Epidemiology: Open Access

Hasanato et al., Epidemiology (Sunnyvale) 2017, 7:1
DOI: 10.4172/2161-1165.1000286

Research Article OMICS International

Incidence of Thyroid Diseases in Female Saudi Adults Visiting a Tertiary Care Hospital in Riyadh

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Received date: December 27, 2016; **Accepted date:** January 12, 2017; **Published date:** January 18, 2017

Abstract

Introduction: Diseases of the thyroid gland are common in adults and the prevalence is increasing in all parts of the world. Ethnicity and geographical locations also affect the prevalence of thyroid disorders along with the age, sex and iodine-intake by the different populations. The objective of our study is to examine the prevalence of thyroid dysfunction in female Saudi adults. It is a quantitative, observational, cross-sectional study involving 199 female Saudi adults visiting the King Khalid University Hospitals, Riyadh. Recruitment of subjects was done by random sampling.

Materials and methods: Informed consent was taken from the participants followed by an interviewing questionnaire to get information about their medical and social history. Also we measured their blood pressure, height and weight. Afterwards, venous blood was collected from each subject and processed to measure the thyroid function (free T4 and TSH) and bone profile (calcium, phosphorus, alkaline phosphatase and vitamin D).

Duration of the study was six months, we excluded endocrine clinic to avoid any bias in the selection of our population.

Results: The mean age of the total 199 females participating in the study was 29 (± 12.2) yrs. More than 50% of women were either overweight or obese with a BMI of more than 25. Amongst the participants, 17% of the females informed us through the questionnaire that they had been previously diagnosed with thyroid diseases, with 10% as hypothyroid and 3% with hyperthyroidism. The remaining 4% had other thyroid diseases. The mean age of these previously diagnosed cases of hypo-and hyperthyroidism were significantly more than the remaining subjects. From these remaining subjects we found 5.5% of women with undiagnosed hypothyroidism. So, the incidence rate of hypothyroidism in female Saudi adults visiting the KKUH was 15.5%. In our studied population, we did not find any new cases with hyperthyroidism.

Conclusion: There is a high incidence of thyroid disorders in the female Saudi adult population. Most common is subclinical hypothyroidism and it mainly affects older females.

Keywords: Prevalence; Blood pressure; Thyroid diseases; Hyperthyroidism; Thyroid diseases; Incidence; Saudi females

Introduction

Thyroid dysfunctions have increased recently and are considered the commonest endocrine diseases [1]. Thyroid diseases can be classified according to the gland function into hypothyroidism and hyperthyroidism which can also be further classified into primary and secondary [2]. In primary thyroid disease the defect is in the thyroid gland itself and the hyperactivity or hypo activity of the gland, while secondary thyroid disease is due to a defect in the posterior pituitary gland which secretes the thyroid stimulating hormone or TSH [2]. There are many causes of hypothyroidism and hyperthyroidism and autoimmunity plays an important role, as in Hashiomotos thyroiditis and Graves' disease which mainly affect females above the age of 30 [2].

Subclinical thyroid disease has been defined biochemically: subclinical hyperthyroidism occurs when serum (TSH) concentrations are low or undetectable, but free thyroxin (T4) and tri-iodothyronine (T3) concentrations are normal; and subclinical hypothyroidism occurs when serum TSH concentrations are raised and serum thyroid hormone concentrations are normal [3,4].

The prevalence of thyroid disorders depends on many factors, such as age, sex, geographical factors, and iodine intake [5]. Several studies have been reported from different parts of the world showing the prevalence of thyroid diseases. One such study showed that thyroid dysfunction was seen in one out of every eight young women in a South Indian population and overall prevalence of thyroid dysfunction among young females in their study was 12.5% [5]. They reported hypothyroidism and hyperthyroidism were 7.3% and 0.3% respectively [5]. Nord-Trùndelag Health's (HUNT) study conducted in Norway with a total of 94,009 participants showed 2.5% of females had hyperthyroidism and the prevalence increased by age up to the age of

80 [6]. The prevalence of hypothyroidism was 4.8% for females respectively [6]. So, overall the prevalence of thyroid dysfunction was found more in the south Indian population compared to Norway. These studies indicate that ethnic differences and geographical locations do affect the prevalence of thyroid dysfunctions.

Thyroid hormones affect many systems, such as cardiovascular, gastrointestinal and musculoskeletal [2]. For the cardiovascular system thyroid hormone plays an essential role in the maintenance of cardiovascular homeostasis under physiological and pathological conditions, and it is involved in the modulation of cardiac contractility, heart rate, diastolic function, and systemic vascular resistance [7-11]. Hypothyroidism is associated with high levels of LDL, total cholesterol, triglycerides obesity, metabolic syndrome and high blood pressure [12-15].

Thyroid disorders have widespread systemic manifestations including their effects on bone and mineral metabolism. Mineral metabolism (calcium and phosphorus) is frequently disturbed in hyperthyroidism [16]. Thyroid hormones play an important role in the homeostasis of calcium and phosphorus levels by their direct action on bone turnover [17,18]. Previous studies carried out on serum calcium and phosphorus levels in thyroid disorders have had conflicting results. Some studies have reported normal levels [19,20], while others have reported decreased serum calcium and phosphorus levels in hypothyroidism [21]. Hyperthyroidism causes excessive excretion of calcium and phosphorus in urine because the high serum calcium levels in hyperthyroidism have a negative feedback on the secretion of parathyroid hormone which has a role in calcium and phosphorus absorption [22].

The aim of our study is to examine the prevalence of thyroid dysfunction in the female Saudi adults because the evidence about the prevalence of thyroid dysfunction among females in Saudi Arabia is very limited. Similarly, the study is interested in the association between thyroid dysfunction with increased age and abnormal bone profile.

Research Methodology

Our study design is an observational, quantitative, cross-sectional study. The inclusion criteria in the study were females visiting the KKUH other than the endocrine clinic and aged above or equal to 20 years old. The exclusion criteria were males, and female children and adolescents less than 20 years old.

The study was approved by the Institutional Review Board (IRB) of the College of Medicine Research Center (CMRC). We interviewed each participant and filled in the questionnaires after taking their written informed consent. The participants were assured that their information would be kept secure and confidential and they had the right to withdraw.

The questionnaire was divided into parts. The first part was general and demographic questions which included age and marital status. The second part was about past and present illnesses. In this section we asked if they had ever been diagnosed with hypothyroidism or hyperthyroidism, and if they were on thyroid medication. We also asked if there were previous diagnoses of any bone disease and the risk factors that could contribute to bone diseases. The source of questions 3-9 was the HUNT study [6]. The source of questions 12-13 was the Bone Density Questionnaire designed by the Valley Medical Group [23]. The third part of the questionnaire was a lifestyle section. We asked them about smoking, alcohol use and exercise. The fourth part was menstrual history which included age of menarche and menopause.

Vital signs such as height, weight and blood pressure were recorded and blood samples were drawn from them for the measurement of parameters like T4, TSH, Vitamin D, phosphorus and calcium levels in the chemistry laboratory of the KKUH. The reference range values of TSH 0.25-5.0 MIU/L, Free T4 0.3-25.8 PM/L, calcium 2.1-2.55 mmol/l, corrected calcium 2.1-2.55 mmol/l, phosphorus 0.87-1.45 mmol/l, vitamin D 75-250 mmol/l and alkaline phosphatase 50-136 U/L were provided by the Clinical Chemistry Laboratory at the KKUH.

The data analysis was performed with Graphpad Prism statistical software version 6 (GraphPad Inc., California, USA). We performed one way ANOVA and post-hoc Tukey's multiple comparison tests to compare the means of different groups. P value <0.05 was considered significant.

Results

A total of 199 females participated in our study aged between 20 to 65 years and their mean age (± SD) was 29.49(± 12.17) years. Most of the participants had attended at least high school with only 15% uneducated and 60% of the participants were single (Table 1).

	All participants (n=199)
Age (years)	29.49 (± 12.17)
Weight (Kg)	69.082 (± 18.1662)
BMI	28.08 (± 7.35)
SBP (mm of Hg)	128.74 (± 17.785)
DBP (mm of Hg)	77.25 (± 15.581)
Free T4 (PM/L)	14.7636 (± 2.04107)
TSH (MIU/L)	2.7645 (± 2.27959)
Corrected calcium (moles/L)	2.3816 (± 1.68130)
Alkaline phosphatase (U/L)	94.5200 (± 21.51451)
Serum phosphorus (mg/dl)	1.1886 (± 0.15096)
Vitamin D (moles/L)	43.08 (± 27.09)
Age of menarche (years)	13.12 (± 2.8)
Age of menopause (years)	49.0 (± 3.6)
Educated up to high school and above (%)	85
Married (%)	40
Data are presented as means (± SD) or percentages (%).	

Table 1: Demographic characteristics of the study participants.

Based on the questionnaire and the laboratory findings, the subjects were divided into four groups, namely healthy (who had all parameters normal and did not report any previous disease), previous hypo (who reported that they were previously diagnosed with hypothyroidism), previous hyper (previously diagnosed with hyperthyroidism) and new hypo (subjects who did not report any previous thyroid disease and

their investigations showed a high TSH level with normal or below normal T4 levels). Out of the 199 participants, 34 (17%) females answered yes to at least one of the thyroid-related questions in the questionnaire, indicating a history of thyroid disease or dysfunction. 31 of these were on medication for their thyroid problem. Of these previously diagnosed cases, 20 were hypothyroid and 6 were hyperthyroid. The remaining eight had other thyroid problems. This information was provided by the participants.

We did not find any new subjects with hyperthyroidism in the studied population (Table 2). On the basis of the questionnaire, 6 subjects had reported hyperthyroidism, and their present investigations for T4 and TSH were within the normal range. So, they were euthyroid at the time of the study. Thus, the combined incidence of hyperthyroidism in our studied population is 3.0%.

	Healthy (n=154)	**Previously diagnosed cases**		**New cases**
		Hypo (n=20)	**Hyper (n=6)**	**Hypo (n=11)**
Age (years)	28.24 (± 11.41)	39.2 (± 13.47) *** (p<0.0004)	26.57 (± 8.5) * (0.04)	28.36 (±14.96)
Weight (Kg)	68.25 (± 18.4	73.05(± 15.9)	78.62 (± 25.88)	70.66 (± 17.20)
BMI	27.7 (± 7.4)	30.31 (± 7.5)	30.9 (± 8.7)	28.45 (± 7.14)
SBP (mm of Hg)	127.82 (± 17.52)	130.84 (± 20.04)	127.85 (± 18.37)	138.81 (± 12.34)
DBP (mm of Hg)	77.01 (± 16.7)	77.05 (± 10.4)	77.14 (± 16.67)	79.36 (± 5.85)
Free T4 (PM/L)	14.75 (± 1.77)	15.5 (± 1.5)	16.22 (± 3.85)	13.35 (± 3.18)
TSH (MIU/L)	2.20 (± 0.98) **** (p<0.0001)	4.00 (± 3.1)	4.06 (± 4.3)	7.87 (± 4.3) **** (p<0.0001)
Corrected calcium (mmoles/L)	2.26 (± 0.09)	2.27 (± 0.12)	2.27 (± 0.07)	2.26 (± 0.092)
Alkaline phosphatase (U/L)	93.80 (± 20.72)	99.84 (± 31.07)	93.14 (± 20.69)	101.45 (± 14.87)
Serum phosphorus (mg/dl)	1.18 (± 0.15)	1.18 (± 0.16)	1.24 (± 0.13)	1.23 (± 0.13)
Vitamin D (mmoles/L)	41.35 (± 26.25)	57.49 (± 34.55) ** (p<0.04)	39.19 (± 20.16)	46.68 (± 30.810
Age of menarche (years)	12.99 (± 1.7)	13.05 (± 1.61)	11.57 (± 1.5)	13.18 (± 1.47)
Age of menopause (years)	48.33 (± 4.24)	50.33 (± 2.5)	No value	48 (± 4.24)
Taking multivitamin supplements (%)	63	90	83	72
Family history of thyroid diseases (%)	28	50	50	45
Data are presented as means (± SD) or percentages (%). P value <0.05 is considered significant T test used				

Table 2: Association between thyroid hormones and different variables.

Among the remaining participants who reported no thyroid related or any other type of illnesses, 5.5% of females were found to have TSH levels significantly above the normal range and free T4 values were either normal or they were low for two cases (Table 2). The previously diagnosed 20 hypothyroid females were mostly euthyroid except for four for whom the TSH levels were above normal. So, the combined incidence of hypothyroidism in our studied population is 15.5%.

We did not find any difference in the age of females between the healthy and hyperthyroidism groups, but the hypothyroidism was significantly more common in the older females. The systolic blood pressure (SBP) was significantly raised in the group with undetected hypothyroidism.

We studied the different parameters for bone profile including the calcium, alkaline phosphates, serum phosphorus and vitamin D. We did not find any significant difference in the serum calcium, alkaline phosphatase or serum phosphorus levels in the groups. Vitamin D levels were found to be significantly higher in the previously diagnosed hypothyroid female subjects. The other groups had no differences in their bone profile in comparison to the healthy subjects.

Discussion

The literature lacks information regarding the prevalence of thyroid diseases in female Saudi adults.

A total of 199 females participated in the study aged between 20 and 65 years with a mean age of 29.49 years. A comparison of the mean

ages of different groups showed that the females reporting hyperthyroidism were younger ($p<0.04$) and those reporting hypothyroidism were older ($p<0.007$). There are plenty of studies showing the association of a higher incidence of subclinical hypothyroidism with increasing age [6,24] but we did not come across any study that showed higher incidence of subclinical hyperthyroidism in younger females. So, subclinical hypothyroidism more prevalent than subclinical hyperthyroidism.

Females with subclinical hypothyroidism are usually reported to have a higher BMI [25-28] but in our study's population we did not find any significant difference between the groups. However, most of the females were either overweight or obese in the studied population as is evident from the mean values of BMI of the different groups.

Nearly 20 females had previously been diagnosed with hypothyroidism, 11 were newly detected with hypothyroidism and 6 were previously diagnosed with hyperthyroidism, so hypothyroidism was the commonest thyroid abnormality with an incidence rate of 15.5%. A study done in a South Indian population with a total of 1,292 subjects showed the overall prevalence of thyroid dysfunction among young females was 12.5% and they found hypothyroidism and hyperthyroidism were 7.3% and 0.3% respectively [5]. We have higher prevalence of both hypothyroidism and hyperthyroidism. We found that hypothyroidism is more prevalent with increasing age similar to the HUNT study's results [6]. A population-based study from India reported that in women, the prevalence of subclinical hypothyroidism was higher, at 11.4% when compared with men, in whom the prevalence was 6.2% [29]. The prevalence of subclinical hypothyroidism increased with age [29]. Also, about 53% of subjects with subclinical hypothyroidism were positive for anti-TPO antibodies [29].

A study performed in Makah, Saudi Arabia concerning the prevalence of thyroid diseases showed that, out of 261 female patients, 142 patients were found to have hypothyroidism and 119 females had hyperthyroidism [30]. The study about Risk Factors for Thyroid Dysfunction among Type 2 Diabetic Patients in Saudi Arabia showed the prevalence of different types of thyroid dysfunction was 28.5%, of which 25.3% had hypothyroidism, where 15.3%, 9.5%, clinical, subclinical hypothyroidism, respectively while the prevalence of hyperthyroidism was 3.2%, of which subclinical cases accounted for 2.7% and overt hyperthyroidism accounted for 0.5% [31].

We also measured some of the parameters of bone profile like serum calcium, phosphorus, alkaline phosphatase and vitamin D levels in the participants as it has already been suggested that thyroid hormones play an important role in the homeostasis of calcium and phosphorus levels by their direct action on bone turnover [17,18]. Previous studies carried out on serum calcium and phosphorus levels in thyroid disorders had conflicting results. Some studies reported normal levels [19,20], while others reported decreased serum calcium and phosphorus levels in hypothyroidism [21]. Vitamin D has been reported to be deficient in the hypothyroid patients [32]. We found that all the subjects in our studied population were deficient in vitamin D even though most of the subjects said yes to taking multivitamins. A comparison of the different groups showed that with the females with previously diagnosed hypothyroidism the levels were significantly higher ($p<0.02$) than with the healthy subjects. This could be due to these females being more regular with the multivitamins as 90% of these females were taking multivitamin supplements in comparison to only 63% from the healthy group.

Our study shows a high incidence rate of thyroid dysfunctions among Saudi females that should draw attention to screen and start early management to prevent complications. This study has some strength as the study design is suitable to assess incidence, the lack of studies on the prevalence of thyroid dysfunction among females in Saudi Arabia and confirms the association between increased age and thyroid disorders. We realize that the study was done with a small sample size and limited population, so it needs to be conducted on a larger population so as to get information about the incidence of hyperthyroidism in this population.

In conclusion, there is a high incidence of thyroid dysfunctions among Saudi females and it mainly affects the older females and those who have a family history of thyroid disease. Also, vitamin D deficiency is prevalent among our population, which was not related to thyroid dysfunctions.

Declarations

Ethics approval and consent to participate

Our study was approved by the Institutional Review Board (IRB) of the College of Medicine Research Center (CMRC). Informed consent was taken for each participant. We assured them that their information was confidential and they had the right to withdraw.

Consent for publication: The manuscript does not contain any individual person's data.

Availability of data and material: Dataset and materials are available.

Competing interests: There are no competing interests.

Funding: This study is not funded

Authors' contributions

Jumanah Abbas Mirah: participated in questionnaire construction, data collection, data entry, statistical analysis and drafting of the manuscript.

Nada Mohammad Al-Shahrani: participated in questionnaire construction, data collection, data entry, statistical analysis and drafting of the manuscript.

Nouf Khalid Alfulyyieh: participated in questionnaire construction, data collection, data entry, statistical analysis and drafting of the manuscript.

Afrah Almutairi: participated in questionnaire construction, data collection and drafting of the manuscript.

Basma Abdullah Ogailan: participated in questionnaire construction, data collection and drafting of the manuscript.

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