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Original Research Article

A Retrospective Study to Investigate the Thyroid Function Status among Postmenopausal Women

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Abstract

Aim: The aim of the present study was to investigate the thyroid function status among postmenopausal women.

Methods: A retrospective study was performed among 100 women aged 45–80 years who attended the Department of Biochemistry, ESICMCH, Bihta, Patna, Bihar, India from December 2021 to November 2022. Among these 90 female subjects, 40 were hypothyroid females and 50 were hyperthyroid females. They were divided into postmenopausal hypothyroid postmenopausal hyperthyroid, and control groups. 10 females were taken in the control group.

Results: A total of 90 females including premenopausal (n=50) post-menopausal (n=40) with thyroid dysfunction and euthyroid females with normal menstrual cycle (Control group= 10) were assessed for T3, T4 and TSH level. Mean TSH value for postmenopausal hypothyroid females was 10.30 ±3.42 µg/dl, for FT3 value was 2.05 ±0.82 pg/dl and mean value for FT4 was 0.46 ±0.34 µg/dl (P<0.01). Mean value for TSH was 0.85 ±0.90 µg/dl, for FT3 mean value was 10.64 ±2.24 pg/dl and mean value for FT4 was 2.85 ±1.01 µg/dl (P<0.01). In hyperthyroid premenopausal females serum TSH level was significantly lower than the control group (P<0.01). Serum FT3 level was significantly higher in hyperthyroid premenopausal and postmenopausal females as compared to control group (P<0.01).

Conclusion: In view of the results obtained from the current research and considering the previous reports, there is a possibility of a shift in the activities of thyroid hormones with age. Considering the improved life expectancy and the fact that the activities of thyroid hormones could influence the reproductive and other metabolic pathways, it is important for us to have a better understanding of the activities of thyroid hormones as a person ages for appropriate management.

Keywords: Thyroid hormones, Thyroid stimulating hormone (TSH), Tri-iodothyronine (T3), Thyroid gland disorders, post-menopausal, tetra-iodothyronine (T4)

Introduction

Human life relies on a delicate balance of hormones such as estrogen, progesterone, testosterone, and many others. Women come across many physiological and anatomical changes throughout their lives, including puberty, pregnancy, and menopause, which are controlled by female sex hormones. Menopause is characterized by the permanent cessation of menstrual periods as a consequence of a gradual and irreversible loss of ovarian function. The decline in ovarian function, metabolic changes and comorbidities cause a wide spectrum of symptoms. [1] Thyroid diseases mainly affect women; the incidence is five to 20 times higher in women than in men. The prevalence of thyroid diseases increases with age. In women, diseases of the thyroid gland are among the most prevalent disorders worldwide, second only to diabetes. [2] Thyroid diseases are more common in older post-menopausal women. Thyroid function and the gonadal axes are related throughout a woman's fertility. The relationship between the two glands is mutual. [3,4] The diagnosis of thyroid disease is difficult in this group of patients because the symptoms like anxiety, heart palpitations, sweating, gaining weight and insomnia are common for the both thyroid and ovarian dysfunction. The additional problems arise from the interpretation of the results of thyroid function tests: according to many observations the serum TSH, thyroxine (T4), and tri-iodothyronine (T3) concentrations depend on age, comorbidities, and medical treatment – these together sometimes make the diagnosis of thyroid dysfunction complicated in older population. Although thyroid status has a well-known impact on

cardiovascular risk, cognitive function, disability, and longevity there is no consensus on universal screening for thyroid dysfunction of postmenopausal and elderly women among medical associations worldwide. [5] Most professional organizations recommend the screening of older women for thyroid dysfunction. The American Thyroid Association (ATA), the Endocrine Society and the American Association of Clinical Endocrinologists (AACE) had recommended aggressive case finding in elderly women.5

According to the 2012 clinical practice guidelines formulated by the AACE and ATA, serum TSH is the best screening test for the primary diagnosis of thyroid disorders. [5] TSH is the preferred test to assess thyroid function, as stated by the National Academy of Clinical Biochemistry (NACB). [6] Thyroid functions can be influenced by nutritional status, associated co-morbidities, co-factors such as body surface area, and others. [7,8] A regular follow-up of the activities of TSH could help in the clinical diagnosis and better management of the patients. According to the available literature, serum TSH concentrations may probably be age-dependent. Increased levels of serum TSH in the elderly, mainly in women, can be physiological or pathological. [9,10]

A cross-sectional study was undertaken to measure the serum TSH, T3, and T4 activities in post-menopausal older-aged women.

Material & Methods

A retrospective study was performed among 100 women aged 45–80 years who attended the Department of Biochemistry, ESICMCH, Bihta, Patna, Bihar, India from December 2021 to November 2022. . Among these 90 female subjects, 40 were hypothyroid females and 50 were hyperthyroid females. They were divided into postmenopausal hypothyroid postmenopausal hyperthyroid, and control groups. 10 females were taken in the control group.

A structured questionnaire was used for the collection of information from the patients. With the help of questionnaire, information relevant to the study about patient's personal history, duration of disease and use of medication was taken. Question regarding their menstrual history was included which helped to assess the menopause during thyroid dysfunction. Women were considered to be menopausal if more than one year had elapsed since their last menstrual period or if they had undergone surgical menopause. Height was measured in inches while weight was taken in kilograms. From height and weight, BMI was calculated.

BMI = weight/height (m2)

Range of BMI for normal weight, underweight and overweight is:

- Underweight --- from 15 to 18.4
- Normal --- 18.5 to 22.9
- Overweight --- from 23 to 27.5

Sample Collection:

Blood samples were collected with the help of professional technicians of INMOL, from the inner side of the elbow by using BD syringes of 5 cc. Then samples were brought to department of biochemistry in vacuette tubes and incubated at 370C for 40 minutes. Then serum was centrifuged at 3000 rpm for 20 minutes and stored at -40 0C in ependorfs till the time of assay.

Reference range for TSH in normal adult 0.4 – 5.5 µg/L patients with TSH level below this range were considered to be hyperthyroid patients and patients above this range were considered to be hypothyroid patients. Reference range for FT3 in normal adults 3.5 – 6.47 pg/L patients having FT3 level below this range were considered as hypothyroid subjects and patients with high FT3 levels than the reference range considered as hyperthyroid subjects. Reference range for FT4 in normal adults 0.8 – 2.7 µg/L patients having FT4 level below this range were considered as hypothyroid subjects and patients with high FT4 levels than the reference range considered as hyperthyroid subjects.

Statistical Analysis

The data were analyzed using SPSS version 15.0 (SPSS Inc., Chicago, 105 IL, USA). Statistical tests included $\chi 2$, Student t, and analysis of variance. A forward conditional method was used for logistic regression modelling, which included both variables exhibiting statistically significant differences in univariate comparisons and other factors with potential clinical significance. P value <0.05 was considered statistically significant.

Results

Table 1: Characteristics of the population

Physical characteristics	Hypothyroid	Hyperthyroid	Control
N	40	50	10
Age (mean ±SD)	40.2 ±15.5	38.2 ±8.32	36.4 ±3.20
Height (ft) **Weight (kg) BMI (mean ±SD)**	5.2 60.2 23.47 ±4.16	5.3 54 24.2 ±0.12	5.1 52 20.22 ±0.70
Marital status	30	42	6 4

MarriedUnmarried	10	8	
Disease history **DiagnosedNew cases**	32 8	38 12	--
Menstrual irregularities	82%	64%	3%

A total of 90 females including premenopausal (n=50) post-menopausal (n=40) with thyroid dysfunction and euthyroid females with normal menstrual cycle (Control group= 10) were assessed for T3, T4 and TSH level.

Table 2: Comparison of Thyroid l levels in pre and post-menopausal Female (Control Group)

Hormonal Parameters	Pre menopause hypothyroid	Post menopause hypothyroid	Control
TSH µg/L **(mean ±SD)**	17.3 ±10.50	10.30 ±3.42	3.14 ±0.55
FT_3 pg/dl **(mean ±SD)**	1.08 ± 0.80	2.05 ±0.82	3.40 ±0.50
FT_4 µg/dl **(mean ±SD)**	0.72 ±0.48	0.46 ±0.34	1.86 ±0.52

Mean TSH value for postmenopausal hypothyroid females was 10.30 ±3.42 µg/dl, for FT3 value was 2.05 ±0.82 pg/dl and mean value for FT4 was 0.46 ±0.34 µg/dl (P<0.01).

Table 3: Mean Thyroid Hormonal levels in hypothyroid pre and post-menopausal Female subjects in comparison to healthy controls

Hormonal Parameters	Premenopausal hyperthyroid	Ll;	Control
TSH µg/dl **(mean ±SD)**	0.85 ±0.90	0.34 ±0.86	3.16 ±0.55
FT3 pg/dl **(mean ±SD)**	10.64 ±2.24	10.50 ±2.12	3.40 ±0.65
FT4 µg/dl **(mean ±SD)**	2.85 ±1.01	3.40 ±0.80	1.80 ±0.52

Mean value for TSH was 0.85 ±0.90 µg/dl, for FT3 mean value was 10.64 ±2.24 pg/dl and mean value for FT4 was 2.85 ±1.01 µg/dl (P<0.01).

Discussion

Menopause is characterized by the permanent cessation of menstrual periods as a consequence of a gradual and irreversible loss of ovarian function. The decline in ovarian function, metabolic changes and comorbidities cause a wide spectrum of symptoms. [1] Menopause hormone therapy (MHT) has been extensive shown to relieve climacteric symptoms, including vasomotor symptoms and genitourinary syndrome. Randomized trials also demonstrate positive effects on bone health and age-stratified analyses indicate more favorable effects in coronary heart disease and all-cause mortality in younger women (close proximity to menopause) compared with women at least a decade post onset of menopause. [11] Thyroid function and the gonadal axes are related throughout a woman's fertility. The relationship between the two glands is mutual. [12,13] Thyroid hormone increase the synthesis of sex hormone binding globulin (SHBG), testosterone, and androstenedione, reducing the clearance of estradiol and androgens while increasing the conversion of androgens to estrone. [14] The main role of estrogens in thyroid physiology is related to the increase in serum concentrations of thyroxine binding globulin (TBG). [15] The fundamental essence of MHT is estradiol and it is important to note the effects of estrogens on thyroid function. The oral administration of estrogens causes a dose-dependent increase of the serum levels of TBG synthesized in the liver. [16]

In hypothyroid females gain in body weight was observed having BMI value 23.47 ±4.16 kg/m2 (P<0.01) which was higher than hyperthyroid and control group. This weight gain in hypothyroidism may be due to the reduction in removal rate of triglycerides and cholesterol which is due to the decrease in the plasma post heparin lipolytic activity. From data obtained general reduction in body weight of hyperthyroid patients was observed. This reduction in weight may be due to the accelerated rate of degradation of most lipids out of proportion to synthesis, so body lipids depots consequently become depleted and levels of various plasma lipid components fall. Significant difference was observed in TSH levels of premenopausal hypothyroid, hyperthyroid and control group females (P<0.01). In premenopausal hypothyroid females elevated TSH level was observed with mean value (P< 0.05). Similarly high serum TSH level in postmenopausal hypothyroid females and low serum FT3 and FT4 levels were observed. Increased level of TSH in this group is either due to the decreased secretion of FT3 and FT4 or failure of thyroid gland itself to secrete thyroid hormone. Decreased serum FT3 may be result of decreased conversion of FT4 to FT3. A large, population-based study conducted by the National Health And Nutrition Examination Survey (NHANES) found higher TSH activities in women in the older age group. [17] An analysis of NHANES III (2007) showed that age-related shifts in TSH activities were not significantly altered when individuals with antithyroid antibodies were

excluded from the study. Alterations in the activities of thyroid hormones under the influence of food (soy) were also previously reported. [18] Aging could influence the activities of various hormones that include the growth hormone, growth hormone-releasing hormone (GHRH), estrogen, progesterone, androgens, follicle-stimulating hormone, insulin-like growth factor 1, and others. [19] Therefore, it is important to understand the activities of thyroid hormones with aging.

Previous studies have examined the effects of MHT on thyroid function in euthyroid postmenopausal women. In the study by Benencia et al [20], postmenopausal women who used oral MHT resulted in an increase in serum TBG and tT4 levels at 3, 6 and 12 months, but within the normal range. Moreover, serum TSH, fT4, and total tri-iodothyronine (tT3) levels did not change significantly and remained within the normal range. As evidenced by the current literature, there is a possibility of variation in the activities of thyroid hormones among women. Experimental studies in the past have highlighted the potential role of estrogen in the development of thyroid dysfunction. Studies found that estrogen receptors, along with their isoforms, on thyroid cells could modulate thyroid function, especially causing cancer. [21,22] The most accepted and probably the potential mechanism by which estrogen causes thyroid dysfunction among women, especially post-menopausal women, is its binding to the thyroglobulin. This restricts the entry of thyroxine into the cells, thereby increasing the concentrations of bound thyroxine and reducing the availability of free thyroid hormones. [23]

Conclusion

In view of the results obtained from the current research and considering the previous reports, there is a possibility of a shift in the activities of thyroid hormones with age. Considering the improved life expectancy and the fact that the activities of thyroid hormones could influence the reproductive and other metabolic pathways, it is important for us to have a better understanding of the activities of thyroid hormones as a person ages for appropriate management. Also, there is a need to understand the baseline thyroid function by measuring the activities of thyroid hormones in euthyroid women at various climacteric stages of life, including pre-puberty, after puberty, pre-pregnancy, after pregnancy, and post-menopause to determine subclinical thyroid disease/thyroid dysfunction.

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