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SERUM THYROID AND ITS REGULATORY HORMONE LEVELS IN OBESE WOMEN WITH SEDENTARY LIFESTYLE

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Abstract: The aim of this study was to investigate thyroid hormones (T_3, T_4) and its regulatory hormone (TSH) levels in obese women with sedentary life style. The studied population consists of 180 female subjects of age group 20-45 years. The study was carried out on female population of Allama Iqbal Town, Samanabad, and Lahore College for Women University, Lahore. The subjects were divided into three categories on the basis of body mass index (BMI): normal weight subjects (n=60) overweight subjects (n=60) and obese subjects (n=60) according to Asian criteria. Thyroid hormone levels were assessed by commercially available Enzyme linked immunosorbent assay (ELISA) kits. Statistical analysis was done by SPSS (version 13.0). It is concluded that although thyroid function was in clinically normal range in all the subjects but when comparison was done between the groups using one way ANOVA serum T_3 concentration was significantly low in obese and overweight subjects in comparison with normal weight subjects ($p \leq 0.005$). Serum T_4 concentration was significantly lower in overweight and obese subjects in comparison to normal weight ($p \leq 0.005$). Serum TSH concentration was significantly higher in obese in comparison with normal weight ($p \leq 0.005$) while it was non significantly higher in overweight subjects ($p \geq 0.05$).
Key words: thyroid hormones, obesity, ELISA

INTRODUCTION

Obesity is a disease that brings several complications and increases the risk of other diseases like metabolic syndrome, diabetes mellitus type 2, and cardio-vascular diseases. A quarter of the population of Pakistan would be classified as overweight or obese with the use of Indo-Asian-specific body mass index (BMI) cutoff values. The

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growing prevalence of type 2 diabetes, hypertension and cardiovascular disease is tied to excess weight (Afridi and Khan, 2004). Obesity develops as a result of complex interactions between a person's genes and the environment characterized by long term energy balance due to excessive calorie consumption, insufficient energy output. Diet and lifestyle play a significant role both in development and control of obesity (Greenspan and Gardner, 1997). Changing lifestyle over the last century, including increased calorie consumption and reduced physical activity have played a key role in obesity development. Many molecular mechanisms reported to be involved in development of obesity.

Obesity has strong endocrinological and neurological basis (Sowers *et al.,* 1992). Thyroid hormones are a major regulator of energy metabolism in vertebrates and defects in thyroid status are frequently associated with changes in body weight. Thyroid hormones regulate in vivo and in vitro the tub gene, which when mutated in tubby mice causes obesity, insulin resistance and sensory defects. These changes could be attributed to thyroid hormone deficiency since T_3 or T_4 treatment restored normal tub expression (Koritschoner *et al.,* 2001). Reinehr and Andler (2002) reported that T_3 and T_4 concentration was significantly higher in obese children compared to those of normal weight. Rosenbaum *et al.* (2001) suggested that changes in body weight were associated with changes in catecholamine excretion and thyroid hormones, which might by virtue of the effects on energy expenditure, have favored a return to usual body weight. Overweight women with a family history of obesity may have lower levels of the thyroid hormone triiodothyronine (T_3) in their blood. Treatment to raise T_3 levels may help reduce some metabolic risk factors associated with abdominal obesity in some overweight women (Yokoyama *et al.,* 2000).

Sari *et al.* (2003) in his study stated that thyroid volume and function may very in obese and non-obese women. Knudsen *et al.* (2005) found a positive correlation between BMI and serum thyroid stimulating hormone (TSH) ($P<0.001$) and a negative association between BMI and category of serum T_4 ($P<0.001$). No association was found between BMI and serum free T_3 levels. Even slightly elevated serum TSH levels are associated with increase in the occurrence of obesity. As main regulators of the body rate of metabolism, thyroid hormones have a profound impact on weight. By increasing enzyme levels in the cell, mitochondria, which

produce energy, thyroid hormones control how the body burns up carbohydrates and fats (Astrup *et al.,* 1996). Hypothyroidism occurs when the thyroid gland does not produce enough energy generating thyroid hormones. Weight gain is a classic symptom of this dysfunction. In such cases levels of thyroid stimulating hormone TSH may rise in an attempt to spur more production and secretion of thyroid hormones from thyroid gland (Kotkiewski *et al.,* 1997). The aim of the present study is to assess the thyroid hormone levels in obese women and to find the correlation of thyroid with obesity.

MATERIALS AND METHODS

The study was carried out on female population of Allama Iqbal Town, Lahore, Alshafa Clinical Laboratory, Samanabad Lahore and Lahore College for Women University Lahore. Study constitutes 180 female subjects of age group 20-45 years. Subjects were divided into three categories 60 obese, 60 overweight and 60 controls (normal weight). Waist was measured horizontally at the level just above the uppermost border of the iliac crest. The measurement was made at a normal minimal respiration. Hip was measured as the maximum circumference over the buttocks (Molarius *et al*., 1999). Central obesity was calculated by dividing the waist measurement over the hip measurement and termed as waist hip ratio (WHR). Height was taken using standard apparatus with the subjects wearing light clothing and without shoes. Weight was measured in the upright position with a weighting scale to the nearest 0.01 kg. Height was measured to the nearest 0.1cm by using a non-stretching tape. Obesity index or (BMI) was calculated as weight (kg) divided by height squared (m^2) to estimate overall body fat distribution (Greenspan and Gardner, 2004). Overweight and obesity was defined according to Asian criteria (Dhiman *et al.,* 2005) and BMI greater than 23 was considered as over weight and BMI greater than 25 was considered obese. Participants who reported smoking at least 3 cigarettes per day during the previous year were classified as current smokers. Physical activity was defined as (i) sedentary, no extra physical activity apart from activities of daily living, (ii) or physical active if they do brisk walking at least half an hour for three days in a week. T_3, T_4 and TSH were measured by Enzyme immunoassay (EIA).

T_3 was estimated using Medicorp HRP EIA Kit (Cat. No. KTSP-21651). T_4 and TSH were measured by using Medicorp HRP EIA Kit (Cat. No. KISP-22551) and Biocheck EIA Kit respectively. The study was approved by the ethical committee of the university. A written consent was taken from all the participants of the study. They cooperated throughout the period of study.

Statistical Analysis:

Statistical analysis was performed using the SPSS (version 13.0) software. All results are expressed as Mean±SD. Spearman correlation was used to find the correlation and ANOVA was applied to find the significance between the studied groups. Data was analyzed statistically applying ANOVA to find significance of results.

RESULTS AND DISCUSSION

Serum T_3, T_4 and TSH concentrations were clinically in the normal range in all the studied groups (Normal weight, overweight and obese) Serum T_3 concentration was 1.16±0.17ng/ml in normal weight, 2.00±0.33ng/ml in over weight subjects and 2.07±0.93ng/ml in obese subjects (Table I). Statistical analysis showed that T_3 concentration in over-weight subjects was significantly higher than that of normal weight subjects ($P \leq 0.05$). Serum T_3 concentrations in obese subjects were significantly low than that of normal weight subjects ($P \leq 0.05$).

Serum T_3 concentration in obese subjects were significantly lower than that of overweight ($p \leq 0.05$). Serum T_4 concentration were 9.99±1.96µg/dl in normal weight subjects, 10.28±0.97 µg/dl in over weight subjects and 11.89±2.43 µg/dl in obese subjects. Statistical analysis showed that serum T_4 concentration was significantly lower in overweight subjects than that of normal weight subjects ($P<0.05$). Serum T_4 concentration was significantly lower in obese subjects than that of normal weights subjects ($P \leq 0.05$). Serum T_4 concentration was non -significantly lower in obese than that of overweight subjects ($P<0.05$).

TABLE I T_3, T_4 and TSH Levels in Normal weight, Overweight and Obese Subjects.

Variables	Normal weight (Mean ± S.D)	Overweight (Mean ± S.D)	Obese (Mean ± S.D)	P- Value
T_3ng/ml	1.16 ± 0.17	2.00 ± 0.33	2.07 ± 0.93	0.000 **↓
T_4 µg/dl	9.99 ± 1.96	10.28 ± 0.97	11.89 ± 2.43	0.000**↑
TSH µIU/ml	1.66 ± 0.26	1.92 ± 0.14	2.82 ± 0.67	0.000**↑

**Significance P ≤ 0.005

Serum TSH concentration was 1.66±0.26 µIU/ml in normal weight subjects, 1.92±0.14 µIU/ml in overweight subjects, 2.82±0.67 µIU/ml in obese subjects. Statistical analysis showed that serum TSH concentration was non-significantly higher in overweight subjects than that of normal weight subjects (P≥0.05). Serum TSH concentration was significantly higher in obese than that of normal weight subjects (P≤0.05). Serum TSH concentration was non-significantly higher in obese than that of overweight subjects (P≥0.05).serum T3 and TSH concentration had a positive significant correlation with BMI (r= 0.361, r=0.413, P<0.05) respectively.

It is suggested that thyroid and its regulatory hormone levels are altered in obesity. Thyroid hormones are potent modulators of adaptive thermogenesis and can potentially contribute to the development of obesity (Krotkiewski, 2002).

Serum T_3 concentration was found significantly lower in over weight and obese subjects as compared to normal weight subject conflicting reports from the literature are available. Stichel *et al.* (2000) studied thyroid function and obesity in children and adolescent. They concluded that in childhood obesity TSH and T_3 levels are significantly increased.

Serum T_4 concentration was found non-significantly higher in obese subjects than that of overweight subjects. Sari *et al.* (2003) reported that thyroid volume and TSH concentration were higher; free T_3 (P<0.001) and free T_4 concentration (P=0.045) were lower in obese women; however all were still in the normal range.

This study shows that serum TSH concentration was found significantly higher in over weight and obese subjects as compared to

normal weight subjects Serum TSH concentration was found non-significantly higher in obese subjects as compared to overweight subjects.

A significant and positive correlation was observed between serum concentration of TSH and BMI in the control group only. Contradictory reports from the literature are available in this regard. Lacobellis *et al*. (2005) and Bastemir*et al*. (2007) observed higher TSH levels in obese subjects with normal thyroid function, while some other studies showed no relationship between TSH and obesity (Wesche *et al*., 1998; Ritz *et al*., 2002). Chang *et al*. (1994) in his studies reported no relationship of TSH with obesity. Lacobellis *et al.* (2005) studied possible relationship of thyroid function with BMI in euthyroid obese women. TSH was positively correlated with BMI. TSH could represent a marker of attenuated energy balance in severe, but uncomplicated obese women.

It is concluded that although thyroid hormones level was in normal range in all the subjects but serum T_3 concentration was significantly lower in obese subjects, T_4 concentration and serum TSH concentration were higher in obese subjects as compared to normal weight subjects and these difference were significant.

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