

**Prevalence of Vitamin B12 Deficiency in Newly Diagnosed Type 2 Diabetes Mellitus Patients: A Review****Gupta Akhil<sup>1</sup>, Gupta Shalini<sup>2</sup>**<sup>1</sup>Assistant Professor, Department of Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur<sup>2</sup>Assistant Professor, Department of Pathology, Mahatma Gandhi Medical College and Hospital, Jaipur

Received: 25-09-2024 / Revised: 23-10-2024 / Accepted: 26-11-2024

Corresponding Author: Dr. Shalini Gupta

Conflict of interest: Nil

**Abstract:****Background:** Vitamin B12 deficiency is increasingly being recognized as a common concern in patients with type 2 diabetes mellitus (T2DM). Vitamin B12 plays a critical role in red blood cell formation, neurological function, and DNA synthesis.**Aim:** This review focuses on the prevalence of vitamin B12 deficiency in newly diagnosed T2DM patients, exploring potential mechanisms, clinical implications, and recommendations for screening and treatment.**Method:** Patients in OPD with new onset diabetes mellitus type 2 who were between age group of 18-50 years with no history of any OHA uptake or any other risk factor to cause vit B 12 deficiency were taken into study.**Result:** 64(32%) patients of newly diagnosed type 2 diabetes were found to be vit B12 deficient, 87(43.5%) patients range in border line category and in 49(24.5) patients vit b12 levels are in normal limit.**Conclusion:** Vitamin B12 deficiency is prevalent among newly diagnosed T2DM patients. Due to the overlap of clinical symptoms between B12 deficiency and diabetic complications such as neuropathy, it is crucial for healthcare providers to consider B12 deficiency in their diagnostic workup.**Keywords:** Type 2 diabetes mellitus, Vitamin B12 deficiency, Prevalence.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

**Introduction**

Type 2 diabetes mellitus (T2DM) is a growing global health concern, affecting approximately 9.3% of the adult population worldwide. T2DM is characterized by insulin resistance and chronic hyperglycemia, which can lead to long-term complications such as cardiovascular diseases, nephropathy, neuropathy, and retinopathy.

In recent years, attention has been drawn to the role of micronutrient deficiencies, including vitamin B12 deficiency, in the management and outcomes of T2DM. Vitamin B12 (cobalamin) is essential for the proper functioning of the brain, nervous system, and production of red blood cells. Deficiency in this vitamin can lead to hematological abnormalities (such as macrocytic anemia) and neurological complications, including peripheral neuropathy, which is already a concern in diabetic patients. Many studies have been done in past to show and prove association of metformin treatment in DM2 patients [2,3] and associated B12 deficiency, but here we high light the presence of vit B12 deficiency before onset of metformin treatment and same will aggravate with onset of metformin treatment and results in its implications in neurological [7], hematological [8] and other

complications [7,8] in T2DM patients and hence Therefore, making understanding the prevalence and risk factors of vitamin B12 deficiency in newly diagnosed T2DM patients is crucial.

**Mechanisms of Vitamin B12 Deficiency in T2DM:** Several factors contribute to vitamin B12 deficiency in T2DM patients. The most significant factor is the use of metformin [1,2], a cornerstone in the treatment of T2DM, which is known to interfere with vitamin B12 absorption in the gut.

**Metformin Use and Vitamin B12 Absorption:** Metformin has been widely prescribed for its glucose-lowering effects and benefits in reducing cardiovascular events. However, long-term use of metformin has been linked to vitamin B12 deficiency through several proposed mechanisms: - Metformin is believed to alter gut motility and bacterial flora, which may impair vitamin B12 absorption. - It may interfere with the calcium-dependent membrane action responsible for B12 uptake in the ileum. - Reduced absorption due to metformin use is dose-dependent and increases with prolonged use [3].

Other Contributing Factors: Apart from metformin, dietary habits, gastrointestinal malabsorption (e.g., due to conditions such as pernicious anemia or chronic atrophic gastritis), and advancing age may contribute to vitamin B12 deficiency. Newly diagnosed patients may already have subclinical deficiency due to a combination of these factors.

**3. Prevalence of Vitamin B12 Deficiency in Newly Diagnosed T2DM Patients:** The prevalence of vitamin B12 deficiency in newly diagnosed T2DM patients varies across different populations and studies, largely due to differences in diagnostic criteria, study design, and population characteristics. A review of literature suggests the prevalence ranges from 10% to 30% in newly diagnosed patients, though some studies report even higher numbers [6].

**3.1. Global Data:** In a study conducted in India, 24.1% of newly diagnosed T2DM patients were found to be vitamin B12 deficient, with a higher prevalence observed in those over the age of 50. In the United States, studies have estimated that 22-33% of patients on metformin therapy develop some degree of B12 deficiency within a few years of initiation, although specific data on newly diagnosed patients is limited. In European populations, similar trends have been observed, with a significant proportion of newly diagnosed patients showing subclinical deficiency.

#### **Risk Factors for Deficiency**

Factors that increase the risk of vitamin B12 deficiency in T2DM patients include: - Age: Older patients have a higher prevalence of deficiency due to decreased absorption and dietary intake.

Dietary habits: Vegan or vegetarian diets, which exclude animal products rich in vitamin B12, are associated with an increased risk [5].

Metformin use: As discussed earlier, metformin is a significant risk factor [1,2,3].

Duration of diabetes: Although the review focuses on newly diagnosed patients, those with longer durations of diabetes are at even greater risk, particularly with prolonged metformin use.

**Clinical Implications:** Vitamin B12 deficiency can lead to a range of clinical symptoms, many of which overlap with complications of T2DM. These include: - 1) Peripheral neuropathy: Vitamin B12 deficiency can cause nerve damage, which may exacerbate or mimic diabetic neuropathy [7], a common complication in T2DM. The overlap of symptoms may lead to underdiagnosis of B12 deficiency.

2) Cognitive impairment: B12 deficiency is associated with cognitive decline and dementia,

particularly in older adults, which could complicate the management of T2DM [7].

3) Hematological abnormalities: Macrocytic anemia, although less common in early B12 deficiency, may present in more advanced stages, leading to fatigue and weakness [8].

#### **Methodology**

Patients in OPD with new onset diabetes mellitus type 2 who were between age group of 18-50 years with no history of any OHA uptake or any other risk factor to cause vit B 12 deficiency were taken into study after taking proper informed consent, sample size was calculated based on previous prevalence study data, After selection of proper study candidate, serum sample was draw taking all aseptic precautions and sent to lab under strict cold chain maintenance

#### **Data obtained is as below**

**Sample size:** Considering prevalence of diabetes to be 15 percent and a confidence interval of 5 percent ,sample size is calculated ,which came out to be 195,hence we screened 200 patients(round off) which are newly diagnosed patients of type 2 diabetes, among the sample patients 122 were male and rest 78 were female

#### **Inclusion Criteria:**

a) Patients age group of 18- 50 years of age with newly diagnosed type 2 diabetes according to ADA criteria for diagnosis of diabetes

#### **Exclusion Criteria:**

- known cases of type 2 diabetes: on or not taking treatment
- known case of vit b12 deficiency
- patients with risk factor for vit b12 deficiency: known case of pernicious anaemia , h/o any GI surgery, alcohol use

Vit b12 level and criteria for deficiency:

Deficiency: serum vit b12 level less than 190 pg/ml

Border line: serum vit b12 level more than 190 pg/ml but less than 300

Sufficient: serum vit b12 level more than 300 pg/ml

#### **Results**

64(32%) patients of newly diagnosed type 2 diabetes were found to be vit B12 deficient ,87(43.5%) patients range in border line category and in 49(24.5) patients vit b12 levels are in normal limit, Vit B12 deficiency was found to be more prevalent among females with new onset diabetes. Detail data analysis is below in tabular form.

**Table 1: Prevalence of Vit B12 deficiency among patients with new onset type 2 DM**

Vit B 12 level	Number	Percentage
Deficient	64	32
Borderline	87	43.5
Sufficient	49	24.5

**Table 2: Vit B12 deficiency Results based on sex group:**

Vit B 12 level	Male (N=122)	Female (N=78)	number	Percentage	
				male	female
Deficient	45	19	64	70.31	29.69
Borderline	42	41	83	50.6	49.4
Sufficient	35	18	53	66.03	33.97

**Table 3: Vit B 12 deficiency among male:**

Vit B 12 level	Male (N=122)	Percentage
Deficient	45	36.88
Borderline	42	34.42
Sufficient	35	28.68

**Table 4: Vit B 12 deficiency among Female:**

Vit B 12 level	Female (N=78)	Percentage
Deficient	19	36.88
Borderline	41	52.56
Sufficient	18	23.07

**Screening and Treatment Recommendations:**

Given the high prevalence of vitamin B12 deficiency in newly diagnosed patients with T2DM, especially those who are planned to be started with metformin therapy, routine screening should be considered. Guidelines for screening and treatment of B12 deficiency in diabetic patients are still evolving, but based on this study our recommendations are : - Baseline Screening of all Newly diagnosed T2DM patients, not only those patients who are at high risk for Vit B12 deficiency (eg. over 50 years old or following a vegetarian/vegan diet, pernicious anaemia, H/O Gi surgery). All newly diagnosed patients should be screened for vitamin B12 levels at diagnosis, to help prevention of complications associated with diabetes and its treatment esp metformin therapy.

Treatment: Oral or intramuscular vitamin B12 supplementation should be provided to those diagnosed with deficiency. The mode of treatment depends on the severity of the deficiency and the presence of neurological symptoms.

**Conclusion**

Vitamin B12 deficiency is prevalent among newly diagnosed T2DM patients. Due to the overlap of clinical symptoms between B12 deficiency and diabetic complications such as neuropathy, it is crucial for healthcare providers to consider B12 deficiency in their diagnostic workup. Early screening, prompt supplementation can help prevent the progression of deficiency-related complications and improve overall quality of life for diabetic patients.

**Future Research**

Further large-scale studies are needed to determine the optimal screening intervals for vitamin B12 deficiency in T2DM patients and to assess the long-term benefits of supplementation on diabetic complications. Additionally, understanding the molecular mechanisms of metformin-induced B12 deficiency could provide insight into preventive strategies that minimize deficiency risk without compromising glycemic control.

**References**

1. Aroda, V. R., & Mudaliar, S. (2012). Metformin and Type 2 Diabetes: Molecular Mechanisms and Clinical Insights. *Diabetologia*, 55(7), 1499–1513.
2. De Jager, J., Kooy, A., Lehert, P., et al. (2010). Long-term treatment with metformin in patients with type 2 diabetes and risk of vitamin B-12 deficiency: Randomised placebo-controlled trial. *BMJ*, 340, c2181.
3. Bauman, W. A., & Shaw, S. (2010). Metformin-related vitamin B12 deficiency: How does it develop and how is it managed? *J Fam Pract*, 59(3), 154–157.
4. Vitamin B12 deficiency in the elderly: H\_W Baik<sup>1</sup>, R\_M\_Russell 1999:19:357-77.
5. doi: 10.1146/annurev.nutr.19.1.357. PMID: 10448529
6. Herrmann W, Schorr H et al. Vitamin B-12 status, particularly holotranscobalamin II and methylmalonic acid concentrations, and hyperhomocysteinemia in vegetarians. *Am J Clin Nutr* 2003; 78(1): 131-6

7. Prevalence of vitamin B12 deficiency in Indian type 2 diabetes subjects on metformin therapy  
Dr R. Anil Kumar, Assistant Professor, Dr Surekha B. Shetty, Assistant Professor, Dr R Lalitha, Assistant Professor, All authors are affiliated to Karnataka Institute of Endocrinology and Research Bangalore, Karnataka, India
8. Lindenbaum J, Heaton EB, Savage DG, Brust JC, Garrett TJ, Podell ER, et al. Neuropsychiatric disorders caused by cobalamin deficiency in the absence of anemia or macrocytosis. *N Engl J Med* (1988) 318(26):1720–8. doi: 10.1056/nejm198806303182604 [DOI] [PubMed]
9. Devalia V, Hamilton MS, Molloy AM, British Committee for Standards in Haematology. Guidelines for the diagnosis and treatment of cobalamin and folate disorders. *Br J Haematol* (2014) 166(4):496–513. Doi: 10.1111/bjh.12959 [DOI] [PubMed]