

Assessment of Thyroid Function Status and Thyroid Antibody Levels Among Tribal Population of Jarugumalai Hills of Salem District, Tamil Nadu, India

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ABSTRACT

Background: Tribal population not only suffers from malnutrition and communicable diseases but also from non-communicable diseases. Globally, one of the most frequent metabolic disorders include thyroid disorders. The study was conducted to estimate the prevalence of Thyroid disorders using Thyroid Function Test, to determine the Anti-Thyroid Peroxidase Antibody levels among the tribal population, and also to determine the factors associated with thyroid disorders among the tribal population.

Materials and Methods: It is a community based analytical cross-sectional study conducted among 375 tribal residents of Jarugumalai hills. Data was collected using a pre tested semi-structured questionnaire. Categorical variables were described using frequency and percentage. Variables significantly associated with thyroid disorders were identified using univariate and multivariate analysis.

Results: Nearly 32% had any form of thyroid disorders. About 18% and 7% respectively had subclinical hypothyroidism and overt hypothyroidism. Also, 12% of the study participant blood samples were positive for Anti Thyroid Peroxidase antibody (ATPO). Female gender Usage of inadequately iodised salt and presence of ATPO were significantly associated with thyroid disorder on multivariate analysis.

Conclusion: Thyroid status assessment showed a high prevalence (32%) among the marginalized population. Multi-pronged approach involving educational, administrative and legal measures must be implemented to curb this problem.

Keywords: Iodisation, Hypothyroidism, Goitre, Thyroiditis, Salt

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INTRODUCTION

Iodine deficiency is more prevalent and nearly 1/3rd of the global population resides in iodine deficient areas.¹ Globally, one of the most frequent metabolic disorders include thyroid disorders and iodine deficiency is the cause for it in vast majority of the cases.^{2,3} Peculiar characteristics of thyroid disorders include easy visibility as a swelling of the gland, easy diagnose and wide spread availability of medical treatment. Major linchpin of management is early diagnosis and treatment.⁴

At risk for thyroid disorders are the South East Asian, Central Africans and Latin American population living in mountainous and remote areas.⁵ Around 42 million in India have any one of the thyroid disorders namely iodine deficiency disorders, hyperthyroidism, hypothyroidism, Hashimoto's thyroiditis, graves' disease and thyroid cancer. Compared to developed nations, hypothyroidism prevalence is more in India and prevalence of 10.9% was reported from a study done in eight cites of India. Even though Universal Salt Iodization program was effectively implemented in the country the hypothyroidism prevalence has not declined.^{6,7}

In India, tribal population represents 8.6% and there are more than 400 tribes. Although rapid transition has occurred in the field of healthcare, still tribal population are lacking behind the general population with respect to health. Health seeking behaviour is also very much unsatisfactory among the tribal community due to their, customs, beliefs, traditional values and myths.^{8,9} Currently, tribal population face the burden of non-communicable diseases and psychological diseases in addition to communicable diseases and malnutrition. By 2027, goal has been set by the expert committee on tribal health to improve the health status of the marginalized tribal population.⁸

Thyroid Disorders have shown a rising trend with age among both sexes. Nearly 33.2% of the tribal population had any form of thyroid disorder in a study done in Himalayan region and subclinical hypothyroidism (24.1%) was most common.² In a study from South Indian population in iodine-sufficient belt of Cochin 9.4% had SCH (11.4% women vs. 6.2% men).⁴ In Autoimmune diseases of thyroid elevated titers of Anti-TPO Ab titers are noted. Among adults 16.7% had anti-TPO Ab as per the results from population-based studies.⁷

Literature search has shown that there is a definite paucity of data regarding thyroid status and levels of thyroid antibodies in tribal areas.

Hence, the objective of the present study was to estimate the prevalence of thyroid disorders, to determine the thyroid antibody levels and to determine the factors influencing thyroid function and thyroid antibody levels by estimating TSH, T3, T4, anti-TPO Ab levels.

METHODOLOGY

It is a community based analytical cross-sectional study conducted in the tribal villages (Melur and Keelur) of Jarugumalai hills in Salem district of Tamil Nadu. The study population identified were, persons ≥ 18 years of age residing in the Study area permanently at the time of the study. There were 750 study populations in the study area and they formed the sampling frame for the study. 12 months was the study duration (January 2023 - December 2023).

Sample of 375 tribal population were included, calculated using $N = Zpq/[L] 2$ formula (where $p = 33.2$, $q = 66.8$, $L = 5$) 10% non-response rate was added to it. Prevalence of thyroid disorders of 33.2% was taken as the reference value for the sample size calculation.² In the 2 tribal villages of Jarugumalai hills (Melur and Keelur) individuals ≥ 18 years of age was 750 (as per the recent voters list) which constituted the sampling frame. Systematic random sampling technique was used to select the study participants. Sampling Interval of 2 was used ($750/375 = 2$) and every alternate individual was selected for this study.

Individual's ≥ 18 years of age who consented for the study, known cases with thyroid disorders were included for the study. Those suffering from psychiatric illness and severe debilitating illness were excluded from the study. A pre tested semi-structured questionnaire was used to capture data through face-to-face interview after getting appropriate approval from local authorities. The questionnaire consisted of the socio-demographic characteristics, details pertaining to use of Iodized salt, knowledge regarding iodized salt and its usage, clinical symptoms and Examination findings. It was followed by salt sample testing and biochemical examination of blood samples.

All participants who gave their informed consent had their blood drawn at random by certified phlebotomists. A 10-milliliter sample of venous blood was drawn for thyroid function tests and biochemical parameter assessment. The serum samples were taken in cold boxes (approximately 4°C) to the testing laboratory where they were kept at -20°C until the assay. The blood samples were left to settle for 15 minutes at room temperature before being centrifuged at 1,100 g for 10 minutes. An automatic analyzer was used for biochemical estimations, and an immunoassay analyzer was used to measure thyroid-stimulating hormone (TSH), thyroxine (T4), and triiodothyronine (T3) and electrochemiluminescence immunoassay (ECLIA) analyzer was used to conduct the anti-TPO Ab assay.

All the participants were adequately informed about the study and written consent was obtained from all prior to conduction of the study. The proposal was approved by the Institutional Ethical Committee of VMKVMCH, Salem district. (Ref ID: VMKVMC&H/IEC/23/001)

Data was analyzed using SPSS Version 22. Frequency, percentage, mean and standard deviation were used to represent study variables. Chi-Square test was used to test the association for univariate analysis and p value < 0.05 was considered as statistical significance. Multivariate binomial logistic regression analysis was done using enter method.

Operational definitions:

Adequately Iodized Salt: A household salt sample is considered appropriately iodized if, upon testing with the iodine test kit, a deep blue color shift is observed, indicating that the iodine level is ≥15 parts per million (ppm).²

Subclinical Hypothyroidism: If blood TSH levels were increased (>6.5 µIU/ml) and serum T4 levels were normal, subclinical hypothyroidism (SCH) was identified.²

Subclinical Hyperthyroidism: When serum T4 levels were normal and TSH was low (<0.45 µIU/ml), subclinical hyperthyroidism was identified.²

Overt Hypothyroidism: When T4 is low (<4.5 µg/dl) and TSH is high, overt hypothyroidism is diagnosed.²

Overt Hyperthyroidism: A low TSH level (<0) and a high T4 level (> 12 µg/dl) were used to identify overt hyperthyroidism.²

RESULTS

In our study, majority of them were females (58.7%) and the mean age was 38.29±14.26 years. Only 69.4% of the tribal population had education up to high school. Nearly 37.5% were unemployed as majority of the study samples were females. Around 42.4% belonged to either upper middle or lower middle socioeconomic status as per BG Prasad scale for 2023 (Table 1).

Table 1: Sociodemographic characteristics of study participants (N - 375)

Socio-Demographic characteristic	Participants (%)
Mean age (Years)	38.29±14.26
Sex	
Male	158 (42.2)
Female	217 (57.8)
Education of head of the household	
Illiterate	79 (21)
Up to High School	260 (69.4)
>High School	36 (9.6)
Occupation of head of the household	
Unemployed	141 (37.5)
Up to skilled	218 (58.1)
>Skilled	16 (4.4)
Socio Economic Status	
Upper	15 (3.8)
Middle	159 (42.4)
Upper Lower	124 (33.1)
Lower	77 (20.6)

Table 2: Selected Characteristics among the study participants (N - 375)

Salt usage characteristic	Participants (%)
Adequately iodized salt usage at household level	
Yes	192 (60)
No	128 (40)
Adequate knowledge regarding iodized salt	
Yes	103 (32.2)
No	217 (67.8)
Clinical Goiter	
Yes	56 (17.5)
No	264 (82.5)
Eye signs present	
Yes	71 (22.2)
No	249 (77.8)
Comorbidity	
Yes	86 (26.9)
No	289 (73.1)

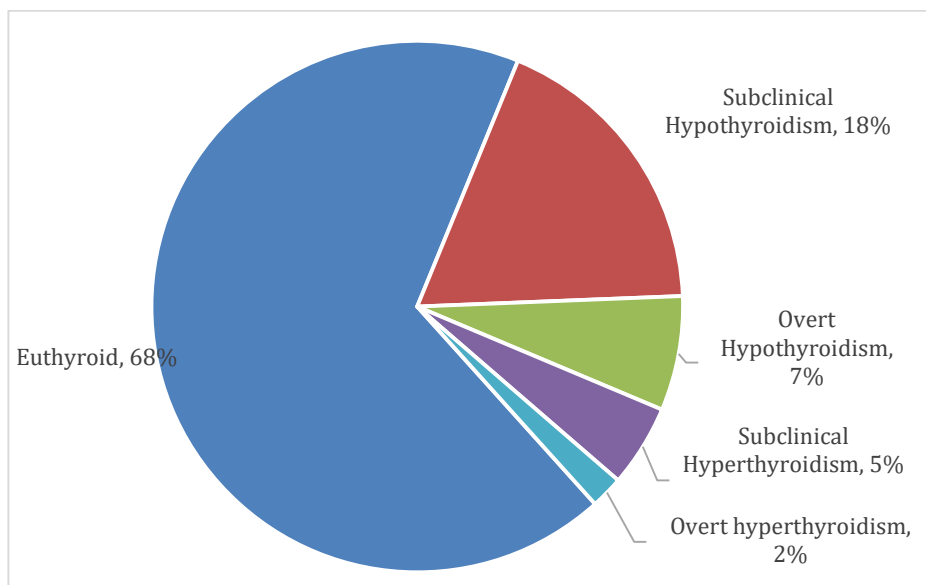


Figure 1: Prevalence of thyroid disorders among the study participants (N - 375)

Table 3: Univariate analysis between thyroid disorders and selected variables

Variable	Thyroid Disorder		P value	Odds Ratio (95% CI)
	Yes (n=120)	No (n=255)		
Age of the study participant				
<45 years	44(36.7)	107(42)	0.329	0.80 (0.51 - 1.25)
≥45 years	76(63.3)	148(58)	Reference	
Gender				
Female	78(65)	127(49.8)	0.006*	1.87 (1.19 - 2.93)
Male	42(35)	128(50.2)	Reference	
Education of the study participant				
<High school	91(75.8)	138(54.1)	0.0001*	2.66 (1.63 - 4.32)
≥High school	29(24.2)	117(45.9)	Reference	
Occupation of the study participant				
<Skilled	54(45)	130(51)	0.28	0.78 (0.50 - 1.21)
≥Skilled	66(55)	125(49)	Reference	
Socioeconomic status of the study participant				
Upper/ Middle	48(40)	126(49.4)	0.088	0.68 (0.43 - 1.05)
Lower	72(60)	129(50.6)	Reference	
Adequately Iodized Salt				
No	80(66.7)	104(40.8)	< 0.0001**	2.90 (1.84 - 4.57)
Yes	40(33.3)	151(59.2)		
Adequate knowledge regarding iodized salt				
Yes	28(23.3)	75(29.4)	0.219	0.73 (0.44 - 1.20)
No	92(76.7)	180(70.6)	Reference	
Presence of ATPO				
Yes	31(25.8)	14(5.5)	< 0.0001**	5.99 (3.04 - 11.79)
No	89(74.2)	241(94.5)	Reference	
Presence of goiter				
Yes	35(29.2)	21(8.2)	< 0.0001**	4.88 (2.53 - 8.32)
No	85(70.8)	234(91.8)	Reference	
Comorbidity				
Yes	24(20)	62(24.3)	0.354	0.77 (0.45 - 1.32)
No	96(80)	193(75.7)	Reference	

Table 4: Multivariate binomial logistic regression analysis findings

Variable	Thyroid disorder		
	P value	Adjusted Odds Ratio (AOR)	95% CI
Female gender	0.016	1.23	1.05 - 1.44
Below high school education	0.235	0.807	0.567-1.149
Usage of not adequately iodized salt	<0.0001	2.516	1.806-3.505
Presence of ATPO Antibody	< 0.0001	2.712	1.958-3.756
Presence of goiter	0.397	0.935	0.567-1.149

Enter method was used for multivariate analysis. Model was found to be statistically significant (Cox and Snell R² = 0.340, Nagelkerke R² = 0.466).

Only 68% of the study participants were in Euthyroid status and 32% had any form of thyroid disorder as per their thyroid profile in our study. About 18%, 7% and 5% respectively were having subclinical hypothyroidism, overt hypothyroidism and subclinical hyperthyroidism (Figure 1). Also, 12% of the study participant blood samples were positive for Anti Thyroid Peroxidase antibody.

Salt samples from households were collected from study participants and only 60% of the salt samples were adequately iodized based on the rapid testing kit findings. Also 32.2% had adequate knowledge regarding iodized salt. About 17.5% and 22.2% had goiter clinically and positive eye signs. Comorbidities were seen in 26.9% of the tribal population and majority were either diabetic or hypertensive (18%)

Variables significantly associated with thyroid disorders in univariate analysis include female gender (p value = 0.0006, OR = 1.97), < high school education (p value = 0.0001, OR = 2.66), usage of not adequately iodized salt (p value = < 0.0001, OR = 2.90), Presence of ATPO antibody (p value = < 0.0001, OR = 5.99), Presence of goiter (p value = < 0.0001, OR = 4.88), All the other study variables were found to be not significant (Table 3).

Variables those were significant in univariate analysis were included for multivariate binomial logistic regression analysis using enter method (Table 4). Female gender (p value = 0.016, AOR = 1.23), Usage of not adequately iodized salt (p value = <0.0001, AOR = 2.51) and presence of ATPO Antibody (p value = < 0.0001, AOR = 2.71) were significantly associated with thyroid disorder based on multivariate analysis.

DISCUSSION

Thyroid disorders are prevalent endocrine disorders and tribal populations residing in hilly areas are at higher risk due to iodine deficiency. Even though universal iodization has been implemented this study intended to assess the current scenario thyroid status and thyroid antibody levels among the tribal community of Salem, Tamil Nadu.

Majority of the study participants were females and mean age was 38.29 ± 14.26 years. Similar to our study mean age of the participants were 39.46 ± 17.51 years, 38.42 ± 5.83 years and 39.57 ± 20.50 years respectively in studies by Ganie MA et al, Chatterjee S et al and Akinepalli P et al.^{2,10,11}

In our study 32% of them had any form of thyroid, about 18%, 7% and 5% respectively were having subclinical hypothyroidism, overt hypothyroidism and subclinical hyperthyroidism. Similarly in Ganie MA et al study on tribal population 33.2% had thyroid disorders with subclinical hypothyroidism accounting for 24.7%.² Also, in a study conducted in Kerala by Menon 19.6% had any form of thyroid disorder and 9.4% had subclinical hypothyroidism.⁴ Studies by Akinepalli P et al, Dhok AJ et al and Chakrabarti P et al reported a thyroid disorder prevalence of 30.2%, 35.7% and 17%.¹¹⁻¹³ This agreement between studies might be due to similar type of study setting, composition of the study participant and distribution of factors influencing thyroid disorder alike across studies

In contrary to our study thyroid disorder prevalence were 3.2%, 7.32%, 66%, and 79.4% respectively in studies by Valiyaparambil PP, Manjula K et al, Bansal A et al, Skaria LK et al.^{14,6,15,16} Studies by Marwaha RK et al, Skaria LK et al, Akinepalli P et al, Chatterjee S et al, Arakeri S et al, Baruah MP et al respectively reported a prevalence of 7.3%, 12.6%, 13.8%, 14.8%, 17.9%, 27%, 27.8%.^{7,16,11,12,10,17,18} This might be due to the differences in the study setting, genetic makeup, environmental characteristics, different age group, changes in the diagnostic standards and criteria set by laboratories. subclinical hypothyroidism was the major thyroid disorder.

Anti-Thyroid Peroxidase Antibody was positive in 12% of the study samples. Similarly 10.6%, 13.6%, 16.7%, 17.2% of the blood samples showed ATPO antibody positivity in Valiyaparambil PP et al, Ganie MA et al, Menon U et al and Baruah MP et al studies respectively.^{14,2,4,18} Whereas, 3,4% and 57% had ATPO antibody in Marwaha RK et al and Arakeri S et al study respectively as they are conducted in selected non-tribal population with different age groups.^{7,17} Goiter was prevalent in 17.5% in our study which was in accordance with Menon U et al, Marwaha RK et al and Bulliyya G et al studies.^{4,7,19} Only few studies have concentrated on assessing the goiter prevalence clinically.

In our study after multivariate analysis, Female gen-

der, Usage of not adequately iodized salt and presence of ATPO Antibody were significantly associated with thyroid disorder. Similarly significant correlation was noted between thyroid disorder and ATPO Antibody in studies by Manjula K et al and Arakeri S et al.^{6,17} Female gender was significant in studies by Akinepalli P et al, and Baruah MP et al.^{11,19} This is primarily due to the predominance of female participants and similar population demographics. Also, certain factors like socioeconomic status, education status and age were not statistically significant in our study attributable to natural variation in the samples included.

LIMITATIONS

In spite of the best effort taken to find out the outcome for the research question, there are some limitations in the study. First, information about clinical indicators of iodine status like prevalence of goiter was available in small number of subjects. Second, other factors that independently affect thyroid function and autoimmunity like smoking, micronutrient deficiency, goitrogen intake were not assessed. Third, being a cross-sectional study causal association and risk estimation cannot be done. So, a future analytical study in the study population can overcome this limitation.

CONCLUSION

In this study, 60% of the households were utilizing adequately Iodized salt which is much lower than the Universal Salt Iodization (USI) target of 90% proposed by the World Health Organization. Thyroid status assessment showed a high prevalence (32%) among the marginalized tribal population probably due to iodine deficiency.

Multi-pronged approach involving educational, administrative and legal measures must be implemented to curb this problem. Education and effective communication strategies to the tribal community involving concerned stakeholders at various levels are essential to increase the awareness on iodine nutrition and its impact on health. Iodized salt levels should be regularly monitored using rapid kits through visit to the shops and markets by concerned authorities and be followed up with appropriate corrective measures.

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DATA AVAILABILITY STATEMENT:

The data will be made available upon reasonable request to the Corresponding author. Kindly mail your requests to vijay.doc09@gmail.com

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