

## **Between Estradiol and Thyroid Hormones in Menopausal Women**

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### **ABSTRACT**

*In menopausal women, the symptoms of thyroid disease may be similar to postmenopausal complaints and are clinically difficult to differentiate. The study assessed Estradiol and thyroid hormones in fifty pre-menopausal and fifty post-menopausal women. In both groups, thyroid hormones [Thyroid Stimulating Hormone (TSH), Total Thyroxine (TT4), and Total Triiodothyronine (TT3)] and Estradiol (E2) were measured. The levels of Estradiol and thyroid hormones were determined using Enzyme Linked Immunosorbent Assay (ELISA) (Biocheck immunoassay, USA). The results showed a significant decrease ( $P < 0.05$ ) in serum TT4 and TT3 levels of post menopausal women [ $7.81 \pm 2.06$  ( $\mu\text{g}/\text{dl}$ ) and  $1.02 \pm 0.11$  ( $\text{ng}/\text{ml}$ )] compared with the results in premenopausal women [ $12.30 \pm 3.96$  ( $\mu\text{g}/\text{dl}$ ) and  $1.21 \pm 0.45$  ( $\text{ng}/\text{ml}$ )]. The study also revealed that there was no significant positive correlation ( $P < 0.05$ ) between Estradiol ( $\text{pg}/\text{ml}$ ) and thyroid hormones in the postmenopausal women. The study concluded that at postmenopausal stage, there is a significant decrease in TT4 and TT3 in postmenopausal women without significant change in TSH and weak positive relationships exist between estradiol and thyroid hormones.*

**Key words:** Thyroid hormones, Estradiol, premenopausal, postmenopausal

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### **INTRODUCTION**

Menopause is a natural change in which there is a cessation of a woman's reproductive ability. It typically occurs in women usually beginning from their late 40s or early 50s [1]. It

is a physiological process characterized by loss of reproductive function as well as the appearance of variety of symptoms, like lethargy, hot flushes, anxiety, sexual problems, tiredness, insomnia, weight gain and mood swings [2]. Thyroid hormones play very important roles in normal reproductive function both through direct effects on the ovaries and indirectly by interacting with sex hormone binding proteins. Estradiol is a form of estrogen, a female sex hormone produced by the ovaries. Estrogen is necessary for many processes in the body and estradiol is the principal estrogen (most potent estrogen). Thyroid disorders increase with age and the symptoms of thyroid disease may be similar to postmenopausal complaints and are clinically difficult to differentiate. Thus because of the importance of estradiol and thyroid hormones, it is important to determine whether there is relationship between estradiol and thyroid hormones in menopause.

### **MATERIALS AND METHODS**

The study population consisted of 100 apparently healthy subjects, recruited at random to include 50 premenopausal women and 50 menopausal women between the ages of 20-44 and 45-77 years respectively. Blood samples were collected from the women for the estimation of TSH, TT4, TT3 and Estrogen. TSH, TT4, TT3 and Estradiol were determined using Enzyme Immunoassay (EIA) [3], [4].

The data generated were presented as mean  $\pm$  standard deviation (SD). The results were analyzed using Statistical Package for Social Sciences (SPSS version 17.0). The differences in the mean for each parameter between the two groups were compared using Student's t test and the relationship between parameters were compared using correlation coefficient (r).

### **RESULTS**

Table 1 shows the hormonal levels of premenopausal and postmenopausal women. There was significant decrease in the mean serum level of Estradiol, TT4 and TT3 of postmenopausal women compared to premenopausal women while there was no significant

increase in TSH. Table 2 shows correlation analysis between Estradiol and thyroid hormones. There was no significant positive correlation between Estradiol and the thyroid hormones.

**Table 1: Hormonal levels of Premenopausal and Postmenopausal women.**

Parameters	Pre menopause	Post menopause	t-test	P-value
<b>Estradiol (pg/ml)</b>	44.15±19.68	12.01±10.15	10.155	0.000*
<b>TSH (µIU/ml)</b>	1.46±0.68	1.48±1.08	-0.144	0.886
<b>TT4 (µg/dl)</b>	12.30±3.96	7.81±2.06	7.115	0.000*
<b>TT3 (ng/ml)</b>	1.21±0.45	1.02±0.11	2.879	0.005*

N=50

\* Statistically significant at  $p < 0.05$

**Table 2: Correlation coefficient (r) between Estradiol, thyroid hormones and demographic data in the menopausal women**

Parameters	r	P-value
<b>Estradiol (pg/ml) and TSH (µIU/ml)</b>	0.045	0.755
<b>Estradiol (pg/ml) and TT4 (µg/dl)</b>	0.017	0.908
<b>Estradiol (pg/ml) and TT3 (ng/ml)</b>	0.128	0.377

N=50

r=correlation coefficient

\*\* = significant correlation ( $p < 0.05$ )

## DISCUSSION

In this study, there was a significant decrease in the value of serum estradiol in postmenopausal women compared with premenopausal women. This has also been mentioned in a previous study which showed that after menopause, the ovaries stop producing estrogens but it is still being made by the adrenal glands, the liver and the fatty tissue within the breast [5]. Also, there was a significant decrease in mean values of serum total thyroxine (TT4) and total triiodothyronine (TT3) in postmenopausal women compared with premenopausal women while there was no significant effect in the mean values of Thyroid Stimulating Hormone (TSH). These findings are in line with the studies which described proliferation of thyroid cells induced by estradiol (E2) [6]. The decreased levels of TT4 and TT3 indicated in the result may be due to the decreased level of estrogen in postmenopausal women. In the blood, almost all the thyroid hormone (99.97%) is bound to plasma protein mainly thyroxine-binding globulin (TBG) and estrogen increases the production of TBG [7]. Hence, if the estrogen level is high, the TBG will bind more thyroid hormone decreasing the free hormone available in the blood, which leads to stimulation of TSH, and the production of more thyroid hormone thus the total thyroid hormone level will be high. However, in postmenopausal women, the low level of TBG due to decreased level of estrogen will cause increased free thyroid hormones levels that will inhibit the stimulation of TSH. The increase in the serum TT4 in the premenopausal women may be due to the fact that when there are elevated levels of estrogen, the amount of TBG in blood also increases. These increased numbers of thyroid binding proteins attach more to the thyroid hormone thereby preventing them from binding to their receptors to carry out their function. Thus, TSH is stimulated to produce more thyroid hormone leading to an increase in TT4.

In premenopausal women estrogen has been shown to prevent atherosclerosis due to its vasculo-protective action and it also helps in maintaining the delicate balance between fighting infections and protecting arteries from damage thus lowering the risk of

cardiovascular disease [8]. The thyroid is responsible for regulating metabolism when there is malfunctioning and can have a number of effects on the body's metabolism which includes fat metabolism [9]. Furthermore, since it has been shown that postmenopausal women are already at an increased risk for heart disease, women with untreated hypothyroidism resulting from the changes in estrogen levels have an even greater risk of cardiovascular events, as well as an increased risk for osteoporosis [10]. In another study it was observed that TT4 and free T4 was negatively associated with total cholesterol and triglyceride and positively associated with High Density Lipoprotein (HDL) [11]. However in this study, estradiol and thyroid hormones showed weak positive correlations which are not significant. This implies that menopause may be associated with potential adverse changes in thyroid function in menopausal women which may be due to the decreased level of estrogen. This relationship is similar to the case that was presented in the management of hypothyroidism [12].

### **CONCLUSION**

The study showed that at postmenopausal stage, there is a significant decrease in TT4 and TT3 in women without significant change in TSH. Weak positive relationships were also observed between estradiol and thyroid hormones. Therefore, the study recommends that women at menopause should be screened for thyroid disorders especially if there is high index of suspicion. This will help to detect any significant abnormality and avoid serious consequences of overt hypothyroidism in menopausal women.

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