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Original Research Article

Exploring the Interplay: Vitamin B12 Levels, Dietary Habits, and Hematological Parameters

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Abstract:

Vitamin B12 is an essential cofactor that is integral to methylation processes important in reactions related to DNA and cell metabolism. Vitamin B12 (also referred to as cobalamin) deficiency is relatively common, with important and variable clinical consequences. Vitamin B12 deficiency, once thought limited to vegetarians and those with pernicious anaemia is increasingly recognized in the general population, including non-vegetarians. This study investigates the correlation between serum Vitamin B12 levels and various factors in patients diagnosed with the deficiency. We examine the relationship between haematological parameters (blood cell characteristics) and dietary patterns. The aim is to understand how these factors interact with B12 deficiency and potentially contribute to its rising prevalence. In B12 deficient patients, hemoglobin levels were significantly higher in lacto-ovo-vegetarians (12.34±2.68) compared to non-vegetarians (11.71±2.62) and lacto-vegetarians (11.21±2.93) (p=0.0476). Similarly, MCV was significantly higher in lacto-vegetarians (89.404±14.51) compared to lacto-ovo-vegetarians (88.59±12.20) and non-vegetarians (86.90±13.16) (p<0.0001).

Keywords: Vitamin B12, Diet, Haemoglobin, Mean Corpuscular Volume.

Introduction

Vitamin B12 also known as cobalamin is a water-soluble vitamin that is involved in the metabolism of nearly every cell of the human body [1]. It is particularly important in the normal functioning of the nervous system via its role inss the synthesis of myelin, [2] and in the maturation of developing red blood cells in the bone marrow. [3].Cobalamin is present mainly in foods of animal origin like meat, eggs and dairy products.[4]

B12 deficiency in India is primarily due to a lack of a balanced diet. For strict vegetarians, the sources are limited to dairy products and the bacteria present in green leafy vegetables. Frying or overcooking meat also greatly depletes the cobalamin content of the food. This places millions of people in India at risk of B12 deficiency.[5] Now, studies have emerged which state that even non-vegetarians are having the said deficiency. With this background in mind, we have done this study to find out the correlation between Vitamin B12 levels and haematological and dietary parameters in patients diagnosed with Vitamin B12 deficiency.

For this study participants' diets were categorized into: Lacto-vegetarian: a plant-based diet with milk products, excluding eggs and meat (>/2 servings of dairy per week) Lacto-ovo-vegetarian: similar to above but includes eggs (>/2 servings of eggs per week) Non-vegetarian: includes meat consumption (>/1 serving of meat per week)

Aims and Objectives:

1. Collect dietary details from participants regarding Vitamin B12 sources, including meat, eggs, and dairy products.
2. Analyze the correlation between serum Vitamin B12 levels and dietary habits.

3. Assess the association between serum Vitamin B12 levels and haematological parameters, with a focus on haemoglobin and mean corpuscular volume (MCV).

Material and Method:

This prospective observational study, spanning 18 months, received Institutional Review Board approval before enrollment. Patients from the General Medicine Department were included based on predefined criteria, with informed consent obtained. Sample size was duration based and a total of 610 participants were included in this study. Cases were identified as patients with Vitamin B12 levels below the reference range, and their data was recorded.

Eligibility Criteria:

Inclusion: Participants aged 18 years and above, both genders presenting to the Department of General Medicine of a tertiary care teaching hospital in Ahmedabad, Gujarat and willing to participate.

Exclusion criteria: included pregnant females, individuals diagnosed with malabsorption syndromes receiving supplementation, post-operative major gastrointestinal surgery patients, those currently on B12 supplementation or recent B12 injections, and moribund patients.

Statistical Analysis: Collected data was coded, entered into Microsoft Excel Worksheet, and analyzed using SPSS 17 software. Categorical data was presented as rates, ratios, and proportions, with a chi-square test for comparison. Continuous data was expressed as mean ± standard deviation (SD) and compared using an unpaired't' test. A 'p' value ≤ 0.05 was deemed statistically significant.

Results and Discussion:

Table 1: Tabular Representation of B12 Level and Haemoglobin

B12 Level (pg/mL)	Hemoglobin(gm/dL)	
	Mean	**Standard Deviation**
<90	11.129	3.453
91-120	11.457	2.764
121-150	11.776	2.903
151-180	11.714	2.745
181-210	11.693	2.193

The Vitamin B12 levels in deficient patients are not significantly correlating with the haemoglobin levels for the entire data set, with a Pearson r value of 0.059 and an R squared value of 0.0035 and a p value of the entire data set being 0.1454. But on further analysis, we found that the p value is 0.034(significant value is p< 0.05) on analysing the haemoglobin in patients having serum vitamin B12 levels less than 120 as compared to the population having B12 values of 121 and above.

Table 2: Tabular Representation of Vitamin B12 and MCV

Vitamin B12 levels (pg/mL)	MCV (fL)	
	Average	**Standard Deviation**
<90	100.846	8.946
91-120	89.919	13.799
121-150	87.194	11.004
151-180	83.355	13.991
181-210	83.139	12.232

There is a significant negative correlation (Pearson's r= -0.4146, p value= <0.0001) between Vitamin B12 levels and MCV values. This denotes an inverse correlation between B12 and MCV values, denoting a higher MCV value for lower B12 values.

Table 3: Tabular Representation of Diet and Haemoglobin

	Haemoglobin(gm/dL)	
	Mean	**S.D.**
Lactovegetarian (n=292)	11.211	2.938
Lacto-ovo-vegetarian (n=95)	12.34	2.683
Nonvegetarian (n=295)	11.711	2.620

Table 3was analyzed using a mixed model two-way ANOVA. The result was a statistically significant difference (p=0.0476) with the highest Haemoglobin being recorded among Lacto-ovo-vegetarians in B12 deficient patients and the lowest among Lactovegetarians.

Table 4: Tabular Representation of Diet and MCV

	MCV (fL)	
	Mean	**S.D.**
Lactovegetarian (n=292)	89.403	14.511
Lacto-ovo-vegetarian (n=95)	88.585	12.199
Nonvegetarian(n=295)	86.900	13.162

Table 4 was analysed using a mixed model two-way ANOVA. The result was a statistically significant difference ($p<0.0001$) with the highest MCV being recorded among Lactovegetarians in B12 deficient patients and the lowest among non-vegetarians.

Table 5: Relationship between Diet, Vit B12 Levels, Hemoglobin and MCV

Diet		**Lacto Vegetarian (N=292)**	**Lacto-Ovo-Vegeterian (N=95)**	**Non-Vegetarian (N=223)**
Vit b12 (pg/dl)	Mean	137.53	149.22	145.28
	SD	39.54	43.60	44.27
Hb gm/dl	Mean	11.21	12.34	11.71
	SD	2.93	2.68	2.62
MCV(fL)	Mean	89.40	88.86	86.90
	SD	14.51	12.20	13.16

These findings suggest potential associations between dietary patterns, Vitamin B12 levels, hemoglobin levels, and MCV values, with lacto-ovo-vegetarians showing higher levels of both Vitamin B12 and hemoglobin compared to the other groups. However, further statistical analysis would be needed to confirm the significance of these differences.

Conclusion

B12 deficiency is a relatively common problem in India across all ages, genders and diets. Due consideration should be given to the fact that patients with suboptimal B12 levels may also present with a relatively normal haemogram and indices and the diagnosis should not be overlooked. It is a misconception that B12 deficiency only occurs in strict vegetarians. Though more common among this subset of the population, it is also quite common among patients consuming meat and eggs and diet alone is not a risk factor for B12 deficiency.

Author's Contribution: All authors have made substantial contributions to the interpretation and analysis of data. The corresponding author had full access to the data and was responsible for the decision to submit the manuscript for publication.

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