

**Original Article**

# IODINE AND THYROID STATUS IN A TRIBAL VILLAGE IN WAYANAD, KERALA IN THE POST IODIZATION ERA – OBSERVATIONS AND IMPLICATIONS

Praveen P Valiyaparambil<sup>1</sup>, Usha V Menon<sup>1</sup>, Vivek Lakshmanan<sup>1</sup>, Sanjeev Vasudevan<sup>2</sup>, Ajitha Kumari<sup>2</sup>, Harish Kumar<sup>1</sup>

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**Author's Affiliation:**

<sup>1</sup>Department of Endocrinology;  
<sup>2</sup>Department of Palliative Medicine, Amrita Institute of Medical sciences, Cochin

**Correspondence:**

Dr Praveen V. P.,  
Email: praveenvp@aims.amrita.edu

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## ABSTRACT

**Background:** Data on thyroid and iodine status in tribal population is scarce. We sought to assess the thyroid and iodine status in this population, by ascertaining the goitre prevalence, thyroid function and thyroid autoimmune markers in adults, and the goitre prevalence and iodine status in school going children from both tribal and non tribal populations

**Methods:** Questionnaire survey and physical examination was done in 50 randomly selected houses from both tribal and non-tribal populations. Goitre, thyroid function, thyroid autoimmunity was assessed in 175 adults and goiter and iodine status were assessed in 83 children.

**Results:** Goitre prevalence was similar in tribal and non-tribal adults (tribal 45.7% vs. nontribal, 42%, P=0.87) and children (14.9% and 19.4%, P=0.77). Goitre prevalence was more in adult females. Thyroid dysfunction was seen in 3.9% of tribal and 4.2% of non-tribals. Abnormal thyroid function tests were all in the thyrotoxic range in tribals whereas they were all in the hypothyroid range in non-tribal. Thyroid autoimmunity was more in the non-tribal compared to tribal population (24.7% vs. 10.6% p=0.026).

**Conclusions:** This is the first data on thyroid status in tribal and non-tribal population from Wayanad district, which has shown a high adult prevalence of goitre. However the prevalence of goitre in children is near the national average, which might indicate an improvement in the iodization status in the post iodization era. The higher prevalence of hyperthyroidism in tribals and significant difference in thyroid autoimmunity between tribals and non-tribals merit further study.

**Keywords:** Iodine, thyroid, goiter, tribal

## INTRODUCTION

Wayanad is not considered to be an iodine deficient district. This dubious distinction goes to idukki, Kottayam and Kasarkod<sup>1</sup>. While conducting medical camps for tribals in Amrita Kripa Hospital, Kalpetta, high prevalence of

large sized goitres in this population came to our attention. Significant proportions of these goitrous subjects develop thyrotoxicosis and compressive symptoms necessitating either medical therapy and/or surgery. The reasons for this high prevalence merited further investigation because of indirect implications

both for physical and social wellbeing. Such large size goitres on a community scale are classically due to the effects of iodine deficiency or less commonly due to exposure to goitrogens<sup>2,3</sup>. Other factors like autoimmunity may contribute to goitre formation. Although there is data pertaining to iodine deficiency disorders in general population in Wayanad there are no studies specifically in tribal population. The food habits of the tribals traditionally included roots and tubers which may contain goitrogenic substances similar to that seen in cassava. However with the rehabilitation processes initiated by the government significant changes in life style have taken place. If iodine deficiency is found to be the main reason then easily rectifiable measures can be taken which can improve the welfare of this socially backward population.

### AIMS AND OBJECTIVES

We sought to answer the questions related to the iodine and thyroid status by ascertaining goitre prevalence, thyroid function and thyroid autoimmune markers in tribal and non tribal population. Goitre prevalence and iodine status of school going children were also assessed in both groups.

### MATERIAL AND METHODS

Wayanad is located in the northern part of Kerala and is a hill station providing habitat to majority of tribal population in Kerala state. A representative area Modakkara, Vellamunda Panchayat was selected as the study area due to high level of cooperation from the local authorities and population. This locality had two tribal groups, Paniya and Kurichiya tribes living in colonies specially earmarked for them by the Government of India. Non tribals were living in adjacent areas. Approval for the study was obtained from the institutional ethics committee and also from the district administrative and health authorities. Among tribal and non-tribal population, 50 houses were selected on a random sampling basis. A team of two doctors and four paramedical staff visited selected houses and conducted a questionnaire survey and physical examination of individuals in the age range of 5-65 years in the homes visited. A previously validated thyroid survey questionnaire<sup>3</sup> in a suitably modified form was used to assess nutrition, salt intake and other

aspects related to health. Interviewed subjects were examined for the presence of goitre and graded as per the standard WHO guidelines. Information pertaining to goitre such as type of diet, type of salt used, were observed by the investigators in the houses visited and recorded in the questionnaire. Venipuncture was done and blood was collected from adult participants for thyroid function tests and anti-thyroid peroxidase antibody estimation. Blood and urine sampling was done after obtaining informed written consent from the adult participants or adult family members, in case of children. Urine for iodine estimation was collected from two children of school going age (age group 5-18 years) randomly selected from each household. Five representative salt samples which included powdered salt and rock salt were analyzed for the iodine content.

### Laboratory methods

Serum Thyroid Stimulating Hormone (TSH), free thyroxine (FT4) and anti-thyroid peroxidase Antibody (Anti TPO), were measured by Chemiluminescence Immunoassay (CLIA) using Abbott Architect 2000SR. Urine iodine was estimated by simple microplate method using ammonium persulphite digestion and Sandell Kolthoffs reaction. Estimation of urine iodine and iodine salt content was performed in the ICCIDD cell, department of community medicine AIIMS, New Delhi.

### Statistical analysis

Statistical software SPSS version 17 was used for analysis. The prevalence of goitre, iodine deficiency and thyroid autoimmune marker were calculated. The tribal and nontribal groups were compared with either chi square test or Mann Whitney U test as appropriate. Correlation between goitre and various factors was calculated. Binary logistic regression was done to analyze goitre etiology.

### RESULTS

In the study, 94 adults (Males 31 and Females 63) and 47 (Males 29 and Females 18) children from the tribal population and 81 adults (23 males + 58 females) and 36 (18 males + 18 females) children from the non-tribal population were included (table 1). Median age of adults in both groups was similar. Body mass index was 21.5 kg/m<sup>2</sup> in the non-tribal group and 19 kg/m<sup>2</sup> in the tribal group (P=0.00). Median age for children was 10.5

years and 7 years respectively in the non-tribal and tribal group respectively (P=0.005). Body mass index was 15.1kg/m<sup>2</sup> in the non-tribal and 14.3 kg/m<sup>2</sup> in the tribal group(P=0.019)

**Table 1: Distribution of common study variable among subjects**

Variable	Tribal	Non tribal	P value
Adults	94(31M+63 F)	81(23M+58F)	
Children	47(29M+18F)	36(18M+18F)	
Median age of adults	41	39	
Adults with goitre	43(45.7%)	34(42%)	0.87
Children with goitre	7(14.9%)	7(19.4%)	0.76
Median urine iodine	38 ug/L	26.2ug/L	0.13
Homes with adequate urine iodine	21.9%	12.5%	0.35
Abnormal thyroid function Tests	3(3.2%)	4(4.9%)	
Anti TPO positivity	10(10.6%)	20(24.7%)	0.26
Iodized salt use	48(34%)	64(47%)	0.16

### Iodine status

The median urine iodine was 26ug/L and 38 ug/L in the non-tribal group and tribal group respectively (p=0.136). Percentage of household with adequate urine(>100ug/l) iodine was 16.7 % (21.9% in non- tribals vs 12.5% in tribal, p =0.35 ).There was no difference in the diet patterns of the tribals and non -tribals and the assumption that their diet included lot of tubers proved to be untrue. Five representative salts samples were analyzed for the iodine content. The results showed that none of the rock salt samples contained iodine. The packed powder form of salt contained iodine in the recommended at least 15ppm of salt at the consumer level. Since all of the salt used in the region came from two shops it could be concluded reasonably that the rock salt is devoid of iodine whereas the powdered salt was indeed iodized. Iodized salt use was higher in the nontribal compared to tribals (54.5% vs 34%), but did not achieve statistical significance (p value =0.163).

### Goitre

In this study 45.7% of adults in tribal group and 42% of adults in non -tribal group had goitre. The goitre prevalence in children were 14.9% and 19.4% respectively in the tribal and nontribal groups . Both in adults and children there was no statistically significant difference in the prevalence rates for goitre between the two groups. Goitre was more in females in adults (p =0.000) where as such an association was not apparent in children (p =0.38). 9.5% percentage of adult participants was smokers. Goitre prevalence was significantly higher in nonsmokers (18.8% vs 47.4%) in univariateanalysis (p=0.03) . Logistic regression

analysis was done to identify the factors responsible for goitre. The resulting equation predicted the goitre occurrence poorly (66.9% prediction). The only two factors which predicted goitre were advancing age andfemale sex . The higher prevalence of goitre in nonsmokers noted in univariate analysis is probably due to the almost exclusive composition of smoker group by males and nonsmoker group by females.

### Thyroid dysfunction and autoimmunity

Among adults 3.5% of tribals and 4.9% of nontribals had abnormal thyroid function tests. Subclinical thyrotoxicosis constituted all of the thyroid function abnormalities in tribals whereas subclinical hypothyroidism was exclusively seen in nontribals. Thyroid peroxidase antibodies ,which serve as markers of thyroid autoimmunity were significantly higher in nontribals (24.7%) compared to tribals(10.6%), P =0.02(figure1). There was no difference in the anti-thyroid peroxidase antibody prevalence between smokers and nonsmokers ( P =0.90)

### DISCUSSION

Though there had been many studies on iodine status and goitre among children of Kerala, studies focusing on tribal populations are rare . Iodine sufficient status as assessed by urine iodine excretion of >100ug/l was seen in 54% of the school children in Wayanad district with a median iodine urine excretion of 100ug/L1. In that study 26% of the salt samples subjected to analysis contained adequate iodine of 15ppm. The current goitre rate in school going children in Kerala is 16.6% as per latest reports published jointly by ICCIDD and IDD cell Kerala

government<sup>4</sup>. There were few studies on goitre prevalence in adults. Endocrine department of Amrita institute had conducted a study [ADEPS -Amrita Diabetes and Endocrine Population Study]<sup>5</sup> among adults above 18yr in three areas of Ernakulam district with a population of 3,50,000. The study sample was 986 and prevalence of goitre was 12% (8.5% grade 1 and 3.5% grade 2). The goiter prevalence among children in the present study is similar to that reported in the ICCIDD survey as well as that reported in a recent nationwide study of school children<sup>6</sup>. But the goitre prevalence in the studied adult population was much higher than that reported in adults in Ernakulam district, however the goitre sizes were rather modest. Grade 2 goitre was seen in 8.5% of the tribal group and 9.9% of the non tribals.

There were number of problems associated with trying to ascertain relative contribution of various studied factors with goitre. The analysis is likely to be more accurate in children at least regarding the incident iodine status. Iodine status of family as extrapolated from urine iodine values in children and use of iodized salt is likely to be less accurate as a predictor of goitre in adults because of lack of information of past iodization status during their childhood and youth. However the role of factors like smoking in goitre causation can be studied only in adults. The two factors which turned out to be significant in the regression analysis in adults are age and sex. In most of the previous studies goitre is negatively correlated with age. The higher prevalence of goitre in female population has been reported in almost all studies previously. This sex difference was not seen in children. The studied factors including the iodine status predicted the goitre poorly in adults underscoring the importance of looking for other unidentified factors. Alternately the current iodine status may not be representative of the past iodine status which would naturally have its bearing on the goitre prevalence in adults. The marked disparity in the goitre prevalence in adults and children might represent improved present iodization status accounting for the lower goitre prevalence in children, comparable to state and national average. The households consuming adequate iodized salt was 48.9% in the ICCIDD survey which is similar to the rates seen in nontribal. So probably we are looking at a much improved iodine status without much disparity between the tribal and non tribal population. However

this is still below the target and hence there is a need to implement corrective measures.

The high prevalence of antibodies in non tribals was striking but within range for that reported in adult population from Ernakulam district in ADEPS study ( TPO positivity - 16.7% in males and 19.8% in females) as well as that reported from Caucasian population<sup>5,7</sup>. Most of the non tribals have been living in this region for more than two generations. There was no significant difference in the diet patterns or environmental exposures which are apparent. The effects of iodine supplementation on thyroid autoimmunity is controversial<sup>8,9</sup>. Except for probable genetic reasons there is no apparent reason why thyroid autoimmunity should be higher in non tribals. Separate binary logistic regression analysis in non tribals did not reveal any role for autoimmunity in the causation of goitre. In view of the relatively modest sample size this requires further study. Smoking was found to be a factor associated with lowered autoimmune markers in some of previous studies<sup>10</sup>. However no difference was found in thyroid autoimmunity between smokers and non smokers. Goitre associated thyroid hyperfunction was seen only in tribals. Hypo function was not seen in any of the tribal subjects studied. Higher prevalence of thyroid hyper function is expected in population with iodine deficiency goitre when iodine deficiency is corrected. We speculate that this could be due to the difference in the genetic makeup of the two groups. It is possible that in tribals iodine utilization is very efficient as a genetic adaptation to past deficiency. The current improved iodine status in the background of goitre could have resulted in thyrotoxicosis. These intriguing facts need to be confirmed and studied further in large surveys. This survey serves to do the ground work needed for undertaking such large scale studies. We acknowledge that the use of palpation to identify goitre may lead to overestimation of goitre prevalence. This is however more true for children and may not cause significant problems in the adult population. Being a pilot study the sample size is small and this is a limiting factor in drawing firm conclusions because of the lower statistical power. The relationship between autoimmunity and goitre and that between goitre and iodine status in non tribals may differ and approach significance with higher sample size.

## CONCLUSIONS

This pilot study reveals high prevalence of mild iodine deficiency and goitre in tribal and nontribal adults. However the goitre prevalence in children is comparable to that in the rest of Kerala. High prevalence of thyroid autoimmunity was noted in nontribal which is on the higher side of that reported for general population. Thyrotoxicosis was more common in tribals whereas hypothyroidism albeit at a subclinical level was the commonest abnormality in non tribals.

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