Epidemicity of Thyroid Gland Disorders Among Ranya Town Dwellers: A Hospital-Based Survey

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ABSTRACT

The current survey was conducted to determine the endemicity of thyroid dysfunctions between Ranya town residents, Kurdistan Region of Iraq. This survey, which covered the period of July 2015 to July 2016, relied on performing thyroid function tests of 2013 cases referred to the central clinical laboratory. The sera of suspected thyroid disorder patients were checked serologically for thyroid stimulating hormone (TSH), total thyroxine (T4) and total tri-iodothyronine (T3). Moreover, the association of age and gender with thyroid disorder occurrence was emphasized. The results revealed that out of 2013 cases, 1584 (78.69%), 153 (7.6%), 121 (6.01%), 85 (4.22) and 70 (3.48%) had suffered from euthyroid, sub-clinical hyperthyroidism, sub-clinical hypothyroidism, hyperthyroidism and hypothyroidism respectively. On the other hand, the analysis of procured data demonstrated that sub-clinical hyperthyroidism, hyperthyroidism and hypothyroidism were escalated with the advancement of age and also females had a greater susceptibility in each age group. Additionally, the prevalence of sub-clinical hypothyroidism cases were decreased in both sexes with the advancing age within each group and the recorded percentage rate of female affections was greater as compared to males. The total affection rate of thyroid gland disorders was estimated as 21.31%. Ultimately, sub-clinical hyperthyroidism was most common among other thyroid disorders and females had a higher incidence of thyroid dysfunctions as compared to males.

Keywords: Thyroid disorders Age Sexes Rania town

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1. INTRODUCTION

Basically, thyroid gland is an endocrine gland related to releasing of some biologically active hormones in humans and other vertebrates. Anatomically, the gland is located in the neck region and physiologically, produces a few hormones comprising thyroxine (T4) and tri-iodothyronine (T3). Synthesis and secretion of thyroid hormones are regulated by thyroid stimulating hormone (TSH) secreted from the anterior pituitary gland (Wendy and Jean, 2007). Thyroid stimulating hormone is produced when the hypothalamus releases a substance called thyrotropin-releasing hormone (TRH) and , in turn, triggers the pituitary gland to release TSH (Zilva et al., 1994).
Thyroid gland synthesizes thyroid hormones by iodination and coupling of two molecules of the tyrosine amino acid (Macchia et al., 1998). Thyroid hormones are associated with many vital metabolic processes for regulation of proper body functions like, normal growth, sexual maturation and mental development (Zilva et al., 1994). Thyroid diseases are common endocrine disorders in global populations and their prevalence could be influenced greatly by sex and age (Carlé et al., 2006, Nagarkar et al., 2015). Thus, women and old individuals are most susceptible to the thyroid dysfunctions as compared to men and younger groups (Carlé et al., 2006, Bose et al., 2015). Furthermore, geographical locations, environmental factors, radiation, iodine-deficiency and iodine excess in the diet are reckoned the salient contributors in emerging thyroid ailments as well (Kochupillai, 2000, GovindanKutty et al., 2013). It is noteworthy to mention that iodine deficiency conduces to goiter development and hypothyroidism (Vanderpump and Tunbridge, 2002).

Thyroid disorders are commonly classified into two major categories; hyperthyroidism and hypothyroidism, depending on whether the levels of serum thyroid hormones are increased or decreased respectively. The thyroid dysfunction has been assessed on the basis of clinical findings and laboratory estimation of serum TSH, total T3 and total T4 level; but measuring levels of TSH is more important and sensitive test for screening thyroid disorders than T4 and T3 (Fatourechi, 2009).

On the other hand, hypothyroidism could be subclassified as primary hypothyroidism and secondary hypothyroidism; primary hypothyroidism denotes that the disease resides in the thyroid gland and associated with increased levels of TSH and decreased free T4 levels. Secondary hypothyroidism is related to both decreased TSH and free T4. In addition to the aforementioned cases, also most people are exposed to subclinical hypothyroidism. The latter condition can be defined as serum TSH levels are greater than the corresponding reference range associated with normal or decreased serum free T4 and free T3 values (Vanderpump and Tunbridge, 2005, Wendy and Jean, 2007, EL-mofty and Soliman, 2013). In contrast, increased total T4 and suppressed level of TSH indicate primary hyperthyroidism; whilst secondary hyperthyroidism correlates with decreased levels of TSH and increased levels of free T4 but subclinical hyperthyroidism is most often caused by release of excess thyroid hormones by the thyroid gland and inhibition of TSH release. The aforesaid condition is defined as a low or undetectable serum TSH with values within normal or increased concentrations of free T4 and free T3 (Bahn et al., 2011, EL-mofty and Soliman, 2013, Witting et al., 2014).

Complications that can arise from untreated thyroid disease include elevated cholesterol levels and subsequent heart diseases (Erem, 2006, Singh et al., 2008). Moreover, thyroid dysfunction is one of the reasons for poor glycemic control in diabetic patients (Singh et al., 2011) and type II Diabetes mellitus (GovindanKutty et al., 2013).

The indigenous individuals differ in their iodine intake, nutritional supplementation and education as well as differences in the contributing environmental factors. In order to design a sustainable health care program and management of affected persons with hypo and hyper thyroid disorders in the local population, collection of the reliable data about the rampanty of this endocrine dysfunction is compulsory. Hence, the present survey came to existence in Ranya town, Sulaymaniyah province, Kurdistan region of Iraq.
2. MATERIALS AND METHODS

2.1 Study population and Survey area

The current research work was performed in the central clinical laboratory in Ranya town from July 2015 to July 2016. The majority of surveyed participants (n=2013) was referred by physicians during the period of investigation, which embraced 599 (29.76%) males and 1414 (70.24%) females.

2.2 Procedure

Blood specimens were collected by venous puncture and placed in the gel tubes without adding any anticoagulant. After clotting, the suspected blood samples were centrifuged for 5 minutes, at 2500 rotations per minute (RPM), then supernatant sera were employed for measurement of TSH, total T4 and total T3 using mini VIDAS, a compact automated immunoassay system (biomerieux company, France). The serological technique is based on the Enzyme Linked Fluorescent Assay (ELFA) principles. All used reagents for analytical reagent grade were supplied by Biomerieux-France. Collected data were processed using Microsoft Software, Excel 2010 and analysed by Graphpad Prism, version (6.01). TSH, T4 and T3 were used in detecting thyroid disorders. According to the leaflet of use kits, normal ranges of different parameters of thyroid profile were presented in table 1.

Table 1. Accepted values of different parameters of thyroid profile

| Parameters        | Normal Values |
|-------------------|---------------|
| TSH               | 0.25-5 μIU/ml |
| Total T4          | 60-120 nmol/l |
| Total T3          | 0.92-2.33 nmol/l |

3. RESULTS

Two thousand and thirteen individuals were exploited in the present study on the basis of thyroid function test to estimate TSH, total T4 and total T3 hormones. Pursuant to the disorder types, participants were divided into five groups which include Euthyroid (normal), hypothyroidism, sub-clinical hypothyroidism, hyperthyroidism and sub-clinical hyperthyroidism. The overall distribution of serologically-examined persons and mean ± SD of each performed test were shown in table 2. The maximum frequency and percentage of thyroid disorder among participant cases where sub-clinical hyperthyroidism whilst the minimum percentage of cases was hypothyroidism.

Table 2. Distribution of thyroid disorders among the participants with mean± SD of TSH, total T4 and total T3 hormones

| Thyroid disorders                  | Frequency | Percent age (%) | Mean ± SD     |
|------------------------------------|-----------|-----------------|---------------|
|                                    |           |                 | TSH | Total T4 | Total T3 |
| Normal                            | 1584      | 78.69           | 1.70±1.10 | 82.64±10.84 | 1.36±0.18 |
| Hypothyroidism                    | 70        | 3.48            | 34.49±22.57 | 40.03±17.40 | 0.62±0.24 |
| Subclinical hypothyroidism        | 121       | 6.01            | 10.75±7.90 | 78.08±12.83 | 1.23±0.17 |
| Hyperthyroidism                   | 85        | 4.22            | 0.06±0.02 | 164.89±54.04 | 3.41±2.65 |
| Subclinical hyperthyroidism       | 153       | 7.6             | 0.09±0.05 | 88.17±12.4 | 1.51±0.28 |

Age and sex distribution of euthyroid participants were highlighted. Out of 1584 normal individuals who were categorized as suspected thyroid disorder, 786 of them were in
the age group ≤ 40 years whilst 798 normal persons were in the age group > 40 years. Details associated with the ages and genders are exhibited in table 3.

Table 3. Distribution and mean ± SD of thyroid function tests in accordance to age and gender regarding Euthyroid

| Gender | ≤ 40 Years | > 40 Years |
|--------|------------|------------|
|        | Male       | Female     | Male   | Female   |
| Frequency | 239       | 547       | 250   | 548     |
| Percentage (%) | 30.41 | 69.59 | 31.33 | 68.67 |
| TSH     | 1.47±0.58 | 1.89±1.14 | 1.42±1.04 | 1.64±1.13 |
| T4      | 81.43±10.43 | 82.52±10.77 | 82.05±10.54 | 83.56±11.16 |
| T3      | 1.36±0.18 | 1.37±0.18 | 1.37±0.19 | 1.34±0.18 |

Frequency distribution, percentage and mean± SD of TSH, total T4 and total T3 ≤ 40 and > 40 year groups of both male and female sub-clinical hyperthyroidism were shown in table 4. Subclinical hyperthyroidism was common in female and rose with advancing age.

Table 4. Distribution and mean ± SD of thyroid function tests in accordance to age and gender regarding sub-clinical hyperthyroidism

| Subclinical hyperthyroidism | ≤ 40 Years | > 40 Years |
|-----------------------------|------------|------------|
|                             | Male       | Female     | Male   | Female   |
| Frequency                   | 15         | 44         | 34     | 60       |
| Percentage (%)              | 25.42      | 74.58      | 36.17  | 63.83    |
| TSH                         | 0.08±0.04  | 0.09±0.05  | 0.10±0.05 | 0.09±0.05 |
| T4                          | 86.69±12.07 | 87.34±11.71 | 85.43±14.87 | 90.69±11.23 |
| T3                          | 1.47±0.16  | 1.59±0.40  | 1.49±0.24 | 1.48±0.21 |
Table 5 demonstrates the frequencies and concentrations of various laboratory parameters in different ages and sexes of hyperthyroidism. In both age groups, the frequency distribution of hyperthyroidism in female is greater than male. Cases of hyperthyroidism > 40 years were more excess than ≤ 40 years.

Table 5. Distribution and mean ± SD of thyroid function tests in accordance to age and gender regarding hyperthyroidism

| Hyperthyroidism                  | ≤ 40 Years | > 40 Years |
|----------------------------------|------------|------------|
| Gender                           |            |            |
| Male                             | 11         | 21         |
| Female                           | 17         | 36         |
| Frequency                        | 39.29      | 36.84      |
| Percentage (%)                   | 60.71      | 63.16      |
| TSH                              | 0.052±0.006| 0.053±0.009|
| T4                               | 195.71±68.64| 163.76±53.93|
| T3                               | 3.88±2.14 | 3.14±1.30 |

The survey revealed that most sub-clinical hypothyroidism had been diagnosed among females in both age groups. The particulars are exhibited in table 6.

Table 6. Distribution and mean ± SD of thyroid function tests in accordance to age and gender in subclinical hypothyroidism

| Subclinical hypothyroidism       | ≤ 40 Years | > 40 Years |
|----------------------------------|------------|------------|
| Gender                           |            |            |
| Male                             | 9          | 8          |
| Female                           | 59         | 45         |
| Frequency                        | 13.24      | 15.09      |
| Percentage (%)                   | 86.76      | 84.91      |
| TSH                              | 10.94±8.80 | 9.81±6.04 |
| T4                               | 78.92±10.99| 76.67±8.39|
| T3                               | 1.22±0.32 | 1.16±0.15 |
Table 7 displays hypothyroidism patients. The hypothyroidism cases were divided into two major groups according to age and each one subdivided into two subgroups according to gender. Generally, most of hypothyroidism cases were above 40 years and also they were females in both age groups.

**Table 7. Distribution and mean ± SD of thyroid function tests in accordance to age and gender in hypothyroidism**

| Hypothyroidism | ≤ 40 Years | > 40 Years |
|----------------|------------|------------|
| Gender         | Male       | Female     | Male       | Female     |
| Frequency      | 4          | 27         | 8          | 31         |
| Percentage (%) | 12.90      | 87.10      | 20.51      | 79.49      |
| TSH            | 34.58±24.13| 33.16±22.89| 35.58±23.59| 35.34±22.94|
| T4             | 31.50±20.61| 39.60±17.91| 47.44±11.30| 39.59±17.92|
| T3             | 0.53±0.22  | 0.61±0.23  | 0.69±0.20  | 0.62±0.26  |

**4. DISCUSSION**

Evidently, thyroid gland disorders, which occur in various forms, are considered a global phenomenon necessitate a prompt therapeutic interference in different countries on our planet. Routinely, thyroid function test is used to detect thyroid dysfunctions worldwide. To perpetuate good health of individuals.

Usually, cases that have TSH level below the normal range; total T4 and total T3 above normal ranges are deemed hyperthyroidism, whilst sub-clinical hyperthyroidism individuals are persons who had decreased serum TSH concentration but exhibited normal concentrations of total T4 and total T3 in their sera. It has been found that some normal physiological processes in females such as pregnancy play a role in elevating levels of total T4 and total T3 (Teti _et al._, 2016). On the other hand, the autoimmune ailment called Grave’s disease induces thyroid gland to produce excessive amount of thyroid hormone which is reckoned a vast common factor for evolution of hyperthyroidism (Brent, 2008, Burch and Cooper, 2015).

Hyperthyroidism is characterized by rising of TSH and dropping thyroid hormones, whilst sub-clinical hypothyroidism distinguished by elevated TSH with a normal value of thyroid hormones. Certainly, iodine deficiency is the most common cause of hypothyroidism worldwide (Vanderpump and Tunbridge, 2002). On the other hand, some pathological disorders are also involved in developing Hypothyroidism. For instance, the most common cause of hypothyroidism in the United States is Hashimoto's thyroiditis (Dunn and Turner, 2016). Investigators believe that this disease occurs as a result of production of TSH stimulation-blocking antibody which, in turn, blocks the action of TSH hormone and
subsequently brings damage and atrophy to thyroid gland and reduces thyroid hormone production (Umar et al., 2010).

In the current study, the prevalence of hyperthyroidism and sub-clinical hyperthyroidism together were greater than both cases of hypothyroidism and sub-clinical hypothyroidism together which may be due to cold weather conditions. In this connection, it has been reported that animals exposed to cold, their TSH secretion had increased promptly, which, in turn, led to elevation of thyroid hormone release and conduced to thyroid gland hyperplasia (Sarne, 2000). Furthermore, acute elevations of serum total T4 and T3 concentrations occur in humans during the early period of exposure to high altitude (Rastogi et al., 1977). Another outcome of this study is that hypothyroidism recorded the minimum percentage rate among all cases of thyroid disorders in Ranya town which may be related to iodine intake because the rate of hypothyroidism will increase in the area of low iodine intake (Vanderpump and Tunbridge, 2002). Iodine-induced hyperthyroidism has been reported throughout the world and even iodine has been administered to treat endemic goitre (Henzen et al., 1999).

Most of the people, sent by physicians to perform thyroid function tests had showed normal laboratory findings of thyroid function test, belong to an older age group and they were females in both age groups. These findings have been confirmed by other researchers (Al-Msari et al., 2014). Generally, in the current research study, the males were less suffering from thyroid disorders in both age groups as compared to the females and the cases of thyroid disorders in both males and females were increased with growing age. The greatest male and female cases were having sub-clinical hyperthyroidism and they were in older age groups in the present study. The prevalence of thyroid disorders has been found to increase linearly with age and virtually all thyroid diseases are common in women (Der et al., 2013). Other researchers showed that in females, thyroid disorders were most common as compared to males (Bustany, 2011, GovindanKutty et al., 2013, Al-Msari et al., 2014, Shahrani et al., 2016) and thyroid disorders would be increased with the advancing age (Mariotti et al., 1995).

The results of the present study revealed that sub-clinical hyperthyroidism, hyperthyroidism and hypothyroidism cases were elevated with the increasing age and female has a greater frequency in each age group cases. The distribution of sub-clinical hypothyroidism cases was decreased in both sexes with the advancing age, but within each group case, the percentage rate of female was greater than in male. In thyroid disorders participants which aged above 65 years old, the prevalence of subclinical hyperthyroidism, overt hyperthyroidism, sub-clinical hypothyroidism and overt hypothyroidism in women are greater than in men (Benseñor et
Thyroid gland is most affected to morphological and physiological alterations by the process of aging as compared to other endocrinal glands (Gesing et al., 2012).

4. CONCLUSIONS

In the light of our survey, it has been concluded that the spread of thyroid disorders between Ranya town residents was 21.31%. Hyperthyroidism and sub-clinical hyperthyroidism were most rampant as compared to hypothyroidism and sub-clinical hypothyroidism. Sub-clinical hyperthyroidism was most common among thyroid disorders and females had a higher incidence of thyroid disorders than males. Advanced ages were more prone to thyroid disorders than young people. Finally, this survey can be exploited as a useful background for the subsequent studies and control policy makers.

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Conflict of interest statement

The authors attest no conflicts of interest concerning the information included in this manuscript.

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