THYROID DISORDERS IN WOMEN OF PUDUCHERRY

Rebecca Abraham, V Srinivasa Murugan, P Pukazhvanthen and S K Sen

Department of Biochemistry, Pondicherry Institute of Medical Sciences, Puducherry-605014, India.

ABSTRACT

Thyroid stimulating hormone (TSH), Free Thyroxine (FT_4) and Free Triiodothyronine (FT_3) were assayed in 505 women of this region. 60 women had previous history of thyroid disease. The remaining 445 women formed the "Disease free group". A "Reference group" was obtained by excluding women with previous and present history of thyroid dysfunction. Of the total 505 women examined 15.8% had thyroid dysfunction and 84.2% were euthyroid. 11.5% were hypothyroid (9.5% sub-clinical) and 1.8% hyperthyroid (1.2% clinical). The geometric mean TSH for the total population was $2.65 \mu IU/ml$. It was significantly ($p=0.025$) lower in the reference population $2.17 \mu IU/ml$. There was no significant difference in the FT_3 and FT_4 values between groups. 19% of women over 60 years had elevated TSH above $4.5 \mu IU/ml$. The 2.5 and 97.5 percentiles of the reference population was $1.1 - 5.2 \mu IU/ml$. 6.1% of women in the reference group had TSH levels above the reference intervals. Hypothyroidism particularly sub-clinical hypothyroidism is predominantly present amongst women in this iodine sufficient region. Evaluation of thyroid status could help in early detection and treatment.

KEY WORDS

Thyroid function, Hypothyroidism, Sub-clinical hypothyroidism.

INTRODUCTION

Thyroid disorders are amongst the most common endocrine diseases in India (1). The prevalence and pattern of thyroid disorders depends on sex, age, ethnic and geographical factors and especially on iodine intake (2). A high iodine intake is associated with lower prevalence of goiter and higher prevalence of hypothyroidism. Low intake is associated with a higher prevalence of hyperthyroidism (3). Hypothyroidism is more common in older women and 10 times more common in women than men (4). The prevalence of hyperthyroidism is also reported as more common in women than men (5).

The total burden of thyroid disorders in India is 42 million. This projection was based on recent nationwide studies on thyroid disorders among adolescents and young adults in the

post salt iodization phase (1). There is however a paucity of data from the Union Territory (UT) of Puducherry. A pilot study in 1997 (6) reported a goiter prevalence of 2.6 % in school children and assessed the region as iodine sufficient. We still lack information on thyroid dysfunction amongst women in this region. This study was designed to address this question. Subclinical and clinical forms of Hyperthyroidism and Hypothyroidism can contribute to morbidity from Osteoporosis, Hyperlipidemia, Hypercholesterolemia, Hyperhomocysteinemia, Cardiovascular and Neuropsychiatry disease specially in the older population (7,8). We undertook this study to provide reference data for TSH, FT_4 and FT_3 in women of this region and evaluate their status of thyroid function.

MATERIALS AND METHODS

505 women who attended the Well Women Health Profile Clinic of the Pondicherry Institute of Medical Sciences formed part of the study group. Their age ranged from 20-80 years. In addition to clinical examination, careful history was taken pertaining to thyroid and or any other illness. Height, weight and blood pressure was recorded. Routine blood investigations included Hemogram, ESR, Peripheral Smear, Blood group and Rh type, Stool and Urine examination. The biochemical

Address for Correspondence :

Prof. Rebecca Abraham

Department of Biochemistry

Pondicherry Institute of Medical Sciences

Puducherry – 605014.

E-mail: ra_cmc@hotmail.com

investigations included Urea, Creatinine, Fasting and Postprandial blood sugar, Cholesterol and Triglycerides. Thyroid function tests were carried out on all women.

Population studied : Total population – comprised all subjects including those with thyroid disease, risk factors and medication. “Disease free” population – subjects with previous history of thyroid disease, goiter and medication were excluded from the total population to get the “Disease Free population. Reference population – subjects with previous history of thyroid disease and / or surgery and / or thyroid medication and those who evidenced overt thyrotoxicosis or overt hypothyroidism on examination and also women with diabetes mellitus and on drugs like lithium were excluded from the total population to get the reference population. This type of grouping was made as per the norms laid out by earlier studies including the NHANES III study. (9,10)

505 women formed part of the study group. The highest number was in the 40- 49 age group (31.4%) and lowest number in the 70-79 age group (3%). Of the total subjects (n=505), 11.9 % (n=60) had previous history of thyroid disease and/or thyroid surgery and/or use of thyroid medication. The remaining 445 participants were defined as the “disease free population”. The reference population constituted 360 subjects.

Laboratory Methods : The thyrotropin, TSH levels of serum samples were analysed using a 3rd generation Chemiluminescence immunometric assay kits (Diagnostic Product Corporation(DPC), LosAngeles, USA) on the Immulite 1000 Chemiluminescence Analyser. The analytical sensitivity was 0.004 μ IU/ml. The FT₄ and FT₃ levels were also analysed by chemiluminescent assay on Immulite 1000 using DPC kits (DPC-USA). The analytic sensitivity of FT₄ was 0.3 ng/dl and FT₃ was 1.0 pg/ml. All sera samples were stored -20°C. The laboratory's reference values were TSH (0.4 – 4.0 μ IU/ml), FT₄ (0.8 – 2.0 ng/dl), FT₃ (1.5 – 4.1 pg/ml).

Data Analysis : Hypothyroidism was classified as clinical if

TSH was ≥ 4.5 μ IU/ml (≥ 4.5 μ IU/L) and FT₄ was ≤ 0.620 ng/dL (~ 8.0 pmol/L) and subclinical if TSH was ≥ 4.5 μ IU/ml and FT₄ ≥ 0.620 ng/dL (8.0 pmol/L). Hyperthyroidism was classified as clinical if TSH was ≤ 0.1 μ IU/ml and FT₄ ≥ 1.705 ng/dL (22 pmol/L) and subclinical if TSH was ≤ 0.1 μ IU/ml and FT₄ ≥ 1.705 ng/dL (22 pmol/L). A TSH concentration of 0.1 – 0.4 μ IU/ml was considered as mildly suppressed (9).

Statistical Analysis : Statistical Analysis was done using Microsoft Office “Excel” with Windows 98 Operating System. For TSH, FT₃ and FT₄ we calculated the mean and Standard deviation and standard error. To generate possible reference limits for TSH we calculated the median 2.5 and 97.5 percentiles from the reference population. Multiple comparison were analysed with the SPSS 12.0 statistical software package (SPSS Inc).

RESULTS

Of the 505 total subjects in the age range 20 – 80 years, 15.8 % had thyroid dysfunction and 84.2% were euthyroid (Table 1) 11.5% were hypothyroid (2% clinical, 9.5% subclinical) (Table 2). 1.8 % had hyperthyroidism (1.2% clinical and 0.6 % subclinical) while 2.6 % had mildly suppressed TSH with normal FT₄ (Table 2). The mean TSH level in the subclinical hypothyroid group was 9.55 ± 7.7 μ IU/ml and hyper thyroid group 0.06 ± 0.04 μ IU/ml. The mean TSH level in the hypothyroid group was 9.54 ± 6.69 μ IU/ml. The median was 6.3 μ IU/ml. The 2.5 and 97.5 percentile of TSH was 5.20 and 27.05 μ IU/ml. The cut off values for subclinical hypothyroidism was TSH > 4.5 μ IU/ml and FT₄ ≥ 0.620 mg/dl. The mean TSH level in the sub clinical hyperthyroid group was 0.06 ± 0.04 μ IU/ml. The median was 0.07 μ IU/ml. The 2.5 and 97.5 percentiles was 0.03 and 0.10. The cut off values for subclinical hyperthyroidism was TSH ≤ 0.1 μ IU/ml and FT₄ ≥ 1.705 mg/dl.

Sixty of the 505 women gave a history of thyroid disease and or thyroid medication. Of these 36.7 % gave biochemical evidence of hypothyroidism (3.3% clinical, 33.3 % subclinical)

Table 1: Characteristics of Thyroid Dysfunction in the Puducherry Study Group

	Total Subjects		Disease Free Subjects	
	n=505	%	n=445	%
Subjects with Thyroid dysfunction	80	15.8	49	11.0
Euthyroid	425	84.2	396	88.9
Hypothyroid	58	11.5	38	8.5
Hyperthyroid	9	1.8	3	10.7
Mildly Suppressed TSH (MST)	13	2.6	8	1.8

Table 2: Status of Hypo and Hyperthyroidism in Total and Disease Free Subjects

	n	Euthyroid		Hypothyroid				Hyperthyroid				TSH & Normal FT ₄ Mildly Suppressed	
				Clinical		Subclinical		Clinical		Subclinical			
		n	%	n	%	n	%	n	%	n	%	n	%
Total	505	445	84.2	10	2.0	48	9.5	6	1.2	3	0.6	13	2.6
Disease Free	425	396	98	9	2.0	29	8.5	1	0.2	2	0.5	8	1.8

Clinical Hypothyroidism: TSH ≥ 4.5 μ IU/L, FT₄ ≤ 0.620 ng/dL: Subclinical; Hypothyroidism: TSH ≥ 4.5 μ IU/L, FT₄ ≥ 0.620 ng/dL

Clinical Hyperthyroidism: TSH ≤ 0.1 μ IU/L, FT₄ ≥ 1.705 ng/dL: Subclinical; Hyperthyroidism: TSH ≤ 0.1 μ IU/L, FT₄ ≥ 1.705 ng/dL

Mildly Suppressed TSH and Normal FT₄: TSH: 0.1 - 0.4 μ IU/L, FT₄: 0.8 - 1.9 ng/dL

and 10% had hyperthyroidism (8.3 % clinical and 1.7 % subclinical) (Table 3). On separating the 60 subjects (who self reported thyroid dysfunction or those on thyroid medication) from the total population, a group of 445 subjects, represented the "disease free population". Thyroid dysfunction was seen in 11% whereas 88.98 % were euthyroid (Table 1). 8.5% were hypothyroid (2% clinical, 9.5% subclinical), 0.7% were hyperthyroid (0.2% clinical, 0.4% subclinical) and 1.8% had mildly suppressed TSH and normal FT₄ (Table 2).

The geometric mean TSH for the total population was 2.65 μ IU/ml. It was lower in the disease free population i.e. 2.43 μ IU/ml and was significantly lower in the reference population 2.17 μ IU/ml ($p=0.025$) (Table 4). There was no significant difference in the FT₃ and FT₄ values between the different groups (Table 4).

The mean TSH concentration increased with age in all groups. In the reference population the highest TSH concentration was seen in the age group 60- 69 years whereas in the total and disease free population in the age group 70 – 79 years. (Table 5). There was no significant difference in FT₄ with age in the different populations. However the FT₃ values declined with age in Total and disease free population (Fig 1,2,3).

Table 6 shows the median, 2.5 and 97.5 percentiles for TSH for the different age groups all increasing with age. The lower limits of the 95% probability interval of the 3 populations were not significantly different. However the upper limit of the total

Figure 1: Mean Serum FT3, FT4, TSH in Total population at different age groups

population was considerably higher than the upper limit of the reference population. Regardless of age the 2.5 and 97.5 percentiles of the reference population was 1.1 – 5.2 μ IU/ml. The number of women with serum TSH (> 4.5 μ IU/ml) was highest between the ages 60 – 80 years in all the 3 groups (Fig.4) and the number of women with low serum TSH ≤ 0.4 μ IU/ml was highest in the age group 70 – 80 years (Fig. 5)

Only one woman in the "Reference Group" had biochemical hypothyroidism. She was 60 years, her TSH was > 10 μ IU/ml

Table 3 : Thyroid status of subjects with previous history of thyroid disease, goiter or taking thyroid medications

Total		Hypothyroid				Total		Hyperthyroid			
		Clinical		Subclinical				Clinical		Subclinical	
n	%	n	%	n	%	n	%	n	%	n	%
22	36.7	2	3.3	20	33.3	6	10	5	8.3	1	1.7

Figure 2: Mean Serum FT₃, FT₄, TSH in Disease Free population at different age groups

and her FT₄ was 0.9 ng/dL. 21 women (5.8%) had their TSH levels between 4.5 and 10 μ IU/ml. Two of these women had FT₄ levels less than 0.6 and four had FT₄ levels less than 0.9 ng/dL (Table 7). Three women (0.83 %) in the reference group had biochemical evidence of hyperthyroidism with TSH less than 0.1 μ IU/ml. Two of these three women had FT₄ levels greater than 1.5 ng/dL. Nine women (2.5 %) had mildly

Figure 3: Mean Serum FT₃, FT₄, TSH in Reference population at different age groups

suppressed TSH i.e. between 0.1 - 0.4 and six of nine (67 %) had FT₄ > 1.5 ng/dL (Table 8).

DISCUSSION

Pondicherry is a Coastal Union Territory. It is wrongly believed that populations residing in coastal areas do not suffer from iodine deficiency disorders as they consume sea food which are incorrectly believed to be rich in iodine (11). A pilot study

Figure 4: Percentage with high (≥ 4.5 mIU/ml) serum TSH at different age groups in Total, Disease and Reference subjects

Figure 4: Percentage with low (< 0.4 μ IU/ml) serum TSH at different age groups in Total, Disease and Reference subjects

Table 4: Serum Levels FT₃, FT₄ and TSH of Total, Disease free and Reference subjects

	n	Age	FT ₃	FT ₄	TSH
Total	505	45.61 ± 0.52	3.01 ± 0.04	1.31 ± 0.01	2.65 ± 0.14
Disease Free	445	45.50 ± 0.56	2.97 ± 0.04	1.30 ± 0.01	2.43 ± 0.13
Reference	360	44.24 ± 0.61	3.02 ± 0.04	1.32 ± 0.01	2.17 ± 0.09

Total Population: Inclusive of Those with thyroid disease risk factors and medication; Disease Free: Excluded subjects who reported thyroid disease, goiter, medication; Reference: Excluded subjects with previous and present thyroid disease and diabetes

Table 5: Serum FT₃ (pg/ml), FT₄ (ng/dl), TSH(μIU/ml) levels in Total, disease free and reference subjects by age

Age Range	Total				Disease Free				Reference			
	n	FT ₃	FT ₄	TSH	n	FT ₃	FT ₄	TSH	n	FT ₃	FT ₄	TSH
20-29	44	3.21 ± 0.10	1.30 ± 0.04	2.60 ± 0.50	40	3.20 ± 0.10	1.32 ± 0.04	1.96 ± 0.18	37	3.19 ± 0.11	1.33 ± 0.04	1.96 ± 0.20
30-39	120	3.03 ± 0.13	1.31 ± 0.03	2.76 ± 0.37	108	2.94 ± 0.07	1.32 ± 0.03	2.32 ± 0.28	94	2.94 ± 0.07	1.32 ± 0.03	2.09 ± 0.14
40-49	159	3.00 ± 0.07	1.33 ± 0.03	2.62 ± 0.23	137	2.95 ± 0.07	1.32 ± 0.03	2.49 ± 0.24	114	2.99 ± 0.07	1.32 ± 0.03	2.13 ± 0.12
50-59	119	2.98 ± 0.07	1.28 ± 0.02	2.44 ± 0.20	107	2.97 ± 0.08	1.27 ± 0.03	2.40 ± 0.21	80	3.07 ± 0.09	1.30 ± 0.03	2.11 ± 0.15
60-69	48	2.98 ± 0.11	1.33 ± 0.05	2.83 ± 0.46	40	2.97 ± 0.11	1.29 ± 0.05	2.82 ± 0.50	25	3.09 ± 0.11	1.32 ± 0.06	2.40 ± 0.31
70-79	15	2.81 ± 0.18	1.28 ± 0.12	3.15 ± 0.85	13	2.84 ± 0.20	1.28 ± 0.14	3.17 ± 0.94	10	2.92 ± 0.06	1.30 ± 0.05	2.32 ± 0.16

conducted in Pondicherry on school children reported a goitre prevalence of 2.6% and assessed the region as iodine sufficient (6). Studies from other coastal districts of Kottayam (Kerala), Portblair and Panaji had documented goitre prevalence rate of 7.05, 9.5 and 16.6% (12, 13, 14). A later study again on school children (11) revealed that 60% of the population was consuming salt with > 5 ppm of iodine. However no previous studies have been done on the iodine status of women in this region.

This Survey included 505 women who attended the Well Women Health Profile Clinic of the Pondicherry Institute of Medical Sciences. Their ages ranged from 20-80 years. 15.8% had thyroid dysfunction. 11.5 % were hypothyroid (overt 2%,

subclinical 9.5%). A recent report from Colorado stated a prevalence of elevated TSH (> 5.1 μIU/ml) in 9.5 % of adult population (15). Interestingly in our study the prevalence would be 9.3 % if the cut off is raised from 4.5 μIU/ml to 5.1 μIU/ml. The classic study of Sawin et al (16) reported a prevalence of 13 % in females over 60 years of age. In our study (19 %) women over 60 years had elevated TSH levels above 4.5 μIU/ml. In the Rotterdam study on elderly women over 55 years subclinical hypothyroidism was seen in 10.8 % of their participants (7). In our study 9.5 % of women from the total population had subclinical hypothyroidism. In the age group above 55 years 12.5 % of women had subclinical hypothyroidism. The prevalence of overt and subclinical hypothyroidism was much higher than that reported by

Table 6: Serum TSH concentration (Median, 2.5 and 97.5 centiles) in different age groups for the total, disease free and reference groups

Age Groups	Total			Disease Free			Reference		
	Median	2.5 Centiles	97.5	Median	2.5 Centiles	97.5	Median	2.5 Centiles	97.5
20-29	1.9	1.3	7.2	1.8	1.2	4.6	1.8	1.2	4.7
30-39	1.8	1.1	14.3	1.8	1.1	5.5	1.8	1.1	5.1
40-49	2.0	1.2	8.8	2.0	1.2	6.8	2.0	1.1	5.0
50-59	2.1	1.1	6.4	2.0	1.2	7.2	2.0	1.1	4.1
60-69	2.1	1.0	8.4	2.2	1.3	6.6	2.1	1.2	5.4
70-79	1.9	1.4	10.6	1.9	1.7	10.9	1.9	1.7	4.8
All	2.0	1.1	8.8	1.9	1.2	6.8	1.9	1.1	5.2

Table 7: Prevalence of Biochemical hypothyroidism in the reference population (Without former or present thyroid disease)

A defined as TSH > 10 µIU/ml, B defined as TSH > 4 and < 10 µIU/ml

A						B					
FT ₄ < 0.6 ng/dL				FT ₄ ≤ 0.9 ng/dL				FT ₄ < 0.6 ng/dL			
n	%	n	%	n	%	n	%	n	%	n	%
1	0.27	–	–	1	100	21	5.8	2	9.5	4	19.04

Table 8: Prevalence of Biochemical hyperthyroidism in the reference population (Without former or present thyroid disease)

A defined as TSH > 0.1 µIU/ml, B defined as TSH > 0.1 and < 0.4 µIU/ml

A				B			
FT ₄ ≥ 1.5 ng/dL				FT ₄ ≥ 1.5 ng/dL			
n	%	n	%	n	%	n	%
3	0.83	2	66	9	2.5	6	66

Hoogendoorn et al (9) and Hollowell et al (10). It may be mentioned here that Hak et al in their Rotterdam study found 1.1 % of their women to have overt hypothyroidism (7) as compared to 2% in the present study.

Hyperthyroidism was seen in 1.8% (overt 1.2% and Subclinical 0.6%) of the total subjects when the cut off value for TSH was < 0.1 µIU/ml. This is very similar to the Colorado study (15) where 2.2% of their subjects had TSH < 0.3 µIU/ml. Our study is also comparable to the Whickham survey where thyrotoxicosis was seen in 1.6% of the total subject (17). In more recent surveys Hoogendoorn et al have reported thyrotoxicosis in 1.2 % subjects (overt 0.4 % subclinical 0.8 %) (9) and Hollowell et al in their (NHANES III) study an incidence of 1.3 % (overt 0.5 % and subclinical 0.7 %)(10). It may be noted here that overt thyrotoxicosis was more prominent in our subjects.

60 women (11.9%) had previous history of thyroid disease, goiter or taking thyroid medication. However only 32 (53.3%) had normal thyroid function. This is comparable to the Colorado study (15) and the NHANES III study (10) wherein only 60% and 67 % respectively of their subjects taking thyroid medication were found to have normal TSH i.e appropriately treated. In our study previously diagnosed hyperthyroidism was seen in 10% subjects (8.3% clinical and 1.7 % subclinical) and previously diagnosed hypothyroidism in 36.7 % subjects i.e. 33.3 % subclinical and 3.3 % clinical. This is much higher than that reported by Bjoro et al in their Hunt study (18).

The geometric mean serum TSH for the total population was 2.66 µIU/ml. This value is higher than that observed by

Hollowell et al in their NHANES III study 1.47 µIU/ml (10) and Hoogendoorn et al 1.29 µIU/ml (9). In the NHANES III study TSH values were higher in the disease free population (1.50 µIU/ml) but was lower in the reference population (1.40 µIU/ml). Hoogendoorn et al (9) did not see any difference in the mean TSH in the total and reference population. In our study there was a significant reduction in the mean TSH level in reference group as compared to the total group (p=0.025). An increase in TSH with age was observed in all 3 groups-total, disease free and reference. Several other workers have reported increase in TSH with age (4,7,15,16,18). However one study Hoogendoorn et al (9) observed a decrease in TSH level with age. In our study the FT₄ levels did not change markedly with age in all three groups. There was a slight decline in FT₃ levels with age. This was more marked in the total and disease free population where an increase in the TSH at age 60 – 79 was marked by a decline in FT₃. In the reference population there was however a slight increase in FT₃ upto 70 years after which it declined. Kundsens et al have also reported an increase in FT₃ with age (19). The mean FT₄ levels in the total population was 1.31 ng/dl (16.89 pg mol/L) and FT₃ was 3.01 pg/ml. There was no significant difference in mean FT₃ and FT₄ levels between groups. Hoogendoorn et al reported an FT₄ concentration of 13.56 pmol/L. They observed no difference in mean FT₄ between the 3 groups. Contrary to our observation they reported an increase in FT₄ with age (9).

It has been proposed that reference intervals for thyroid function tests should be based on the 95% probability intervals obtained in a well selected group of healthy people (20). NHANES III, a survey designed to give national normative

estimates of the health and nutritional status of the US population found in the total female population a median serum TSH of 1.49 μ IU/ml with 2.5 and 97.5 percentile of 0.21 and 7.12 μ IU/ml respectively (10). However in the reference population median TSH was 1.39 μ IU/ml and 2.5 and 97.5th percentile were 0.41 and 4.09 μ IU/ml. In our study the median serum TSH was 2.0 μ IU/ml in the total population and 1.49 μ IU/ml in the reference population, which was comparable to the NHANES study. The 2.5 and 97.5 percentile in the total was 1.1 and 8.8 μ IU/ml respectively and in the reference 1.1 and 5.2 μ IU/ml. The difference in TSH value between these 2 population particularly the 97.5 percentiles has initiated a discussion on whether the TSH reference interval should be based on the total population or on such a reference population (20).

In our study as in the NHANES III (9) the lower limit in the two groups (total and reference) were the same but the upper limit was considerably lower in the reference population than in the total population. Our median of 1.9 and upper limit of 5.20 μ IU/ml corroborated well with the 'HUNT' study (18) who reported a median of 1.60 and an upper limit of 5.70 in females. The normal range given on a laboratory report is actually only a reference range for an ostensibly normal population usually derived from cross-sectional studies of population uncorrected for any underlying or occult disease. For TSH it has earlier ranged from 0.5-7.0 mU/L. With refinement of techniques it has dropped to 0.5-5.5 mU/L(21). Other confounding factors include individual and ethnic variations. The issue of a true normal range of TSH therefore relates to the issues of screening and early treatment.

The number of women with serum TSH > 4.5 μ IU/ml was highest between 60-80 years in all 3 groups (fig.4). The overall prevalence has been reported to be 4 – 10 % in the general population and upto 20% in women older than 60 years (16,19). Our overall prevalence in this age group was 22%. The number of women with low serum TSH $\leq$ 0.4 μ IU/ml was highest in the age group 70 – 80 years and the percentage was 13.15 %.

Only one women in the reference population (0.27 %) had overt hypothyroidism with TSH > 10 μ IU/ml and FT4 $\leq$ 0.9 ng/dL. In the Hunt study (18) 0.9% of women had TSH $\geq$ 10 μ IU/ml and 5.1 % had TSH between 4 and 10 μ IU/ml as compared to 5.8 % in our study. In our study 0.83% of women had TSH < 0.1 μ IU/ml and 2.5% had a TSH between 0.1 – 0.4 μ IU/ml. In the Hunt study 0.46 % of women had TSH < 0.05 μ IU/ml and 0.33% and TSH between 0.2 and 0.5 μ IU/ml (18).

Both overt hyper and hypothyroidism have a variety of adverse

effects and should be treated. However diagnosis and treatment of subclinical thyroid function remains controversial. It has been reported that subclinical hyperthyroidism is a risk factor for atrial fibrillation particularly in older persons (18). However, a recent report from Netherland demonstrates that subclinical hypothyroidism is also a strong indicator of risk for atherosclerosis and myocardial infarction in elderly females (21).

This is the first study conducted on women from this coastal region of Puducherry, South India, with respect to thyroid disorders. This study demonstrates that Hypothyroidism mainly subclinical hypothyroidism was alarmingly high in this region. The percentage of women with elevated TSH was particularly high in the 60-80 years age group. This indicates that thyroid disease should be considered during routine evaluation of this susceptible group and should be followed by appropriate detection and treatment. The finding that a large number of women unknowingly have laboratory evidence of thyroid dysfunction supports the usefulness of screening for early detection. In the elderly and women of perimenopausal age where TSH levels were elevated, further research may determine whether treatment of subclinical hypothyroidism will benefit in preventing adverse health outcomes such as Osteoporosis, Cardiovascular diseases and Hyperlipidemia. We hope to extend the study to a larger cross section of men and women in this region keeping in mind environmental and etiological factors like auto immunity, drugs, Iodine and non-thyroidal illness.

REFERENCES

1. Kochupillai N. Clinical Endocrinology in India. Curr Sci 2000;79:1061-7.
2. Delang F. The Disorders induced by iodine deficiency. Thyroid 1994;4:107-28.
3. Laurberg P, Pedersen KM, Hreidarsson A, Sigfusson N, Iversen E, Knudsen PR. Iodine intake and the pattern of thyroid disorders: a comparative epidemiological study of thyroid abnormalities in the elderly in Iceland and in Jutland, Denmark. J Clin Endocrinol Metab 1998; 83:765-9.
4. Vanderpump MP, Turnbridge WM. Epidemiology and prevention of clinical and subclinical hypothyroidism. Thyroid 2002; 12:839-47.
5. Tunbridge WM, Vanderpump MPJ. Population Screening for autoimmune thyroid disease. Endocrinol Metab Clin North Am 2000; 29:239-53.
6. Kapil U, Ramachandran S, Tandon M. Assessment of Iodine deficiency in Pondicherry. Ind Pediatrics 1998; 35:357-9.

7. Hak AE, Pols HAP, Visser TJ, Drexhage HA, Hoffman A, Witteman JCM. Subclinical hypothyroidism is an independent risk factor for atherosclerosis and myocardial infarction in elderly women: The Rotterdam Study. *Ann Intern Med* 2000; 132:270-78.
8. Morris MS, Bostom AG, Jacques PF, Selhub J, Rosenberg IH. Hyperhomocysteinemia and hypercholesterolemia associated with hypothyroidism in the third U.S. National Health and Nutrition Examination Survey. *Atherosclerosis* 2001; 155:195-200.
9. Hoogendoorn EH, Hermus AR, de Vegt F, Ross AH, Verbeek ALM, Kiemeneij LALM et al. Thyroid function and prevalence of Antithyroperoxidase Antibodies in a population with Borderline Sufficient Iodine Intake: Influences of Age and Sex. *Clin Chem* 2006; 52:104 – 11.
10. Hollowell JG, Staehling NW, Flanders DW, Hannon WH, Gunter EW, Spencer CA, et al. Serum TSH, T₄ and Thyroid Antibodies in the United States Population (1988 – 1994): National Health and Nutrition Examination Survey (NHANES III). *J Clin Endocrinol Metab* 2002; 87:489-99.
11. Kapil U, Singh P, Pathak P. Status of Iodine Nutriture and Salt Iodization in Union Territory of Pondicherry, India. *Pak J Nutr* 2002;1(5): 234-5.
12. Kapil U, Jayakumar PR, Singh P, Aneja P, Pathak P. Assessment of iodine deficiency in Kottiyam district, Kerala state: a pilot study. *Asia Pacific J Clin Nutr* 2002;11:33-5.
13. Kapil U, Ramachandran S, Tandon M. Assessment of iodine deficiency in Andaman district of Union Territory of Andaman and Nicobar. *Ind J Maternal and Child Health* 1998c;9: 19-20.
14. Kapil U, Nayar D, Ramachandran S. Assessment of iodine deficiency in Tiswadi block, Goa. *The Ind Practitioner* 1996;9:749-50.
15. Canaris GJ, Manowitz NR, Mayor G, Ridgway EC. The Colorado Thyroid Disease Prevalence Study. *Arch Intern Med* 2000; 160: 526-34.
16. Sawin CT, Castelli WP, Hershman JM, Mc Namara P, Bacharach P. The aging thyroid. Thyroid deficiency in the Framingham Study. *Arch Intern Med* 1985; 145:1386-8.
17. Tunbridge WM, Evered DC, Hall R, Appellton D, Brewis M, Clark F, et al. The spectrum of thyroid Disease in a community: the Whickham survey. *Clin Endocrinol (Oxf)* 1977; 7:481-93.
18. Bjoro T, Holmen J, Kruger Q, Midthjell K, Hunstad K, Schreiner T, et al. Prevalence of thyroid disease, thyroid dysfunction and thyroid peroxidase antibodies in a large unselected population. The Health Study of Nord-Trondelag (HUNT). *Euro J Endocrinol* 2000; 143:639-47.
19. Knudsen N, Jorgensen T, Rasmussen S, Christiansen E, Perrild H. The prevalence of thyroid dysfunction in a population with borderline iodine deficiency. *Clin Endocrinol* 1999; 51:361-7.
20. Baloch Z, Carayon P, Conte – Devolx B, Demers LM, Feldt-Rasmussen U, Henry JF, et al. Laboratory medicine practice guidelines. Laboratory support for the diagnosis and monitoring of thyroid disease. *Thyroid* 2003; 13: 123-6.
21. Wartofsky L, Dickey RA. The evidence for a narrow thyrotropin reference range is compelling. *J Clin Endocrinol Metabol* 2005; 90:5483-8.