

A Study to Demonstrate the Relationships of T2DM with the Sociodemographic Profile

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Abstract:

Aim: The aim of the present study was to assess the prevalence of vitamin B12 deficiencies among T2DM patients and its factors in a tertiary care hospital in Bihar region.

Methods: We conducted this study as retrospective study in Department of Pharmacology, Darbhanga Medical College, Laheriasarai, Darbhanga, Bihar, India. Participants in the study were type 2 diabetics using metformin who visited the General Medicine outpatient department. We conducted the study for one year. 200 subjects were included in the study.

Results: About 46% of samples were of patients aged 40-50 years, while only 12% were over the age of 60. The respondents' average age was 48.92 ± 8.52 years. In our survey, there was a preponderance of men (55%), and only 45% were females. Around 16% of the population was illiterate, while 31% had completed middle school and 22% had completed high school. Regarding occupation, 25% were unemployed, while 40% and 24% were engaged in unskilled and semi-skilled occupations, respectively. Around 43% of diabetic patients were diagnosed between the ages of 40 and 50, whereas 39% of diabetic patients were diagnosed before the age of 40. Nearly half had diabetes mellitus for 5-10 years, while only 14% had diabetes for beyond 10 years. In addition, 25% of the study sample had a positive family history of type 2 diabetes. In our study, the duration of diabetes mellitus, duration of metformin intake, and dose of metformin were statistically significant (p -value < 0.05) among the variables related to diabetes mellitus and vitamin B12 deficiency. We described the association between variables related to diabetes mellitus and vitamin B12 deficiency among the study respondents. We found no significant correlation for other variables (p -value $= > 0.05$). We showed the correlation between serum vitamin B12 value and study variables.

Conclusion: According to the findings of the study, a large proportion of the sample group was deficient in vitamin B12. This study also demonstrates that there are gaps in the identification and treatment of vitamin B12 deficiency in the study area, as it is frequently undiagnosed. The longer duration and higher daily dose of metformin were the risk factors for vitamin B12 insufficiency.

Keywords: Metformin, Antidiabetic Drugs, Causes Of Vitamin B12 Deficiency, Type-2 Diabetes Mellitus, Metformin Therapy.

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Introduction

Hyperglycemia is a symptom of the metabolic disorder diabetes mellitus, which is characterized by difficulties in the breakdown of carbohydrates, lipids, and proteins. Patients with diabetes are deficient in absolute or relative insulin. Diabetes mellitus is a significant non-communicable disease whose prevalence has exploded during the past two decades.[1] In the technologically advanced world of the twenty-first century, diabetes mellitus has arisen as a significant threat to public health, and

with time it has become an epidemic that cannot be ignored. [2,3]

According to a recent report by the World Health Organization (WHO), India has the highest number of diabetics in the world, surpassing China. [4] Diabetes mellitus affects around 88 million Southeast Asians, a number that is projected to rise to 153 million by 2045. Diabetes mellitus affects around 77 million people in India between the ages of 20 and 79 accounting for 8.9% of the population. [5] In the

"biguanide" class, metformin is an anti-hyperglycemic medication. Metformin decreases blood glucose levels and is the cornerstone of treatment for type 2 diabetes. [6] Metformin decreases the insulin resistance characteristic of T2DM by enhancing insulin sensitivity. If glycemic control is insufficient, we may use metformin alone or in combination with other oral hypoglycemic medications. [7]

Cobalamin is an important B vitamin that is water soluble. Vitamin B12 plays a significant role in normal brain function (both central nervous system and peripheral nervous system), DNA synthesis, and red blood cell (RBC) synthesis. [8] Vitamin B12 is naturally abundant in non-vegetarian diets, and the recommended daily requirement (RDA) is 2.4 micrograms per day. A normal vitamin B12 concentration exceeds 221 pmol/L in the human body. [9] Nearly 50% of subclinical vitamin B12-deficient patients have normal vitamin B12 levels. [10] Metformin inhibits calcium-dependent channels in the ileum, hence preventing the absorption of vitamin B12 in the ileum. Several studies have shown that extended use of metformin causes vitamin B12 insufficiency through this mechanism. [11-12] A severe deficit may cause significant neurological problems. [13]

The aim of the present study was to assess the prevalence of vitamin B12 deficiencies among T2DM patients and its factors in a tertiary care hospital in Bihar region.

Materials and Methods

We conducted this study as retrospective study in Department of Pharmacology, Darbhanga Medical College, Laheriasarai, Darbhanga, Bihar, India. Participants in the study were type 2 diabetics using metformin who visited the General Medicine outpatient department. We conducted the study for one year. 200 subjects were included in the study.

Selection Criteria: The inclusion criteria were patients having type 2 diabetes for at least two years, aged between 30 and 75 years, free of urinary tract infection complaints, taking metformin up to the maximum daily dose of 2,000 mg, and willing to participate in the study. Patients with type 1 diabetes, type 2 diabetes mellitus patients on insulin therapy or mixed therapy (insulin with metformin or other hypoglycemic drugs), pregnant women, patients with pernicious anemia or a history of malabsorption syndrome after gastrointestinal surgery, patients with chronic hepatitis, and those with hypothyroid disorders were excluded from the study.

Data Collection Procedure: We adopted a semi-structured questionnaire to get data from study participants through interviews. We used a questionnaire containing information on sociodemographic characteristics, metformin use among diabetes mellitus patients, diabetes mellitus history, lifestyle behaviors, anthropometric measurement, examination findings, and biochemical markers. After receiving consent, a single investigator performed the interview, and their responses were documented on the questionnaire. Each participant was interviewed for 10 to 15 minutes. A thorough medical history was taken and after collecting blood samples, biochemical analyses were conducted.

Data Analysis: Data were entered in Microsoft Excel (Microsoft Corporation, Redmond, WA) and analyzed using SPSS v. 23 (IBM Corp., Armonk, NY). Descriptive and analytic statistics were used for our data analysis. We carried out a descriptive analysis and presented qualitative data as frequencies and percentages as well as means and standard deviations for qualitative data. The odds ratio was determined, and the chi-square test was employed for statistical analysis (a p-value of less than 0.05 is considered as significant).

Results

Table 1: Sociodemographic characteristics of the study respondents

Variables		Frequency (%)
Age	< 40 Years	30 (15%)
	40-50 Years	92 (46%)
	51-60 Years	54 (27%)
	> 60 Years	24 (12%)
Gender	Male	110 (55%)
	Female	90 (45%)
Education	Illiterate	32 (16%)
	Primary school	48 (24%)
	Middle school	62 (31%)
	High school	44 (22%)
	UG/PG	14 (7%)
Occupation	Unemployed	50 (25%)
	Unskilled	80 (40%)
	Semi-skilled	48 (24%)
	Skilled	12 (6%)
	Farmers/shop owners	10 (5%)

About 46% of samples were of patients aged 40-50 years, while only 12% were over the age of 60. The respondents' average age was 48.92 ± 8.52 years. In our survey, there was a preponderance of men (55%), and only 45% were females. Around 16% of

the population was illiterate, while 31% had completed middle school and 22% had completed high school. Regarding occupation, 25% were unemployed, while 40% and 24% were engaged in unskilled and semi-skilled occupations, respectively.

Table 2: Variables pertaining to lifestyle, diabetes mellitus and vitamin B12

Variables		Frequency (%)
Smoking history	Yes	44 (22%)
	No	156 (78%)
Alcohol consumption	Yes	74 (37%)
	No	126 (63%)
Comorbidities	Hypertension	24 (12%)
	COPD	12 (6%)
	Anaemia	8 (4%)
	CAD	8 (4%)
	Others	16 (8%)
Age of onset of diabetes mellitus	< 40 Years	78 (39%)
	40-50 Years	86 (43%)
	51-60 Years	24 (12%)
	> 60 Years	12 (6%)
Duration of diabetes mellitus	<5 years	70 (35%)
	5-10 years	102 (51%)
	>10	28 (14%)
Family history of diabetes mellitus	Yes	50 (25%)
	No	150 (75%)
Metformin duration	< 5 Years	78 (39%)
	5-10 Years	96 (48%)
	> 10 Years	26 (13%)
Metformin dose (mg/day)	500	2 (1%)
	1000	90 (45%)
	1500	78 (39%)
	2000	30 (15%)
HbA1c	<7	118 (59%)
	>7	82 (41%)
Vit B 12 deficiency	Normal	110 (55%)
	Borderline	36 (18%)
	Deficiency	54 (27%)
Vit B 12 values	<148pmol/ liter	54 (27%)
	148-221 pmol/ liter	36 (18%)
	>221 pmol/ liter	110 (55%)
Anemia	Yes	114 (57%)
	No	86 (43%)

Around 43% of diabetic patients were diagnosed between the ages of 40 and 50, whereas 39% of diabetic patients were diagnosed before the age of 40. Nearly half had diabetes mellitus for 5-10 years, while only 14% had diabetes for beyond 10 years. In addition, 25% of the study sample had a positive family history of type 2 diabetes. Estimated 48% and 13% of the study group had been on metformin for 5-10 years and > 10 years, respectively. Around 45% of patients were taking 1000 mg of metformin

per day, whereas just 15% were taking 2 g per day. About 45% of responders on metformin report taking 500 mg twice daily, while 39% were taking 500 mg three times daily. In our study, 27% of participants had vitamin B12 deficiency, approximately 18% had borderline levels, and the mean vitamin B12 level was 308.6 ± 6115.58 pmol/L. Around 27% of respondents were deficient in vitamin B12 (148 pmol/Litre), whereas 55% were normal (> 221 pmol/litre).

Table 3: Correlation between serum Vitamin B12 value and study variables

Variables	Correlation coefficient (r)	p-value
Age	- 0.096	0.316
Age of onset of diabetes mellitus	0.133	0.182
Duration of diabetes mellitus	- 0.501	< 0.0001
Duration of metformin use	- 0.507	< 0.0001
Daily dose of metformin	- 0.342	0.0007
BMI	0.137	0.182
Hemoglobin	0.931	< 0.0001
HbA1c	0.133	0.180
Serum creatinine	- 0.127	0.212

We found no significant correlation for other variables (p -value = > 0.05). We showed the correlation between serum vitamin B12 value and study variables.

Discussion

Diabetes mellitus is a complex metabolic disorder. The major clinical manifestation is chronic hyperglycemia which results from impaired insulin secretion or/and impaired insulin action. Diabetes mellitus classifications include type 1 insulin-dependent, type 2 insulin-independent, gestational diabetes, and other less common types (e.g., MODY). [14] Generally, type 2 diabetes mellitus (T2DM) is a global health concern that is steadily rising. [15] For instance, an estimated 422 million adults with diabetes worldwide were reported in 2014. [16]

About 46% of samples were of patients aged 40-50 years, while only 12% were over the age of 60. The respondents' average age was 48.92 ± 8.52 years. In our survey, there was a preponderance of men (55%), and only 45% were females. Similarly, we noted male preponderance in studies by Reinstatler et al [17], Baidya et al [18] and Chattopadhyay et al. [19] and in which males made up 50.3%, 52% and 57% respectively. Around 16% of the population was illiterate, while 31% had completed middle school and 22% had completed high school. Regarding occupation, 25% were unemployed, while 40% and 24% were engaged in unskilled and semi-skilled occupations, respectively. Around 43% of diabetic patients were diagnosed between the ages of 40 and 50, whereas 39% of diabetic patients were diagnosed before the age of 40. Nearly half had diabetes mellitus for 5-10 years, while only 14% had diabetes for beyond 10 years. In addition, 25% of the study sample had a positive family history of type 2 diabetes. Estimated 48% and 13% of the study group had been on metformin for 5-10 years and > 10 years, respectively. In the study by Krishnan et al [20], 83.9% of patients were taking over 1000 mg of metformin per day. In research conducted by Ko et al [21], about 62.5% were on a daily metformin dose of 1000 mg, and 12% were on a daily metformin dose of 2000 mg. The study by Chattopadhyay et al [19] showed that 57% of participants took over 1000

mg to 2 g of metformin daily, and 41% took over 500 mg to 1000 mg daily.

Around 45% of patients were taking 1000 mg of metformin per day, whereas just 15% were taking 2 g per day. About 45% of responders on metformin report taking 500 mg twice daily, while 39% were taking 500 mg three times daily. In our study, 27% of participants had vitamin B12 deficiency, approximately 18% had borderline levels, and the mean vitamin B12 level was 308.6 ± 6115.58 pmol/L. Around 27% of respondents were deficient in vitamin B12 (148 pmol/Litre), whereas 55% were normal (> 221 pmol/litre). In our study, the duration of diabetes mellitus, duration of metformin intake, and dose of metformin were statistically significant (p -value < 0.05) among the variables related to diabetes mellitus and vitamin B12 deficiency. Using proton pump inhibitors and H2 blockers, as well as the duration of metformin therapy, was found to be significantly associated with vitamin B12 deficiency in the Damiao et al. study. [22] In the Krishnan et al [20] study, non-Malay race and diabetes duration were significantly associated with vitamin B12 deficiency. HbA1c, homocysteine levels, metformin duration, and dose were all associated with vitamin B12 deficiency in the Miyan et al. study. [23]

We described the association between variables related to diabetes mellitus and vitamin B12 deficiency among the study respondents. We found no significant correlation for other variables (p -value = > 0.05). We showed the correlation between serum vitamin B12 value and study variables.

Conclusion

According to the findings of the study, a large proportion of the sample group was deficient in vitamin B12. This study also demonstrates that there are gaps in the identification and treatment of vitamin B12 deficiency in the study area, as it is frequently undiagnosed. The longer duration and higher daily dose of metformin were the risk factors for vitamin B12 insufficiency. A vitamin B12 shortage increases the likelihood that diabetic neuropathy may worsen. Therefore, monthly vitamin B12 measurement is required for diabetic patients on long-term, high-dose metformin. Preventative or therapeutic vitamin B12 supplementation can mitigate this issue.

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