CHAPTER 11

CONCLUSION

The prevalence and pattern of various diseases vary from country to country over the decades. Epidemiological surveys have proved to be a valuable source of inputs into this much needed vital statistics. Such data is very essential to estimate the magnitude and impact of any disease in order to design preventive and curative strategies. Moreover, this information is very crucial for the policy makers in the health care sector in order to make decisions on fund allocation and priority fixation, especially in countries with limited resources. Since it has many limitations hospital based disease statistics cannot replace epidemiological data.. As the clientele of each hospital vary widely depending on the population it caters for, the data may not give the true picture of the disease burden in the community.

Even after many decades of independence, there is a gross lack of epidemiological data from India especially on non-communicable diseases such as diabetes mellitus, obesity, hypertension, dyslipidemia and thyroid disorders. However, regarding diabetes and other cardiovascular risk factors there have been few national and regional cross sectional community studies, though population of Kerala with very high health indices were not adequately represented in them. Regarding thyroid disorders there are no epidemiological data on adults other than the study on iodine deficient population of Gujarat done many years ago. However the prevalence thyroid disorders were hypothesized as about 6% as an extrapolation of the data from children.
Hence the purpose of this work was to generate valuable epidemiological data regarding the iodine status, thyroid disorders, and diabetes mellitus in an adult south Indian population from Kerala.

Initial study was conducted as a cross sectional house to house survey of population aged 18-80 years in Ernakulam district. Among 3024 subjects surveyed, 986 participated in clinical examination and biochemical tests. Iodine status of this adult population was assessed for the first time and was found to be Iodine sufficient. Iodine deficiency was seen only in 15.1% of these subjects while 30.1% had more than adequate iodine levels. This may be due to the widespread use of iodized salt as well as the consumption seafood mainly fish. 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%). The prevalence of goiter was found to be higher than expected for an iodine sufficient population and this was similar to the finding observed in studies among children.

Among these subjects 19.6% had thyroid function abnormalities; subclinical hypothyroidism being the commonest disorder. More importantly for many subjects it was newly detected. This is much higher than the previously hypothesized prevalence figure (6%) which was an extrapolation from children’s data. Among the study population anti TPO antibody was positive in 16.7% and anti TG antibody was positive in 12.1% of the subjects. Both antibodies were positive in 57 patients (5.8%). In the population with normal thyroid function only 9.5% had positive Anti TPO antibody and 8.5% were anti TG antibody positive whereas of those with thyroid functional abnormalities 46.3% had positive anti TPO antibody and 26.8% were anti TG antibody positive. Thyroid dysfunction, goiter and autoimmunity were significantly higher in females than males and this was similar to the findings in other parts of the world. Though there have been similar studies in many other countries these are the only community data available especially on an iodine sufficient Indian adult population which comprehensively evaluated all aspects of thyroid disorders.
Hence these data are widely quoted by other researchers and also frequently referred by national bodies and other authors as reference data.

The results of this study showed the prevalence of known diabetes as 9.2% and total Diabetes as 19.1% in this urban population. Increasing age, positive family history of DM, increasing BMI, male gender, high STR and presence of AN turned out to be the significant variables associated with high risk of diabetes. Obesity (BMI >25) was present in 31.7% of the study subjects and was significantly higher in females (35.8%) than males (25.3%). In this study population 20.2% had history of hypertension and after evaluation total prevalence of hypertension was 32% (M 32.5% vs. F 31.8% p NS). In this population 32% had high cholesterol and 23.2% had high triglycerides. Diabetes prevalence seen in this study has been widely quoted as probably the highest in India, by many international journals.

Another important observation of comparable prevalence of thyroid dysfunction in type 2 diabetic and non-diabetic subjects in this community was contradictory to the results of some clinic based studies which showed higher prevalence of thyroid problems in diabetic subjects. There are no similar community based studies from this part of the world during the last 2 decades which looked at this interesting relation between diabetes and thyroid.

After assessing the magnitude of thyroid problem in the general population as a second step another cross sectional community survey of middle age and above females subjects (above 35years), with highest prevalence of thyroid problems was conducted in another area of Kochi corporation. Among the 540 subjects surveyed 508 subjects participated in the clinical examination, ultrasound evaluation of thyroid as well as biochemical assessment. From this population, 471 subjects with full data were analyzed. Results showed that diabetes was present in 19.1% and hypertension was seen in 21.4% of these subjects. Obesity was present in 44.2% of subjects and
high cholesterol was seen in 19.7% and high triglyceride was seen in 14.1% of females.

Median UIE of these subjects was 162.8 mcg/l suggesting iodine sufficiency. UIE had negative correlation with age and systolic BP, but had no correlation with TV, thyroid nodularity, FT4, TSH or anti TPO antibody levels.

Known thyroid problems were present in 7.2% of females but after testing thyroid dysfunction was present in 31.3% of subjects. Commonest problem was subclinical hypothyroidism (17.1%) followed by hypothyroidism (10.5%). The mean TV of the normal healthy females in this population (n109) was 8.80 + 3.1 ml. The 3rd centile of TV was 4.58ml and 97th centile of TV was 15.3 ml and volume higher than this can be considered as goiter for this population. This is the first time normal volume is defined for any adult Indian population. Age and postmenopausal state showed strong negative correlation with TV whereas triceps and subscapularis skin fold thickness showed positive correlation. In these subjects, 15.7% had clinical Goiter. Abnormal sonographic findings were seen in 30% of the subjects were as follows: - Nodular changes were seen in 18.7%, diffuse goiter in 10%, subcentimetric nodules in 5.7%. Thyroid structural abnormalities were more common among subjects with age more than 50yrs and those with goiter.

Among these females 24% had thyroid autoimmunity as evidenced by positive anti TPO antibody which had significant correlations with TSH and thyroid volume. However, only about 40% of the goiters and thyroid dysfunction had autoimmune etiology which much less than western data. Overall the results of these two studies have shown the pattern of thyroid dysfunction, goiter prevalence and diabetes in this iodine sufficient population. Iodine status of these study populations was found to be sufficient probably due to the consumption of iodized salt and seafood. Prevalence of goiter was higher than expected for an iodine sufficient adult population suggesting possible presence of
unidentified goitrogens. Thyroid dysfunction was found to be much higher than previously hypothesized and commonest disorder was subclinical hypothyroidism followed by overt hypothyroidism. This pattern may be what is observed in areas previously iodine deficient after attaining iodine sufficiency. Considering the fact that the IDD survey in 1984-86 had classified Kerala as a state with iodine deficiency and subsequently ICMR survey in 2001 reporting iodine sufficiency may support this explanation. Lack of data on pattern of thyroid dysfunction in the pre iodization era makes it difficult to draw any firm conclusions. Furthermore, similar studies conducted after a decade or so in the same population can only provide more definite answers to these questions. However, the fact that only about 40% of the goiters and thyroid dysfunction had autoimmune etiology unlike the data from other parts of the world where this percentage is around 80-100% points to the possible role of unidentified factors such as environmental toxins contributing to thyroid dysfunction in this population which can be evaluated only by needs further large studies in future.

11.1 WHAT THIS STUDY HAS ACHIEVED?

This study concluded that diabetes mellitus, obesity and thyroid disorders are common problems in this community and majority of these problem remain undetected. This studied population is iodine sufficient and current iodine levels appear to have no significant etiological role in goiter, thyroid structural abnormalities, thyroid autoimmunity or thyroid dysfunction. Goiter prevalence is higher than that is recommended for iodine sufficient population. Subclinical hypothyroidism is the commonest thyroid disorder seen in this population. Thyroid autoimmunity is present in 40-50 % of goiters and thyroid dysfunction. But for almost 50-60% of the thyroid problems no apparent etiological factors were present. Moreover the normal thyroid volume of an iodine sufficient adult female population was documented in Kerala population. Considering the fact that the treatment of thyroid dysfunction is very cheap and effective, early detection of thyroid problems in the high risk population can be very rewarding in terms of preventing loss of
productivity and long term morbidity of the population. The findings of this study would also help to increase the awareness of medical personnel about the high prevalence of thyroid disorders in our population so that they can have a high index of suspicion for testing especially in high risk patient groups.

**Salient findings from this study are listed as follows:**

- Iodine status of adults was evaluated and found to be iodine sufficient
- Prevalence of thyroid disease burden is identified as much higher (19.7%) than previously hypothesized (6%) from children data.
- Prevalence of goiter in adults was described as 12.6% in this iodine sufficient population.
- Prevalence and spectrum of thyroid disorders were identified in adult Indian population and subclinical hypothyroidism was found to be the commonest disorder in this population for the first time.
- Autoimmunity is found to be responsible for about 40-60% of thyroid disorders
- Prevalence of diabetes and IGT and other co morbidities like hypertension, obesity and dyslipidemia were described for a Kerala population for the first time and diabetes prevalence was found to be probably the highest reported from India
- Population prevalence of acanthosis nigricans, the simple cutaneous marker of insulin resistance was described (16%) for the first time in Indian population
- For the first time in an Indian community type 2 diabetes patients were found to have similar prevalence of thyroid problems as non-diabetic subjects
- Normal thyroid volume of females above 35 years is recognized as 8.3ml for iodine sufficient population for the first time in India
Sonological abnormalities of thyroid gland are described for the first time in an adult female population.

To sum up this study has provided valuable epidemiologic data on important endocrine disease in an Indian adult population for the first time. Though regional and of small sample size compared to many studies from western world, this data should act as an eye opener to motivate health agencies to conduct nationwide surveys in this field. Until such data is generated these results are invaluable for health care sector and policy makers like the Government of India while planning and developing national strategies to tackle these health problems.

11.2 FUTURE SCOPE FOR RESEARCH

The findings of this study open many new questions. Thyroid disorders are quite common in our population and are more than diabetes in older females. But iodine status or autoimmunity do not explain all thyroid dysfunction or goiter. Others than these two common factors there are genetic and environmental factors which can affect thyroid volume, thyroid hormone levels as well as autoimmunity. Possible role of environmental pollutants such as perchlorate, pesticides, triclosan, tobacco etc need to be evaluated to get answers to these questions. But estimation of these factors are expensive and beyond the scope of this study. Hence to address these issues further large studies should be designed. Another important aspect is the incidental relation of Iodine and non-thyroidal illness such as hypertension, which can be further explored in view of the increasing burden of cardiovascular diseases.