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Original Research Article

Frequency of Vitamin B12 Deficiency Among Type 2 Diabetes Mellitus Patients Presenting at a Tertiary Care Hospital

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Abstract: *Vitamin B12 deficiency is a recognized metabolic complication among patients with type 2 diabetes mellitus, potentially contributing to neuropathy and haematological abnormalities. Limited regional data exist regarding its burden in routine clinical practice.* ***Objective:*** *To determine the frequency of vitamin B12 deficiency among type 2 diabetes mellitus patients presenting at a tertiary care hospital.* ***Methods:*** *This study included 194 T2DM patients aged 25 to 70 years. T2DM was defined as elevated fasting blood glucose (≥126 mg/dL), HbA1c (≥6.5%), or a 3-year history of antidiabetic medication use. Patients with parathyroid disorders, pre-existing renal disease, and chronic liver disease were excluded. Patients were assessed for Vitamin B12 deficiency (B12 levels < 200 pg/mL). Data was analyzed using SPSS 26. Vitamin B12 deficiency was presented as frequencies and percentages. Stratifications were performed using the chi-square test, with P values < 0.05 considered significant.* ***Results:*** *The mean age of 194 patients with T2DM was 50.98±11.99 years. The study had 105 (54.1%) males and 89 (45.9%) females. Eighty-three (42.8%) patients had hypertension, 76 (39.2%) were smokers, and 138 (71.1%) had BMI >24.9 kg/m². The frequency of vitamin B12 deficiency was 15.5% (n=30). Patients aged 55 years or older had the highest frequency of deficiency, but this association was not significant (P = 0.06).* ***Conclusion:*** *This study found a moderate prevalence of vitamin B12 deficiency in type 2 diabetic patients (15.5%). In older patients, the frequency of deficiency was higher, but not significant.*

Keywords: Vitamin B12 Deficiency, Type 2 Diabetes Mellitus, Prevalence, Hypertension, HbA1c

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Introduction

Diabetes is a metabolic disorder that is a major global health concern that affects millions of people across the globe. It is characterized by elevated blood glucose levels that occur either due to insufficient insulin secretion or the body's reduced ability to utilize insulin efficiently. This condition leads to several complications across multiple organ systems and can significantly impair quality of life. According to a report, Type 2 diabetes mellitus (T2DM) in particular has arisen as a significant public health challenge worldwide, with estimates suggesting that the number of affected individuals will rise by 200 million by 2040 (1-5). Persistent hyperglycaemia associated with metabolic disturbances can cause organ injury in individuals with T2DM. This may lead to the development of life-threatening complications, particularly microvascular and macrovascular complaints, which are known to upsurge the risk of cardiovascular disease by two to four times (6).

Vitamin B12 is a water-soluble vitamin chiefly obtained from animal-based foods. Intrinsic factor, a glycoprotein created by the stomach's parietal cells, is essential for the absorption of vitamin B12 in the terminal ileum. When absorbed, vitamin B12 functions as a coenzyme in metabolic processes involved in the synthesis of DNA and fatty acids. Deficiency of this vitamin can contribute to haematological and neurological complications (7,8).

Liver stores a substantial amount of vitamin B12; prolonged impairment of absorption due to factors including insufficient dietary intake and malabsorption syndromes can progressively deplete these reserves, resulting in deficiency. Research has demonstrated that vitamin B12 deficiency affects roughly 3% of people aged 20-39 years, 4% of those aged 40-59 years and 6% of people aged 60 years and above. A study has indicated that vitamin B12 deficiency occurred in 11.52% of patients with T2DM (9-12).

Vitamin B12 deficiency has received increased attention in recent years due to its potential impact on a range of health conditions, including T2DM. Due to the paucity of local literature on this subject, the goal of this study is to determine the frequency of vitamin B12 deficiency among T2DM patients. The findings of this study will aid our medical professionals in timely screening for Vitamin B12 Deficiency, leading to early management and improved quality of life due to this neglected complication of T2DM. Interpreting vitamin B12 levels can be complex because serum levels may not always reflect tissue levels precisely. Therefore, clinicians must consider potential causes of vitamin B12 deficiency when evaluating T2DM patients.

Methodology

A cross-sectional study was conducted in the Department of Medicine at DHQ Teaching Hospital, Dera Ismail Khan, from 05-07-2024 to 05-01-2025, with ethical approval from the hospital's IRB. A sample of 194 patients was selected for this research, based on a previous proportion of vitamin B12 deficiency of 11.52% (12) among type 2 diabetic patients, a confidence level of 95% and an absolute precision of 4.5%. Consecutive non-probability sampling was used to enrol eligible patients.

Eligible patients were both male and female gender, aged 25 to 70 years, diagnosed with T2DM. T2DM was defined as patients presenting with fatigue, nocturia, and increased thirst. Diagnosis was made by considering any one of the following criteria: fasting blood sugar ≥126 mg/dl, HbA1C ≥6.5%, or the patient being on antidiabetic medications for the last 3 years. Patients with parathyroid disorders, pre-existing renal disease, or chronic liver disease were excluded.

Written informed consent was obtained from all the patients. Baseline demographics such as age, gender, BMI, educational status, occupation status, socioeconomic status, and area of residence were recorded. Patients diagnosed with type 2 diabetes mellitus were examined for vitamin B12 deficiency by taking 5 milliliters of blood in blood collection tubes using aseptic precautions and sent for laboratory assessment. Diagnosis was based on a serum B12 level higher than 200 pg/mL. This

whole assessment was supervised by a consultant with minimum 5 years of post-fellowship experience. A pre-designed, structured pro forma was used to record the details of each patient.

SPSS 26 was used to analyze the data. Mean + SD were determined for age, serum B12 level, and BMI. Frequencies and percentages were determined for gender, vitamin B12 deficiency, hypertension, smoking, educational status, occupational status, socioeconomic status, and area of residence. Vitamin B12 deficiency was stratified by age, BMI, hypertension, smoking, educational status, occupation status, socioeconomic status, and area of residence to address potential effect modifiers. A post-stratification Chi-square test was performed, with p-values < 0.05 considered significant.

Results

The study had 194 patients with T2DM; their mean age was 50.98±11.99 years. The mean serum vitamin B12 level was 282.23±49.52 pg/mL. The mean body mass index (BMI) was 25.86±1.30 kg/m2.

Regarding the patient demographic profile, 105 (54.1%) were male, and 89 (45.9%) were female. Socioeconomic status showed that 68 (35.1%) were from the lower economic class, 97 (50.0%) from the middle class, and 29 (14.9%) from the upper economic class. Other demographic variables, such as educational status, occupational status, and residence status, are shown in table no. 1. Regarding comorbidities 83 (42.8%) patients had hypertension. Seventy-six (39.2%) were smokers, and 138 (71.1%) were classified as overweight (>24.9 kg/m²) (Table 2). The frequency of vitamin B12 deficiency was 15.5% (n = 30) (Figure 1). Table 3 presents the stratification of vitamin B12 deficiency with various demographics and comorbidities.

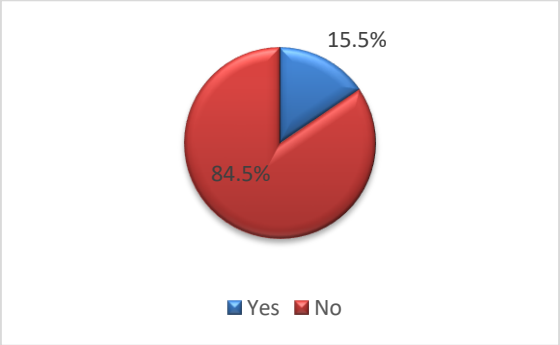

Figure 1: Frequency of Vitamin B12 deficiency

Table 1: Demographic profile of the patients

Demographics		n	%
Gender	Male	105	54.1%
	Female	89	45.9%
Socioeconomic status	Lower class	68	35.1%
	Middle class	97	50.0%
	Upper class	29	14.9%
Education status	Literate	93	47.9%
	Illiterate	101	52.1%
Occupation status	Employed	87	44.8%
	Unemployed	107	55.2%
Area of residence	Urban	100	51.5%
	Rural	94	48.5%

Table 2: Comorbidities

Comorbidities		n	%
Hypertension	Yes	83	42.8%
	No	111	57.2%
Smoking	Yes	76	39.2%
	No	118	60.8%
BMI (Kg/m^2)	18 to 24.9	56	28.9%
	> 24.9	138	71.1%

Table 3: Stratification of vitamin B12 deficiency with demographics and comorbidities

Demographics and comorbidities		Vitamin B12 deficiency				P value
		Yes		No		
		n	%	n	%	
Age distribution (Years)	25 to 40	3	10.0%	42	25.6%	0.06
	41 to 55	10	33.3%	63	38.4%	
	> 55	17	56.7%	59	36.0%	
BMI (Kg/m2)	18 to 24.9	10	33.3%	46	28.0%	0.55
	> 24.9	20	66.7%	118	72.0%	
Hypertension	Yes	12	40.0%	71	43.3%	0.73
	No	18	60.0%	93	56.7%	
Smoking	Yes	10	33.3%	66	40.2%	0.47
	No	20	66.7%	98	59.8%	

Gender	Male	14	46.7%	91	55.5%	0.37
	Female	16	53.3%	73	44.5%	
Socioeconomic status	Lower class	11	36.7%	57	34.8%	0.30
	Middle class	12	40.0%	85	51.8%	
	Upper class	7	23.3%	22	13.4%	
Education status	Literate	12	40.0%	81	49.4%	0.34
	Illiterate	18	60.0%	83	50.6%	
Occupation status	Employed	16	53.3%	71	43.3%	0.30
	Unemployed	14	46.7%	93	56.7%	
Area of residence	Urban	16	53.3%	84	51.2%	0.83
	Rural	14	46.7%	80	48.8%	

Discussion

The relationship between vitamin B12 deficiency and type 2 diabetes mellitus (T2DM) is well documented in the literature. The current study investigated a cohort of 194 T2DM patients; vitamin B12 deficiency was observed in 15.5% of patients. The mean age of the patients was 50.98±11.99 years, and the mean BMI was 25.86±1.30 kg/m², indicating a middle-aged and mostly overweight population. A study in Nepal found a 21.8% prevalence of deficiency, which was significantly associated with older age, higher metformin dosage, longer treatment duration, and a vegetarian diet. (13) These findings highlight the composite nature of the deficiency where pharmacological and lifestyle factors converge. A study from Peshawar, Pakistan, reported a 65.7% frequency, associating vitamin B12 deficiency with increased age, higher body mass index (BMI), longer diabetes duration, and longer metformin use. (14) This difference in the prevalence across studies could be attributed to population-specific factors such as genetic predispositions, dietary patterns lacking in fortified foods, or differences in metformin prescribing doses and durations.

Further evidence from studies reinforces the dose and duration-dependent relationship. In another study, a 10.1% prevalence was reported, with deficiency independently associated with metformin use for more than 10 years, a daily dose of 2000 mg, and poor glycaemic control, indicated by elevated HbA1c. (15) An analysis of secondary data from Jordan found 25.6% prevalence of the deficiency, concluding that prolonged treatment and greater cumulative dose increased the odds of deficiency. (16) These regional studies confirmed metformin as a key iatrogenic cause of B12 deficiency but also revealed a wide prevalence range, suggesting that local clinical practices, dietary habits and possibly genetic factors moderate the risk.

Metformin induces B12 deficiency through interference with the calcium-dependent membrane action necessary for the absorption of the intrinsic factor-B12 complex in the terminal ileum. (17) This hypothesis is supported by the findings from various studies that higher doses and longer durations of metformin are associated with lower serum B12 levels. The clinical appearance and detection of vitamin B12 deficiency present a significant challenge. It has been mentioned in several studies that the neurological symptoms of B12 deficiency, such as peripheral neuropathy, can closely mimic or exacerbate diabetic neuropathy, which leads to misdiagnosis and delayed intervention. (18,19) This diagnostic commonality underscores the critical importance of routine biochemical screening rather than relying solely on symptomatic presentation.

A detailed analysis of demographic and socioeconomic factors in the present study did not reveal statistically significant associations with B12 deficiency. The distribution of deficiency across age groups showed a non-significant trend (p=0.06), with 56.7% of deficient cases being over 55 years old. This finding aligns with several studies that have demonstrated B12 deficiency is associated with older age. (13,14)

The present study has several limitations. The study had a cross-sectional design and was conducted in a single centre, which may limit the generalizability of the results compared to other centres with different patient demographics and presentations. The study lacks data on metformin administration and dosage, which are essential variables discussed in the aforementioned studies. Future longitudinal studies should incorporate detailed pharmacological histories, dietary assessments, and functional biomarkers of B12 status to elucidate the temporal dynamics and the full clinical impact of deficiency in this population.

Conclusion

In conclusion, the present study found a moderate prevalence of vitamin B12 deficiency in type 2 diabetic patients (15.5%). A higher frequency of deficiency was observed in older patients, but the association did not reach statistical significance (P = 0.06).

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRB)

Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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