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Thyroid Dysfunctions in Tribal Women of the Bastar Region of Chattisgharh, India

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Abstract. **Background**: The Bastar region receives heavy rainfall and frequent flooding, leading to depletion of iodine from the superficial soil layer. Also, consumption of sea food is deficient in this area. Hence, these sources of iodine deficiency raises concerns about the thyroid status of Bastar residents. Thyroid dysfunction is a common endocrine disorder that has signs and symptoms that mimic those of other common diseases. **Methods**: The signs and symptoms of 150 subjects who visited the General Medicine Department, Govt. Medical College, in Jagdalpur raised the possibility that they had thyroid disease. That their signs and symptoms were not explained by non-thyroid diseases constituted the study inclusion criterion. The subjects were analyzed for levels of tri-iodothyronine (T_3), tetra-iodothyronine (T_4), and thyroid stimulating hormone (TSH). Data was analyzed by Anova tests and correlation analyses. **Results**: Based on their thyroid hormone and TSH levels, subjects were classified into four groups: 20.66% were euthyroid, 59.33% were hypothyroidism, 12.66% had subclinical hypothyroidism, and 7.33% were hyperthyroidism. Some males (n = 15, 10%) but mostly females (n = 135, 90%) were included in the study. T_3, T_4, and TSH levels significantly differed between all four groups ($p < 0.001$). The study also analyzed the correlation between T_3, T_4 and TSH in different groups. **Conclusion**: Subclinical hypothyroidism should be treated with thyroid hormone therapy to prevent progression to overt hypothyroidism and other clinical manifestations. Inclusion of non-goitrogenic foods and exclusion of goitrogenic foods also should be recommended to patients who have thyroid dysfunction.

Keywords • Hypothyroidism • Hyperthyroidism • Subclinical hypothyroidism • Thyroid stimulating hormone • Tri-iodothyronine (T_3) • Tetra-iodothyronine (T_4)

Introduction

The most common endocrine diseases in India are thyroid related disorders.[1] Impaired thyroid gland function is accompanied by signs and symptoms that mimic those of other common diseases, such as fatigue, dyspnea, weight gain, palpitations associated with anemia, cold intolerance, and tiredness. However, laboratory detection of subclinical or early thyroid disease usually occurs before these manifestations of disease develop.[2]

In India, with a population of 1.21 billion, an estimated 108 million people suffer from endocrine and metabolic disorders. Of these 108 million, 42 million suffer from thyroid disorders.[1]

In a 1997 study of 800 children in India referred for thyroid problems, investigators determined the percentages of the children whose laboratory tests determined their thyroid status: 79% were hypothyroid, 19% were euthyroid, and 2% were hyperthyroid.[3]

In 2005 and 2006, The Third National Family Health Survey was conducted in India. The study was coordinated by the International Institute for Population Sciences and was under the aegis of the Government of India. Data collected in the Survey indicated that the proportion of women in the Chattisgharh region who were undernourished was 43%. This compared with 46% in Bihar, 42% in Madhya Pradesh, and 41% in Orissa.[4]

Data from the survey also indicated that in older patients and in pregnant women, symptoms common.[5] Symptoms were so common, in fact, that it became meaningless to try to distinguish which people had thyroid diseases on the basis of symptoms or a virtual lack of symptoms. In other words, symptom

were not a useful criterion for predicting who had and did not have thyroid disease.

Due to lack of information on the thyroid status of women of Bastar we conducted the present study to evaluate the thyroid dysfunction among these women. A tenth of the study subjects were men.

Materials and Methods

Subjects who visited the Medicine Department of Govt. Medical College in Jagdalpur were carefully examined. Patients with a previous history of thyroid dysfunction, goiter, under-medication, pregnancy, acute illness, liver diseases, and other pathologies were excluded from the study. Of the remaining subjects, 150 had signs and symptoms that resembled those of thyroid disorders. These subjects comprised the disease free population and were included in the study groups.

The quantitative determination of thyrotrophin (TSH), total triiodothyroinine (T_3) and total tetraiodothyronine (T_4) in human serum was estimated by a microplate immunoenzymetric assay using the reagent kit by Monobind, Lake forest, USA.[6,7,8,9,10] For estimation of the total T_3 and and total T_4, a competitive enzyme immunoassay (Type 5) was performed. In this procedure, immobilized antibody (Ab) is mixed. The mixing results in an enzyme antigen conjugate and a serum that contains the native antigen. A competitive reaction then results between the enzyme Ag conjugate the native antigen (Ag) for a limited number of insolubilized binding sites. After equilibrium is attained, the Ab-bound fraction is separated from unbound Ag by decantation or aspiration. The Ab-bound fraction is inversely proportional to the native Ag concentration.

For the measurement of TSH levels, the immobilization takes place during the assay at the surface of a microplate well through the interaction of streptavidin. The streptavidin is coated on the well and exogenously added biotinylated monoclonal anti-TSH antibody. The monoclonal biotinylated Ab (the enzyme labeled Ab) and serum containing the native Ag are mixed. Upon mixing, reaction results between the native Ag and Ab without competition or steric hindrance to form a soluble sandwich complex simultaneously, the complex is deposited to the well through the high affinity reaction of streptavidin and biotinylated Ab. After equilibrium is attained the Ab-bound fraction is separated from unbound Ag by decantation. The enzyme activity in the Ab-bound fraction is directly proportional to the native Ag concentration.

Data analysis. The normal laboratory reference values for TSH (0.28-6.28μIU/mL), T_4 (4.8-11.6 μg/dL in females), T_4 (4.4-10.8 μg/dL in males), and T_3 (0.52-1.85 ng/mL). For these analyses, hypothyroidism was classified as clinical if high TSH was defined as a concentration (≥ 4.5μIU/mL) and low T_4 value as ≥ 4.5 μg/dl (≥ 57.9 nmol/L).[11] Subclinical or mild hypothyroidism was classified as TSH (≥ 4.5μIU/mL) and T_4 as ≥ 4.5 μg/dL (≥ 57.9 nmol/L). Hyperthyroidism was defined as clinically significant if TSH (≥ 0.1 μIU/mL) and T_4 ≥ 13.2 μg/dL (≥ 169.9 nmol/L).[11]

Statistical analysis. Biostatistical Analysis was done by using Microsoft Office Excel with Windows operating system. Coorrelations among the parameters in individual groups were established using Graph Pad Prism software.

Table 1. Distribution table of thyroid disorders in different levels of age groups.

Age Groups	Subclinical Hypothyroidism (n=19)	Hypothyroidism (n=89)	Hyperthyroidism (n=11)	Euthyroid (n=31)
10-19	2	10	4	3
20-29	6	18	1	4
30-39	4	24	4	14
40-49	4	22	1	5
50-59	1	13	-	3
60-69	2	2	-	2
70-79	-	-	1	-

Results

Those patients who attended the medicine ward of Govt. Medical College in Jagdalpur were randomly selected on the basis of signs and symptoms which are associated with thyroid dysfunction. The total 150 patients who were selected ranged in age from 10-to-80 years. The euthyroid group consisted of (n

= 31, 20.6%), subclinical hypothyroidism (n = 19, 12.6%), hypothyroidism (n =89, 59.3%), and hyperthyroidism (n =11, 7.3%).

Table 1 shows the distribution of patients' thyroid disorders within different age groups. Thyroid disorders were maximum among patients 30-to-39 years old. With increase in age (> 50 years), the number of thyroid disorders decreased.

Table 2 shows the differences between T_3, T_4, and TSH levels in the four study groups: subclinical hypothyroidism, hypothyroidism, hyperthyroidism, and euthyroidism. Mean levels of all three hormones significantly differed between the groups ($p < 0.0001$). The mean TSH level in hypothyroidism was 15.38 ± 11.40 µIU/mL, and that in hyperthyroidism was 5.42 ± 7.14 µIU/mL. The mean T_4 level in hypothyroidism was 3.80 ± 1.82 µg/dL and in hyperthyroidism was 12.22 ± 4.73 µg/dL. The mean T_3 level in hypothyroidism was 0.43 ± 0.25 ng/mL and in hyperthyroidism was 1.15 ± 1.66 ng/mL.

Table 3 shows correlations of T_3, T_4, and TSH in the different groups of patients with thyroid dysfunctions. Correlation of T_3 and T_4 levels in subclinical hypothyroidism ($r = 0.7062$), in hypothyroidism ($r = 0.8016$), and hyperthyroidism ($r = 0.8000$) was positively significant. The correlation between T_3 and TSH in hypothyroidism was ($r = -0.4510$) negatively significant, while in subclinical hypothyroidism ($r = 0.2635$) was positively significant, and in hyperthyroidism ($r = -0.5069$) was insignificant. When T_4 and TSH was correlated it was found that in hypothyroidism ($r = -0.7371$) and in hyperthyroidism ($r = -0.785$) the correlation was negatively significant while in subclinical hypothyroidism ($r = -0.2780$) was found to be insignificant.

Table 2. Mean and Standard deviation in different groups at T3, T4 and TSH levels.

Hormones	Subclinical Hypothyroidism (n=19)	Hypothyroidism (n=89)	Hyperthyroidism (n=11)	Euthyroid (n=31)	*p* value
T3	1.17 ± 0.55	0.43 ± 0.25	1.15 ± 1.66	1.21 ± 0.33	$P < 0.0001$
T4	7.48 ± 2.45	3.80 ± 1.82	12.22±4.73	7.38 ± 1.93	$P < 0.0001$
TSH	10.18 ± 4.15	15.38 ± 11.40	5.42 ± 7.14	4.76 ± 1.53	$P < 0.0001$

Table 3. Correlation table in different groups of thyroid dysfunctions.

Correlation between groups	Subclinical Hypothyroidism (n=19) *r* value	Hypothyroidism (n=89) *r* value	Hyperthyroidism (n=11) *r* value
T3 & T4	0.7062**	0.8016**	0.8000**
T3 & TSH	0.2635*	-0.4510***	-0.5069*
T4 & TSH	-0.2780*	-0.7371***	-0.7853***

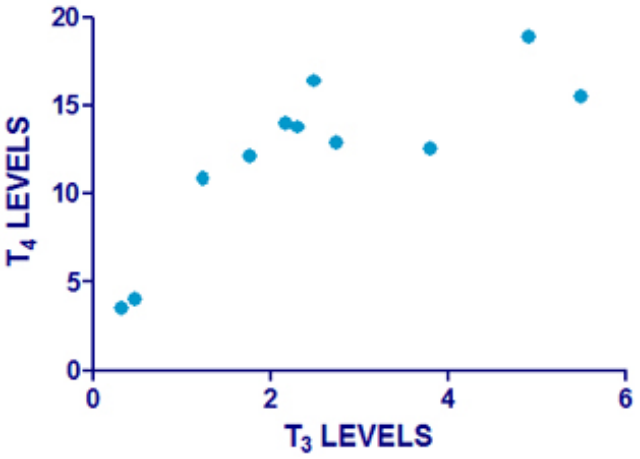
*= Insignificant, **= Significant Positive correlation, ***= Significant Negative Correlation.

Discussion

Hormones are key bioregulatory molecules, elaborated and secreted into the circulation to achieve timely growth and organ development as well as to adaptively regulate metabolism to achieve bodily homeostasis. Conversely, disorders of different organ systems can in turn influence the endocrine functions. Therefore, hormone measurement has recently achieved a position of pivotal importance in the practice of scientific medicine.

The Bastar region in Chattisgharh has heavy rainfall; because of this, frequent flooding is particularly likely to wash away and therefore decrease the iodine of the the superficial layer (in which iodine is present) of the soil. Iodine deficiency in the soil is aggravated by soil erosion from deforestation. In areas with no iodine deficiency, 60%-to-75% of the iodine needs are met by the iodine present in the diet and the rest through the iodine content of water.[12, p. 20] Be-

Figure. 1. Correlation between T_3 and T_4 in Hyperthyroidism.



cause the sea is far away from this region, the consumption of iodine-containing sea foods is low in this region.

With severe and prolonged iodine deficiency, the effects of an inadequate supply of thyroid hormone may occur. This condition is referred to as "hypothyroidism."[13]

Because no researchers have studied the incidence of thyroid dysfunction in the Bastar region, the present study was conducted. It included 150 patients. Based on their signs and symptoms, they were analyzed for different thyroid dysfunctions. The ages of the total study subject group ranged from 10-to-80 years.

In the study conducted at Pondicherry by Rebecca et al.,[14] 15.8% of study subjects had thyroid dysfunctions: 11.5% had hypothyroidism (2% overt and 9.5% subclinical). In contrast, in our present study, 79.4% of subjects had thyroid dysfunctions: 59.37% had hypothyroidism, 7.3% had hyperthyroidism, and 12.6% had subclinical hypothyroidism.

The strikingly larger percentage of subjects with thyroid dysfunctions in our study is most likely based on the subjects' high iodine and goitrogen ingestion. Pondicherry is a Coastal Union Territory where far more sea food is consumed in the Bastar region. Bastar is away from the sea and hence consumption of iodine-containing sea food is deficient.

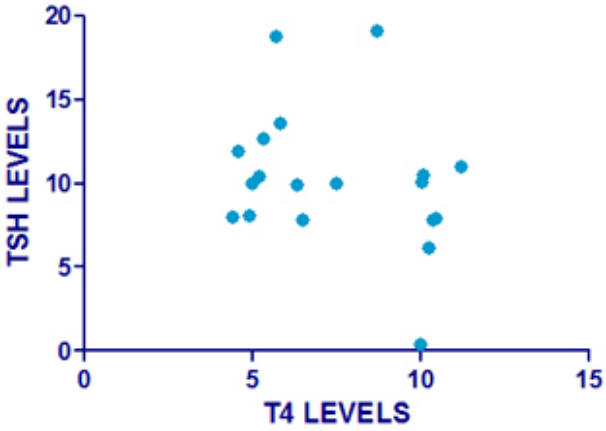
Also, it has been observed that residents of Bastar consume more goitrogenic foods than in many other regions. Most goitrogens are naturally-occurring chemicals that are ingested in foods or drugs. These chemicals can interfere with thyroid function in different ways. Some goitrogenic compounds induce antibodies that cross-react with the thyroid gland; others interfere with thyroid peroxidase, the enzyme that organifies iodide to iodine and adds the iodine to tyrosine residues on thyroglobulin during the production of thyroid hormones. Either way, the thyroid is not able to produce as many of thyroid hormones as are needed to regulate metabolism. Also in such patients, intake of non-goitrogenic foods should be enhanced. Such foods have the opposite effect on the thyroid gland, stimulating rather than suppressing the gland's function.[18]

The prevalence of hypothyroidism was high in the 30-to-39-year age group, which was 16%. This contrasts with 8.66% for the 50-to-59-year olds, and 1.33% for 60-to-69-year olds.

The percentage of hyperthyroidism among the 30-to-39-year-olds was 2.66%. Among the 10-to-19-years-olds, the percentage was 2.66%, and among those age more than 40 years, the percentage decreased.

In contrast to our findings, the Hallowell et al. study suggested that serum TSH values were slightly

Figure 2. Correlation between T_4 and TSH in Subclinical Hypothyroidism.

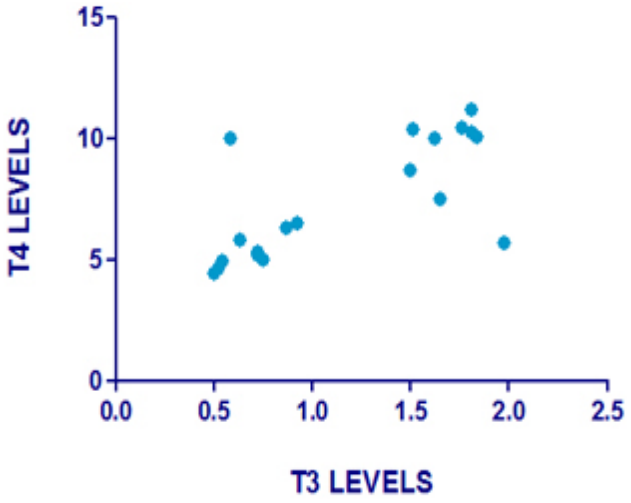


higher in children aged 12-to-19 than in young adults aged 20-to-29-years. We found instead that TSH levels increased in the 20-to-29-year-old group compared to children aged 12-to-19.

One more objective of the present study was to learn the prevalence of subclinical hypothyroidism in women of Bastar. Of our total randomized study population, we found that 12.6% were classified as subclinical hypothyroidism. This contrasts with the higher prevalence of subclinical hypothyroidism of 4.3%-to-9% in Hollowell et al. and Colorado studies.[11,17] Our study showed that subclinical hypothyroidism can have subtle clinical manifestations and nonspecific symptomology, such as dry skin, cold intolerance, constipation, and easy fatigability.

The possible advantages of treating subclinical hypothyroidism generally include, first, preventing

Figure 3. Correlation between T_3 and T_4 in Subclinical Hypothyroidism.



progression to overt hypothyroidism. Second, thyroid hormone therapy may improve the serum lipid profile, thereby potentially decreasing the risk of death from cardiovascular causes.[15] And finally, treatment may reverse the symptoms of mild hypothyroidism, including psychiatric and cognitive abnormalities.[16]

Recommendations Based on Study Findings. This was the first study of women from the southern part of Chattisgharh. The findings are such that they strongly warrant further evaluation of thyroid dysfunction among the larger population of this area. Based on our finding, we first believe that widespread routine screening is important to identify those individuals susceptible to or afflicted by thyroid disorders. This is especially important in that the signs and symptoms of thyroid dysfunctions mimic those of many other common diseases.

Second, we recommend those who live in the region take steps to prevent thyroid dysfunctions. For example, the intake of non-goitrogenic foods must be enhanced, and the intake of goitrogenic foods should be avoided by patients who suffer from any type of thyroid dysfunction. Also, once detected, subclinical hypothyroidism should be corrected by thyroid hormone therapy to prevent progression to overt hypothyroidism and other clinical manifestations.

References

1. Kochupillai, N.: Clinical endocrinology in India. *Curr. Sci*., 79:1061-1067, 2000.
2. Bernard, M.: Signs and symptoms of thyroid dysfunction. *Hosp. Phys.*, 42(10):43-48, 2006.
3. Meena, P.: Diorders of thyroid gland in India: Endocrinology, Part I. *Indian J. Pediat*., 64:11-20, 1997.
4. Summary of Findings: *The Third National Family Health Survey* (NFHS-3). 2005-06:
5. Eden, S. et al.: Screening for thyroid diseases in the elderly. Serum concentrations of thyrotropin and 3,5,3'-triiodothyronine in a representative population of 79 year old women and men. *Comp. Gerontol*., 2:40-45, 1988.
6. Gharib, H., Ryan, R.J., Mayberry, W.E., et al.: Radioimmunoassay for triiodothyronine (T_3): Affinity and specificity of antibody for T_3. *J. Clin. Endocrinol*., 33:509, 1971.
7. Chopra, I.J., Ho, R.S., and Lam, R.: An improved radioimmunoassay of triiodothyronine in human serum. *J. Lab. Clin. Med*., 80: 729, 1971.
8. Sterling, L.: *Diagnosis and treatment of thyroid diseases*. Cleveland, CRC Press, 1975, pp. 9-51 .
9. Barker, S.B., Determination of protein bound iodine. *J. Biol. Chem*., 173:175, 1948.
10. Young, D.S., Pestaner, L.C., and Gilberman, U.: Effects of drugs on clinical laboratory tests. *Clin. Chem*., 21:3660, 1975.
11. Hollowel, J.G., Staehling, N.W., Flanders, D.W., et al.: Serum TSH, T_4, and thyroid antibodies in the United States population (1988-1994): National Health and Nutrition Examination Survey (NHANES III). *J. Clin. Endocrinol. Metab*., 87:489-99, 2002.
12. Gopalan, C. and B. V., Ramashastri: 2002. *Nutritive Value of Indian Foods*. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 2002.
13. Markou, K. N. Georgopolous, Kyriazopoulou, V., and Vogenakis, G.A.: Iodine induced hypothyroidism. *Thyroid*, 11:501-507, 2001.
14. Rebecca, et al.: Thyroid disorders in women of Puducherry. *Indian J. Clin. Biochem*., 24(1):52-59, 2009.
15. Kek, P.D., Ho, S.C., and Khoo, D.H.: Subclinical thyroid disease. *Singapore Med. J*., 44(11):595-600, 2003.
16. Cooper, D.S.: Subclinical Hypothyroidism. *N. Engl. J. Med*., 345:260-265, 2001.
17. Canaris, G.J., Manowitz, N.R., Mayor, G., et al.: The Colorado Thyroid Disease Prevalence Study. *Arch. Intern. Med*., 160:526-534, 2000.
18. Siddhanti, S.R., King, M.W., and Tove, S.B.: Influence of dietary fat on factors in serum that regulate thyroid cell metabolism. *J. Nutr.,* 120 (11):1297-304, 1990.