.**



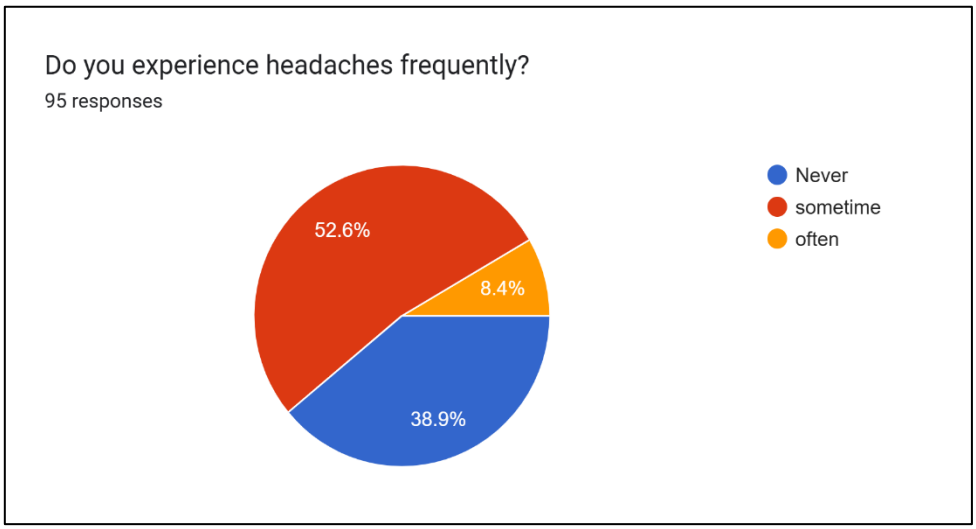
- Tingling in hands/feet = **49.5%-Sometimes, 47.4%- Never, 3.2% - Often.**



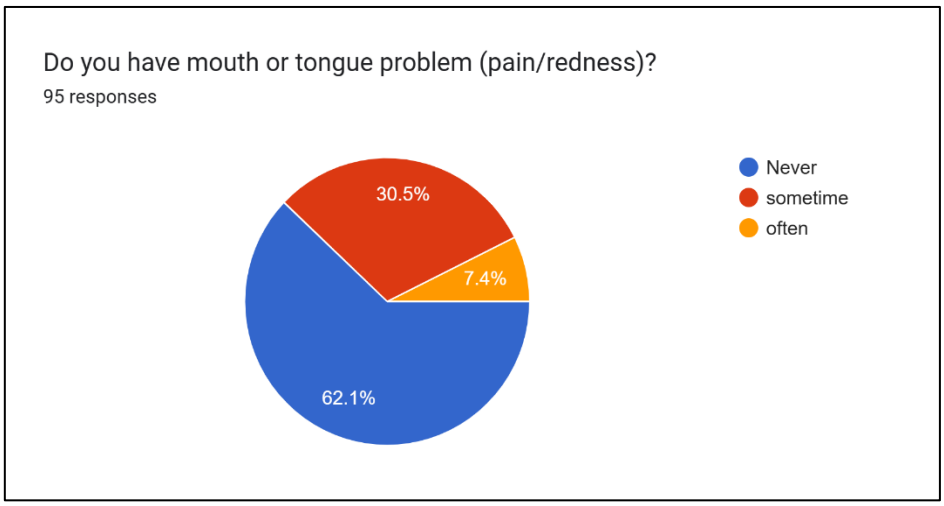
- Pale skin = **14.7%-Sometimes, 82.2%- Never, 1.1% - Often.**



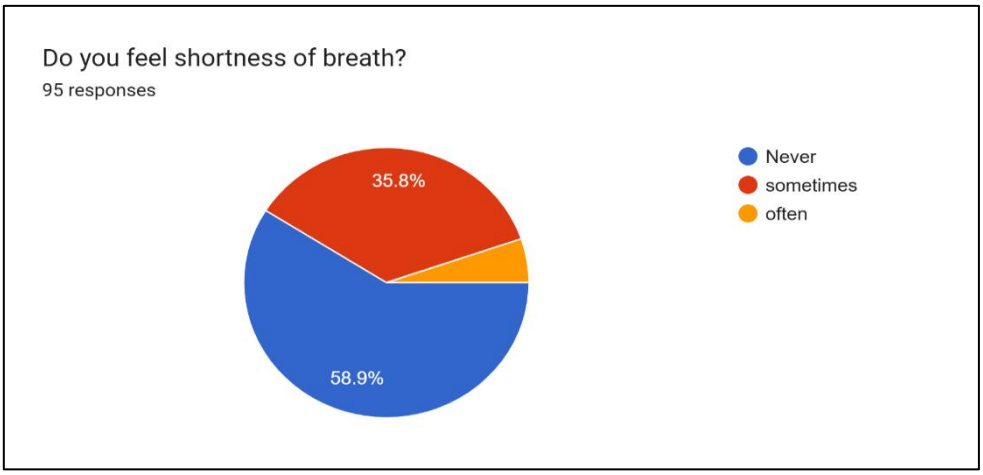
- Headaches = **52.6%-Sometimes, 38.9%- Never, 8.4% - Often.**



- Mouth ulcers = **30.5%-Sometimes, 62.1%- Never, 7.4% - Often.**



- Shortness of breath = **35.8%-Sometimes, 58.9%- Never, 5.3% - Often.**



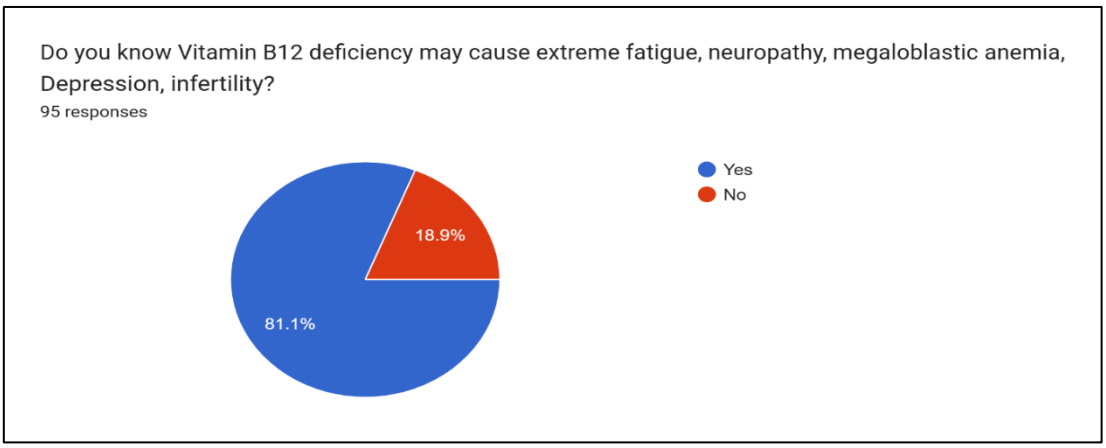
4.4 Diseased condition of participants

- Vitamin B12 deficiency is associated with several clinical conditions that affects to the body. In this survey, commonly observed diseased condition in relevant to vitamin B12 includes peptic ulcer, diabetes mellitus, Heart disease, neurological disease etc. Additionally, check the awareness of participants of vitamin B12 deficiency condition.

- Vitamin B12 deficiency may cause extreme fatigue, neuropathy, megaloblastic anemia, Depression, infertility.

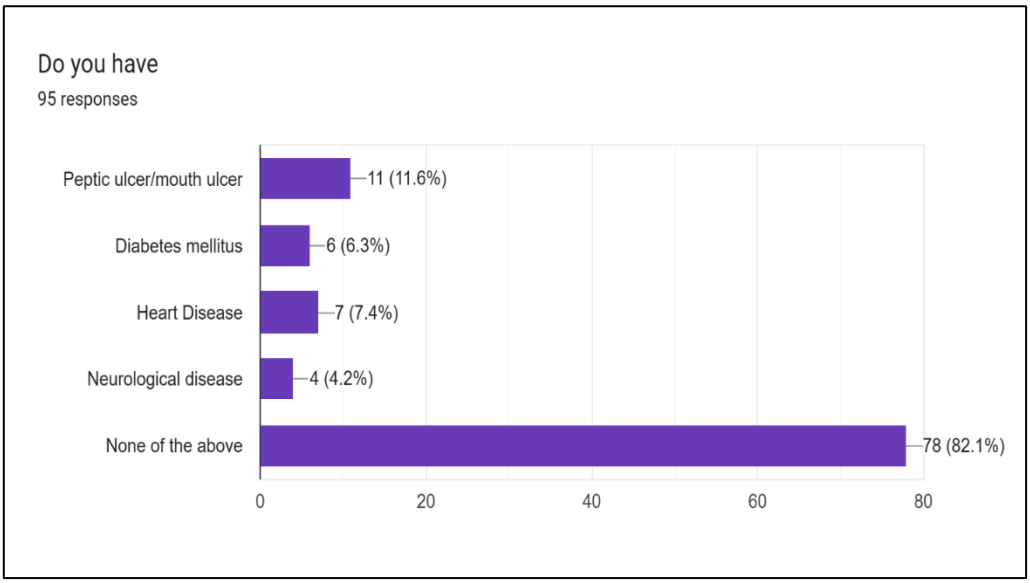
- Following 81.1% responders are aware about this and only 18.19% responders are unaware about this.

- However, 82.1% participant reported they do not have any diseased condition mentioned in question.



Associated Diseased Condition. (Multiple selection)

- Peptic ulcer/mouth ulcer; 78 responses
- Diabetes mellitus; 6 responses
- Heart Disease; 7 responses
- Neurological disease; 4 responses
- None of the above; 78 responses



4) Survey Result

The following table summarizes the critical findings of our survey on **"Awareness of vitamin B12 Deficiency among Undergraduate students".**

Survey Questionnaire	Percentage (%)	Responders(count)
Section-1 ; Dietary habits		
Vegetarian and Non-vegetarian	63.2% (non-vegetarian) 38.8% (vegetarian)	60 35
Aware about importance of Diet	96.8%	92
Section-2 ; Awareness of Vitamin B12 deficiency		
Awareness	92.5%	86
Vit.B12 cause sever health problems	79.6%	74
Section-3 ; Symptoms monitoring	Sometimes	Sometimes
1. Dizziness	65.3%	62
2. Tiredness	77.9%	74
3. Confusion	60%	57
4. Tingling in hands/feet	49.5%	47
5. Pale skin	14.7%	80
6. Headache	52.6%	50
7. Mouth ulcer	30%	29
Section-4 ; Diseased condition of participants		
Participants have		
1. Peptic ulcer	11.6%	11
2. Diabetes Mellitus	6.3%	6
3. Heart disease	7.4%	7
4. Neurological disease	4.2%	4
5. Nono of the above	82.1%	78

5) Conclusion

Vitamin B12 deficiency survey in undergraduate students gives result that 70 – 77% students are facing problem if tiredness, fatigue, headache and other problems. Most of girls are also facing neurological problems and the reason behind is only vitamin B12 deficiency. Daily intake and dietary source for vitamin B12 plays vital role for healthy individuals and thus undergraduate population is building blocks of newborns.

This survey gives vigilance for unawareness irritation, anger issue and problems related to unenthusiastic behaviour and mood swings alters personality of undergraduates, further intolerance lead to anaemia, neurological disorders in young population.

The present study on vitamin B12 deficiency among UG students highlights that this condition is a significance and growing health concern in the young population. The analysis of survey data indicates that a considerable percentage of students in vitamin B12 deficiency and risk due to dietary habits, irregular eating patterns, and lack of awareness.

In conclusion, spreading awareness and encouraging preventive actions are essential for improving students health.

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Conflict of Interest Statement: All authors have nothing else to disclose.