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Thyroid Dysfunction in a Cross Section of Population in Dhaka City

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Abstract

Thyroid disorders are highly prevalent in the world population. The aim of this study was to investigate the thyroid dysfunction and its correlation with serum thyroid hormones among a cross-section of population in Dhaka City, Bangladesh. Microparticle enzyme immuno-assay (MEIA) and fluorescent polarization immuno-assay (FPIA) method were used to analyze the level of thyroid stimulating hormone (TSH), triiodothyronine (T3) and thyroxin or tetraiodothyronine (T4) in serum. A total of 289 individuals (95 males and 194 females), aged 10-77 years were studied and thyroid dysfunction was found among 10.03% of individuals (males 8.42% and females 10.82%); of them 3.46% were subclinical hypothyroidism, 3.80% hypothyroidism, 1.73% subclinical hyperthyroidism, and 1.04% hyperthyroidism. The prevalence of subclinical hypothyroidism was significantly higher in females than males. Also, Thyroid dysfunction was found higher in middle age than earlier and older age groups in both males and females.

Key words: Thyroid dysfunction, thyroid stimulating hormone (TSH), triiodothyronine (T3), tetraiodothyronine (T4)

Introduction

Thyroid disorders are one of the most important public health problems of the world[1]. It is common in the general population and the prevalence increases with age[2]. In general, if there is too little thyroid hormone in the body, then it is called hypothyroidism, or if too much thyroid hormone, then it is called hyperthyroidism. The vast majority of thyroid disease is the "hypo-type". Both forms can occur at any age, but hypothyroidism is more common as people get older, especially in older women[3]. It is usually autoimmune in origin, presenting as either primary atrophic hypothyroidism or Hashimoto's thyroiditis[4].

The thyroid gland is a butterfly-shaped gland in the front of the neck. It influences many systems of our body, especially the speed of our metabolism – the more the hormone, the faster our metabolism goes. Hypothyroidism symptoms, even when sub-clinical, include: fatigue, cold extremities, low body temperature, poor skin healing, dry skin, coarse hair, loss of the outer third of the eyebrows, constipation, poor immune function, depression, increased blood cholesterol, blood pressure problems, fibro-cystic breasts, long menstrual periods, infertility, mild diabetes, muscle pains and in pregnancy and childhood, mental retardation and developmental delay. Hyperthyroidism, which is less common, can manifest as anxiety, sleep disturbance, heart palpitations, thin, oily skin and hair, frontal hair loss, bulging eyes (called Graves disease) and other biochemical abnormalities such as osteoporosis. Both forms can occur at any age, but hypothyroidism is more common as people get older. Many women develop thyroid disease in association with pregnancy or menopause. There is a complex relationship between the thyroid, sex, adrenal and sugar-controlling hormones; if one goes off, the others often follow[3].

The problem of thyroid disorder is extensive in our country, even more than that of other developing countries[5]. Thyroid disorder has wide range of aetiology. So, its diagnosis is very difficult and no single method can help in evaluating the thyroid[5]. The type of evaluation can vary from very simple blood tests, to more complex procedures that are only done in special cases. Most doctors begin with a TSH, or thyroid stimulating hormone. This is a hormone made by the pituitary gland (in the brain), which tells the thyroid how much hormone to make. High TSH means the pituitary thinks there is not enough thyroid hormone, which is the situation with hypothyroidism. Low TSH implies hyperthyroidism. The other common test is the actual amounts of thyroid hormone in the blood. The most common, T_4, can be measured several ways. In the body, T_4 is converted to T_3, which is approximately ten times more active than T_4. It is important to measure T_3 as well as T4. So, if these tests are normal, then it is assumed that the thyroid system is working adequately[3]. The purpose of this study was to investigate the thyroid dysfunction and its relationship with thyroid hormones of a cross section of population in Dhaka City based on age and sex.

Materials and Methods

Study population: Blood samples were obtained from the total of 3,245 individuals having endocrine disorder, of them 289 subjects (95 males and 194 females) were screened as suspected for thyroid dysfunction in Dhaka City during April 2008 to March 2009. The personal information of patients was recorded.

Clinical specimen: For the determination of thyroid hormones (T_3, T_4 and TSH), a total 289 blood samples were taken from the patients.

Determination of thyroid hormones: Blood samples were collected by venepuncture from patients and control. The samples were allowed to clot and the serum separated by centrifugation at 10,000 rpm for 15 min at room temperature. Serum samples were stored at -20°C until tested. T_3, T_4 and TSH levels were measured by microparticle enzyme immuno-assay (MEIA) method and fluorescent polarization Immuno-assay (FPIA) method using AxSYM autoanalyzer (Abbott, USA). Normal range values were 0.80-2.00 ng/ml for T_3, 4.50-12.00 µg/dl for T_4 and 0.47-5.01 µIU/ml for TSH. Subclinical hypothyroidism was defined as an elevated TSH level (10.0 µIU/ml) together with normal serum thyroid hormone (T_3 and T_4) levels. Hypothyroidism was defined as an elevated TSH together with a decreased serum thyroid hormone level. Subclinical hyperthyroidism was defined as a decreased TSH (0.30 µIU/ml) together with normal thyroid hormone (T_3 and T_4) level and hyperthyroidism was defined as a decreased TSH together with elevated or normal thyroid hormone levels.

Statistical analysis: Data analysis was performed using SPSS software version 10 (Chicago, USA). The results were presented as mean ± SE.

Results

The present study was conducted over a period of one year (April 2008 March 2009). A total of 289 individuals (male 95, female 194), aged between 10 and 77 years were recruited in this study. Blood samples (n = 289) were obtained from the patients with suspected thyroid dysfunction. Among them, males and females were 32.87% and 67.13% respectively. The total suspected individuals (thyroid dysfunction, 289 subjects) were categorized according to five age groups (0-15, 16-30, 31-45, 46-60 and >60). In the early age group (0-15) suspected (thyroid dysfunction) patient was 3.61% (males 0, females 3.61%). Then the rate was increased sharply with advancing age. The highest prevalence in the middle age group (31-45) was observed 41.16% (males 42.11%, females 40.21%). Then it was significantly decreased with increasing age. However, in case of male high rate was also found in the age group of 46-60 (38.95%) (Fig. 1).

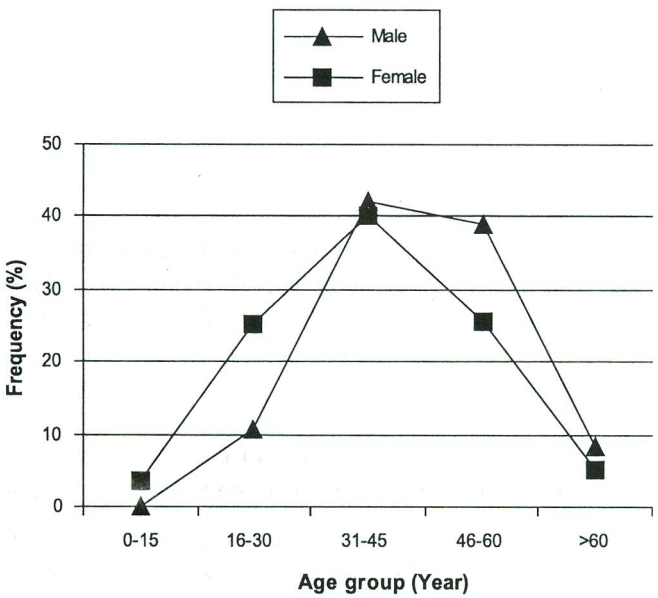

Fig. 1: *Age and gender distribution of suspected patients with thyroid dysfunction (n = 289).*

Among 289 people of different age group, thyroid dysfunction was found in 29 subjects (10.03%) (Fig. 2a); of them males were 8.42% (8 of 95) and females were 10.82% (21 of 194) (Fig. 2b).

Considering the positive individuals (thyroid dysfunction, 29 subjects), it was observed that the highest rate of thyroid dysfunction was found in age group 31-45 years in case of male and 46-60 years in case of female. It is notable that in the middle age group (31-45 years), the percentage of thyroid dysfunction in females was much higher than in males (females: 52%, males: 25%) but in the late age group (46-60 years) the values were reverse (females: 10%, males: 50%). Both in early and older age group the prevalence rates were very low both in case of male and female (Fig. 3).

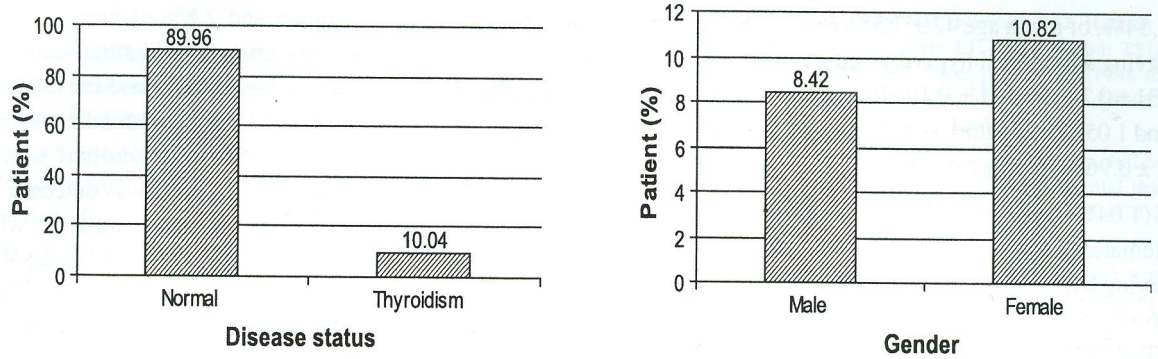

Fig. 2: *Thyroid dysfunction among total (n = 289) individuals (a) with gender (b).*

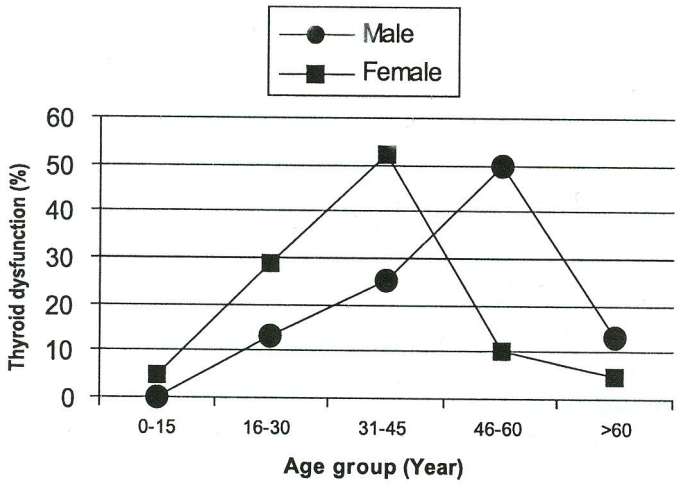

Fig. 3: *Pattern of thyroid dysfunction with age and gender (n = 29).*

The patients of subclinical hypothyroidism, hypothyroidism, subclinical hyperthyroidism and hyperthyroidism were categorized on the basis of TSH, T_3 and T_4 level in the serum according to the method described above and the percentage of those four types of thyroidisms were 1.05, 4.22, 2.10 and 1.05% in case of male and 4.64, 3.61, 1.54 and 1.03% in case of female respectively (Table 1).

Table 1: ***Nature of thyroid dysfunction in relation to gender***

Dysfunction	Frequency, No. (%)		
	Male	Female	Total
Subclinical hypothyroidism	1 (1.0)	9 (4.6)	10 (3.5)
Hypothyroidism	4 (4.2)	7 (3.6)	11 (3.8)
Subclinical hyperthyroidism	2 (2.1)	3 (1.5)	5 (1.7)
Hyperthyroidism	1 (1.0)	2 (1.0)	3 (1.0)
Total	8 (8.4)	21 (10.8)	29 (10.0)

In case of subclinical hypothyroidism we found total ten subjects (3.46%), including one male (1.05% of mean age 28 ± 0 years) and nine females (4.64% of mean age 37 ± 2.64 years). The mean TSH (mean ± SE) values of males and females were 10.02 ± 0 µIU/ml and 27.61 ± 10.49 µIU/ml respectively. For T_3 it was 1.23 ± 0 and 0.98 ± 0.08 ng/ml respectively, and for T_4 it was 5.96 ± 0 and 7.33 ± 0.79 µg/dl respectively (Table 2).

Eleven subjects (3.80%), four males (4.22%, of mean age 50.5 ± 8.08 years) and seven females (3.61%, of mean age 35.14 ± 6.94 years), were diagnosed as having hypothyroidism. The mean TSH value was 74.61 ± 20.60 (in males) and 69.99 ± 10.84 µIU/ml (in females). For T_3 it was 0.71 ± 0.14 and 1.02 ± 0.23 ng/ml, and for T_4 it was 3.67 ± 1.75 and 2.50 ± 0.59 µg/dl for males and females respectively. Two male (2.10%, of mean age 53.5 ± 1.50 years) and

Table 2: ***Mean values of Age, T3, T4 and TSH in thyroid dysfunction subjects (n = 29)***

Dysfunction	Male				Female			
	Age	T3	T4	TSH	Age	T3	T4	TSH
Subclinical hypothyroidism	28 ± 0	1.23 ± 0	5.96 ± 0	10.02 ± 0	37 ± 2.64	0.98 ± 0.08	7.33 ± 0.79	27.61 ± 10.49
Hypothyroidism	50.5 ± 8.08	0.71 ± 0.14	3.67 ± 1.75	74.61 ± 20.60	35.14 ± 6.94	1.02 ± 0.23	2.50 ± 0.59	69.99 ± 10.84
Subclinical hyperthyroidism	53.5 ± 1.50	1.05 ± 0.14	7.16 ± 1.04	0.31 ± 0.22	42 ± 7.58	1.05 ± 0.07	9.81 ± 0.96	0.21 ± 0.10
Hyperthyroidism	54 ± 0	1.58 ± 0	15.02 ± 0	0.02 ± 0	29 ± 7.02	5.26 ± 2.74	18.54 ± 5.47	0.16 ± 0.14

Data was represented as Mean ± SE. T3 = Triiodothyronine; T4 = Tetraiodothyronine; TSH = Thyroid stimulating hormone.

three female (1.54%, of mean age 42 ± 7.58 years) subjects were diagnosed as having subclinical hyperthyroidism with the mean TSH value of 0.31 ± 0.22 and 0.21 ± 0.10 μIU/ml, the mean T_3 value of 1.05 ± 0.14 and 1.05 ± 0.07 ng/ml, and the mean T_4 value of 7.16 ± 1.04 and 9.81 ± 0.96 μg/dl respectively.

Three subjects (1.04%), one male (1.05%, of mean age 54 ± 0 years) and two females (1.03%, of mean age 29 ± 7.02 years), were diagnosed as having hyperthyroidism. The mean TSH value was 0.02 ± 0 and 0.16 ± 0.14 μIU/ml, for T_3 it was 1.58 ±0 and 5.26 ± 2.74 ng/ml, and for T_4 15.02 ± 0 and 18.54 ± 5.47 μg/dl in males and females respectively. The rate of subclinical hypothyroidism was about four times higher in females than in males. But, the rate was lower in males than in females in case of hypothyroidism, subclinical hyperthyroidism and hyperthyroidism.

In case of male, the mean age range of the patients was from 28 ± 0 to 54 ± 0 years but in females the range was from 29 ± 7.02 to 42 ± 7.58 years (Table 2). Hypothyroidism, subclinical hyperthyroidism and hyperthyroidism were found in males at the late age (46-60 years), but in case of females the dysfunctions were found in middle age (31-45 years) (Table 2, Fig. 3).

Discussion

Thyroid disorders are common in the general population. The incidence of thyroid dysfunction increases with advancing age[6]. The major disorders (problems) of thyroid gland are hyperthyroidism and hypothyroidism, which have been reported in over 110 countries of the world with 1.6 billion people at risk[7]. The overall thyroid dysfunction in general population of Bangladesh is 10.03% in our study, which is lower than a previous study in Iran[8]. The prevalence of thyroid dysfunction increases with advancing age and in subjects with thyroid antibodies[9-13], which supports our study.

The prevalence of hyperthyroidism/thyrotoxicosis and hypothyroidism vary in different countries[7]. In our study, the prevalence of subclinical hypothyroidism, hypothyroidism, subclinical hyperthyroidism and hyperthyroidism was 3.46, 3.80, 1.73 and 1.04% respectively, which are lower than a study in Pakistan, where the prevalence of these thyroidisms was 5.4, 4.1, 5.8 and 5.1% respectively[7].

The prevalence of subclinical hypothyroidism in America is about 4.3%[14], Brazil 5%[15], Japan 8.7%[16], England 8%[17] and Libya 6.18%[18]. The prevalence rate of hypothyroidism in our study was 3.8%, which was higher than that reported among Japanese (1.1%)[16], Brazilians (1.4%)[19] and Libyan (1.2%)[18] studies. In case of subclinical hyperthyroidism (1.73%) was also higher than a previous studies[18,20-21]. These studies showed a lower incidence of subclinical hyperthyroidism among middle-age subjects and a higher incidence among subjects more than 60 years old. Prevalence of hyperthyroidism (1.04%) in our study was lower than the prevalence of Brazil (1.9%)[19] but was higher than in Japan (0.3%)[16], Korea (0.5%)[22], England (0.5%)[17], America (0.5%)[14] and Libya (0.84%)[18]. Cross-sectional studies have reported that 7.5% of women and 2.8% of men of all ages in Whickham, UK had abnormal serum thyroid-stimulating hormone (TSH) levels[23]. The Colorado Thyroid Disease Prevalence Study 2000 reported that among 25,682 subjects attending a state-wide health fair, 11.7% of subjects had an abnormal serum TSH concentration[10]. Primary hypothyroidism was detected in 9.5% and hyperthyroidism in 2.1% of subjects, most of who were asymptomatic[24]. In the 20-year follow-up study of the Wickham survey cohort[23], the mean annual incidence of spontaneous hypothyroidism increased from 4 to 27% in women who had positive thyroid antibodies. The Third National Health and Nutrition Examination Survey (NHANES III) 2003, from a sample of 17,353 people aged 12 years representing the geographic and ethnic distribution of the US population, reported a prevalence of hypothyroidism in 4.6% (0.3% clinical and 4.3% subclinical) and hyperthyroidism in 1.3% (0.5% clinical and 0.7% subclinical)[25].

The WHO/UNICEF/ICCIDD neonatal TSH classification[26] categorizes Bangladesh and Guatemala as being more severely affected compared with the indicators for school children (goitre, ultrasound and urinary iodine). This could be a result of (1) iodine deficiency being a more serious problem in pregnant women and the developing foetus, perhaps due to higher iodine requirements and/or different levels of iodine intake/absorption, (2) the foetus may be more sensitive to mild iodine deficiency, and (3) the TSH classification scheme may need adjustment, with the current cut-off values categorizing iodine deficiency disorder (IDD) levels more severe than other indicators of iodine deficiency[27]. There are many theories about why the thyroid gland is so sick, but no one theory seems to explain it all. The combination of factors include (1) autoimmune disease, (2) iodine competition (our environment is filled with "halides" that can compete with iodine absorption and processing), (3) toxins, (4) nutritional deficiency, (5) stress, (6) genetically, etc.[3]. The prevalence of subclinical hypothyroidism was higher in females than males. Results of this study, however, are similar the prevalence established by other studies done previously. The difference in the prevalence may result from immunological changes that increase or decrease thyroid hormone levels during pregnancy and the postpartum period in female. These prevalence differences between subjects in this study and others may be due to differences in age, gender, family history, and pathophysiologic conditions[18].

Autoimmune disorders occur more frequently in women, presumably secondary to the effects of steroids on the immune system. It has been hypothesized that immune inhibitory cytokines produced by the mother, foetus or placenta inhibit the immune response during pregnancy. The subsequent decrease in these inhibitors in the postpartum period allows for exacerbation or onset of autoimmune disease. Both hypothyroidism and hyperthyroidism can occur in the postpartum period as result of thyroiditis. Postpartum thyroiditis is a transient form of autoimmune thyroid dysfunction that generally occurs within 3 to 6 months postpartum[28].

Conclusion

Our results show incidence of thyroid dysfunction of common people and its relationship with thyroid hormones on the basis of age and sex. In Dhaka City, Bangladesh, a cross section of population we studied, thyroid dysfunction was more common among females than males. Thyroid function tests and routine assessment of thyroid hormone levels are recommended in populations with high health risks, including lipid disorders, goitre, autoimmune disorders, infertility, women after menopause, and women who are pregnant or postpartum. Thyroid health has been correlated with healthy longevity. Since the thyroid affects so many tissues and functions of the body, thyroid health can ultimately save huge amounts of time, energy, money and quality of life.

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