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Original Research Article

Prevalence of vitamin B12 deficiency in thyroid dysfunction and its correlation with anti-thyroid peroxidase antibodies

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ABSTRACT

Background: Thyroid dysfunction, particularly autoimmune thyroid disease (AITD), is linked to micronutrient deficiencies. This study assessed the prevalence of vitamin B12 deficiency in thyroid dysfunction, its levels in subclinical hypothyroidism, and its correlation with anti-thyroid peroxidase (anti-TPO) antibodies.
Methods: A cross-sectional study of 124 thyroid dysfunction patients and 90 euthyroid controls was conducted. Serum TSH, free T3, free T4, anti-TPO, and vitamin B12 were measured. Statistical analyses included Chi-square tests, t-tests, ANOVA, and Pearson correlation.
Results: Vitamin B12 deficiency was significantly higher in cases (29.84%) versus controls (16.67%, p=0.034). Among thyroid subtypes, overt hypothyroidism had the lowest mean B12 (151.63±45.78 pg/ml). Anti-TPO positivity was higher in cases (56.45% versus 0%, p<0.0001) and negatively correlated with B12 (r=-0.159, p=0.020). Subclinical hypothyroidism (49.20% of cases) showed intermediate B12 levels (201.86±54.45 pg/ml). Anaemia (Hb: 10.99±2.27 g/dl versus 12.70±2.88 g/dl, p<0.0001) and lower albumin (4.08±0.69 g/dl versus 4.33±0.61 g/dl, p=0.0056) were prevalent in cases.
Conclusion: Vitamin B12 deficiency is common in cases with thyroid dysfunction, especially in autoimmune hypothyroidism. Routine vitamin B12 screening is recommended in these patients.

Keywords: Vitamin B12, Thyroid dysfunction, Anti-TPO antibody, Hypothyroidism, Autoimmune thyroid disease

INTRODUCTION

Thyroid dysfunction affects ~42 million people in India, with hypothyroidism (3–5% prevalence) often linked to autoimmune etiology.[1] Vitamin B12 deficiency causes hematologic and neurologic complications and is frequently associated with autoimmune thyroid disease (AITD) due to shared mechanisms like atrophic gastritis or pernicious anemia.[2,3] Symptoms of both conditions (fatigue, cognitive decline) overlap, leading to underdiagnosis.[4] While studies report varying B12 deficiency rates (6–55%) in AITD, data on subclinical hypothyroidism (SCH) and B12 correlation with anti-TPO are limited.[5,6] This study aimed to determine B12 deficiency prevalence in thyroid dysfunction, evaluate B12 levels in subclinical hypothyroidism, and assess the B12–anti-TPO correlation.

METHODS

Study type

This study involved a cross-sectional observational study.

Study place

This study was carried out in the P. G. Department of Medicine, Swaroop Rani Nehru Hospital, MLN Medical College, Prayagraj and the study was carried out over for a 12-month period from 01 March, 2024 to 01 March 2025.

Inclusion criteria

The study included patients of age >18 years, diagnosed with thyroid dysfunction.

Exclusion criteria

Patients with pregnancy, chronic alcoholism, pre-existing B12 deficiency, or B12-altering drugs were excluded.

Procedure

After taking written informed consent from patients of thyroid disorders, presenting in the Medicine OPD of SRN Hospital, Prayagraj, through history (presenting complaint, history) of blood transfusion, drug history, personal history of weight loss, history of constipation/ diarrhea, history of menstrual irregularities, family history) taken examination was taken, and the patient was enrolled according to the inclusion criteria. Blood investigations were done, the prevalence of vitamin B12 was estimated, and the association of B12 levels with TPO antibodies was seen. Cases were compared with a control group comprising 90 samples.

Statistical analysis

Statistical software statistical package for the social sciences (SPSS) version 26 (SPSS Inc., Chicago, IL, USA) was employed to analyse the data that was entered in Microsoft Excel. Continuous variables were assessed using the mean (standard deviation) value when necessary. To analyse the dichotomous variables, the Chi-square test was employed and they were presented in number/ frequency. To compare the means between the two or more groups, analysis by Student's t-test was used. A p value of <0.05 or 0.001 was regarded as significant.

RESULTS

Demographic parameters are shown in Table 1. Cases were older than controls (46.81±18.11 versus 37.59±14.76 years, p<0.0001).

From the context of clinical profile, the symptoms which were more frequent in cases were body ache (34.68%), weight gain (17.74%) and constipation (10.48%) (p<0.05). Associated comorbidities were more amongst cases of thyroid dysfunctions then control such as hypertension (21.77% versus 2.22%) and diabetes (11.29% versus 0%) (p<0.0001) as shown in Table 1.

Thyroid parameters of cases and controls are shown in Table 2. TSH were abnormal in all the cases (were high in 66.94% of cases, and low in 33.06% of cases) versus normal in all controls (p<0.0001). Anti-TPO were positive in 56.45% of cases versus 0% controls (p<0.0001). Subclinical hypothyroidism was the most common dysfunction (49.20%).

Table 1: Baseline characteristics.

Variables	Cases (n=124)	Controls (n=90)	P value
Age (years)	46.81±18.11	37.59±14.76	<0.0001*
Female sex (%)	74 (59.67)	54 (60.00)	0.962
Hypertension (%)	27 (21.77)	2 (2.22)	<0.0001*
Diabetes (%)	14 (11.29)	0 (0.00)	<0.0001*

*P value statistically significant

Table 2: Thyroid dysfunction subtypes and B12 levels.

Thyroid dysfunction type	Prevalence of thyroid dysfunction (n=124)		Vitamin B12		P value
	Cases (n=124)	(%)	Mean	SD	
Hyperthyroidism	13	10.48	182.47	50.29	F=51.264 p<0.0001*
Overt hypothyroidism	22	17.74	151.63	45.78	
Subclinical hyperthyroidism	28	22.58	298.34	60.12	
Subclinical hypothyroidism	61	49.20	201.86	54.45	

*P value statistically significant

Among the 124-thyroid dysfunction, the most prevalent form of thyroid dysfunction was subclinical hypothyroidism, observed in 49.20% of patients, followed by subclinical hyperthyroidism (22.58%), overt hypothyroidism (17.74%), and hyperthyroidism (10.48%). When vitamin B12 levels were compared across these thyroid categories, the lowest mean B12 levels were noted in patients with overt hypothyroidism (151.63±45.78 pg/ml), while the highest levels were seen in those with subclinical hyperthyroidism (298.34±60.12 pg/ml). Comparison of vitamin B12 Deficiency in cases and control were done which is shown in Table 3. The comparison of vitamin B12 deficient and sufficient status amongst subjects with thyroid dysfunction and demonstrated a statistically significant difference in distribution (Chi square=6.17, p=0.046). A higher proportion of thyroid dysfunction (29.84%) had low vitamin B 12 levels, compared to 16.67% in euthyroids (Figure 1).

Table 3: Comparison of vitamin B12 deficiency prevalence between thyroid dysfunction and euthyroid.

Prevalence of vitamin B12 deficiency	Thyroid dysfunction		Euthyroid		P value
	Present	(%)	Present	(%)	
No	87	70.16	75	83.33	0.034*
Yes	37	29.84	15	16.67	

*P value statistically significant

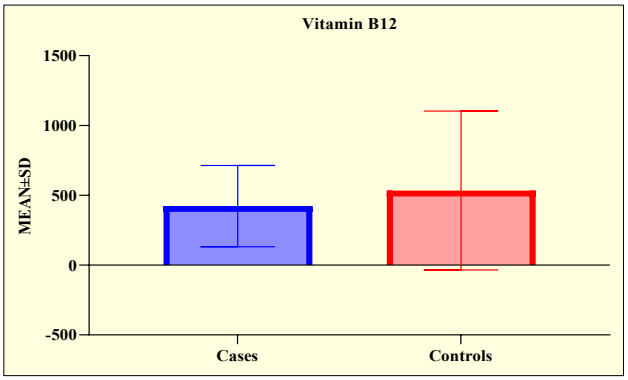

Figure 1: Vitamin B12 deficiency prevalence in cases versus controls.

The prevalence of vitamin B12 deficiency (Figure 2) was found to be significantly higher among Thyroid dysfunction (29.84%) compared to euthyroid (16.67%). Conversely, 70.16% of Thyroid dysfunction had normal B12 levels, while a greater proportion of euthyroid (83.33%) were B12 sufficient. This difference was statistically significant with a p-value of 0.034, indicating a meaningful association between Vitamin B12 deficiency and the thyroid dysfunction group, potentially linking thyroid dysfunction with impaired B12 status.

The scatter plot shows the relationship between serum vitamin b12 levels and anti-TPO among study participants. Most data points are clustered at lower B12 levels (Figure 3).

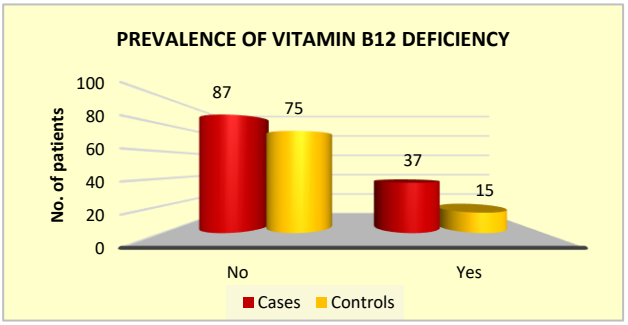

Figure 2: Comparison of vitamin B12 deficiency prevalence between thyroid dysfunction and euthyroid.

Other observations

Study show thyroid dysfunction show lower hemoglobin level in cases than control (case-10.99±2.27 versus control 12.70±2.88 g/dl, p<0.0001). In study also show reduced albumin level found in cases than control (case- 4.08±0.69 versus control-4.33±0.61 g/dl, p=0.0056), finding also suggest that serum calcium level low in cases as compared to control (cases 5.48±4.11 versus control 8.75±2.86 mg/dl, p<0.0001).

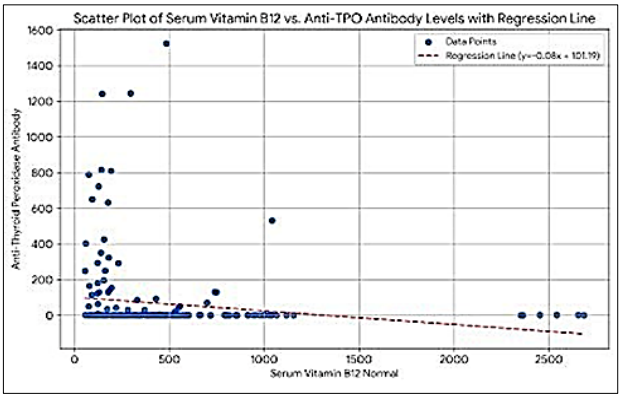

Figure 3: Scatter plot showing negative correlation between B12 and anti-TPO.

DISCUSSION

This study highlights a significantly higher prevalence of vitamin B12 deficiency among patients with thyroid dysfunction compared to euthyroid controls. The deficiency was particularly pronounced in patients with AITD, as evidenced by elevated anti-TPO antibody levels. These findings are consistent with prior research like Gupta et al and Benites-Zapata et al that reported vitamin B12 deficiency in 27–68% of hypothyroid patients, especially those with autoimmune etiology.[3,8]

A statistically significant negative correlation was observed between vitamin B12 levels and anti-TPO antibody titers (r=–0.302, p=0.002), reinforcing the hypothesis of an autoimmune link, possibly mediated through mechanisms like autoimmune gastritis and pernicious anaemia. Similar correlations have been reported by Kacharava et al, who found elevated anti-TPO levels in B12-deficient patients and suggested a diagnostic role for B12 screening in AITD.[9]

Subclinical hypothyroidism patients also demonstrated a trend toward lower B12 levels, although not always statistically significant. This aligns with findings by Aon et al, who reported borderline B12 levels in such patients, highlighting the clinical relevance of early screening despite the absence of overt symptoms.[11]

Our results support routine screening of vitamin B12 in hypothyroid patients, particularly those with positive anti-TPO antibodies. Early detection and treatment of deficiency could mitigate neurological and hematological complications, many of which overlap with symptoms of thyroid dysfunction.

Despite supportive findings, the lack of intrinsic factor and gastric parietal cell antibody testing limits definitive conclusions regarding the exact mechanism of deficiency. Nevertheless, given the overlapping autoimmune pathogenesis, these results underscore the need for an integrated diagnostic approach in managing thyroid disorders.

Limitations

This study is a single-center, cross-sectional designed. More studies are needed to establish the correlation. This study does not address confounding factors like lifestyle and dietary habit.

CONCLUSION

Vitamin B12 deficiency is prevalent in thyroid dysfunction, strongly linked to autoimmune etiology (anti-TPO positivity). Subclinical hypothyroidism patients also showed reduced vitamin B12 levels. Routine B12 assessment and supplementation should be integrated into thyroid disorder management to prevent complications.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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