Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL 15, ISSUE 03, 2024

Original Research Article

CORRELATION BETWEEN VITAMIN B12 AND LIPID PROFILE IN PATIENTS ATTENDING TERTIARY CARE HOSPITAL OF MADHYA PRADESH

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Abstract

Background: Vitamin B12 is an important micronutrient and its deficiency has been associated with various health issues like mild fatigue to severe neurological impairment and macrovascular diseases like coronary artery disease. **Aim:** The main aim was to find the correlation between vitamin B12 and lipid profile levels in patients attending Chirayu Hospital, Madhya Pradesh. **Materials and Methods:** This is a retrospective observational study done by including the lab records of patients who attended Chirayu Hospital and got their lipid profile and vitamin B12 levels done between January to June, 2023. After considering inclusion and exclusion criteria, the remaining subject's data was considered for the study. Vitamin B12 was estimated by CLIA method on Maglumi 2000 and lipid profile was estimated on Vitros 4600 equipment. Data was analyzed using appropriate statistical methods. **Results:** A total of 171 subjects aged between 18 to 89 years were included in the study. Out of total 171 subjects, 87 were males and 84 were females. The percentage of vitamin B12 deficiency among the subjects included in this study was 1.5%. There was no significant correlation between vitamin B12 and lipid profile levels ($p>0.05$). **Conclusion:** Early detection and treatment of dyslipidemia and vitamin B12 deficiency may help in preventing vascular and neurological complications. The

results of this study suggest that there is no correlation between vitamin B12 deficiency and dyslipidemia.

Key words: Vitamin, Deficiency, Dyslipidemia, Cardiovascular disease

Introduction

Vitamin B12 is an important micronutrient and has various metabolic roles in carbohydrate and lipid metabolism, DNA synthesis, and erythropoiesis.[1] Vitamin B12 deficiency has been associated with various health issues like mild fatigue to severe neurological impairment, diabetes and various macrovascular diseases like coronary artery disease, myocardial infarction and cerebral ischemia.[2,3] The lipid profile is a group of tests including the estimation of total cholesterol, triglyceride, HDL and LDL cholesterol levels.[4] Abnormalities in lipid profile predict the risk of atherosclerosis, coronary artery disease and macrovascular complications like myocardial infarction and stroke.[5]

Vitamin B12 acts as the cofactor of two major enzyme systems i.e. methylmalonyl coenzyme A mutase and methionine synthase in the body. Methylmalonyl coenzyme A mutase, cofactor of vitamin B12 converts methylmalonyl coenzyme A to succinyl coenzyme A.[5] The succinyl coA formed from methyl malonyl co.A goes to kreb 's cycle for ATP synthesis. so low B12 levels increase methyl malonyl acid level, this inturn inhibits carnitine palmitoyl transferase1, an important enzyme in beta oxidation. Inhibition of beta oxidation builds up fatty acids and triglycerides. This will result in dyslipidemia.[6]

Some studies have shown significant negative correlation with the parameters of lipid profile except HDL and these parameters improved on vitamin B12 supplementation.[4,7] The status of vitamin B12 and its correlation with lipid profile has not been studied till now extensively in Madhya Pradesh. In addition, early supplementation of vitamin B12 prevents serious complications like neurological disorders and vascular complications like stroke. Hence, the present study was taken up to assess vitamin B12 levels in patients attending a tertiary care hospital of Madhya Pradesh along with its association with lipid profile.

Aims & Objectives

This study was taken up to find out the correlation between vitamin B12 and lipid profile levels in patients attending Chirayu Hospital. The main objectives are (1) To determine the percentage of subjects with vitamin B12 deficiency in patients attending Chirayu Hospital. (2) To find the correlation of vitamin B12 levels with lipid profile in patients attending Chirayu Hospital.

Materials & Methods

This is a retrospective observational study done in Chirayu Medical College and Hospital, Bhopal. Permission from Institutional Ethical Committee was taken before the start of the study (CMCH/EC/2023/79). In this study, the lab records of both IPD and OPD patients who attended Chirayu Hospital and got their lipid profile and vitamin B12 levels done were considered for the study. Subjects having renal disorder, liver disorder, thyroid disorder, cancer, and pregnancy were excluded from the study. After exclusion criteria, the remaining subjects were included in the study. Data of subjects between January to June 2023 was considered for the study. Values of serum lipid profile and vitamin B12 levels and other demographic data such as age, gender was collected and statistical analysis was done. Demographic data such as height, weight, marital status, dietary preferences and history of diabetes, hypertension, alcoholism and smoking was not included as it was not available in lab records.

Vitamin B12 was estimated by CLIA method on Maglumi 2000 using Maglumi company kit. A value between 200 to1100 pg/mL was considered normal. Measuring range on this equipment was 12.5 to 2000 pg/mL.[8] Subjects with vitamin B12 levels less than <200 pg/mL were considered to have deficiency , between 201 – 300 pg/mL as borderline deficiency, between 301 – 1100 pg/mL as normal[9] and greater than 1101 as above normal range respectively. As the upper detecting range was 2000 pg /mL on Maglumi for vitamin B12, this value was considered for statistical purposes in subjects whose values reported above 2000pg/mL. Vitamin B12 deficiency above normal range is rarely seen in normal healthy individuals except in those on treatment with vitamin B12.

Lipid profile parameters like total cholesterol was estimated by cholesterol oxidase peroxidase method , triglycerides by glycerol phosphate oxidase method, HDL cholesterol by direct enzymatic method and LDL cholesterol was calculated using Friedewald's equation on Vitros 4600 equipment. The cutoff values for total cholesterol, triglycerides, LDL cholesterol are less than 200 mg/dL, 150 mg/dL and 130 mg/dL. A value of greater than or equal to 40 to 60 mg/dL was considered normal for HDL cholesterol.[10,11]

Statistical analysis: The values will be documented in MS excel and correlation will be analyzed by online available tool for Pearson's correlation coefficient.

Results

A total of 171 subjects aged between 18 to 89 years were included in the study. Out of total 171 subjects, 87 were males and 84 were females. The mean age of all study subjects is

50.9 ± 15.3 years, males is 52.6 ± 15.6 years and females is 49.0 ± 14.8 years. [Table-1] shows the biochemical parameters of study subjects in total, males and females.

[Table-1]: Biochemical Parameters of Study Subjects in Total and Gender wise.

	Mean ± SD		
Parameters	**Total**	**Males**	**Females**
Vitamin B12 (pg/mL)	831.3 ± 585.7	829.8 ± 589.3	832.9 ± 585.4
Triglycerides (mg/dL)	152.1 ± 81.7	161.5 ± 98.3	142.3 ± 59.0
Total cholesterol (mg/dL)	168.2 ± 114.2	155.3 ± 58.9	181.6 ± 150.9
HDL cholesterol (mg/dL)	42.9 ± 27.8	38.5 ± 15.0	47.4 ± 36.2
LDL cholesterol (mg/dL)	91.5 ± 42.1	89.5 ± 45.4	93.5 ± 38.5
VLDL cholesterol (mg/dL)	31.0 ± 17.6	32.9 ± 20.9	29.0 ± 13.1

All the study subjects are sub grouped into 4 groups based on vitamin B12 levels as Deficiency group (<200 pg/mL), Borderline deficiency (201 -300 pg/mL, Normal (301 – 1100 pg/mL) and Above Normal (>1100 pg/mL). [Table-2] shows the study characteristics of subjects divided group wise based on vitamin B12 levels. It includes number of males and females in each group and mean and standard deviation values of vitamin B12 and lipid profile of each group. The significance was not checked between the groups as the number of subjects in deficiency and borderline deficiency groups are only 3 each and the difference in sample size is more between the other two groups.

[Table-2] Study characteristics of subjects group wise based on vitamin B12 levels.

	Mean ± SD			
Parameters	**Deficiency**	**Borderline deficiency**	**Normal Range**	**Above Normal Range**
Total Subjects (171)	3	3	125	40
Males / Females	0 / 3	2 / 1	64 / 21	21/ 19
Percentage (%)	1.75%	1.75%	73.1%	23.4%
Age (in years)	31.0 ± 15.1	56.7 ± 7.2	51.1 ± 14.8	51.2 ± 16.7
Vitamin B12 (pg /mL)	141.0 ± 55.5	255.0 ± 45.3	548.3 ± 175.4	1810.7 ± 307.1
Triglycerides (mg/dL)	206.0 ± 40.1	206.0 ± 78.6	155.8 ± 86.3	132.4 ± 64.5
Total cholesterol (mg/dL)	115.0 ± 57.7	137.7 ± 26.6	176.1 ± 129.7	149.7 ± 48.3
HDL cholesterol (mg/dL)	24.3 ± 12.7	39.7 ± 18.2	45.6 ± 30.8	36.0 ± 15.2

LDL cholesterol (mg/dL)	50.0 ± 43.3	82.3 ± 17.4	95.3 ± 43.1	83.2 ± 38.0
VLDL cholesterol (mg/dL)	41.3 ± 8.1	41.0 ± 15.5	31.9 ± 18.8	26.5 ± 12.9

[Table/Fig-3]: Correlation of vitamin B12 levels with lipid profile in total subjects.

Parameters	**Total Subjects**		
	Correlation of vitamin B12 levels		
	r value	**p value**	**Significance**
Triglycerides	-0.095	0.216	NS
Total Cholesterol	-0.086	0.263	NS
LDL Cholesterol	-0.125	0.103	NS
HDL Cholesterol	-0.097	0.206	NS
VLDL Cholesterol	-0.103	0.180	NS

NS – Not Significant, p value >0.05

[Table-3] shows the correlation of vitamin B12 with lipid profile levels in total study subjects. Correlation was not checked in each group, as the sample size is small in each group.

Discussion

In our study, the percentage of subjects with vitamin B12 deficiency and borderline deficiency are 1.75% each and majority were women. This was very less in comparison to study done on reproductive age group women in Pakistan in 2011, where it was found that prevalence of vitamin B12 deficiency was 52.4% and positive association was observed with rural population.[12]Also in a study done in Bangladesh in diabetic people, 31.1% had B12 deficiency, 6.7% had borderline deficiency and 62.2% had normal B12 levels.[13] The low percentage of vitamin b12 deficiency in our study might be due to inclusion of both healthy and non healthy subjects who attended hospital and had both their B12 and lipid profile done.

Also, in a study done by Lecumberri et al, vitamin B12 deficiency was reported as 8.4% in patients having retinal vein occlusion which is slightly more than 6.2% in controls.[14] In a review study done by Metz it was summarised that vitamin B12 deficiency does not always correspond to Pernicious anaemia and there is no significant increase of vitamin B12 deficiency in vegetarians in comparison to non vegetarian.[15] In a cross sectional study done on university attending young women, it was found that 24.9% had vitamin B12 deficiency. All the lipid profile parameters were in normal range with high HDL values as expected in young women.[16]

Vitamin B12 deficiency is associated with altered lipid profile and plays an important role in prediction of metabolic risk.[1] Dyslipidemia denotes increase in concentration of Total

cholesterol, LDL cholesterol, triglyceride or decrease in concentration of HDL cholesterol alone or in combination.[10]

Dyslipidemia is a key risk factor for atherosclerosis and cardiovascular disease. Low B12 status in children, adolescents, pregnant mothers was associated with higher adiposity and lipids as well as increased risk of insulin resistance, type 2 diabetes mellitus and cardiovascular diseases**.**[6] Low B12 levels might increase lipid accumulation in adipocytes and trigger dyslipidemia in mice suggesting that low B12 and dyslipidemia might be casually related.[7]

Vitamin B12 also acts as cofactor for methionine synthase and facilitates the remethylation of homocysteine to methionine, which is later activated into S-adenosyl methionine (SAM).SAM acts as methyldonor to neurotransmitters and membrane phospholipids. Hence, deficiency of vitamin B12 will disrupt the methylation process and it will lead to increase in serum homocysteine levels. Hyperhomocysteinemia was found to have toxic effects on neurons and the vascular endothelium.[17] Both vitamin B12 deficiency and cardiovascular diseases have been linked to high homocysteine concentration. Homocysteine disturbs phospholipid metabolism by affecting the assembly or secretion of very low-density lipoprotein (VLDL), leading to abnormal lipid levels.[18]Vitamin B12 has inverse correlation with homocysteine levels and has a protective role in cardiovascular diseases.[19] Pregnant women with low B12 values had significantly higher BMI, cholesterol, triglycerides and homocysteine than pregnant women without normal B12 levels. Low B12 values induces induces expression of cholesterol synthesis and transport regulators.[1]

In our study, there was no significant difference in age between men and women. Also, males had high triglyceride levels and low total cholesterol, LDL and HDL cholesterol levels in comparison to women. These findings correspond to the study done by Ambroz et al. In that study, among those treated with statins, women and men had similar total cholesterol levels up to the age of 50 years and after 50 years, women had higher levels of total cholesterol than men. HDL cholesterol levels where higher in women than men in all age groups regardless of statin treatment. Triglyceride levels were higher in men than women before age of sixty years regardless of statin treatment. In the same study, women less than 45 years had lower levels of total cholesterol and LDL cholesterol levels as compared to men.[20]

In our study, there was no significant correlation between serum vitamin B12 levels and triglycerides, total cholesterol, LDL cholesterol and HDL cholesterol levels. These findings are contradictory to the findings observed in study done by Sara et al.In this study

done on healthy young Saudi women, it was found that low serum vitamin B12 levels very inversely associated with higher total cholesterol, LDL cholesterol and triglyceride levels.[3] Also, vitamin B12 deficiency was significantly associated with hyper homocysteinemia and low HDL in a study done on population in Haryana. There was no significant association between vitamin B12 and other lipid profile parameters.[21]In a study done by Mahalle et al in patients diagnosed with coronary artery disease on angiography, percentage of vitamin B12 deficiency was 86.7%. Also B12 levels were inversely associated with triglycerides and VLDL cholesterol and directly associated with HDL cholesterol.[22]

In a retrospective study done by Wen long et al on elderly individuals with normal BMI, it was observed that increase in B12 levels were associated with decrease in serum triglycerides. Enhanced bacterial B12 biosynthesis improved liver lipid metabolism by preventing triglyceride accumulation**.**[4] According to Sezgin et al, treatment with B12 decreases triglyceride levels and also cholesterol levels in patients with triglyceride levels more than 150 mg/ dL**.**[5] Levels of serum total cholesterol and triglyceride were increased and Vitamin B12 and HDL levels were decreased in diabetic group in comparison to normal subjects without diabetes.[9]

Vitamin B12 deficiency is associated with triglyceride and cholesterol by HDL ratio. In people with diabetes and vitamin B12 deficiency there was higher odds of having coexisting coronary artery diseases. It is also recommended to get tested for vitamin B12 levels routinely for patients on metformin.[23] On the contrary, a study done by Guo et al found that serum B12 concentration, dietary B12 intake and supplements use were not significantly associated with mortality risk in coronary heart disease patients.[2]

Conclusion

Early detection and treatment of dyslipidemia and vitamin B12 deficiency may help in preventing vascular and neurological complications. The results of this study suggest that there is no correlation between vitamin B12 deficiency and dyslipidemia.

Limitation

The limitations of this study include small sample size and lack of follow up in patients after treatment. Also, factors affecting vitamin B12 and lipid profile were not considered in this study. Prospective study followed by estimation of lipid profile values before and after treatment with vitamin B12 would have helped better in understanding the relationship between vitamin B12 and lipid profile.

Funding: None

Conflict of Interest: None

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