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Research Article

Prevalence of Vitamin A Deficiency in Patients with Thyroid Disorders

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Abstract

Background: It has been established by various studies that there is significant rise in endocrine disorders worldwide. Thyroid gland diseases are the most prevalent endocrine disorders in the world and the second one in the list is diabetes mellitus. In India, autoimmune thyroid disorders have been estimated to be the most frequent endocrine disorders. Thyroid diseases are very common in the areas along Himalayas even after post iodination.

Aim: To assess the prevalence of auto immune thyroid disease and vitamin A deficiency in patients with deranged thyroid functions, visiting a tertiary level hospital in Dhauladhar region of HP.

Methodology: This study includes OPD patients above 18 years of age and who were advised thyroid function tests by the clinicians. Critically ill patients were excluded from the study. Chemiluminescence method was used to do thyroid function tests (T3, T4, TSH) along with anti thyroperoxidase antibody (ATA) while vitamin A levels were done by ELISA, after serum separation of 120 subjects. ATA level >50uIU/ml was recorded as positive and a value less than 35 µg/dl was taken as Vitamin A deficiency.

Results: In our study, 42.48 (± 12.32) years was the mean age of study population. There were forty subjects each in hypothyroid, hyperthyroid and controls groups. ATA positive rate was 52.5% (63/120) in our study. In 40 cases of hypothyroidism, 19 cases had vitamin A deficiency (value less than 35 µg/dl). In 40 cases of hyperthyroidism, 16 cases had vitamin A deficiency and in 40 controls, only 6 had vitamin A deficiency. Our study concluded that there was 5.13 times more chance of vitamin A deficiency in hypothyroid patients than in controls. Association was positive and statistically significant (p-0.003).

Conclusion: For better health, it is advisable that every patient with thyroid dysfunction should be screened for vitamin A status and treated if necessary.

Keywords: Endocrine Disorders; Thyroid Gland; Vitamin A

Introduction

Endocrine disorders are increasing day by day world over. Thyroid gland diseases are the most prevalent endocrine disorders in the world and the second one in the list is diabetes mellitus. In India also, thyroid disorders are the most common among all the endocrine diseases as per study by Kochupillai, N. [1]. The number of patients with significant thyroid disease in the country in the post salt-iodization phase is approximately 42 million. Thyroid hormones released by the thyroid gland are necessary for the normal development, growth and all body functions.

The interaction between thyroid hormones and vitamin A metabolism has been established already. Beta Carotene is converted into vitamin A. Thyroid hormone helps in conversion of beta-carotene to vitamin A. Hence it is very common for hypothyroid patients and those with Hashimoto's Thyroiditis to have significantly less levels of vitamin A. In hyperthyroidism, both beta-carotene and retinol levels were found to be normal. In hyperthyroid cases, transport protein (Pre Albumin and Retinol Binding Protein) levels were lower but these levels remained unchanged in hypothyroidism. It was postulated [2] that the plasma carotene levels alteration found in hypothyroid subjects is not directly due to a lack of thyroid hormone in the metabolism of vitamin A but due to indirect effect of thyroid disease. It was also shown in animal studies that moderate vitamin A deficiency alone does not produce any measurable effect on the pituitary-thyroid axis. Concurrent Iodine deficiency and vitamin A deficiency produce more severe primary hypothyroidism than iodine deficiency alone [3].

Aims and Objectives

To study and evaluate Vitamin A levels in thyroid function disorders.

Methodology

This case control study was conducted at a tertiary level hospital in Dhauladhar region of HP. The study was conducted after dividing patients in three groups and there were forty patients each in hypothyroid, hyperthyroid and controls(euthyroid) groups. These patients were among those who were attending hospital laboratory (freshly diagnosed and not on vitamin supplements). A whole blood sample of 5 ml was collected from the consenting subjects after obtaining an informed written consent. The clotted blood samples were centrifuged at a speed of 2000 rpm for 10 minutes in a centrifuge machine. Then the tubes were taken out and the clear supernatant serum was collected. Thyroid hormone values along with ATA were measured by chemiluminescent enzyme immunoassay while vitamin A levels were estimated by ELISA. Referral laboratory cut-off values were : TSH more than 5.4μIU/ml as hypothyroid, TSH less than 0.5μIU/ml as hyperthyroidism.

Statistical analysis was done using EpiinfoV7 software. Variables were expressed as mean. Student t test was used to assess statistical significance between variables. A value of $p < 0.05$ was considered statistically significant. Association was established using odds ratio.

Observations

In hypothyroid cases, there were 87.5% females and 12.5% males. Similarly in hyperthyroid cases, there were 85% females and 15% males, implying that females are more prone for thyroid disorders overall (Figure 1).

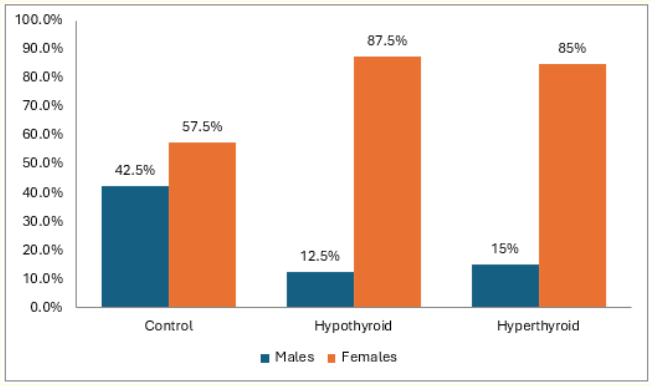

Figure 1: Gender distribution of cases and controls.

Among 40 cases of hypothyroidism, 32.5% have T3 value less than 69 ng/dl, and 50% have T4 values less than 4.4μg/dl. However all the patients have TSH more than 5.4 IU/ml (Figure 2).

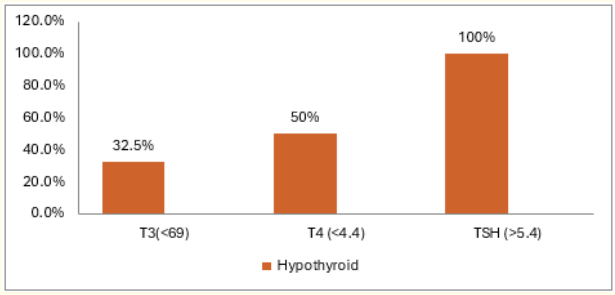

Figure 2: Thyroid function status in hypothyroid cases.

Among 40 cases of hyperthyroidism, 57.5% have T3 value more than 202ng/dl, and 57.5% have T4 values more than 11.6μg/dl. However, again all the patients have TSH value less than 0.53 μIU/ml. This observation signified that TSH is more reliable indicator for thyroid function disorder (Figure 3).

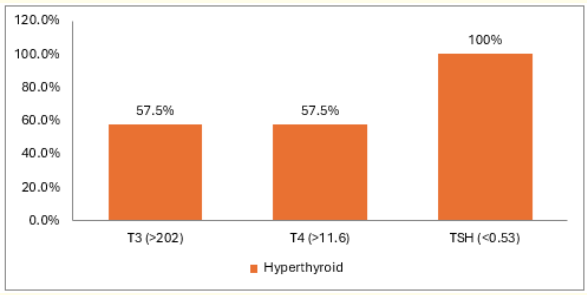

Figure 3: Thyroid function status in hypethyroid cases.

Anti thyroperoxidase antibody (ATA) status was measured in all 120 cases. It was more than 50 IU/ml in 75% cases of hypothyroidism and in 67.5% cases of hyperthyroidism. While in controls, ATA was more than 50 IU/ml in 15% cases only, implying that auto immunity has significant relation with thyroid function disorder (Figure 4).

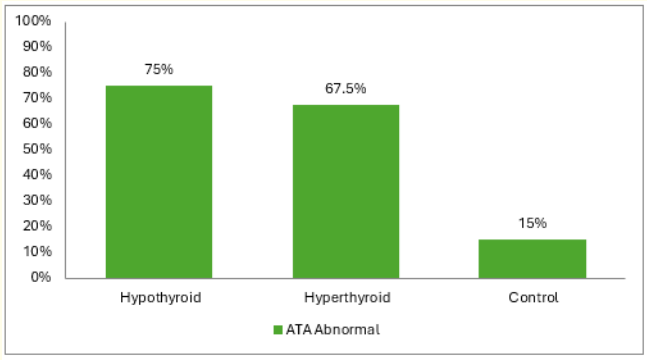

Figure 4: Ata status in cases and controls.

A value less than 35 µg/dl of Vitamin A was taken as a deficiency. Vitamin A was measured in all cases and its deficiency was maximum in hypothyroidism cases where it was 47.5%. Similarly Vitamin A deficiency in hyperthyroidism was 40% whereas in controls deficiency was only 15% (Figure 5).

In 23 cases of hyperthyroidism where T_3 value was more than 202 ng/dl, Vitamin A deficiency was found in 2 cases. In 23 cases of hyperthyroidism with T_4 value more than 11.6 µg/dl, 2 cases were found to have Vitamin A deficiency. While in all 40 cases of hyperthyroidism, where TSH values were less than 0.53 µIU/ml,

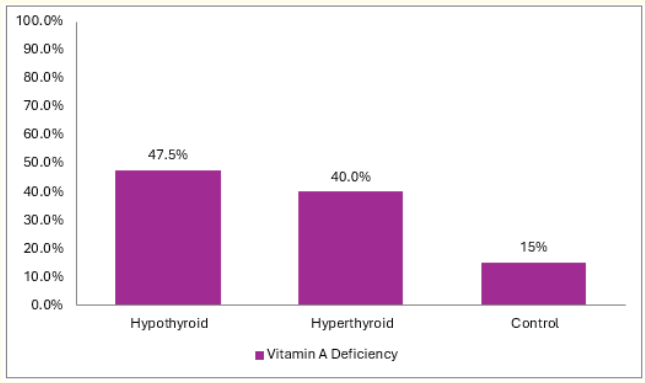

Figure 5: Vitamin A status.

3 cases were reported to have Vitamin A deficiency. Mean level of vitamin A among hyperthyroid was 47.4(±9.7) (Table 1).

Hyperthyroid	Vitamin A Deficiency	Mean (±SD) of vitamin A
T3	2/23 (8.7%)	47.4(9.7)
T4	2/23 (8.7%)	
TSH	3/40 (7.5%)	

Table 1: Vitamin A deficiency among hyperthyroid.

In our study it was established that hyperthyroid group of patients had 3.78 times more chances of vitamin A deficiency than in control patient group. Association was positive and was statistically significant (p-0.02) (Table 2).

	Vitamin A Deficiency		Total	OR (95%CI), p value
	Present	Absent		
Hyperthyroid	16 (40%)	24(60%)	40 (100%)	3.78 (1.29-11.05), 0.02
Controls	6 (15%)	34 (85%)	40 (100%)	
Total	22	48	80	

Table 2: Association of vitamin A deficiency with hyperthyroidism.

Vitamin A deficiency was reported in 6 cases, among the 13 cases of hypothyroidism with T_3 value less than 69 ng/dl. Similarly in 20 cases of hypothyroidism, with T_4 value less than 4.4 µg/dl, 10 cases had Vitamin A deficiency. And in all 40 cases of hypothyroid group, with TSH value more than 5.4 µIU/ml, 19 cases had Vitamin A deficiency. Mean level of Vitamin A among hypothyroidism was 37.5 (±7.7) (Table 3).

Hypothyroid	Vitamin A deficiency Number (%)	Mean (±SD) of Vitamin A
T3 (<69)	6/13 (46.2%)	37.5(7.7)
T4 (<4.4)	10/20 (50%)	
TSH (>5.4)	19/40 (47.5%)	

Table 3: Vitamin A deficiency in hypothyroid cases.

As per our study, hypothyroid patients had 5.13 times more chance of vitamin A deficiency than in controls. Association was positive and statistically significant (p-0.003) (Table 4).

	Vitamin A Deficiency		Total	OR (95%CI), p value
	Present	Absent		
Hypothyroid	19 (47.5)	21 (52.5)	40 (100)	5.13 (1.76-14.90), 0.003
Controls	6 (15.0)	34 (85.0)	40 (100)	
Total	25	55	80	

Table 4: Association of vitamin A deficiency with hypothyroidism.

Discussion

In a study published in Acta Medica Austriaca by Aktuna., *et al*. [4], it was shown that the beta-carotene (pro vitamin A) values are significantly higher in hypothyroidism, while in hyperthyroidism they were lower. Similarly, it has been reported by Sworczak., *et al*. [5] that vitamin A enhances the hepatic conversion of T4 to T3 and vitamin A deficiency is associated with decreased thyroid iodine uptake, limited synthesis and secretion of hormones, as well as thyroid enlargement. Farhangi., *et al*. [6] concluded that serum TSH concentration in patients who have been treated for vitamin A deficiency, were significantly reduced. And suggested that therefore vitamin A supplementation might reduce the risk of subclinical hypothyroidism in pre-menopausal women. Zimmermann., *et al.* [7] concluded that vitamin A supplementation was effective in treating vitamin A deficiency in areas of mild Iodine deficiency and had an additional benefit; vitamin A supplementation can decrease excess TSH stimulation of the thyroid and thereby reduce the risk of goiter and its sequelae.

Morley JE., *et al*. [8] have shown in their study on rats that thyroid gland size decrease with Vitamin A supplementation and also there was increase in 125I thyroid uptake. Similarly *in vitro* studies they established that vitamin A enhanced T4 to T3 conversion in hepatic homogenates. In another study on rats Oba K., *et al*. [9] observed that there was decreased hormone synthesis in the thyroid glands of the vitamin A-deficient rats, leading to increase weight of thyroid gland. They also found that on vitamin A supplementation this state reverted back to normal.

Ingenbleek Y [10] in his study on animals has proposed that vitamin A deficiency reduces synthesis of thyroglobulin and impairs coupling of iodotyrosine residues to form thyroid hormone. This action results in depressed generation of physiologically active thyroid hormones. Biebinger R., *et al*. [11], however, has shown in their study on rats that moderate vitamin A deficiency alone has no measurable effect on the pituitary-thyroid axis. But concurrent Iodine deficiency and vitamin A deficiency produce more severe primary hypothyroidism than Iodine deficiency alone.

Yet in another study, Garcin H., *et al*. [12] found that in vitamin A-deficient animals there were increased levels of thyroxine and triiodothyronine and changes in serum transport of these hormones. While Branter., *et al*. [13] found that unexpectedly higher concentrations of plasma vitamin A (as free retinol) in hyperthyroid cats, compared to those in controls, is due to competition between retinol and thyroxine for same protein binding site and their transportation is similar to humans.

Raghu P., *et al*. [14] had proved in their study that vitamin A (as free retinol) and T4 were both carried by a complex composed of retinol binding protein and transthyretin (a.k.a. thyroxine binding prealbumin) in humans. Goswami UC., *et al*. [15] had shown in their study that the levels of beta-carotene and retinol were increased in the hypothyroid patients and these levels were decreased in the hyperthyroid patients.

Summary and Conclusion

Total 120 subjects were taken for the study and divided into three groups of 40, 40 and 40 each; hypothyroid, hyperthyroid and euthyroid (control). The findings are summarized as under:

- The study sample comprised of 120 patients out of which 28 were male and 92 were females. 42.48(±12.3) years was the mean age of the study group.
- In 40 patients of hypothyroid group, 13 patients had T3 value less than 69 ng/dl and 20 patients had T4 value less than 4.4 µg/dl. All the patients in hypothyroid group had TSH value more than 5.4 µIU /ml.
- Hyperthyroid group consisted of 40 patients, and out of these 23 patients had T3 value more than 202 ng/dl and 23 patients had T4 value more than 11.6 µg/dl. TSH value was less than 0.53µIU /ml in all the patients of this group.
- Anti Thyroperoxidase Antibody was measured in all the patients. In 30 patients of hypothyroidism, ATA value was more than 50 IU/ml. In 27 patients of hyperthyroidism, ATA value was more than 50 IU/ml, and in 40 controls only 6 patients had ATA value more than 50 IU/ml.
- In 40 patients of hypothyroidism, 19 patients had vitamin A deficiency (value less than 35 µg/dl). In 40 patients of hyperthyroidism, 16 patients had vitamin A deficiency and in 40 controls, only 6 patients had vitamin A deficiency.

It could be concluded from the present study that in this geographical region thyroid function disorders are quite prevalent and are often associated with auto immunity. It was found in our study that hypothyroid patients had 5.13 times more chance of vitamin A deficiency than in person with normal thyroid function. This association was positive and statistically significant (p-0.003).

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