

# The correlation between iodine nutrition and autoimmunity among hyperthyroid goiter patients in tertiary care hospital of Tamil Nadu



Suresh Pichandi<sup>1\*</sup>, Sivakumar J<sup>2</sup>, Ganesh V<sup>3</sup>, Janakiraman P<sup>4</sup>, Ramadevi K<sup>5</sup>

<sup>1</sup>Associate Professor, <sup>3</sup>Tutor, Department of Biochemistry, Sri Venkateshwara Medical College and Research Center, Puducherry, <sup>2</sup>Associate Professor, Department of Biochemistry, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil Nadu, <sup>4</sup>Tutor in Statistics, Department of Community Medicine, PES Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, <sup>5</sup>Professor and Head, Department of Biochemistry, Madras Medical College and Govt. Rajivganthi General Hospital, Chennai, Tamil Nadu, India

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## ABSTRACT

**Background:** Iodine is a trace element that is essential for the formation of thyroid hormones. It is essential for the human life's growth and development. The thyroid gland size and functions affected by deficient or excessive intake of iodine. Iodine excess intake was found to associating with iodine-induced hyperthyroidism (IH) and autoimmune thyroiditis.

**Aims and Objectives:** The present study was to find the hyperthyroid goiter patient nutritional status by urinary iodine excretion (UIE) measurement and correlate them with thyroid hormone and thyroid autoantibodies. **Materials and Methods:** In this study, 100 adult hyperthyroid goiter subjects and 100 apparently normal adult subjects were conveniently recruited in this study. Urinary iodine estimation and serum TSH, fT<sub>4</sub>, fT<sub>3</sub>, AMA, and ATG were estimated, which were estimated for case and control groups. **Results:** The hyperthyroid goiter patient mean UIE concentration was 278.98 µg/L and 68% of excess UIE which was found. There was significant difference in the UIE between the hyperthyroid goiter patient and control (P<0.001). The following types of goiter, based on palpation, were identified among the 100 hyperthyroid patients: Grade I – 4%, Grade II – 63%, and Grade III – 33%. There were elevated serum AMA levels with positive correlation of excess iodine for hyperthyroid goiter patient. **Conclusion:** In this study, there were excess UIEs among patients; hence, these associated complications, namely, benign goiter (14%), thyroiditis (43%), cancer of thyroid (4%), and thyrotoxicosis (39%) were observed.

**Key words:** Goiter; Iodine-induced hyperthyroidism; Thyroiditis; Thyrotoxicosis; Urinary iodine excretion

## INTRODUCTION

Iodine is an essential trace element required for the thyroid hormone synthesis. It is important for the growth and development of human life.<sup>1</sup> It regulates biochemical reactions of protein synthesis and enzymatic activity. The dietary iodine major sources are water, sea food, and iodized salt. The World Health Organization (WHO) iodine recommended daily intake for different age groups is given in (Table 1).<sup>2</sup> Deficient or excessive iodine intake

may affect thyroid gland size and functions.<sup>3</sup> In worldwide, there are two billion people affected by iodine deficiency approximately.<sup>4</sup> Deficiency of iodine causes iodine deficiency disorders (IDD), including stunted physical growth, abortion, stillbirth, Squint deafness, neonatal cretinism, impaired mental abilities, hypothyroidism, and its complications.<sup>5</sup> Universal salt iodination program was implemented to eradicate the IDD. Urinary iodine measurement is a good marker to measure the dietary iodine intake.<sup>6</sup>

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### Address for Correspondence:

Dr. Suresh Pichandi, Associate Professor, Department of Biochemistry, Sri Venkateshwara Medical College Hospital and Research Centre, Puducherry, India. **Mobile:** +91-9894421782. **E-mail:** suresh.chanth82@gmail.com

**Table 1: WHO recommendations for Daily dietary intake of iodine**

Age or population group	Iodine intake in micrograms per day ( $\mu\text{g}/\text{day}$ )
Children 0-5 years	90
Children 6-12 years	120
Adults >12 years	150
Pregnancy	250
Lactation	250

The iodine deficiency was eliminated by universal salt iodination from goiter endemic areas, but prevalence of goiter not been eliminated. The post iodination study reports say that due to iodine excess occurrence of thyroid-related disorders has been found a steady upward trend.<sup>7,8</sup> It has been found that excess intake of iodine has associated with iodine-induced hyperthyroidism (IIH) and autoimmune thyroiditis due to increasing the chance of thyroid cell mutations by the stimulation and proliferation of thyroid follicular cells.<sup>9</sup> IIH has been reported in many iodine supplementation programs study.<sup>10</sup>

In our tertiary care hospital endocrine surgery unit, data shown steady upward trend graph of increasing occurrence of thyroid disorders in our region (Figure 1).<sup>8</sup> This prompted us to investigate the iodine status among hyperthyroid goiter patients attending our hospital and to correlate with their thyroid function.

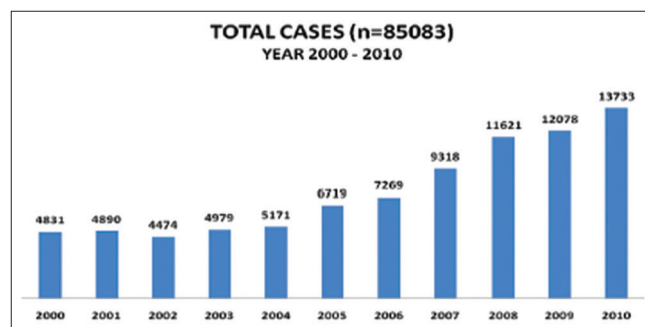
### Aims and objectives

The aim of present study was to find the hyperthyroid goiter patient nutritional status by measurement of urinary iodine excretion (UIE) and correlate them with thyroid hormone and thyroid autoantibodies.

## MATERIALS AND METHODS

In this study, the samples were collected from the patients of the Department of Endocrine Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai. One hundred hyperthyroid goiter patients and 100 age-matched normal adult were included in study. Urinary iodine estimation<sup>11</sup> and serum TSH, fT<sub>4</sub>, fT<sub>3</sub>, AMA, and ATG were estimated for case and control groups.

Grading of goiter was determined according to the criteria recommended by the joint WHO/UNICEF/ICCIDD<sup>12</sup> for all the goiter patients. All the patients with goiter underwent fine-needle aspiration cytology to diagnose the pathology of the goiter. Tc99 scan: Patients who had toxic level of thyroxine underwent Tc99 scan and uptake of thyroid for further confirmation and classification.



**Figure 1:** Patient statistics of department of endocrine surgery in a tertiary care hospital in South India<sup>8</sup>

### Statistical analysis

The data processing and analysis were done by STATA 13 version software. The quantitative data of case and control were presented as mean and standard deviation and comparison of means was done by student t-test. The categorical data analyzed by Chi-square ( $\chi^2$ ). The non-parametric data were expressed as median and inter quarter range and comparisons among the groups were done using Kruskal–Wallis test. The Pearson's correlation test was used to find associations between analyses.

## RESULTS

The mean age of hyperthyroid goiter patient was  $34.10 \pm 10.75$  years, while the controls adult had  $35.38 \pm 9.72$  years. The mean urinary iodine excretion (UIE) patients group was  $278.98 \pm 146.34 \mu\text{g}/\text{L}$ , while the controls had  $155.03 \pm 37.71 \mu\text{g}/\text{L}$  (Table 2). There was significant difference in the UIE between the hyperthyroid goiter patient and control ( $P < 0.001$ ). The result shows that excess UIE among the hyperthyroid goiter patients. The following types of goiter, based on palpation, were identified among the 100 hyperthyroid patients: Grade I – 4 %, Grade II – 63%, and Grade III – 33%.

Based on the results obtained, the patients were classified into two types:

Type I: UIE: Based on the urinary iodine level, the hyperthyroid goiter patients were classified into four groups as per WHO criteria (Figure 2). Only 15% of the hyperthyroid patients had iodine deficiency, while 68% had more than adequate iodine nutrition and among that 50% had very high excretion of iodine ( $>300 \mu\text{g}/\text{L}$ ), while 17% had normal iodine status.

Type II: Pathophysiological classification: Based on the thyroid hormone profile, and antibody titters, the 100 hyperthyroid goiter patients were classified into four groups as thyroiditis ( $n=43$ ), thyrotoxicosis subjects ( $n=39$ ), benign ( $n=14$ ) and

cancer of thyroid (n=4) (Figure 3). The comparison was done among thyroiditis, thyrotoxicosis, benign, cancer of thyroid, and goiter patient's subjects, median value of urinary iodine was 305 (470–110), 300 (400–192), 190 (300–115), and 297.5 (435–187.5) (Table 3).

Pearson's correlation was used to find the correlation and association between analysts. There was a significant positive correlation between UI and AMA ( $r=0.2278^*$ ) ( $P<0.05$ ) in hyperthyroid patient's subjects (Table 4 and Figure 4). Furthermore, a significant positive correlation between UI and ATG ( $r=0.2291^*$ ) ( $P<0.05$ ) was found in those subjects (Table 4 and Figure 5).

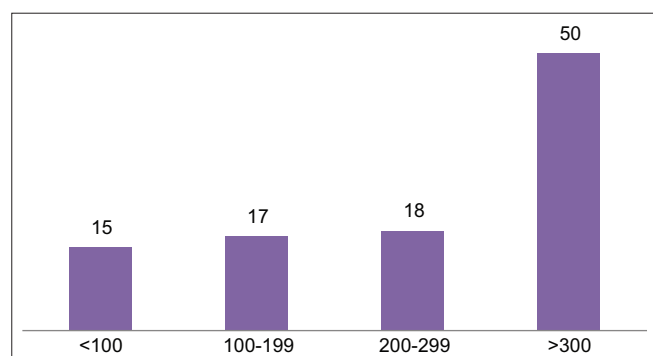


Figure 2: Classification based on urinary iodine excretion

Table 2: Case–control thyroid profile for adult group

Variable	Case n=100	Control n=100	P-value
Age (Years)	34.10±10.75	35.38±9.72	<0.001**
UIE(µg/L)	278.98±146.34	155.03±37.71	<0.001**
Ref. (100–200)			
TSH (micro IU/ml)	0.08±0.11	1.80±0.80	<0.001**
Ref (0.35–5.0)			
FT4 (ng/dl)	4.33±2.70	1.62±0.29	<0.001**
Ref (0.8–2.0)			
FT3 (pg/dl)	8.53±5.65	2.81±0.58	<0.001**
Ref. (2.0–4.4)			

\*P<0.05 Statistically significant

Table 3: Patients with goiter presenting as various disorders of hyperthyroid

Variable	THYROIDITIS Median±IQ N=43	TOXIC Median±IQ N=39	BENIGN Median±IQ N=14	PAP CA Median±IQ N=4	P Value
UI	305.0 (470–110)	300 (400–192)	190 (300–115)	297.5 (435–187.5)	0.2005
TSH	0.1 (0.06–01)	0.01 (0.04–0.01)	0.2 (0.3–0.1)	0.2 (0.3–01)	*0.0008
FT3	6.4 (12.1–5.3)	6.5 (10.2–5.4)	6.5 (10.1–3.1)	7.7 (12.9–3.1)	0.4755
FT4	4.0 (5.9–2.9)	3.9 (4.8–2.5)	2.0 (6.0–1.2)	3.9 (5.5–2.7)	0.8310
AMA	75.0 (75.8–74.6)	77.4 (78.0–74.7)	72.7 (74.6–71.2)	72.4 (75.2–70.9)	*0.0001
ATG	673.0 (673–132)	655 (974–132)	655.0 (888–492)	888.0 (944–510)	0.5068

\*P<0.05 Statistically significant

## DISCUSSION

Iodine is an important micronutrient required for the synthesis of thyroid hormone. Thyroidal and size and functions may be affected by deficient or excessive intake of iodine.<sup>13</sup> In this study, we have taken 100 clinically proven hyperthyroid patients. The mean UIE of the study patients group was 278.98 µg/L, while the controls had 155.03 µg/L. Iodine excess is the hall mark that is observed among our patients in this study. These results showed that there is no iodine deficiency among the patients and the USI program has also eliminated the iodine deficiency as reported by many studies. We have found that 68% of hyperthyroid goiter patients had more than adequate iodine nutrition and among that 50% had very high excretion of iodine (>300 µg/L). The highest median urinary iodine concentration of 305 and 300 µg/L was found in thyroiditis and thyrotoxicosis of the study group.

All the complications known to be associated with excess iodine, namely, thyroiditis (43%), thyrotoxicosis (39%), benign goiter (14%), and cancer of thyroid (4%) have been observed in this study.

Excess iodization is one of the causes that produces destruction of the follicle of thyroid resulting in thyroiditis. Furthermore, excess iodine stimulates the immune system that changes in the immunological status, finally resulting in the production of autoantibodies which gradually destroy the thyroid glandular tissue.<sup>14</sup>

Post iodine supplementation phase has been found to be accompanied by a change in the epidemiological pattern of thyroid cancer, with increasing prevalence of papillary cancer in an autopsy study.<sup>15</sup>

The mechanism at the pathophysiology of endemic goiter produced by iodine excess intake may involve to

Table 4: Correlation analysis in hyperthyroidgoiter patients						
	UI	TSH	FT4	FT3	AMA	ATG
UI	1					
TSH	0.0442	1				
FT4	0.0731	-0.4126**	1			
FT3	0.0874	-0.4737**	0.6939**	1		
AMA	0.2278*	0.1217	0.1878*	0.2343*	1	
ATG	0.2291*	0.1771*	0.1624*	0.2396*	0.9537**	1

\*\*P<0.01,\*P<0.05

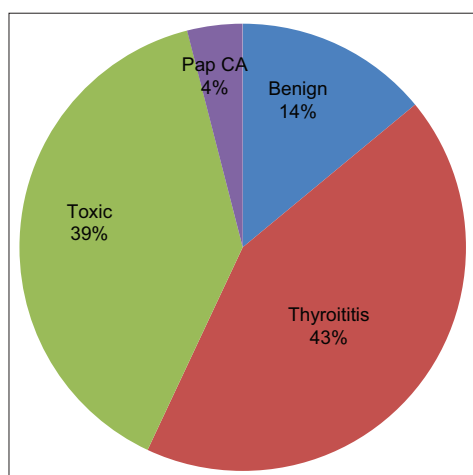


Figure 3: Classification based on pathophysiology of goiter

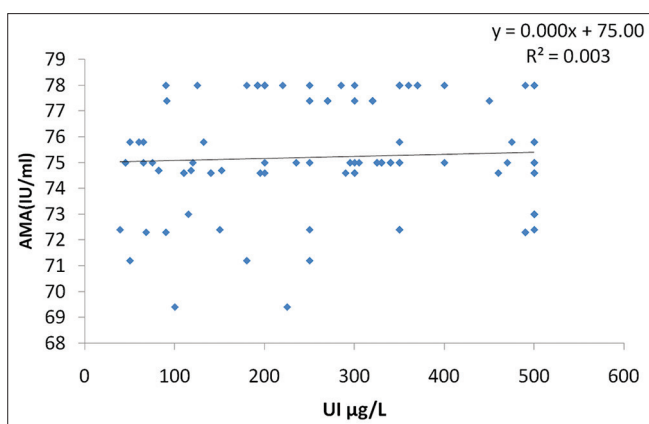


Figure 4: UI versus AMA

damage of thyroidparenchyma.<sup>16</sup> Autoimmune growth factor like thyroidgrowth-stimulating immunoglobulin’s playing a major role in the pathogenesis of growth in thyroid of this condition.<sup>17</sup>

**Limitations of the study**

This small hospital-based study for urinary iodine concentration in hyperthyroid goiter patient may not be representative of community iodine nutrition and similar large number of sample required for community settings to find the iodine nutrition in hyperthyroid goiter patient.

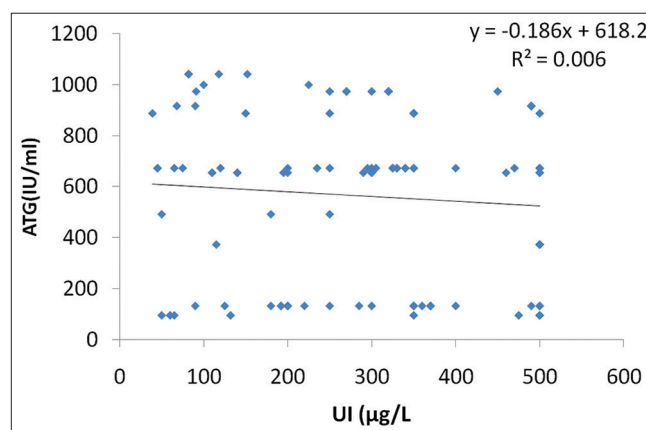


Figure 5: UI versus ATG

**CONCLUSION**

Iodine is adequately available in the coastal regions of our country and Tamil Nadu with a large coastal area, the chances of iodine deficiency are much less. Universal salt iodination program has also eliminated the iodine deficiency as reported by many studies. Iodine excess is the hall mark that is observed among our patients in this study. All the complications known to be associated with excess iodine, namely, thyroiditis(n=43), thyrotoxicosis subjects (n=39), benign (n=14), and cancer of thyroid (n=4) have been observed in this study. Chronic exposure to excess iodine, which may ultimately create a generation of thyroid cripples, should be prevented by careful monitoring and regular follow-up of iodine supplementation. From this study, we would recommend that thyroid patients should be evaluated for autoimmune thyroiditis and thyroid function and urinary iodine.

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**Author's Contributions:**

**SP-** Concept and design of the study, prepared first draft of manuscript; **SJ-** Reviewed the literature and manuscript preparation; **JP-** Concept, coordination, statistical analysis; **GV-** Help for manuscript preparation **RK-** Manuscript editing, revision of the manuscript.

**Work attributed to:**

Madras Medical College and Govt.Rajivganthi General Hospital, Chennai - 600 003, Tamil Nadu, India.

**Orcid ID:**

Dr. Suresh Pichandi - <https://orcid.org/0000-0002-9254-5774>  
 Dr. Sivakumar J - <https://orcid.org/0000-0002-6944-7439>  
 Janakiraman P - <https://orcid.org/0000-0002-5802-8861>  
 Dr. Ramadevi K - <https://orcid.org/0000-0003-0602-5420>

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