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ORIGINAL ARTICLE

Study of Thyroid Profiles in the Elderly

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ABSTRACT

Background: Advanced age is associated with changes in the pituitary thyroid axis which lead to changes in the thyroid functions in the absence of thyroid diseases. There is limited data regarding the prevalence of thyroid disease in the elderly Egyptian. It is very important to evaluate the thyroid function in the elderly people. **Methods:** 126 asymptomatic volunteers (41 males & 85 females) were initially interviewed and examined, and those fulfilling the clinical inclusion criteria were selected. Serum samples were taken and free T3, free T4 and TSH were measured. **Results**: Our study showed that the thyroid function abnormalities were present in 20 subjects (15.9%). The prevalence rates of thyroid function abnormalities occurred in 8 males (19.5%) and 12 females (14.1%). Subclinical hypothyroidism was the most common thyroid dysfunction which occurred in in 11 subjects (8.7%) 8 females, with prevalence rate of 9.4% in the females and in 3 males with prevalence rate of 7.3%. Subclinical hyperthyroidism was the second most common thyroid abnormality which occurred in 5 subjects (4%) with 7.3% in males (3 males)) and 2.4% in females (2 females). The prevalence rate of clinical hypothyroidism was (1.6%) (2 females) and in males 0%., and of clinical hyperthyroidism was (1.6%) 2 males and no female. According to the age group, thyroid dysfunction as general occurred in 20 subjects (23.5%) in those people < 70 years, and (0%) in those ≥ 70 years, with significant p-value < 0.05.**Conclusions:** Thyroid dysfunction is common in elderly subjects.

Keywords: Thyroid; Elderly; Hypothyroidism

INTRODUCTION

Thyroid diseases are one of the commonest endocrine disorders in the world. There are many causes in the elderly as in the Youngers like autoimmune diseases, medications, surgery and radiotherapy. Additionally the aging process contributes to the high prevalence of thyroid disorders in the elderly [1].

As the one gets older the thyroid gland gets smaller because of the fibrosis and atrophy which accompanied the aging. The situation gets worse because of the increase prevalence of the auto-antibodies, which reaching up to 20% in the women over 6o years. Also as the age advanced, the thyroid gland becomes nodular due to the increase incidence of the neoplastic lesions [2]. Microscopically also the thyroid gland appearance is changed with the age. The most obvious changes are the increase in the interfollicular connective tissues, the decrease in the follicular size and the reduction in the colloid content. At the same time the follicular cells decrease in the size, in the number and become flat [3].

In two thousand fifteen Malik et al. reported that the volume of the thyroid gland decreases after the age of 50 years [4].

Thyroid dysfunction is common in the old populations. The primary hypothyroidism occurs in 10% of the females and 2% of the males above 60 years. Ten to 15% of the patients with hyperthyroidism are older than 60 years [5].

In the countries with sufficient iodine, the prevalence of spontaneous hypothyroidism is between one and 2%, and is more common in the elderly women. The prevalence is higher in surveys of the old people in the community. A lower prevalence is observed in areas of iodine deficiency [6]. With ageing, Thyrotropin secretion in response to TRH is reduced and thus serum thyrotropin is usually lower in the elderly subject than in the younger subject due to decrease thyroid hormone concentrations, which could be due to decrease in the sensitivity of the thyrotroph of the pituitary gland [7].

During the aging process, gender-specific changes in the thyrotropin and free thyroid hormones levels have been noticed. In the old men, the free thyroid hormones decrease with the age but the TSH concentration do not change while in the old women the free thyroid hormones do not change but the TSH increases[8]. Subclinical hypothyroidism and subclinical hyperthyroidism, as well as thyroid neoplasms, require special attention in the elderly subjects. [8] Higher FT4 level within the normal reference range was associated with frailty in the euthyroid men who aged ≥ 75 years and in the postmenopausal women, it is associated with lower bone mineral density, increase bone loss, and increase risk of fractures [8].

Autoimmune thyroid disease (Hashimoto's thyroiditis) is the most common cause of primary hypothyroidism in the area of high iodine intake. Iodine deficiency remains the most common cause of primary hypothyroidism worldwide [9].

The incidence of primary hypothyroidism steadily rises with the age, mainly due to the increased incidence of the autoimmune thyroiditis [10].

The Changes in the thyroid functions are more common in the old populations and are associated with reduced life expectancy as compared with those with the stable thyroid functions. However, altered pituitary response with advanced age would cause some TSH elevations which should not be considered as subclinical hypothyroidism and the need for thyroxin supplementation [10].

This study aimed to estimate the prevalence of thyroid dysfunction and to study the thyroid profile in the elderly people in Zagazig city, Egypt. Many drugs and coexistent diseases affect the thyroid gland and because of the subtle clinical manifestations of thyroid diseases in the old population, it is very important to evaluate the thyroid profile in old people such as the fT3, the fT4, and the TSH.

METHODS

This cross sectional descriptive study was conducted in the community in the Zagazig city in the period between April 2017 and February 2018, after obtain the approval from Institutional Review board in the Zigzag University and the consent from the subjects who were selected from the geriatric clubs and geriatric residences (homes) and from the general community according the inclusion and exclusion criteria.

The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Collection of samples: This study aimed to evaluate the thyroid function in the elderly subjects in Zagazig city and to estimate the prevalence of thyroid dysfunction in the study group. The sample size is calculated using OPEN-EPI program. The CI is 95% and the power is 80%. The old population in Zagazig city is about 50.000, the thyroid dysfunction in general population is about 8.9%, so the sample size is (126). The study was conducted on 126 subjects (41 male and 85 female) who were apparently healthy elderly subjects aged 60 years and older. The Participants were subjected to detailed history and clinical examination including blood pressure, pulse, height and weight. Blood samples were collected to assess the levels of f T3, f T4, and TSH. All participants answered questionnaires according to the inclusion and exclusion criteria.

Inclusion criteria: include any asymptomatic old person who is 6o years and more.

Exclusion criteria: include any elderly with history of thyroid disease, other endocrine disease like diabetes mellitus or family history of thyroid or endocrine diseases. Any elderly on drugs that affect the thyroid profile like lithium, amoidarone, and Glucocirticoids, and those with chronic diseases like chronic renal disease and chronic liver disease.

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 23. Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done:

Independent samples Student's t-test of significance was used when comparing between two means.

Mann Whitney U test was used when comparing two means of not normally distributed data.

A one-way analysis of variance (ANOVA) was used when comparing between more than two means if data is normally distributed.

Kruskal-Wallis test used when the normality, homogeneity of variances, or outliers' assumptions for One-Way ANOVA are not met.

Chi-square (X2) test of significance was used in order to compare proportions between two or more qualitative parameters.

Fisher Exact test is a test of significance that is used in the place of chi square test in 2 by 2 tables, especially in cases of small samples.

RESULTS

106 subjects were euthyroid (85.7%), and thyroid disorders were presents in 20 subjects (15.9%) as shown in figure 1. The prevalence rate of thyroid function abnormality was higher in the males (19.5%) than in the females (14.1%). Subclinical hypothyroidism was the most common thyroid dysfunction in the studied group with the prevalence rate of about (9.4%) in the females and (7.3%) in the males. subclinical hyperthyroidism was the second most thyroid abnormality which accounted for (7.3%) in the males and (2.4%) in the females. While the prevalence rate of the clinical hypothyroidism in the females is about (2.4%) and in the males is (0%) and the prevalence rate of clinical hyperthyroidism in the females is (0%) and in the males is (4.9%) as shown in table 4.

The prevalence rate of the thyroid dysfunction in the elderly and its variation according to age group showed high significant difference (P value < 0.001) in the thyroid dysfunction as general. Also it showed significant difference in subclinical hypothyroidism between both age groups as shown in table 5.

Table 1. Baseline demographic data of the study group.

Demographic data	All patients
Count (%)	**126 (100%)**
Age (years)	
Mean ± SD	67.6± 7.1
Median (Range)	66 (60 - 95)
Body weight (Kg)	
Mean ± SD	96.5 ± 30.4
Median (Range)	90.5 (45 - 163)
Height (cm)	
Mean ± SD	160.5± 12.7
Median (Range)	160 (135 - 185)
BMI (Kg/m^2)	

Mean ± SD	37.6± 11.6
Median (Range)	36.6 (18.7–74.1)
Gender	
Female	85 (67.5%)
Male	41 (32.5%)
HTN	
No	101 (80.2%)
Yes	25 (19.8%)
Systolic blood pressure (mmHg)	
Mean ± SD	125.6± 20.3
Median (Range)	120 (100 - 210)
Diastolic blood pressure (mmHg)	
Mean± SD	80.3± 12.6
Median (Range)	80 (60 - 120)
Pulse (beat/min)	
Mean± SD	77.95± 10.1
Median(Range)	79 (62 - 120)

Table 2. Thyroid profile of the normal subjects.

Thyroid profile	All normal patients	Normal females	Normal males
Count (%)	**106 (100% of normal and 84.1% of total population)**	**72 (67.9% of normal and 44.4% of total population)**	**34 (32.1% of normal and 27% of total population)**
Free T3			
Mean ± SD	2.50± 0.46	2.55± 0.46	2.39± 0.47
Median (Range)	2.5 (1.1–3.4)	2.55 (1.5–3.4)	2.5 (1.1–2.9
2.5thpercentile	1.18	1.5	1.1
97.5thpercentile	3.4	3.4	2.9
Free T4			
Mean ± SD	1.35± 0.30	1.31± 0.32	1.45± 0.24
Median (Range)	1.3 (0.8–2.0)	1.2 (0.8–2.0)	1.5 (1.1–2.0)
2.5thpercentile	0.82	0.8	1.1
97.5thpercentile	2.00	1.985	1.992
TSH			
Mean ± SD	1.59± 1.04	1.68± 1.18	1.38± 0.62
Median (Range)	1.5 (0.4–5.0)	1.55 (0.4–5.0)	1.4 (0.6–3.0)
2.5thpercentile	0.4	0.4	0.6
97.5thpercentile	4.98	4.985	2.956

Table 3. Comparison between subjects <70 years and those ≥70 years of normal population regarding the thyroid profile.

Thyroid profile	< 70 years	≥ 70 years	Test	p-value (Sig.)
Count (%)	65 (61.3%)	41 (38.7%)		
Free T3				
Mean ± SD	2.58 ± 0.40	2.38 ± 0.55	1.438 *	0.157 (NS)
Median (Range)	2.6 (1.7 – 3.4)	2.35 (1.1 – 3.4)		
2.5th percentile	1.7	1.1		
97.5th percentile	3.395	3.372		
Free T4				
Mean ± SD	1.37 ± 0.31	1.33 ± 0.29	-0.265•	0.791 (NS)
Median (Range)	1.3 (0.9 – 2.0)	1.3 (0.8 – 1.9)		
2.5th percentile	0.9	0.8		
97.5th percentile	1.95	1.872		
TSH				
Mean ± SD	1.4 ± 0.73	1.88 ± 1.38	-0.910•	0.363 (NS)
Median (Range)	1.4 (0.4 – 3.4)	1.5 (0.4 – 5.0)		
2.5th percentile	0.4	0.4		
97.5th percentile	3.365	4.986		

* Independent samples Student's t-test. • Mann Whitney U test.
p< 0.05 is significant.Sig.: significance.

Table 4. Prevalence rate of thyroid dysfunction in elderly and its variation according to gender.

Parameter	Females	Males	Test	p-value (Sig.)
Count (%)	85 (67.5%)	41 (32.5%)		
Thyroid dysfunction as general				
	12 (14.1%)	8 (19.5%)	0.603‡	0.438 (NS)
Subclinical hypothyroidism				
	8 (9.4%)	3 (7.3%)	0.152^{F}	1.00 (NS)
Subclinical hyperthyroidism				
	2 (2.4%)	3 (7.3%)	1.789^{F}	0.328 (NS)
Clinical hypothyroidism				
	2 (2.4%)	0 (0%)	0.980 ^{F}	1.00 (NS)
Clinical hyperthyroidism				
	0 (0%)	2 (4.9%)	4.213 ^{F}	0.104 (NS)

‡ Chi-square test. ^{F}Fisher's Exact test p< 0.05 is significant. Sig.: significance.

Table 5. Prevalence rate of thyroid dysfunction in elderly and its variation according to age group.

Parameter	< 70 years	≥ 70 years	Test	p-value (Sig.)
Count (%)	85 (67.5%)	41 (32.5%)		
Thyroid dysfunction as general	20 (23.5%)	0 (0%)	11.467‡	<0.001 (HS)
Subclinical hypothyroidism	11 (12.9%)	0 (0%)	5.813[F]	0.016 (S)
Subclinical hyperthyroidism	5 (5.9%)	0 (0%)	2.511[F]	0.173 (NS)
Clinical hypothyroidism	2 (2.4%)	0 (0%)	0.980 [F]	1.00 (NS)
Clinical hyperthyroidism	2 (2.4%)	0 (0%)	0.980 [F]	1.00 (NS)

‡ Chi-square test. [F]Fisher's Exact test p< 0.05 is significant. Sig.: significance.

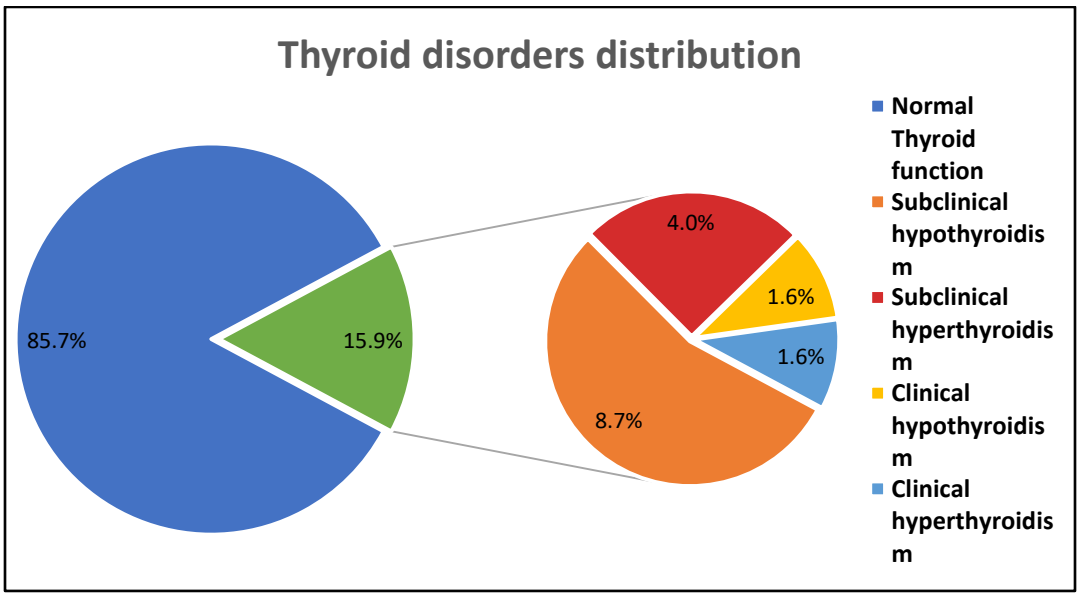

Figure 1. Shows the distribution of the thyroid disorders in the study group.

DISCUSSION

Thyroid dysfunction is common in the elderly subjects. A strong clinical awareness is needed in the elderly population because of the subtle clinical presentations of the thyroid diseases. The present study is the first of its kind to study the thyroid function in the elderly, and to estimate the prevalence rates of thyroid dysfunction in Zagazig city in the elderly Egyptian.

Our study showed that the thyroid function abnormalities were present in 20 subjects (15.9%) of the study group. The prevalence rates of thyroid function abnormalities were in males (19.5%) higher than in females (14.1%). Subclinical hypothyroidism was the most common thyroid dysfunction with a prevalence rate of 9.4% in the females and 7.3% in the males. Subclinical hyperthyroidism was the second thyroid abnormality with 7.3% in males

and 2.4% in females. The prevalence rate of clinical hypothyroidism in females was 2.4% while in males 0%, and the prevalence rate of clinical hyperthyroidism in females was 0% while in males 4.9%.

The upper limit for normal TSH level of our study was 4.98mIU/L.

Resario PW & Calsolari MR et al. reported that in the elderly Brazilians the upper limit for normal TSH was 4.6 mIU/L, which was slightly higher than that which reported for Brazilian adults aged 18-60 years [12]. In the National Health and Nutrition Examination Surveys III (NHANES), the 97.5th percentile of TSH was 5.9% and 7.49% for the age groups of 70-79 years and ≥ 80 years, respectively [13]. Fontes et al. evaluated prospectively 1200 subjects of both sexes. They found TSH increased with age in the whole group. There was no statistical difference in the analysis of these independent subgroups: 20–49 versus 50–59 years old ($p > 0.05$), and 60–69 versus 70–79 years old ($p > 0.05$). Consequently, they achieved different TSH RI for the three major age groups, 20 to 59 years old: 0.4 - 4.3 mIU/L, 60 to79 years old: 0.4 - 5.8 mIU/L and 80 years or more: 0.4 - 6.7 mIU/L. Conversely, FT4 progressively decreases significantly with age, but the independent comparison test between the sub-groups showed that after age 60 the same RI was obtained (0.7 - 1.7 ng/dl) although the minimum value was smaller than that defined by the manufacturer. In the comparison between TSH data obtained by this study and those defined by the manufacturer (without segmentation by age) 6.5% of subjects between 60 and 79 years and 12.5% with 80 years or more would have a misdiagnosis of elevated TSH. They concluded that TSH normal reference range increases with age, justifying the use of different RI in subjects 60 years old and over, while FT4 decreases with age. Using specific-age RI, a significant percentage of the elderly will not be misdiagnosed as having subclinical hypothyroidism [14].

Kim et al. reported that the TSH reference interval in the Korean population was found to be between 0.62 and 6.68 mIU/L, and was higher than that of Western countries because they involved in their study subjects older than 70 years [15]. A cross sectional study was conducted on 100 elderly patients aged ≥60 years both males and females recruited from the Geriatric Outpatient Clinical Al-Zahra General Hospital in Qatif city in Al-Sharqia region of the kingdom of Saudi Arabia by Mahmoud, the study revealed that Out of 100 elderly, 20% were found to have abnormal thyroid function tests hypothyroidism was seen in 15% of subjects and 5% had hyperthyroidism. 10% of patients showed overt hypothyroidism and 5% had Sub-clinical hypothyroidism. Overt hyperthyroidism was noted in 3% subjects and subclinical hyperthyroidism in 2% subjects. Prevalence of thyroid dysfunction was more among females 20% than in males 6%, showing a female preponderance. This was seen in both hypo and hyper thyroid states [16].

Benseñor et al. and Ceresini et al. reported that subclinical hyperthyroidism is more common than overt hyperthyroidism in the elderly which is estimated to have a prevalence of 3–8%. [17, 18]. While the study of Madhauvan et al. which was conducted on 100 elderly individuals from Bangalore city in India showed that overt thyroid disorders both hypothyroidism and hyperthyroidism are more common than subclinical disease [19].

Kim et al. studied the thyroid function in the Korean population, and they reported that overt hypothyroidism was 1.22% in people aged 60-69 years and 0.58% in those ≥ 70 years. Subclinical hypothyroidism on the other hand was 2.62% in people aged 60-69 years and 2.97% in those ≥ 70 years. Overt hyperthyroidism was 0.26% in people aged 60-69 years and 0.83% in those ≥ 70 years; and subclinical hyperthyroidism was 4.30% in people aged 60-69 years and 3.13% in those ≥ 70 years [15].

CONCLUSION

Thyroid dysfunction is common in elderly subjects. A strong clinical awareness is needed in the elderly population because of the subtle clinical presentations. The reference interval of TSH was found to be (0.4uIU/ml- 4.98uIU/ml).

In this study the upper limit for the normal TSH was a 4.98 uIU/ml for the elderly population who were their ages were between 60-95 years in Zagazig city in Sharkia.

Limitation: This study was undertaken in only one city and is of a Small sized sample of the whole population so, a large sized sample is needed. Antithyroid antibodies were not estimated in the study.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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