Prevalence of vitamin B12 deficiency in Western Uttar Pradesh

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Abstract:
Background: Vitamin B 12 deficiency can occur due to a variety of causes. The aim of this retrospective study was to find out the prevalence of Vitamin B-12 deficiency in general population who attended in our clinic.

Material & Methods:
Laboratory data of 255 patients who visited our clinic over a period of 3 months from Oct 2020 to Dec 2020 was collated and analysed.

Result:
Data of patients of both sexes from 12 to 82 years were included in the analysis. Maximum number of participants were in the age group of 31 to 40. 53 % of participants were males and 47 % were females. In the given population studied, 25 % (n=63) were vitamin B 12 deficient. 62 % males (n=39) and 38 % females (n=24) were found to be vitamin B 12 deficient. A higher proportion of vegetarians were vitamin B 12 deficient. A significant proportion of diabetes patients were also found to be deficient.

Conclusion:
One-fourth of the population across a wide age group were found to be vitamin B12 deficient. Vegetarian patients are at a higher risk of deficiency and must be assessed on a regular basis.

Introduction:
Vitamin B12 is water-soluble vitamin which is known to play an important role in the normal functioning of the brain and nervous system. It also plays a role in the formation of red blood cells (RBCs) and deoxyribonucleic acid (DNA) and has a significant role in fatty acid and amino acid metabolism.[1,2]

Due to the diverse physiological functions in the human body, the deficiency of this vital vitamin, presents as a myriad clinical presentation ranging from neurological symptoms such as impaired memory, dementia, delirium, peripheral neuropathy, subacute combined degeneration of the spinal cord, and hematological manifestations such as megaloblastic anemia and pancytopenia. [3]

Vitamin B12-food sources and metabolism:
Vitamin B 12 is not produced by the human body. Meat is the primary source of vitamin B 12 and other animal products such as fish and egg also serve as a source. Among the plant sources, green leafy vegetables provide vitamin B 12. [4]

Absorption of B12 is both passive and active; passive absorption occurs through buccal, duodenal and ileal mucosa but it is very inefficient with only less than 1% of an oral dose absorbed. Active absorption is from the ileum; and is mediated by the intrinsic factor (IF) secreted from the gastric parietal cells. [4,5]

Vitamin B 12 is present as two active forms in the body – methyl cobalamin and adenosylcobalamin. The methyl cobalamin-dependent enzyme is involved in action of methionine synthase-mediated DNA synthesis. This may be the active principle in all the rapidly dividing cells and the epithelial and mucosal surfaces. The adenosylcobalamin dependent enzyme, methyl malonyl coenzyme A mutase is involved in isomerization of methyl malonyl CoA to succinyl CoA. This metabolic pathway is important for fatty acid synthesis and is involved in myelin sheath synthesis.[5,6]

Dietary causes of vitamin B 12 deficiencies:
The primary cause of B12 deficiency is due to lack of a balanced diet, including one source of calories, one source of protein, very high intake of fresh vegetables, and adequate intake of fresh whole seasonal fruits and adequate water. A balanced diet helps in better absorption of vitamin B 12 from food sources. [7]

The second cause of deficiency is the manner of cooking the foods. Meat is the only definite source of B12 in the non-vegetarian diet, but deep-fried meat destroys the vitamin B 12. The harmless bacteria contaminating natural food sources such as green leafy vegetables are the only source of B12 in a strict vegetarian diet. The consumption of green leafy vegetables is low in India, and even among those who consume leafy vegetables, it is often thoroughly washed for fear of pesticide residues or to remove the dirt, and it is always cooked before consumption resulting in loss of nutrients. [7]

Gastric and intestinal causes of vitamin B 12 deficiency:
The most common gastric cause of vitamin B 12 deficiency is autoimmune atrophic gastritis, due to the presence of antiparietal cell antibodies and the consequent lack of IF due to gastric atrophy. Gastric bypass surgery, total or partial gastrectomy or gastric mucosal atrophy due to corrosive ingestion are other reported causes.[8,9]

Ileocecal tuberculosis is a common cause of vitamin B 12 deficiency in India and may result in a permanent defect in vitamin B 12 absorption. [4]

Vitamin B 12 deficiency in patients with diabetes:
Metformin in patients with type 2 diabetes (T2DM) is a well-known cause of vitamin B 12 deficiency. [10]
The issue of vitamin B 12 deficiency in patients with diabetes is quite complex. It has been reported that vitamin B12 deficiency is also associated with an adverse lipid profile in patients withT2DM [11]. Deficiency of vitamin B12 causes elevated serum homocysteine, which has been shown to be a risk factor for hypertension[12] and T2DM [13] diabetes-related complications[14] and coronary artery disease (CAD) [15]. This assumes special significance due to the higher risk of diabetes and CAD in the Indian population.

With a host of factors affecting the intake and absorption of vitamin B12, and the long-term health complications in specific populations, an early diagnosis and treatment of vitamin B12 deficiency is essential.

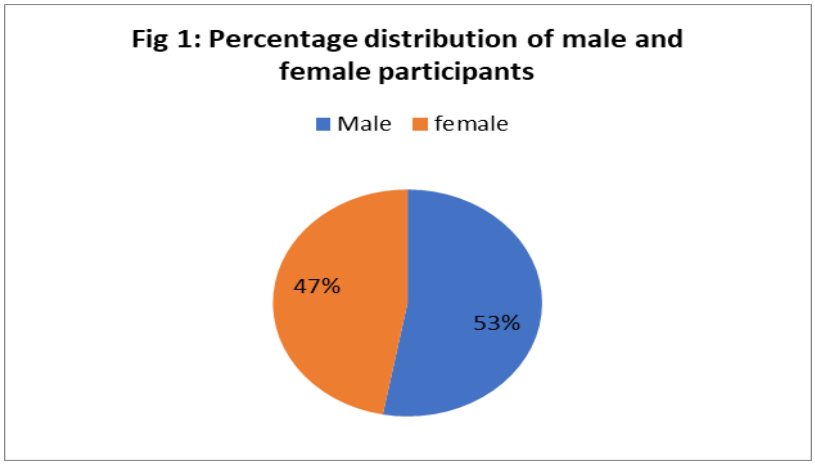
This study was undertaken to study the prevalence of vitamin B 12 deficiency in the general population who attended our clinic for various conditions. The prevalence was correlated with age, staple diet and diabetes status.

Materials and methods:
Laboratory data of 255 patients who visited our clinic over a period of 3 months from Oct 2020 to Dec 2020 was collated and analysed.

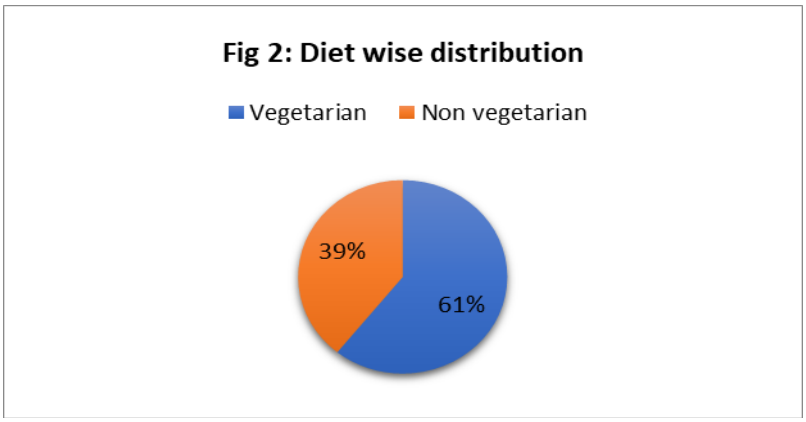
Results:
Data of patients of both sexes from 12 to 82 years were included in the analysis. The age wise distribution of the participants is presented in Table 1. Maximum number of participants was in the age group of 31 to 40. 53 % of participants were males and 47 % were females. (Fig 1)

Table 1: Age wise distribution of participants

	Age Group Wise Distribution
12 to 30	39
Male	20
Female	19
31 to 40	*60*
Male	31
Female	29
41 to 60	18
Male	13
Female	5
61 t0 82	7
Male	6
Female	1
Total	255



61 % of the participants in the study were vegetarian and 39 % were non-vegetarian. (Fig 2) 16.86 % participants were prediabetic with an HbA1c in the range of 5.5 to 6.4. 13.72 % were frank diabetics with an HbA1c of 6.5 and above.



In the given population studied, 25 % (n=63) were vitamin B 12 deficient. (Table 2) 62 % males (n=39) and 38 % females (n=24) were found to be vitamin B 12 deficient.

Table 2: Vitamin B 12 deficiency

V-B12 DefIciency	63	
Of the B12 deficient		
Male	39	62%
Female	24	38%
Age Group		
Vegetarian	41	65%
Non-Veg	22	35%
Diabetic Patient	26	41%
Non-Diabetic	37	59%

The age wise distribution of vitamin B 12 deficiency is presented in Table 3. Prevalence of the deficiency was higher between 31 to 60 years.

Table 3 : Demographics B12 deficiency

Age	Number	M	F
12-30	9	6	3
31-40	18	10	8
41-50	16	10	6
51-60	12	6	6
61-85	8	7	1

Total	63	39	24

A higher percentage of vegetarians (65 %) were found to be deficient as compared to non-vegetarians (35%) . The prevalence of deficiency was 41 % in the diabetes population and 59 % in the non-diabetes population.

Discussion:

The data on vitamin B 12 deficiency in the Indian population is scattered in small population-based studies across the country. The threshold used to define normal from deficient values for the blood concentration of vitamin B12 differs widely across studie. While the Institute of Medicine (1998) recommended 120–180 pmol/L (170 to 250 pg/ mL) plasma vitamin B12 as a depletion range, it may vary with the assay method used.[16] A disparity in the laboratory methods used for assessment, low specificity of available biomarkers of vitamin B12 levels and no consensus regarding the cuts offs used to define low vitamin B12 status, has made it difficult to draw conclusions on the prevalence of vitamin B12 deficiency. [17]

In one comprehensive review of literature by Malik and Trilok Kumar [17] including 14 studies the deficiency prevalence reached 78.5% and 61.7% among adults and elderly, respectively, based on varying cut offs. Higher vitamin B12 levels were reported in women than men. Hyperhomocysteinemia (Hcy .15 mmol/L) was lower in females as compared to males (60% vs 90%, 14.9% vs 57.4% and 3.6% vs 20.9% respectively in three studies). Predictably, vitamin B12 deficiency was higher in vegetarians.

In the retrospective cross-sectional study by Singla et al [18] data captured in electronic medical records (EMR) of an endocrine practice and from a diagnostic laboratory was analysed in a tier 3 city in North India. From an urban endocrine practice, database of 11913 patients was searched for reports of vitamin B12 levels. The overall prevalence of vitamin B12 deficiency was 47% in this population. Prevalence of vitamin B12 deficiency was 37.76% in people with pre-diabetes (n = 92), 31.23% in people with endocrine problems other than diabetes and pre-diabetes (n = 285) and 18.25% in people with diabetes (n = 378).

A similar trend was seen in the study by Ramamoorthy et al [19] which evaluated vitamin B 12 deficiency prevalence among the diabetes population. A total of 1500 individuals [900 normal glucose tolerance (NGT), 300 prediabetes and 300 type 2 diabetes (T2DM)] who were not on vitamin B12 supplementation were randomly selected from the Chennai Urban Rural Epidemiological Study (CURES) follow-up study. The mean levels of vitamin B12 significantly decreased with increasing degrees of glucose tolerance (NGT 444 ± 368; prediabetes 409 ± 246; T2DM 389 ± 211 pg/ml, $p = 0.021$). The prevalence of absolute vitamin B12 deficiency was 14.9% while 37.6% had borderline deficiency. The prevalence of absolute vitamin B12 deficiency was significantly higher among individuals with T2DM (18.7%) followed by prediabetes (15%) and NGT(13.7%) [p for trend = 0.05]. The prevalence of vitamin B12 significantly increased with age ($p < 0.05$) and in those with abdominal obesity ($p < 0.001$). Men and vegetarians had twice the risk of vitamin B12 deficiency compared to women and non-vegetarians, respectively. Among individuals with NGT, prediabetes and T2DM, vitamin B12negatively correlated with homocysteine.

The results of our study are in sync with the studies available from various parts of India. Our study conducted in a clinic in Noida in NCR found the prevalence of vitamin B 12 deficiency to be 25 % in the assessed population, with vegetarians at a higher risk of deficiency. Both pre-diabetic and diabetic patients were found to have vitamin B 12 deficiency with nearly half the deficient population being diabetic.

Given that the Indian population is susceptible to vitamin B 12 deficiencies, combined with the higher risk of diabetes and CVD in this subset of patients, regular assessment of the population for the deficiency must be done.

Conclusion:

As seen in this sample population, one-fourth of the population across a wide age group were found to be vitamin B12 deficient. People with diabetes are likely to have higher levels of vitamin B12 presumably due to higher chances of being prescribed with vitamin B12 supplements. In Indian context and in light of this data, it may be prudent to either supplement vitamin B12 in people with neuropathic symptoms or at least rule out vitamin B12 deficiency by testing for it. Vegetarian patients are at a higher risk of deficiency and must be assessed on a regular basis.

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