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# Prevalence of Vitamin B12 Deficiency in Patients with Thyroid Disorders

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**Abstract**
**Background:** To assess prevalence of vitamin B12 deficiency in patients with thyroid disorders.
**Material and Methods:** A total of 105 patients, comprising both genders, were enrolled in the study due to thyroid disease. The assessment involved measuring thyroid-stimulating hormone, free T4, free T3,vitamin B12, and thyroid antibodies (ab). Gastrin levels were determined through radioimmunoassay, while vitamin B12 levels were analyzed using the Access chemiluminescence immunoassay.
**Results:** Out of 105 patients, males were 45 (42.9%) and females were 60 (57.1%). Out of 105 patients, 62 (59.4%) had Hashimoto thyroiditis, 40 (38.7%) had Grave's disease and 3 (2.8%) had other diseases. The difference was significant (P< 0.05). Out of 62 cases of Hashimoto thyroiditis, 35 had normal and 27 had low vitamin B12 level. Out of 40 cases of Grave's disease, 33 had normal and 7 had low vitamin B12 level. Out of 3 cases of other thyroid diseases, 2 had normal and 1 had low vitamin B12 level. The difference was non- significant (P> 0.05). Out of 24 cases of normal gastrin, males were 8 and females were 16. Out of 11cases of elevated gastrin level, 4 were males and 7 were females. The mean Vit B12 level in cases of normal gastrin level was 107 pmol/L and in cases of elevated gastrin level was 95 pmol/L. Positive PCA was seen in 2 and 9 patients having normal and elevated gastrin level respectively. **Conclusion:** There was high prevalence of vitamin B12 deficiency patients with thyroid diseases. Therefore, routine screening and assessment of vitamin B12 status can help detect deficiencies early and enable appropriate supplementation if needed.

**Keywords:** Thyroid Diseases, Gastrin, PCA, Vitamin B12.

## INTRODUCTION

Vitamin B12 deficiency can occur as a standalone condition or be linked to different underlying health conditions. This deficiency is known to cause a broad spectrum of symptoms related to hematological, neurological, psychiatric, and cardiovascular health.[1] The classic signs of deficiency include glossitis, megaloblastic anemia, and deterioration of myelin. However, the neurological and psychiatric symptoms associated with vitamin B12 deficiency are especially concerning. These symptoms may encompass myelopathy, neuropathy, impaired memory, depression, and dementia. Notably, even subclinical deficiency can lead to these manifestations, and if left untreated, they may become irreversible.[2] Thyroid disorders, particularly hypothyroidism, have been studied in relation to vitamin B12 deficiency.[3] While there is evidence suggesting a higher prevalence of vitamin B12 deficiency in patients with thyroid disorders, the exact prevalence can vary depending on the population studied and the criteria used for diagnosis. The relationship between thyroid disorders and vitamin B12 deficiency is likely multifactorial and can involve factors such as impaired absorption of vitamin B12, autoimmune processes, and nutritional deficiencies.[4]
Reduced levels of vitamin B12 in the bloodstream have been associated with elevated levels of homocysteine and methylmalonic acid (MMA), which can aid in the detection of early-stage cobalamin deficiency. Hyperhomocysteinemia, a condition characterized by high homocysteine levels, is linked to an increased risk of atherothrombosis. Additionally, pernicious anemia is associated with a higher likelihood of developing gastric carcinoids and gastric cancer.[5]

The evaluation of patients with B12 deficiency typically involves a laborious and complex procedure known as the radio-labeled absorption test (Schilling test), which requires multiple urine collections and exposes the individual to radiation.[6] Moreover, even if the Schilling test yields normal results, it does not rule out the possibility of impaired absorption of food-bound B12, necessitating an alternative test known as the egg yolk–

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cobalamin absorption test. Assessing fasting gastrin levels can also be a valuable tool in determining the underlying cause of B12 deficiency.[7]

The purpose of our study was to investigate the prevalence of vitamin B12 deficiency in patients with thyroid disorders.

**METHODOLOGY**

Following a careful assessment of the study's relevance and obtaining approval from the ethical review committee, a total of 105 patients, representing both genders, were selected for inclusion in the study. Prior to commencing the study, informed consent was obtained from all participating patients.

The study involved recording various data such as name, age, and gender of the participants. A comprehensive clinical examination was conducted on all the selected patients. A case history form was completed to gather relevant information. The following tests were performed: estimation of thyroid-stimulating hormone, free T4, free T3, vitamin B12, and thyroid antibodies (antimicrosomal ab and thyroglobulin ab). In cases where B12 levels fell below the normal range (<133 pmol/L), fasting serum gastrin levels and parietal cell antibodies (PCA) were measured.

Antimicrosomal and antithyroglobulin antibody tests were conducted using a semi-quantitative microtiter particle agglutination method. A positive result was indicated by a reaction at a dilution of 1:100 or higher. Parietal cell antibody levels were measured through indirect immunofluorescence, utilizing mouse gastric mucosa as the substrate. A titre greater than 1:20 was considered positive. Gastrin levels were measured using radioimmunoassay, while vitamin B12 levels were assessed using the Access chemiluminescence immunoassay.

The collected results were compiled and subjected to statistical analysis using the Mann-Whitney U test. A significance level was set at a P value less than 0.05.

**RESULTS**

Out of 105 patients, males were 45 (42.9%) and females were 60 (57.1%) [Table 1].

**Table 1: Patients distribution**

| **Total- 105** | | |
|---|---|---|
| **Gender** | **Males** | **Females** |
| Number (%) | 45 (42.9%) | 60 (57.1%) |

**Table 2: Clinical diagnosis of patients with autoimmune thyroid disease**

| **Autoimmune thyroid disease** | **Number (%)** | **P value** |
|---|---|---|
| Hashimoto thyroiditis | 62 (59.4%) | 0.02 |
| Grave's disease | 40 (38.7%) | |
| Other | 3 (2.8%) | |

Out of 105 patients, 62 (59.4%) had Hashimoto thyroiditis, 40 (38.7%) had Grave's disease and 3 (2.8%) had other diseases. The difference was significant (P< 0.05) [Table 2].

**Table 3: Prevalence of vitamin B-12 deficiency**

| **Autoimmune thyroid disease** | **Vitamin B-12** | | **P value** |
|---|---|---|---|
| | **Normal (70)** | **Low (35)** | |
| Hashimoto thyroiditis (62) | 35 | 27 | 0.92 |
| Grave's disease (40) | 33 | 7 | 0.01 |
| Other (3) | 2 | 1 | 0.71 |

Out of 62 cases of Hashimoto thyroiditis, 35 had normal and 27 had low vitaminB12 level. Out of 40 cases of Grave's disease, 33 had normal and 7 had low vitamin B12level. Out of 3 cases of other thyroid diseases, 2 had normal and 1 had low vitamin B12 level. The difference was non- significant (P> 0.05) [Table 3].

**Table 4: Normogastrinemic and hypergastrinemic patients with low serum B12 concentrations**

| **Parameters** | **Normal gastrin (24)** | **Elevated gastrin (11)** | **P value** |
|---|---|---|---|
| Male: Female | 8:16 | 4:7 | 0.03 |
| Vit B12 level (pmol/L) | 107 | 95 | 0.21 |
| Positive PCA | 2 | 9 | 0.05 |

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Out of 24 cases of normal gastrin, males were 8 and females were 16. Out of elevated gastrin level, 4 were males and 7 were females. The mean Vitamin B12 level in cases of normal gastrin level was 107 pmol/L and in cases of elevated gastrin level was 95 pmol/L. Positive PCA was seen in 2 and 9 patients having normal and elevated gastrin level respectively [Table 4].

**DISCUSSION**

Vitamin B12 deficiency can occur in individuals with thyroid disorders, particularly in those with hypothyroidism.[8] It is observed that Hypothyroidism can lead to reduced production of stomach acid, which is necessary for the absorption of vitamin B12 from food.[9] This impaired absorption can increase the risk of developing vitamin B12 deficiency. Autoimmune diseases, such as Hashimoto's thyroiditis can also be associated with pernicious anemia.[10] Pernicious anemia is an autoimmune condition in which the body's immune system attacks cells in the stomach that produce intrinsic factor—a protein required for vitamin B12 absorption. If intrinsic factor is not produced adequately, it impairs the absorption of vitamin B12.[11] Some medications used to treat thyroid disorders, such as metformin (used for diabetes management) and proton pump inhibitors (used to reduce stomach acid), can interfere with vitamin B12 absorption or utilization, further increasing the risk of deficiency.[12]

Thus, it's important for individuals with thyroid disorders, especially hypothyroidism, to monitor their vitamin B12 levels regularly.[13] Routine screening and assessment of vitamin B12 status can help detect deficiencies early and enable appropriate supplementation if needed.[14] Routine blood tests, such as measuring serum vitamin B12 levels, can help identify deficiency, and supplementation may be recommended if levels are low.[15] We performed this study to assess prevalence of vitamin B12 deficiency in patients with thyroid disorders.

Our findings revealed that out of the 105 patients included in the study, there were 45 males (42.9%) and 60 females (57.1%). Among the patients, 62 individuals (59.4%) were diagnosed with Hashimoto's thyroiditis, 40 (38.7%) had Grave's disease, and the remaining 3 (2.8%) had other types of thyroid diseases. In a study conducted by Collins et al. [16], they reported varying prevalence rates of vitamin B12 deficiency in hypothyroidism: 10%, 18.6%, and 40.5% in three separate studies. Additionally, the prevalence of deficiency in autoimmune thyroid disease was reported as 6.3%, 28%, and 55.5% in three different studies. These prevalence rates of vitamin B12 deficiency in hypothyroidism and autoimmune thyroid disease reflect the nutritional status of the population.

Out of 62 cases of Hashimoto thyroiditis, 35 had normal and 27 had low vitamin B12 level. Out of 40 cases of Grave's disease, 33 had normal and 7 had low vitamin B12 level. Out of 3 cases of other thyroid diseases, 2 had normal and 1 had low vitamin B12 level. Out of 24 cases of normal gastrin, males were 8 and females were 16. Out of 11 cases of elevated gastrin level, 4 were males and 7 were females. The mean Vit B12 level in cases of normal gastrin level was 107 pmol/L and in cases of elevated gastrin level was 95 pmol/L. Positive PCA was seen in 2 and 9 patients having normal and elevated gastrin level respectively.

In a study conducted by Ness-Abramof et al. [17], they aimed to determine the prevalence of vitamin B12 deficiency among patients with autoimmune thyroid disease (AITD) and investigate whether the evaluation process could be simplified by measuring fasting gastrin levels. The study included 115 patients with AITD, and their serum B12 levels were measured. Among the participants, 32 patients (28%) with AITD exhibited low levels of B12 in their serum. Further analysis was conducted on patients with low serum B12 levels (<133 pmol/L). Fasting serum gastrin levels were measured in 26 patients, and it was found to be higher than the normal range in 8 patients. Parietal cell antibodies (PCA) were also measured in 27 patients with B12 deficiency, and positive results were obtained in 8 patients. In order to investigate the cause of elevated gastrin levels, gastroscopy with biopsy was performed on 5 patients with high gastrin levels. As a result, all 5 patients were diagnosed with atrophic gastritis. The prevalence of pernicious anemia, as determined by high serum gastrin levels in patients with low B12, was found to be 31%.

In a study conducted by Centanni et al. [18], a total of 62 asymptomatic patients with autoimmune thyroid disease (AITD) were screened for serum gastrin levels, parietal cell antibodies (PCA), and pentagastrin-resistant achlorhydria. Among these patients, 22 individuals exhibited hypergastrinemia. Subsequently, gastroscopy was performed on these patients, and the diagnosis of atrophic gastritis was confirmed in all cases.

The association between AITD and vitamin B12 deficiency is likely attributed to the presence of autoimmune disorders, specifically atrophic gastritis and/or pernicious anemia. Both conditions can impair the absorption of vitamin B12. Atrophic gastritis has been found to have a prevalence of up to 35% in patients with AITD. The authors of the study suggested that measuring fasting serum gastrin concentration could be the most reliable test for diagnosing atrophic gastritis in patients with autoimmune thyroid disease, even before the onset of clinical symptoms. In contrast, Caplan et al. [19] found that there was no significant difference in vitamin B12 levels between patients with hypothyroidism and the control subjects included in their study.

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## CONCLUSION

There was high prevalence of vitamin B12 deficiency patients with thyroid diseases. Therefore, routine screening and assessment of vitamin B12 status can help detect deficiencies early and enable appropriate supplementation if needed.

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