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Research Article

PREVALENCE OF VITAMIN B12 DEFICIENCY IN TYPE 2 DIABETES MELLITUS

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ABSTRACT

Vitamin B_{12} named as Cobalamin a water-soluble vitamin plays significant role in several biological process such as DNA synthesis, Neurological function, and Optimal Haemopoiesis etc. The deficiency of vitamin B_{12} affects a number of processes, including the methylation of homocysteine, nucleoprotein, myelin production, DNA synthesis, lipid and glucose metabolism, and others. Vitamin B_{12} deficiency is a potential comorbidity that is often overlooked, but puts many diabetic patients at risk of developing particular complications. Various research showing an association between type 2 diabetes mellitus and a vitamin B_{12} deficiency. The purpose of the study is to find out the prevalence of vitamin B_{12} deficiency in Type 2 diabetic patients. 200 subjects of Type 2 diabetic patients were studied over a period of six months from August 2023 to February 2024 in the OPD of Kayachikitsa, Department of Ayurveda, IMS, Banaras Hindu University, Varanasi. **Results:** The present study summarizes that the prevalence of vitamin B_{12} deficiency in T_2DM patients were 19% and 36% of respondents has borderline vitamin B_{12} level. The results also shows that the majority of male were having the deficiency of the vitamin B_{12} level as compare to the females. Study also shows the association of age and the vitamin B_{12} level ($p<0.05$).

INTRODUCTION

Diabetes mellitus is one of the known non communicable disease. It is a known as a metabolic disorder of carbohydrates characterized by the low or high glucose level in the blood. There are many types of diabetes such as pre-diabetes, type 1 diabetes, type 2 diabetes, gestational diabetes, MRDM. 90% of all instances of diabetes are type 2 diabetes mellitus, which is the primary cause of the diabetes epidemic. Non-insulin dependent diabetes mellitus is known as type 2 diabetes. Adult-onset diabetes is the term for it and typically affects adults who have a sedentary lifestyle, are stressed, overweight, or obese. Obesity and overweight are the most common risk factors responsible for diabetes. Patients with diabetes have an increased risk of developing various chronic problems, such as nephropathy, neuropathy, retinopathy, cardiovascular disease, and sepsis brought on by abnormal blood glucose levels.

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It has been shown that vitamin B12 insufficiency is quite common in diabetic individuals. Various research showing an association between type 2 diabetes mellitus and a vitamin B12 deficiency. Various biological process affected by the deficiency of vitamin B_{12} such as myelin synthesis, DNA synthesis, nucleoprotein, methylation process of homocysteine, lipid and carbohydrate metabolism etc.

Vitamin B_{12} named as Cobalamin a water-soluble vitamin plays significant role in several biological process such as DNA synthesis, Neurological function, and Optimal Haemopoiesis etc (Kwape et al., 2021). The micronutrient has two main functions:1. act as cofactor for the methyl-malonyl-CoA mutase and 2. methionine synthase enzyme. The primary symptoms of a vitamin B_{12} deficiency are neurological and haematological impairment. Vitamin B_{12} deficiency have potential of co morbid conditions which is often ignored in diabetic patients. There are many risk factors which affects the level of the micronutrient in the blood. Such as Metformin treatment known as the front-line medicine prescribed by most of the healthcare professionals. Several studies reported that the Metformin a medicine which associated with the vitamin B_{12} deficiency (Malla et al., 2021). Furthermore, the old age also a dominant factor in the

deficiency of the micronutrient. Vitamin B_{12} deficiency in diabetic patients also associated with diabetic neuropathy. Determining the prevalence in the type 2 diabetic patients could help in deciding that the how significant the screening of vitamin B_{12} should consider in the diabetic patients. The objective of the present study is to find out the prevalence of vitamin B_{12} deficiency in type 2 diabetic patients.

METHODS AND MATERIALS

This was a cross-sectional design to find out the prevalence of vitamin B_{12} deficiency type 2 diabetic patients. 200 type 2 diabetic patients are the subjects were screened over a time period of six months from August 2023 to February 2024 in OPD of Kaya Chikitsha, Department of Ayurveda, IMS, Banaras Hindu University, Varanasi. The informed consent signed by all the subjects. Age, sex, and other demographic details, waist and hip circumference, BMI were estimated. Fasting blood glucose, post prandial blood glucose, HbA1c, and serum vitamin B12 and details of medication including dose, duration and type of medicine were taken from the patients reports. The study considered the value of vitamin B_{12} level as deficient who has $\leq$191pg/ml whereas, vitamin B_{12} level $\geq$350pg/ml considered normal and who has between the 191-350pg/ml considered borderline of vitamin B_{12} level. (Jayashri et al., 2018)

The inclusion criteria of the study were the patient with Type 2 Diabetes Mellitus aged 30-75 years with the history of diabetes more than 6 months. The exclusion criteria were the patients with pregnancy, Type1 diabetic patients, alcoholic other complications included as lactose intolerance, severe hepatic, renal disorder and other chronic complications. Respondent having any supplement or other experimental medicine also excluded from the study.

Statistical Analysis Method: The Categorial variables are presented in percentage% and the continuous variables are reported in mean $\pm$ standard deviation. Chi square test was used to determine the association of the age and sex with vitamin B_{12} level. Significance is assessed at 5% level of significance.

RESULTS AND DISCUSSION

The study enrolled 200 type 2 diabetes mellitus patients. The characteristics of the T_2DM patients and the prevalence of vitamin B_{12} deficiency in diabetic patients and its association with age and gender are described in the results.

Table 1: Characteristics of the T_2DM patients in the study

Characteristics (n=200)	Values
Age (Years) Mean [SD]	50.86 ($\pm$11.29)
Male n [%]	114 [57]
Female n [%]	86 [43]
BMI (Kg/m^2) Mean [SD]	27.78 ($\pm$6.08)
Vitamin B_{12} (pg/ml) Mean [SD]	362.13 ($\pm$209.62)

Table 1 summarizes the mean ($\pm$ standard deviation) of the (continuous variables) age was 50.86 ($\pm$11.29) years, in the study majority of population aged between 51 to 80 years of age. 27.78 ($\pm$6.08) kg/m^2 was the body mass index and vitamin B_{12} level was 362.13 ($\pm$209.62) pg/ml. Data represented that the 57% are males and 43% are female respondents in the study.

Table 2: Vitamin B_{12} Level of the patients

Vitamin B_{12} Level (pg/ml)	Total
<191	19%
191-350	36%
>350	45%
Total	200 (100%)

Table 2. shows that the 19% of respondents were having deficient (<191pg/ml) vitamin B_{12} level. 45% were having normal (>350pg/ml) vitamin B_{12} level and 36% of respondents were having borderline (191-350) pg/ml. The study shows the prevalence of Vitamin B_{12} deficiency in Type$_2$ Diabetic patients is 19%. A study of Pflipsen et al. shows 22% prevalence of vitamin B_{12} deficiency in 203 patients of type 2 diabetic patients. Several cross-sectional studies show the prevalence of vitamin B_{12} ranges 5.8 to 33%. Variation in the range of prevalence due to the different food choices and cultural believes in different regions of the world. India is a country of various cultural and traditional beliefs that affects the people dietary choice. Many individuals have only vegetarian food due to their belief or choice. Metformin is also known as a prime factor in the prevalence of vitamin B12 deficiency in type 2 diabetic patients. Metformin is a drug known as the front-line medicine prescribed by most of the healthcare professionals. Many other

factors affect the vitamin B_{12} level in the patients. The factors should be determined for the proper treatment in the further study. Healthcare professionals should also monitor the vitamin B_{12} level of the patients at least once in a year as previous research papers also suggested. Figure 1. shows the graphical representation of vitamin B_{12} level in the patients.

Figure 1: Graph representation of vitamin B_{12} level

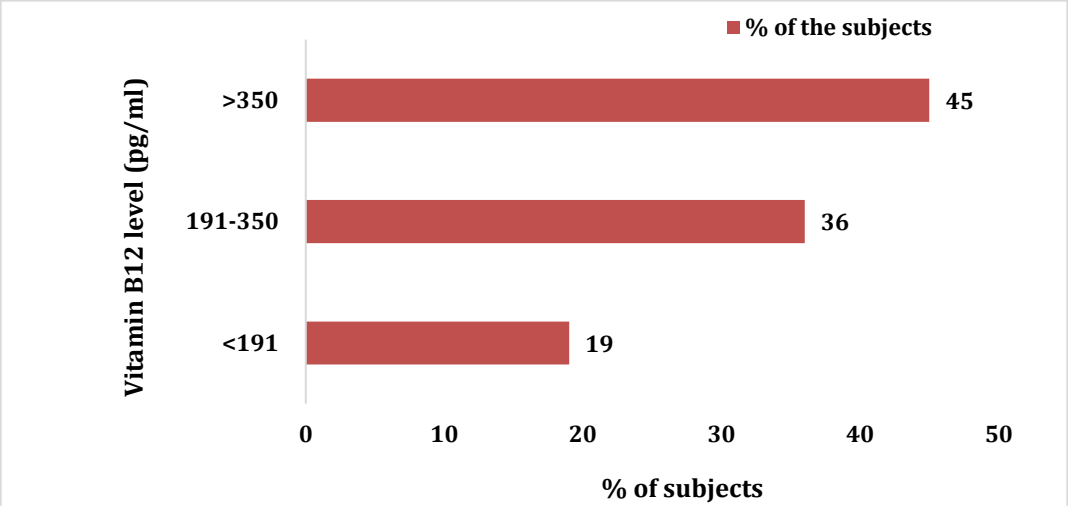

Table 3: Distribution of respondents on the basis of gender according to their Vitamin B_{12} level

Vitamin B_{12} Level (pg/ml)	Gender		Total	p-value
	Female	Male		
<191 Deficient	11.7%	24.6%	19%	p = 0.065
191-350 Borderline	40.7%	32.5%	36%	
>350 Normal	47.7%	42.9%	45%	

Table 3 shows that the deficiency of the vitamin B_{12} in type 2 diabetic patients. Whereas, 24.6% of males and only 11.7% of female were having the deficiency. 32.5% of male and 40.7% females were having the vitamin B_{12} level on borderline. 42.9% of males and 47.7% of females were having normal level of the serum vitamin B_{12} level. The results shows that the majority of male were having the deficiency of the vitamin B_{12} level as compare to the females. A study of Jayashri et al. reported that the males are more prone to having the deficiency as compared to females. It was also found that there is no significant correlation between the gender and the vitamin B_{12} level in the Type 2 diabetic patients as the p value greater than 0.05 (p>0.05). So, the reason for the difference might be the diverse culture, food choices, or the dose metformin treatment.(Almatrafi et al., 2022) These factors should be monitor for the accurate reason for the difference. The figure 2 and 3 shows the graphical representation of the data.

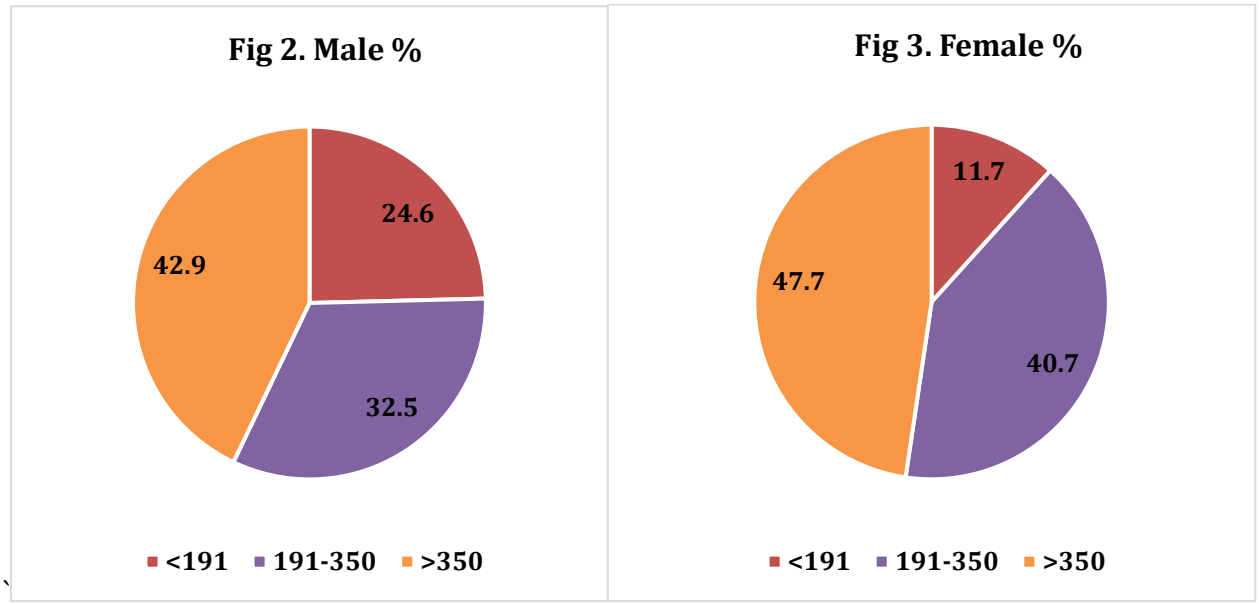

Figure 2 & 3: Representation of Respondents % on the basis of gender according to their vitamin B_{12} level

Table 4: Distribution of the respondents (%) on the basis of the age according to their Vitamin B_{12} level

Age (years) / Vitamin B_{12} Level (pg/ml)	≤40	41-50	51-60	60<	Total	P-value
<191	25.5%	21.7%	10.3%	23.3%	19%	p=0.023
191-350	51.2%	30.4%	36.8%	25.5%	36%	
>350	23.3%	48%	52.9%	51.2%	45%	

The table 4 shows that the 25.5% of respondents <40 years of age were having the deficiency and only 10.3% respondents in the age group between 51-60 years were deficient. 51.2% of the respondents were on borderline in the age group less than 40 years and 25.5 % are in the age group of more than 60 years. The study also found that the significant correlation between vitamin B_{12} level and age of the respondents because the p value is 0.023 less than 0.05 ($p<0.05$). The study shows that the age is associated with the vitamin B_{12} level in the patients. As previous studies reported that the old age population having higher prevalence of the Vitamin B_{12} deficiency in the diabetic patients. (Miyan & Waris, 2020) Some studies did not had association of age and vitamin B_{12} level also exists. (Shahwan et al., 2018) In this study the 23.3% patients having deficient vitamin B_{12} level in >60 years of age. >40 years population in diabetic patients should have monitor their vitamin B_{12} level to cure earlier as its deficiency increase the risk of neuropathy. Low vitamin B_{12} level associated with the neurological conditions e.g. sensory and cognitive nerve dysfunction. (Almatrafi et al., 2022) Earlier diagnosis can be helpful in maintaining normal neurological function. (Jayashri et al., 2018) Figure 4. shows the graphical representation of the respondents on the basis of the age according to their Vitamin B_{12} level.

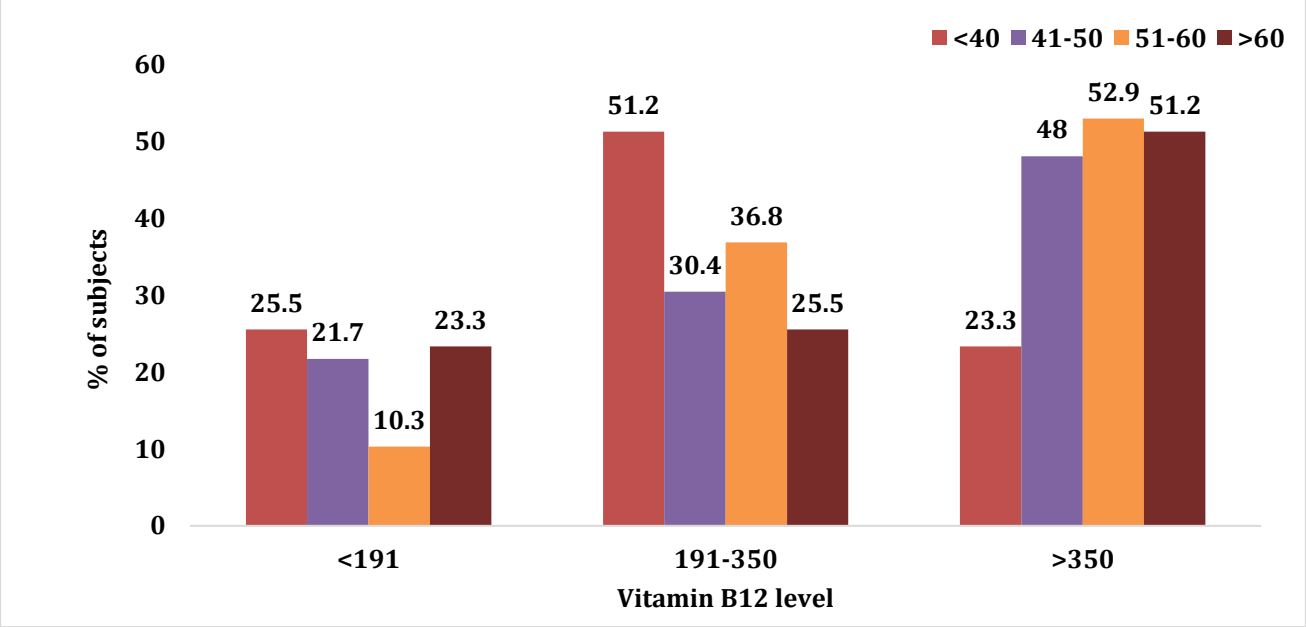

Figure 4: Graphical representations of the respondents (%) on the basis of the age according to their Vitamin B_{12} level

CONCLUSION

The prevalence of the Vitamin B_{12} level in type 2 diabetic patients needs to be recognize by the health care experts as various studies having the prevalence ranges from 5.8 to 33%. In the present study, the prevalence of vitamin B_{12} deficiency is 19%. The present study also shows the significant association between age and vitamin B_{12} level in the patients. Increasing age affects the level of vitamin B_{12} in type 2 diabetic patients. (Miyan & Waris, 2020) The present study also shows that the majority of male were having the deficiency of the vitamin B_{12} level as compare to the females but the gender is not associated with the vitamin B_{12} deficiency as ($p>0.05$). The reason for the difference might be the factors such as diverse culture, food choices, age and the metformin treatment. These factors should be monitor in the further study assess the reason for the difference. The vitamin B_{12} level of the patients with diabetes should be screened once in a year to early diagnosis of the deficiency to maintain the quality of life. The deficiency of the vitamin B_{12} results various complication related to sensory and peripheral neuropathy. The treatment can be reverse the complication in the early diagnosis (Kumar et al., 2017).

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