

# Study of Vitamin B12 Deficiency in Patients with Type 2 Diabetes Mellitus

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## Abstract

**Introduction:** Vitamin B12 is an essential micronutrient required for optimal hemopoietic, neurocognitive, and cardiovascular function. Biochemical and clinical Vitamin B12 deficiency has been demonstrated to be highly prevalent among patients with type 1 and type 2 diabetes mellitus.

**Aim:** This study aims to study the prevalence of Vitamin b12 deficiency in Type II diabetes patients.

**Materials and Methods:** In this observational study, 50 patients with type II diabetes from 40 to 80 years of both genders were included in the study. Patients data such as random blood sugar, hemoglobin A1c (HbA1c), and serum Vitamin B12 were collected.

**Results:** Maximum number of patients was in the 51–60 years age group (48%). The mean HbA1c level was  $9.52 \pm 2.13\%$ . The mean Vitamin B12 was  $321.57 \pm 124.28$  pg/ml. The prevalence of Vitamin B12 deficiency was 18%, the borderline deficiency was 28%.

**Conclusion:** Our results found an 18% prevalence of Vitamin B12 deficiency in type 2 diabetic patients. Vitamin B12 deficiency may lead to clinically significant complications and increased morbidity among people with diabetes.

**Key words:** Glycated hemoglobin, Type 2 diabetes mellitus, Vitamin B12

## INTRODUCTION

Diabetes mellitus (DM), a chronic metabolic non-communicable disease, has attained epidemic proportions worldwide. As of 2015, >415 million adults have DM, and this number is estimated to increase to 642 million by 2040. More than 95% of all adults with DM have type 2 DM (T2DM). India is one of the epicenters of the global DM epidemic and has the second highest number of people with the disease in the world (~69 million individuals as of 2015).<sup>[1]</sup>

Type 2 diabetes is frequently treated by primary care physicians who manage both the disease and its multiple comorbidities. Vitamin B<sub>12</sub> deficiency is potential

comorbidity that is often overlooked, despite the fact many diabetic patients are at risk for this specific disorder. For example, many diabetic patients are treated with metformin, a medication that lowers serum Vitamin B<sub>12</sub> levels and is associated with Vitamin B<sub>12</sub> deficiency.<sup>[2-4]</sup> In addition, almost half of all diabetic patients are older than 60, an age group in which the prevalence of metabolically confirmed B<sub>12</sub> deficiency ranges from 12% to 23%.<sup>[5,6]</sup>

Indians, due to religious and cultural reasons, consume a predominantly vegetarian diet; hence, the prevalence of Vitamin B12 deficiency in the general population ranges from 16% to 67%.<sup>[7]</sup> It plays an essential role in the functioning of the brain and nervous system and the formation of red blood cells. In addition to anemia, Vitamin B12 deficiency may increase the severity of peripheral neuropathy in patients with T2DM.<sup>[8]</sup> Furthermore, because Vitamin B12 participates in the most important pathway of homocysteine (Hcy) metabolism, a reduction in Vitamin B12 would increase plasma concentrations of Hcy, which is strongly linked to cardiovascular disease in patients with T2DM and polycystic ovary syndrome.<sup>[9]</sup>

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**Aim**

This study aims to study the prevalence of Vitamin b12 deficiency in Type II diabetes patients.

**MATERIALS AND METHODS**

This observational study was conducted in the Department of General Medicine, Ramanathapuram Government Headquarters Hospital. Fifty patients with diagnosed T2DM in the age group of 40–80 years were included in the study. Patients with T1DM, thyroid disorders, hemolytic anemia, hemoglobin variants, pregnancy, hepatic diseases, and infectious diseases were excluded from the study. Individuals with a history of treatment with Vitamin B12 injection or multivitamin injections in the past 6 months were also excluded from the study. Blood samples were collected for the estimation of blood sugar, hemoglobin A1c (HbA1c), and Vitamin B12. Serum Vitamin B12 was estimated using chemiluminescence immunoassay. Biochemical Vitamin B12 deficiency was defined as serum Vitamin B12 level <200 pg/dl. Data were presented as frequency and percentage.

**RESULTS**

In this study, 50 patients age more than 40–80 years were included in the study. The maximum number of patients were in the 51–60 years age group (48%) followed by 40–50 years (28%) Figure 1. The majority of patients were male (64%) and females were 36% Figure 2. The mean random blood sugar level was  $241.61 \pm 98.23$  mg/dl. The mean duration of diabetes was  $18.28 \pm 4.26$  years. The mean HbA1c level was  $9.52 \pm 2.13\%$ . The mean Vitamin B12 was  $321.57 \pm 124.28$  pg/ml. The prevalence of Vitamin B12 deficiency was 18%, the borderline deficiency was 28% Figure 3.

**DISCUSSION**

Vitamin B12, also called cobalamin, is a water-soluble vitamin involved in the optimal functioning of the hemopoietic, neurocognitive, and vascular systems. It is involved in DNA synthesis, fatty acid metabolism, and energy production.<sup>[10]</sup> Vitamin B12 exerts its physiological effects by facilitating the methylation of Hcy to methionine which is later activated into S-adenosyl methionine that donates its methyl group to methyl acceptors.<sup>[11]</sup> Similarly, Vitamin B12 mediates the conversion of methylmalonyl coenzyme A (coA) to succinyl coA, a process when hindered, results in accumulation of serum methylmalonic acid, thereby causing the defective fatty acid synthesis of the neuronal membranes.<sup>[12]</sup>

Several cross-sectional studies and case reports have documented an increased frequency of Vitamin B12 deficiency among T2DM patients.<sup>[13,14]</sup> Metformin use has been unequivocally demonstrated as the prime factor associated with Vitamin B12 deficiency among patients with T2DM.<sup>[15]</sup> Studies assessing type 2 diabetic patients on metformin have reported the prevalence of Vitamin B12 deficiency to range from 5.8% to 33%.<sup>[16]</sup> This wide variation in the reported prevalence could probably be explained by the varied study definitions of Vitamin B12 deficiency.

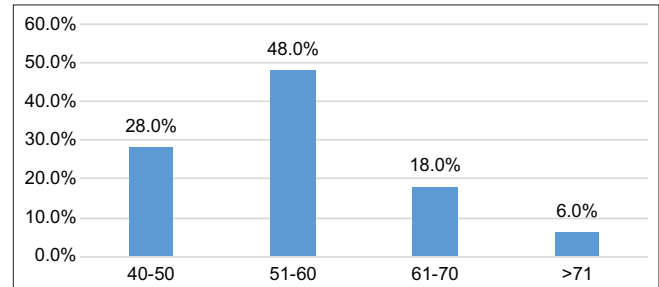


Figure 1: Age distribution

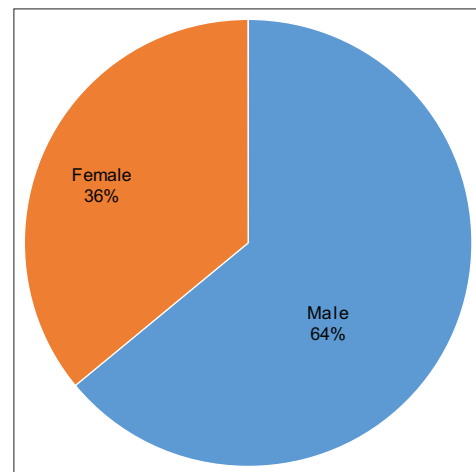


Figure 2: Gender distribution

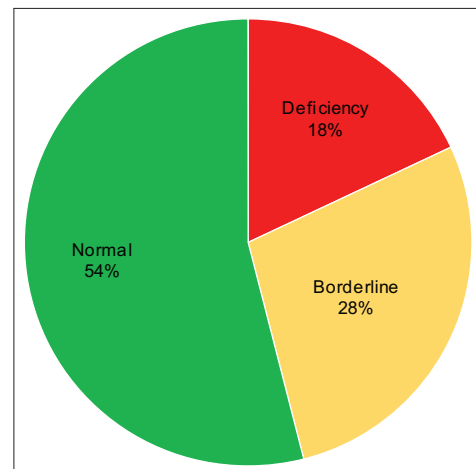


Figure 3: Vitamin B12 deficiency

Pflipsen *et al.* showed 22% of the diabetic patient as having Vit. B12 deficiency, considering Vit. B12 level 350 pg/mL as normal.<sup>[13]</sup> In their study, they too found the impairment more in longer term patients in their study. This may be due to increased IR and long-term metformin use.<sup>[17]</sup>

Choi and Shi<sup>[18]</sup> and Becher *et al.*<sup>[19]</sup> also found similar findings in their study. These findings in support of the previous observations extend the knowledge on the role of Vitamin B12 and its risk factor on type 2 diabetes patients. This highlights the importance of regular screening of B12 levels. Still, none of the guidelines as of today recommend measuring B12 levels regularly in type 2 diabetes, but physicians may do so for an upgraded diagnostic procedure.

## CONCLUSION

Vitamin B12 is a water-soluble vitamin whose deficiency causes a rise in serum Hcy, which can cause people with diabetes to experience permanent, clinically significant problems and increased morbidity. However, patients with T2DM have low serum Vitamin B12, which might be the reason for their various complications as the disease progressed, according to our study.

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