

Study on Vitamin B12 and Folate Levels in Patients with Diabetes Mellitus Admitted to Niloufer Hospital

P. K. Rajeev¹, Karnabathula Karunya², Vinod Kumar Mandala³,
Ponnathota Mallareddy⁴

¹Associate Professor, Department of Paediatrics, Niloufer Hospital, Osmania Medical College, Hyderabad, Telangana, India.

²Resident, Department of Paediatrics, Niloufer Hospital, Osmania Medical College, Hyderabad, Telangana, India.

³Assistant Professor, Department of Paediatrics, Niloufer Hospital, Osmania Medical College, Hyderabad, Telangana, India.

⁴Assistant Professor, Department of Paediatrics, Niloufer Hospital, Osmania Medical College, Hyderabad, Telangana, India.

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Corresponding author: Dr. Ponnathota Mallareddy

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Abstract

Background: In this study, we wanted to evaluate the prevalence of vitamin B12 deficiency and folate deficiency in type 1 diabetes patients in the South Indian paediatric population. Hence this study was undertaken to evaluate serum B12 and folate levels in type 1 diabetes mellitus patients. Vitamin B12 is an essential micronutrient, required for optimal hemopoietic, neurologic and cardiovascular function. However, there is insufficient data regarding the prevalence of vitamin B12 deficiency and folate deficiency in the South Indian paediatric population.

Materials and Methods: This was a hospital-based prospective observational study conducted among paediatric patients with type I diabetes mellitus presented to the Department of Paediatrics, Niloufer hospital, affiliated with Osmania Medical College which is the largest tertiary care centre in the state of Telangana, situated in the heart of Hyderabad from November 2021-2022.

Results: To study the prevalence of vitamin B12 and folate deficiency in type 1 DM patients among the study population, 51% belonged to the age group of 6-10 years, 30% belonged to 11-14 years, and 19% belonged to less than 5 years. The prevalence of vitamin B12 deficiency was 25% and prevalence of folate deficiency was 15% and the prevalence of both vitamin B12 and folate deficiency was 2%.

Conclusion: Type 1 Diabetes Mellitus is an autoimmune condition known to be associated with multiple co-morbidities. Vitamin B12 deficiency is a potential co-morbidity that is often overlooked in these patients. Hence the prevalence of vitamin B12 deficiency was 25% and folate 15% and also the prevalence of both vitamin B12 and folate deficiency was 2% in type 1 DM patients.

Keywords: Type 1 Diabetes Mellitus, Vitamin B12, Folate, Autoimmune Disease

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Introduction

Type 1 diabetes mellitus (IDDM) results from the autoimmune destruction of insulin-producing beta cells and is characterized by the presence of insulinitis and beta-cell autoantibodies. It is associated with other autoimmune endocrine disorders like Hashimoto's thyroiditis, pernicious anaemia and autoantibodies like PCA, anti-TPA antibodies leading to the development of the autoimmune polyglandular syndrome. [1]

IDDM and Autoimmune Disorders

Autoimmune gastritis and pernicious anaemia are common autoimmune disorders, present in up to 2% of the general population. In patients with type 1 diabetes, the prevalence of autoimmune disorders is increased up to 3 to 5 fold. [2-4] Presence of parietal cell antibodies (PCA) and antibodies to intrinsic factors have been demonstrated in these patients. [5,6] These factors could contribute to the occurrence of B12 deficiency in these patients. The association of vitamin B12 deficiency in type 1 diabetic patients has been demonstrated in previous studies. [7,8]

Aims and Objectives:

1. To determine vitamin B12 and folate deficiency in type 1 DM.
2. To determine the necessity of screening for vitamin B12 and folate deficiency in type 1 diabetes mellitus.

Materials and Methods:

This was a hospital-based prospective observational study conducted among paediatric patients with type I diabetes mellitus presented to the Department of Paediatrics, Niloufer hospital, affiliated with Osmania Medical College which is the largest tertiary care centre in the state of Telangana, situated in the heart of Hyderabad from November 2021-2022.

Inclusion Criteria:

- Patients with K/C/O Type I Diabetes Mellitus or newly diagnosed Type 1 DM
- Both genders
- Parents/guardians of children with the above-mentioned criteria willing to give informed consent.

Exclusion criteria:

- Patients with liver disorders, renal failure, drugs which alter serum vitamin B12 levels, previous gastrointestinal surgery, and established vitamin B12 deficiency.
- Parents or guardians of the children not willing to give informed consent.

Study Procedure

Children with type I diabetes mellitus, satisfying the inclusion criteria were enrolled in the study and admitted after getting informed consent from their parents/guardians. Detailed history for every case was taken from the parent/guardian. A physical examination was conducted, and significant findings were noted. Investigations done included a complete blood picture, peripheral smear, serum B12, and serum folate. The treatment, investigations and disease course were documented.

Statistical Methods

The data were entered in Microsoft Excel 2010 version. Data were analyzed using Microsoft Excel 2010 and Epi Info 7.2.0. Descriptive and inferential statistical analyses were used in the present study. Results on continuous measurements were presented in Mean \pm SD (Min-Max) and results on categorical measurements were presented in numbers (%). Significance was assessed at a 5% level of significance. Student t-test was used to compare inter-group variation for continuous variables. Pearson's correlation coefficient was used to assess the relationship between the two variables.

- Type 1 diabetes was diagnosed based on history, clinical evaluation and laboratory findings. The American Diabetes Association criteria were used for the diagnosis.
- Vitamin B12 levels were also evaluated based on a published meta-analysis report which considers a value less than 148 pmol/L (200 pg/mL) as deficient.
- Serum folate levels: 5-20 ng/ml. The deficiency was considered if levels were less than 5 ng/ml.

Results

Among the study population, 51% belonged to the age group of 6-10 years, 30% belonged to 11-14 years and 19% belonged to less than 5 years. Among the study population, 57% were females and 43% were males and 83% belonged to lower socioeconomic status according to

the modified Kuppuswamy classification. Among the study population, a history of diabetes mellitus was present in 48% and 52% of them were diagnosed with diabetes in the hospital. Among the study population, 16% had diabetes for the past 4 years, followed by 2 years (11%) and 3 years (9%). 6% had diabetes for the past 5 years.

Among the study population, 90% did not have any history of autoimmune disease in the family. Only 2% had a history of asthma in the siblings and 8% had a history of hypothyroidism in mothers. Among the study population, 98% were on insulin. Only two patients were on both insulin and oral hypoglycemic agents. Among the study population, 46% had a normocytic normochromic picture, 30% had microcytic hypochromic picture, 18% had a normocytic hypochromic picture and 6% had a macrocytic picture.

Table 1

Age group (yrs)	Frequency	Percent
Less than 5 years	19	19%
6 – 10 years	51	51%
11-14 years	30	30%
Total	100	100.00%
Mean ± Standard deviation	8.65 ± 3.16 years	
Range	6 months - 14 years	
Age Distribution		
Gender	Frequency	Percent
Female	57	57%
Male	43	43%
Total	100	100.00%
Gender distribution		
Socioeconomic status	Frequency	Percent
Upper	4	4%
Middle	5	5%
Lower middle	8	8%
Lower	83	83%
Total	100	100.00%
Distribution of study participants according to socioeconomic status		
History of Diabetes Mellitus	Frequency	Percent
History	48	48%
De novo diagnosis	52	52%
Total	100	100.00%
Distribution of study participants according to History of diabetes mellitus		

Duration of Diabetes	Frequency	Percent
6 months	2	2%
1 year	4	4%
2 years	11	11%
3 years	9	9%
4 years	16	16%
5 years	6	6%
Total	48	48%
Mean \pm Standard deviation	3.09 \pm 1.25 years	
Range	6 months - 5 years	

Distribution of study participants according to the duration of diabetes

Table 2

History of autoimmune diseases	Frequency	Percent
Asthma in sibling	2	2%
Hypothyroidism in mother	8	8%
No history	90	90%
Total	100	100.00%

History of autoimmune diseases

Type of treatment	Frequency	Percent
Insulin	98	98%
Insulin and oral hypoglycemic agents	2	2%
Total	100	100.00%

Treatment of study population

Parameters	Mean \pm Standard deviation
Haemoglobin (gm %)	12.34 \pm 1.81
Leucocyte count(cu.mm)	17537.73 \pm 11845.288
Platelet count(cu.mm)	3.96 \pm 1.66
Serum B12(pg/ml)	299.198 \pm 1.66
Serum folate(ng/ml)	5.33 \pm 0.5

Mean values of complete blood picture parameters

Smear Findings	Frequency	Percent
Macrocytic	6	6%
Microcytic hypochromic	30	30%
Normocytic normochromic	46	46%
Normocytic hypochromic	18	18%
Total	100	100.00%

Smear findings

Table 3

Symptoms (Tingling, Numbness, Paraesthesia)	Frequency	Percent
Present	0	0%
Absent	100	100.00%
Total	100	100.00%

Symptoms of B12 deficiency

B12 deficiency in T1DM	Frequency	Percent
Present	25	25%
Absent	75	75%
Total	100	100.00%

Prevalence of B12 deficiency

Among the study population, all the patients were asymptomatic. None of them had symptoms of B12 deficiency and 25% had a deficiency of Vitamin B12.

Table 4

Folate deficiency among T1DM		
	Frequency	Percent
Present	15	15%
Absent	85	85%
Total	100	100.00%
Prevalence of Folate deficiency		
Vitamin Deficiency		
	Frequency	Percent
Only B12	23	23%
Only Folate	13	13%
Both Vitamin B12 and Folate	2	2%
Prevalence of vitamin deficiency		

Among the study population, 15% had folate deficiency and 2% had both deficiency of folate and Vitamin B12.

Discussion:

Type 1 diabetes mellitus is an autoimmune condition known to be associated with multiple co-morbidities. Vitamin B12 deficiency is a potential co-morbidity that is often overlooked in these patients. Defining the prevalence of low serum vitamin B12 levels in the diabetic population may aid physicians to consider screening for vitamin B12 levels in Type 1 diabetic patients and carry out further evaluations.

There are limited studies on the B12 levels in type 1 diabetics in the South Indian population. Therefore, defining the prevalence of low serum B12 levels in the type1 diabetic population may help determine whether primary care physicians should consider screening for vitamin B12 levels in diabetic patients and carry out a further evaluation with other metabolic markers such as methylmalonic acid (MMA) and holotranscobalamin.

In the present study, 51% belonged to the age group of 6-10 years, 30% belonged to 11-14 years and 19% belonged to less than 5 years. The mean age was 8.65 ± 3.16 years ranging between 6 months - 14 years. Whereas in the study done by Pradhan S and Thapa S [9], the mean age

was found to be 10.44 ± 3.68 years. In the study of Koshy AS et al [10], it was found that the mean age was 17.6 ± 4.96 years ranging between 3-28 years. In the study of Wale Tesega W et al [11], the mean age was found to be 56.3 ± 10.6 years. In the study of Yakubu M et al [12], the mean age was found to be 50.4 ± 6.8 years and in the study of Khan A et al [13], the mean age was 66.49 ± 13.35 years.

In the present study, 16.07% had type1 diabetes for the past 4 years, 11% for 2 years, 9% for 3 years, and 6% had diabetes for the past 5 years. The mean duration was 3.09 ± 1.25 years ranging between 6 months - 5 years. Whereas in the study done by Koshy AS et al [10], the mean duration was 6.48 ± 3.83 years ranging between 8 months - 17 years. In the study of Wale Tesega W et al [11], the median duration was found to be 5 years. In the study done by

Yakubu M et al [12], the median duration was found to be 6 years. In the study of Khan A et al [13], the mean duration was found to be 9.16 ± 5.59 years.

In the present study, we found that the prevalence of vitamin B12 deficiency was 25%. Whereas in the study done by Pradhan S and Thapa S [9], it was 40%. In the study of Koshy AS et al [10], the prevalence of vitamin B12 deficiency was 54%. In the study of Wale Tesega W et al [11], it was 5%. In the study of Yakubu M

et al [12], it was 32.1%. And in the study of Khan A et al [13], the prevalence of vitamin B12 deficiency was 29.66%. [14,15]

In the present study, we found that the prevalence of folate deficiency was 15%. Whereas in the study done by Salah N [14], it was 18.7%. And in the study done by Wale Tesega W et al [11], the prevalence of folate deficiency was 23.8%.

Conclusion:

The present study was conducted in the Department of Paediatrics, Niloufer hospital, affiliated with Osmania Medical College to study the prevalence of vitamin B12 and folate deficiencies in type 1 DM patients. The prevalence of Vitamin B12 deficiency was 25% and the prevalence of folate deficiency was 15%. The prevalence of both vitamin B12 and folate deficiency was 2%.

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