3. To assess the prevalence of thyroid autoimmunity and to identify its relation with thyroid disorders
4. To find out the population prevalence of diabetes and co morbidities such as obesity, hypertension, dyslipidemia in adult population in central Kerala
5. To assess the coexistence of diabetes and thyroid disorders in this population

Secondary Objectives
1. To study the older female subpopulation with high prevalence of thyroid problems
2. To evaluate the iodine status and its relation with thyroid volume and other factors in this population
3. To assess the prevalence of clinical goiter and nodularity in this population using ultrasound.
4. To establish the normal thyroid volume of study subjects
5. To explore the relation between Iodine status, autoimmunity, prevalence of goiter and other thyroid disorders among the study population.

SECTION II

CHAPTER 2
2.1 BACKGROUND

Thyroid gland disorders are considered as a common endocrine disease worldwide second only to diabetes mellitus. The spectrum thyroid disorders in any country at any time depend largely on iodine status of that population. Hence assessing the iodine status of the population is very important in interpreting the varying patterns of thyroid disorders in any part of the world.

In the pre salt iodization era iodine deficiency disorders such as endemic goiter and cretinism were the common thyroid problems encountered in many countries. But over the last two decades many countries have made rapid strides towards eliminating iodine deficiency disorders, especially after the implementation of the universal salt iodization by the UNICEF [94]. Once iodine deficiency, arguably the most common thyroid disorder worldwide, has been tackled, the focus would naturally shift to other thyroid disease like autoimmune thyroid disorders, subclinical hypothyroidism, hyperthyroidism and thyroid cancers, which can affect the morbidity and quality of life of affected individuals. In addition to the direct impact of thyroid disorders in the health status of a community, undetected thyroid dysfunction can affect the quality of life, work performance and economic productivity of the individuals considerably. Importantly, studies have shown that in addition to overt hypo- and hyperthyroidism, subclinical thyroid dysfunction too has a detrimental effect on health. Subclinical hyperthyroidism also has been shown to increase all-cause mortality [95] as well as the risk of atrial fibrillation and osteoporosis [96]. Similarly subclinical hypothyroidism has been associated with
dyslipidemia, increased risk of atherosclerosis and cardiovascular diseases [97-99], depression, ovulatory dysfunction, infertility [100, 101] and can adversely affect pregnancy [102, 103]. Subclinical thyroid disease is often asymptomatic, and may be identified only through screening.

Prior to the implementation of universal salt iodization, studies done in Kerala had shown that 11 out of 14 districts were iodine deficient and prevalence of goiter widely varied from place to place 8-23%. Since the implementation of universal salt iodization in 1986, results of many recent studies done in various parts of India [57, 104] have shown that iodine status of the population has become adequate, though pockets of iodine deficiency still exist [105]. Hence India is said to be in the transition phase from iodine deficiency to iodine sufficiency. But the spectrum of thyroid dysfunction and thyroid autoimmune status of adult population in the post iodization phase remains largely unknown as most of the nationwide surveys were conducted among school children [50, 106]. However based on data from school children, it has been hypothesized that about 42 million Indian adults suffer from thyroid problems which is about 6% of the 72 million adults above 18 years [48].

2.2 OBJECTIVES

The purpose of the present study was to assess the prevalence of various thyroid disorders and to evaluate iodine status and thyroid autoimmunity in adult population residing in Kerala, a coastal state of south India.

2.3 MATERIALS AND METHODS

2.3.1 SAMPLE SELECTION AND STUDY DESIGN

Amrita Diabetes and Endocrine Population Survey (ADEPS) was conducted in South Central Kerala in four randomly selected areas of the Ernakulam District in order to obtain a representative sample (Fig. 2.1). The total population in the
selected area was estimated at 350,000. As this study was designed to look at the prevalence of not only diabetes but also other rare endocrine disorders such as thyroid disorders and calcium disorders the sample size was calculated accordingly. For diabetes prevalence, the sample size was estimated at 750 adults based on an estimated 12% prevalence of DM in the community, an $\alpha$ error (type 1 error) of 0.05 and allowable error on the estimate of 20%. The prevalence of other endocrine disorders in the Indian adult population is not known but assuming similar figures as published, a prevalence of 3-4% would require a sample size of 3000. Assuming an average of 3 adults per household, 350 houses from each area were selected totaling 1050 households and approximately 3000 adults. Institutional ethics committee had approved this study.

In the second stage, Wards were considered the primary sampling unit and these, households were selected as per the sampling scheme suggested by W.H.O with modifications on the number of clusters to get the required sample size i.e.: 50 clusters of 7 houses each. Field workers visited the three survey areas and obtained survey data from all adult residents above the age of 18 years from selected house clusters. A resident was defined as a person who had resided in the surveyed house for at least fifteen days in the previous three months. The fieldworkers conducted a 15-minute survey collecting details of demographic and socio-economic status (SES), medical history, lifestyle details and dietary pattern. Economic status was assessed indirectly using a scoring system looking at the type of house, household possessions etc and classified as poor, middle or high-income group. Physical activity was assessed by questionnaire and graded into four categories of sedentary, mildly active, moderately active and highly active.
The final study sample included 931 houses and 3069 adults. The surveyed population was invited to participate in the second phase of the study, which was conducted in their own locality. About 32% (n= 986) underwent the second phase of the study, which included physical evaluation and biochemical investigations organized in their locality (Fig.2.2). Though, ideally a randomly selected sample would have been preferable, due to practical problems this could not be done. Informed consent was obtained from all those who participated in the second phase of the study.
After signing informed consent document, all phase 2 participants underwent anthropometrical measurements such as height, weight, physical examination and biochemical evaluation for thyroid function, thyroid autoimmunity status and iodine status. Medical history verification, physical examinations including blood pressure (BP) and goiter evaluation were done by physician to minimize observer variation (Fig 2.3). Goiter was graded as per the definition provided by the WHO/UNICEF / ICUDD (1992).

Grade - 0  No goiter

Grade –1  A mass in the neck that is consistent with enlarged thyroid that is palpable but not visible. When neck is in normal position, it moves upward in the neck when the subject swallows.

Grade - 2  Swelling in the neck that is visible when neck is in normal position that is consistent with an enlarged thyroid when palpated.
Fasting venous blood sample was collected from all 986 subjects and transported to labs on ice (Fig 2.4). Serum was separated and stored in -70°C till analysis. Samples of urine were collected from 969 subjects in wide mouthed iodine free screw capped plastic container. Urine was refrigerated till analysis.
Serum Thyroid Stimulating Hormone (TSH), free Thyroxine (FT4) and free T3 (FT3), anti Thyroid peroxidase antibody (Anti TPO antibody), anti Thyroglobulin antibody (Anti TG antibody) were measured by Electro Chemiluminescence Immuno-Assay (ECLIA) using Elecsys 2010 Roche.

Urine iodine was estimated by simple microplate method using ammonium persulphite digestion and Sandell Kolthoff’s reaction at AIIMS IDD Lab, New Delhi [107].

2.3.2 DEFINITIONS

**Hypothyroidism** – Subjects who were previously diagnosed to have hypothyroidism and were taking levothyroxine and those with serum FT4 < 0.92ng/dl and TSH > 4.2uIu/ml were categorized as hypothyroid.

**Subclinical hypothyroidism** - those with normal serum FT4 and TSH > 4.2uIu/ml were classified as having subclinical hypothyroidism

**Hyperthyroidism** - Subjects who had been diagnosed to have hyperthyroidism and were on treatment for this condition and those with serum FT4 >1.71ng/dl and TSH <0.27uIu/ml were considered as having primary hyperthyroidism.

**Subclinical Hyperthyroidism** - Subjects with normal serum FT4 and TSH <0.27uIu/ml were considered as having subclinical hyperthyroidism.

**Abnormal TFT** – Those without any history of thyroid disease but having a thyroid function test which is not classifiable into any of the above four categories were classified into this group.

Anti TPO antibody levels more than 50Iu/ml and Anti TG antibody levels more than 325Iu/ml were considered positive for thyroid autoimmunity. Data was analyzed using SPSS version-11.0.
Table 2.1 Iodine status – Categories of urine iodine levels of the study subjects

<table>
<thead>
<tr>
<th>Median Urinary Iodine Concentration (mcg/L)</th>
<th>Corresponding Approximate Iodine Intake (mcg/day)</th>
<th>Iodine Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>&lt;30</td>
<td>Severe deficiency</td>
</tr>
<tr>
<td>20-49</td>
<td>30-74</td>
<td>Moderate deficiency</td>
</tr>
<tr>
<td>50-99</td>
<td>75-149</td>
<td>Mild deficiency</td>
</tr>
<tr>
<td>100-199</td>
<td>150-299</td>
<td>Optimal</td>
</tr>
<tr>
<td>200-299</td>
<td>300-449</td>
<td>More than adequate</td>
</tr>
<tr>
<td>&gt;299</td>
<td>&gt;449</td>
<td>Possible excess</td>
</tr>
</tbody>
</table>

2.4 RESULTS

The initial survey of 3069 subjects showed that 2.2% (67) of the population had already-diagnosed thyroid disorders and majority of these were females (M-7, F-60). Twenty four subjects had history of hypothyroidism whereas 12 gave history of hyperthyroidism. Among the population 98.4% were using iodized salt. Among the surveyed population, 986 subjects (M -389 F -587) participated in the second phase of the study. Mean age was 44.8 ± 14.9 years. Age and gender distribution of the study subjects are shown Fig. 2.5.

Majority of the study subjects (52.9%) belonged to middle income category whereas 30 % were from poor income category and 16.1% were from high income category. Three fourth of the subjects had less than high school education (75%) where as 25% had above high school education. According to the occupation and leisure time activities, 56% were engaged in mild physical activities, 40.6% were doing moderate physical activities whereas only 3.4% doing vigorous physical activities as part of their occupation. Only 5.35 of these subjects were strict vegetarians and 93.5% were nonvegetarians.

Among the female population 42.2% were in the postmenopausal period. Among the males 41.2% were teetotalers where as 12.9% were exalcohol users.
38.2% were social drinkers whereas 7.2% admitted to regular alcohol drinking. Among males 34% were current smokers whereas 24.5% were exsmokers whereas 41.3% of subjects never smoked. None of the females had smoking or alcohol using habits.

In this population 24 reported that they had hypothyroidism, 7 had hyperthyroidism whereas 8 subjects were not sure of type of their thyroid problem. Eight subjects had undergone thyroid surgery and a case of diagnosed papillary carcinoma undergoing treatment was also noted. Family history of thyroid disorder was present in 41 (4.6%) subjects (M 3.7% F 5.2%).

![Age and gender distribution of the study subjects (986)](image)

**2.4.1 IODINE STATUS**

Urine iodine estimations were done in 954 subjects. Results showed that median urine iodine excretion (UIE) was 211.4mcg/l (mean 220.3 ± 99.5mcg/L) suggesting iodine sufficiency. Iodine deficiency, UIE < 100 mcg/l was seen only in 15.1% of the subjects while 30.1% had UIE rate of > 300 mcg/l. There was no value above 500 mcg/l. Iodine deficiency was similar in all age groups but iodine excess was lower in older subjects (Fig. 2.6)
2.4.2 GOITER

The total prevalence of goiter was 12.2% (Grade 1 - 8.7%, Grade 2 - 3.5%) and was significantly higher (p < 0.001) in females than males (16.1% vs. 6.0%). Prevalence of goiter decreased significantly (p=0.02) with increasing age among females (Table 2.2). Though males ≥60 years had more goiter than young subjects, this difference was not statistically significant (p = 0.23).

The median UIE for goitrous subjects was within normal range, but was significantly (p= 0.006) lower than nongoitrous subjects (180mcg/l vs. 218mcg/l) suggesting possible role of iodine in the etiology of goiter. Goiter was more common among iodine deficient subjects (17.1%) compared to those with normal or high UIE (11.5%). Among the 117 subjects with goiter only 21.4% had iodine deficiency.

Anti TPO antibody was positive in 33% and Anti TG antibody was positive in 25% of the goitrous population. Neither iodine deficiency nor autoimmunity could be detected in 42% of goitrous people. Regarding thyroid function status of goitrous subjects, 18.4% had hypothyroidism, 13.2% had subclinical hypothyroidism and 4.3% had hyperthyroidism and the rest (64.1%) were euthyroid.
Table 2.2 The prevalence of different grades of goiter among both genders

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Goiter %</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Grade 1</td>
<td>Grade 2</td>
</tr>
<tr>
<td>&lt; 40</td>
<td>6.5</td>
<td>20.1</td>
<td>15.1</td>
<td>10.1</td>
<td>5</td>
</tr>
<tr>
<td>40 – 60</td>
<td>3.8</td>
<td>15.4</td>
<td>10.9</td>
<td>7.9</td>
<td>2.7</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>9.1</td>
<td>8.7</td>
<td>8.9</td>
<td>6.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

2.4.3 THYROID FUNCTION STATUS

Subjects taking amiodarone, lithium and subjects with pregnancy were excluded from this analysis. Biochemical evaluation of thyroid status among 971 subjects showed 19.6% had thyroid function abnormalities; subclinical hypothyroidism being the most common disorder (Table 2.3). Thyroid dysfunction was found significantly (p<0.001) more frequently among females than males. Thirty-four subjects had TFT, which were not classifiable without repeat testing.

2.4.3.1 OVERT HYPOTHYROIDISM

There were 24 self-reported hypothyroid patients in the study population, among these 17 were on levothyroxine replacement, while 7 were not on any treatment. 58.2% of those on treatment had TSH value >4.2uIu/ml suggesting inadequate replacement therapy.

After biochemical evaluation, 14 new cases of hypothyroidism were diagnosed, indicating prevalence of hypothyroidism as 3.9%. Hypothyroidism was significantly higher (p<0.001) among females (6%) than males (0.8%). Among subjects with hypothyroidism only 13.6% had positive family history of thyroid problems compared to 4% in subjects with normal thyroid function. Fifty six percent of the hypothyroid subjects had goiter (34.2% Grade 1 and 21.1% Grade 2). Autoimmunity was the most common cause of hypothyroidism since 68.4% (26/38)
of hypothyroid patient were anti TPO antibody positive whereas only 30.8% were Anti TG antibody positive. Median UIE of hypothyroid subjects was 203mcg/l.

Table 2.3 Pattern of Thyroid Dysfunction among the study population (971)

<table>
<thead>
<tr>
<th>Thyroid Status</th>
<th>Males (383)</th>
<th>Females (588)</th>
<th>Total (971)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal TFT</td>
<td>332 (86.7%)</td>
<td>449 (76.4%)</td>
<td>781 (80.4%)</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>3 (0.9%)</td>
<td>35 (5.9%)</td>
<td>38 (3.9%)</td>
</tr>
<tr>
<td>Hyperthyroidism</td>
<td>5 (1.3%)</td>
<td>8 (1.4%)</td>
<td>13 (1.3%)</td>
</tr>
<tr>
<td>Sub. hypothyroidism</td>
<td>24 (6%)</td>
<td>67 (11.5%)</td>
<td>91 (9.4%)</td>
</tr>
<tr>
<td>Sub. hyperthyroidism</td>
<td>2 (0.8%)</td>
<td>12 (1.9%)</td>
<td>14 (1.4%)</td>
</tr>
<tr>
<td>Abnormal TFT*</td>
<td>17 (4.7%)</td>
<td>17 (2.1%)</td>
<td>34 (3.4%)</td>
</tr>
<tr>
<td>Total abnormalities</td>
<td>51 (13.3%)</td>
<td>139 (23.6%)</td>
<td>190 (19.6%)</td>
</tr>
</tbody>
</table>

(*Abnormal TFT means abnormal values, which cannot be classified into any 5 categories)

2.4.3.2 SUBCLINICAL HYPOTHYROIDISM

Subclinical hypothyroidism with normal free T4 and high TSH was the most common thyroid function abnormality present in the population (9.4%). This was significantly more common in females (11.4 %) than males (6.2%) (p<0.001). Prevalence of this condition increased steadily with age (Fig.2.7), especially in females. Sixteen percent of subclinical hypothyroid subjects had goiter (Grade 2 1.1% and the rest being Grade 1). Fifty three percent of subclinical hypothyroid subjects had positive anti TPO antibody, while only 30.8% had positive anti TG antibody. Median UIE of hypothyroid subjects was 203mcg/l.
2.4.3.3 HYPERTHYROIDISM AND SUBCLINICAL HYPERTHYROIDISM

Overt hyperthyroidism was present in 1.3% of the population; whereas 1.4% had subclinical hyperthyroidism. Among hyperthyroid patients 39% had goiter (Grade 1 15.4% and Grade 2 23.4%), 35.7% had positive anti TPO antibodies, while 30.8% had anti TG antibodies. There were no cases of T3 thyrotoxicosis in this cohort. Median UIE of hyperthyroid subjects was significantly (p=0.05) higher (336.6mcg/l), while that of subclinical hyperthyroidism was significantly lower (93.5mcg/l) than the rest of the population.

![Graph](image)

Fig. 2.7 Relationship between thyroid dysfunction and age

Unclassified thyroid functional abnormalities were those, which could not be classified into any of these 4 categories. There were 3 subjects whose results were suggestive of central hypothyroidism (low FT4 and low TSH levels) and one suggestive of central hyperthyroidism or thyroid hormone resistance (high FT4 and high TSH). There were 10 subjects who had low FT4 and, 20 who had high FT4 with normal TSH value.
2.4.4 THYROID ANTIBODIES

Among the study population anti TPO antibody was positive in 16.7% anti TG antibody was positive in 12.1% of the subjects and both antibodies were positive in 57 patients (5.8%). Females had significantly higher prevalence of both antibodies than males [anti TPO antibody 19.8% vs. 11.8% (p<0.001) and anti TG antibody 15.1% vs. 6.1% (p<0.001)]. In the population with normal thyroid function only 9.5% had positive Anti TPO antibody and 8.5% were anti TG antibody positive whereas among those with thyroid functional abnormalities 46.3% had positive anti TPO antibody and 26.8% were anti TG antibody positive. Family history of thyroid dysfunction was seen only in 5.6% of subjects with thyroid autoimmunity compared to 4.2% in the antibody negative population.

2.4.5 CORRELATIONS

As the sample size of each type of thyroid dysfunctions was not large enough, the subjects with thyroid function abnormalities were considered together as a group and were compared with euthyroid subjects. Univariate analysis of different variables was done to evaluate the associations of thyroid functional abnormalities in this population. Variables included were age, gender, economic status, education status, BMI, family history of thyroid disease, goiter, urine iodine levels and presence of anti-thyroid antibodies. Among them female gender (p<0.001), presence of goiter (p<0.001), presence of anti TG antibody (p<0.001) and presence of anti TPO antibody (p<0.001), were only found to be significantly associated with thyroid functional abnormalities.

Logistic regression analysis was done including those variables with a p-value of 0.2. The results showed that odds of getting thyroid dysfunction females is 1.67 times more than in males (p=0.015). Subjects with goiter were more likely to have thyroid dysfunction compared to normal subjects (OR = 1.79, p=0.002). Positive anti-TPO was found to be stronger predictor of thyroid disease (OR = 6.82, p<0.001) than positive anti-TG (OR = 1.98, p=0.006).
2.5 DISCUSSION

The present study has described the pattern of thyroid disorders at community level in an iodine sufficient adult population of south India for the first time and the results are very different from the pattern reported in many other countries.

About three decades ago Wickham survey [108] conducted between 1972 and 1974, among the adult population of UK (n=2779) demonstrated prevalence of goiter (Grade1=8.6%, grade 2=6.9%), hyperthyroidism (M=2.3% F=2.7%), hypothyroidism (M=1%, F=1.4%), first time for a Caucasian population. After that the nationwide survey conducted among US population (9–12 years) showed that 4.6% of them had hyperthyroidism whereas 1.3% had hypothyroidism but prevalence varied between different races. The results also indicated that a large proportion of the US population has undetected thyroid dysfunction and that screening is highly essential [109]. A study from an iodine sufficient area of Denmark had shown that prevalence of hypothyroidism and subclinical hypothyroidism was 0.4% and 4.0% respectively, whereas prevalence of hyperthyroidism was 1.3% [110]. But in an iodine sufficient Japanese population, prevalence of hypothyroidism and hyperthyroidism were much lower (1.39% and 0.61% respectively) [111].

In India, previous nationwide surveys among school children in the post iodization phase [50] has shown much lower incidence of thyroid disorders even among goitrous subjects compared to our study. The total prevalence of hypothyroidism was only 0.79% whereas subclinical hypothyroidism was 4.9%. But prevalence of hyperthyroidism (1.0%) was similar to the present study. It also showed a persistently high prevalence (23%) of goiter and comparatively higher UIE for goitrous subjects suggesting the role of other factors such as autoimmunity and goitrogens as causative agents in children. But the present study among an adult population shows a lower goiter rate but higher prevalence of thyroid dysfunction
than children. This could be the influence of aging or other environmental chemicals on thyroid function and pathology. A recent large study in school children in Delhi showed a goiter prevalence of 9.2% [106]. In a small study conducted in iodine deficient adult population of Sikkim state had shown that functional decompensation occurs in majority of goitrous subjects [112]. But in the present study only 36% of the goitrous subjects had thyroid dysfunction. Another community survey of iodine deficient adult population in Gujarat, a state the western part of India in had assessed the TSH status of the study subjects and found that 7% of them had high TSH value [113]. Such a study on iodine sufficient adult population from India is lacking and hence a direct comparison with our results was not possible. However this study showed much higher prevalence of thyroid disorders among adults than previously hypothesized based on children data [48].

This study showed that though median UIE was lower in goitrous subjects it was higher than the suggested normal range. This higher prevalence of goiter despite sufficient iodine levels points to the role of other unidentified goitrogen exposure in the community which may be difficult to identify.

The urine iodine excretion rates of the study population were adequate. Results of the previous studies of iodine status conducted among school children in Ernakulam district [114] as well as entire Kerala state [115] had also shown that median UIE was adequate. 97.4% of the study population was using iodized salt, and were mainly non-vegetarian coastal population with high fish intake in their regular diet. These factors could have contributed to the iodine levels seen in this study. Though 30% subjects had higher than adequate (>300 mcg/l) UIE, there was no value above 500mcg/l which would have suggested over iodization. Neither high nor low iodine levels were found be correlating with thyroid dysfunction when compared with euthyroid subjects.
But UIE was significantly higher for hyperthyroid subjects suggesting the possible role of more than adequate iodine levels in the etiology of this condition. On the contrary UIE was significantly lower in subjects with subclinical hyperthyroidism. This is similar to the results seen in studies conducted in areas recently attained iodine sufficiency suggesting a possible protective role of high iodine level against subclinical hyperthyroidism [21, 116].

Among thyroid dysfunction subclinical hypothyroidism being the most common condition, its prevalence was significantly higher among females and steadily increased with increasing age among females. This is much higher than the prevalence reported by similar studies in other countries [7, 109-111, 117]. In fact these results may represent the pattern of thyroid dysfunction seen during the transition of one area from iodine deficiency to sufficiency. Studies have clearly shown that prevalence of subclinical hypothyroidism and autoimmune thyroid disorders increases with increasing iodine status of the population [111, 118, 119] though some other studies have not shown this trend [120]. It is also known that a high iodine intake is associated with lower goiter prevalence and higher prevalence of hypothyroidism whereas, as lower iodine intake is associated with higher prevalence of hyperthyroidism [121]. But there is no pre iodization data available for present study population to make a more meaningful comparison of these findings.

Unclassified thyroid dysfunction was seen in 30 subjects in this cohort. These may represent the subjects who are having thyroiditis or those on the recovery phase of thyroiditis or sick euthyroidism etc. These abnormalities could also be due to the effect of drugs such as salisylates or beta-blockers etc or due to the rare presence of thyroid hormone antibodies [122, 123]. Even drugs like metformin taken by many diabetic patients can also cause low TSH. These subjects need further follow up to have a correct diagnosis.
The results of this study have shown that female gender and presence of goiter are more predictive of thyroid dysfunction and this is similar to the results of other studies. Among subjects with thyroid dysfunction, autoimmunity was the commonest etiology of these disorders. Positive anti TPO antibody is found to be correlating strongly with thyroid dysfunction than anti TG antibody. This suggests that anti TPO antibody alone is a much better predictor of thyroid dysfunction, which can be used reliably in clinical practice. Family history of thyroid disease was not seen as a significant factor in this study whereas about 50% of the thyroid autoimmune cases had positive family history in Caucasian population. Iodine status, economic status, educational level and age were not significantly associated with thyroid dysfunction.

This study has some limitations. This was done in coastal urban area and may not represent the data from high land or mid land area though previous statewide surveys of iodine status have not shown much difference between these areas. The sample size is rather small compared to many other studies abroad and the study population had more females than males. Those who had abnormal TFT, which do not fit into any groups, could not get their TFT repeated, as we have not followed up these subjects. We have not assessed the nodularity of the goiter and FNAC of goiters were not done. We did not assess the urinary excretion of goitrogens among this population, which could have given lot of valuable information.

2.6 CONCLUSION

To summarize, this study clearly showed that undetected thyroid disorders are very high in this iodine sufficient community necessitating development of appropriate screening strategies to detect and treat these conditions considering the magnitude of health problems it can cause to the population.

The high prevalence of subclinical hypothyroidism should be viewed with due importance in this population considering its potential to cause dyslipidemia and cardiovascular disease. This also suggests the need for larger studies with adult
population from across the nation to get a clearer profile of thyroid disorders in India. Finally, this highlights the fact that in addition to iodine deficiency diseases, other thyroid disorders too need to be given equal importance in adult populations, especially in regions, which are moving from iodine deficiency to iodine sufficiency.