

Relationship Between Tri-Iodothyronine (T3) And Body Mass Index In Healthy Euthyroid Subject In Khartoum State

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Abstract: Body weight and overt thyroid dysfunction are associated, although the effect of hypothyroidism and hyperthyroidism on body weight have been clearly demonstrated there is no Sufficient data on the relationship between body mass index and minor differences within the normal range of thyroid hormones. This study was carried out to investigate the relationship of fluctuations of triiodothyronine (t3) with body mass index in euthyroid subject. 90 blood samples were collected from euthyroid healthy individual of known age, gender, weight, height and biochemical picture of triiodothyronine(t3) in period between June to October 2016, chosen from general population in Khartoum state. The individual are classified into three groups according to body mass index underweight group with BMI less than 18.9, overweight group with BMI more than 24.9 as case groups and 30 apparently healthy individual with normal weight, BMI (18.9 – 24.9) serve as control group. T3 was measured by enzyme immunoassay test kit. Data was analyzed using SPSS computer program. The study showed that, there was significant increase in the mean of serum t3 level between three groups (underweight group, normal weight group and overweight group) ($1.73 \pm 0.34^{ng/ml}$, $1.46 \pm 0.51^{ng/ml}$, $0.94 \pm 0.47^{ng/ml}$) respectively. (p.value .000).

There was a significant increase in mean when compared underweight group with normal weight group (1.73 ± 0.34 versus 1.46 ± 0.51 , p. value .024). also mean was significantly increase when compared normal weight with overweight. (1.46 ± 0.51 versus 0.94 ± 0.47 , p- value =0.000), there was significant increase in mean when compared underweight group vs overweight group (1.73 ± 0.34 versus 0.94 ± 0.47 , p.value .00).

There was significantly weak negative correlation between serum t3 and body mass index in three groups ($r = -0.500 / p = 0.00$), also there was insignificant weak negative correlations between serum t3 and age of study groups ($r = -0.169 / p = .111$). In conclusion, there was significant increase in t3 level in study groups and there was negative correlation between BMI, t3 and age.

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I. Introduction

The thyroid is one of the largest endocrine glands of the body. Thyroxin (T4) and triiodothyronine (T3), together referred to as thyroid metabolic hormones, play an important role in basal metabolism and the functioning of almost all tissues and systems in the body.⁽¹⁾ The relationship between thyroid function and body weight in euthyroid individuals has been given a great medical concern. Various researchers have studied the effect of the thyroid hormones on body mass index (BMI), and it has been demonstrated that overt thyroid dysfunction affects body weight,⁽²⁾ overt hypothyroidism is associated with an increase in body weight, predominantly caused by oedema, whereas hyperthyroidism results in a reduction of weight, mainly due to catabolic effects on e.g. adipose and muscle tissue.⁽³⁾

However, variations in thyroid function exist also between individuals with thyroid hormones' levels within the reference (physiologic) range⁽⁴⁾. These slight differences within the normal thyroid function may have important implications for the regulation of body weight and thus the prevalence of obesity.⁽⁵⁾

obesity, especially central obesity, is linked to many endocrine abnormalities, including thyroid dysfunction. because T3 regulates energy metabolism and plays a critical role in glucose and lipid metabolism, food intake, and the oxidation of fatty acids. Evidence suggests that slight variations in thyroid function, even as indicated by tests that are within laboratory reference ranges, contribute to the development of regional obesity and the tendency to gain weight⁽⁶⁾.

Effects of hypothyroidism and hyperthyroidism on body weight have been clearly demonstrated. But there is no sufficient data available on the relationship between the body mass index (BMI) and minor differences within the normal range of thyroid function.⁽⁷⁾ Therefore, this study aims to investigate the fluctuations of the tri-iodothyronine hormone with respect to BMI in euthyroid subjects.

Pervious study performed by Tasnim Farasat¹, Tahira Mughal², Sidra Farooq¹ in obese women in Pakistan (2011) showed that serum T3 concentration was significantly low in obese and overweight subjects in comparison with normal weight subjects⁽⁶⁾. Another study performed in Babylon by Tahrear Mohammed Natah¹, Moshtak Abdul-Adheem, Maysaa Adil Hadi, Hadeel Fadhil Haider Kamil Zaidan⁵, Ali Hmood Al-Saadi⁶ (2013). Conducted that Thyroid metabolic hormone especially T3 regulate the resting metabolic rate and the mild thyroid dysfunction was linked to significantly changes in body weight (positive correlation among T3 with BMI)⁽¹⁾.

II. Materials And Methods

Study Population: The study was carried out at College of Medical laboratory Science and the subjects were recruited from, general population in Khartoum (Sudan) from June to October 2016. A total of 90 euthyroid subject were enrolled in this study; divided into three groups, 30 euthyroid with normal body mass index (Control group), 30 euthyroid underweight, and 30 overweight as case group. The study was approved by hospital's ethics committee. Informed consent was obtained from patients before blood sampling.

Inclusion criteria:-

The subjects did not suffer from any kind of thyroid disease or pathogenic condition that could affect the concentration of the thyroid hormones in the serum and they were not under any medication which could affect the thyroid function or the concentration of T3 in the serum were included in this study.

Exclusion criteria: Any person with hyperthyroidism, hypothyroidism, family history of thyroid disease, pregnancy, diabetes mellitus an abnormal TT3 value were excluded.

Sample collection and analysis

About 3ml of venous blood was collected from the antecubital vein by taking aseptic precautions. Care was taken to prevent venous stasis during the sample collection. The blood was allowed to clot and the serum was separated by centrifugation. The serum samples were collected in plain tubes and stored at -20°C. T3 was measured by enzyme immunoassay test kit⁽⁸⁾.

In Anthropometrical measurements Body mass index (BMI) was calculated using the formula $BMI = \frac{\text{weight (kg)}}{\text{height}^2 \text{ (m)}^2}$ and classifying under weight ($BMI < 18.9$), normal ($BMI 18.9 - 24.9$), overweight and obese ($BMI > 25$). Data was analyzed using SPSS computer program, the mean and standard deviation were obtained. The independent 't. test', One way Anova and Person correlation were used for comparison between variables. (p value of ≤ 0.05) was considered as significant.

III. Results

In comparison between groups there was a significant increase in the mean of t3 between three groups, When compared underweight group with normal weight group. (Mean \pm SD) (1.73 ± 0.34 versus 1.46 ± 0.51). There was significant increase in mean level of t3 when compared normal weight with overweight. (1.46 ± 0.51 versus 0.94 ± 0.47), also there was significant increase in mean of t3 level when compared underweight group vs overweight group (1.73 ± 0.34 versus 0.94 ± 0.47) (p. value = 0.000) as in table (1).

Table (1): mean Comparison of serum T3 level between three groups (under Weight, Normal weight and over weight).

Variable	Groups	NO	(Mean \pm S.D)	p-value
T3level	Under weight	30	1.73 ± 0.34	.000
	Normal weight	30	1.46 ± 0.51	
	Over weight	30	0.94 ± 0.47	

Results expressed as Mean \pm SD and significant differences considered as p-value ≤ 0.05 .

The result showed mean difference between three groups as in table (2)

Table (2) mean difference of t3 between study groups.

	Groups	Mean Difference (I-J)	P-value
Post Hoc Test	Underweight versus normal weight	.26597*	.024
	Underweight versus over weight	.79500*	.000
	Normal weight versus over weight	.52903*	.000

The results of this study showed, there were no significant differences in triiodothyronine (T3) between male and female subject as show in table (3)

Table (3): Mean Concentration Of Serum T3 according To Gender In Study Group

Variable	Sex	NO	(Mean ± S.D)	P-value
T3	Male	24	1.46±0.38	0.274
	Female	66	1.34±0.60	

Results expressed as Mean ±SD and significant differences considered as p-value ≤0.05. The distribution of cases according to gender showed that, 73.3 were female and 26.7 were male as in figure (1)

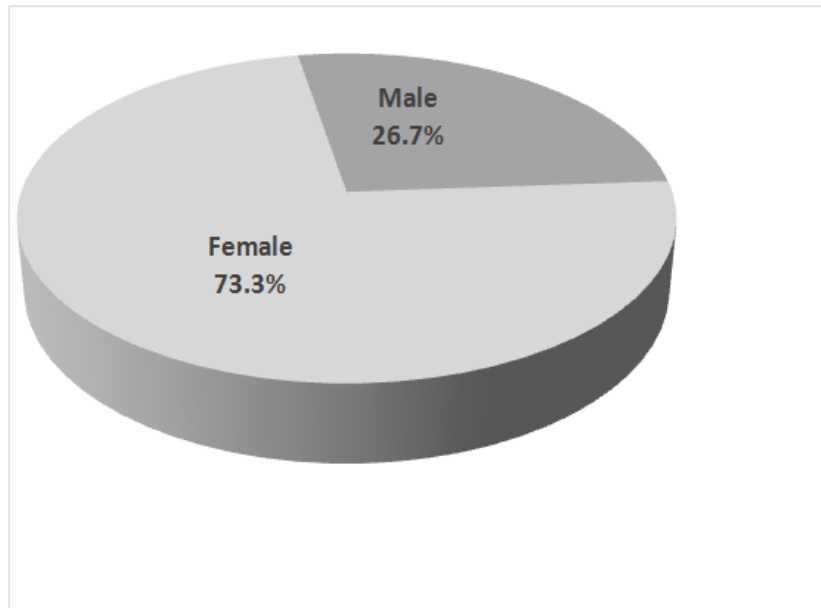


Fig (1) Distribution of cases according to gender

There was significantly negative correlation between serum t3 and BMI ($r=-0.500$, $p .000$) as in fig (2) also there was insignificantly negative correlations between serum t3 and age ($r= -0.169$, $p, value=0.111$) as in fig (3)

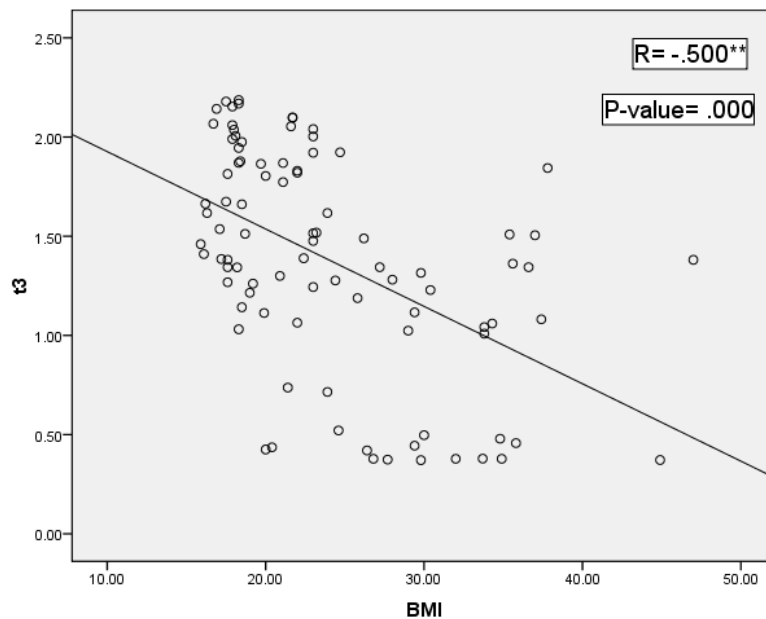
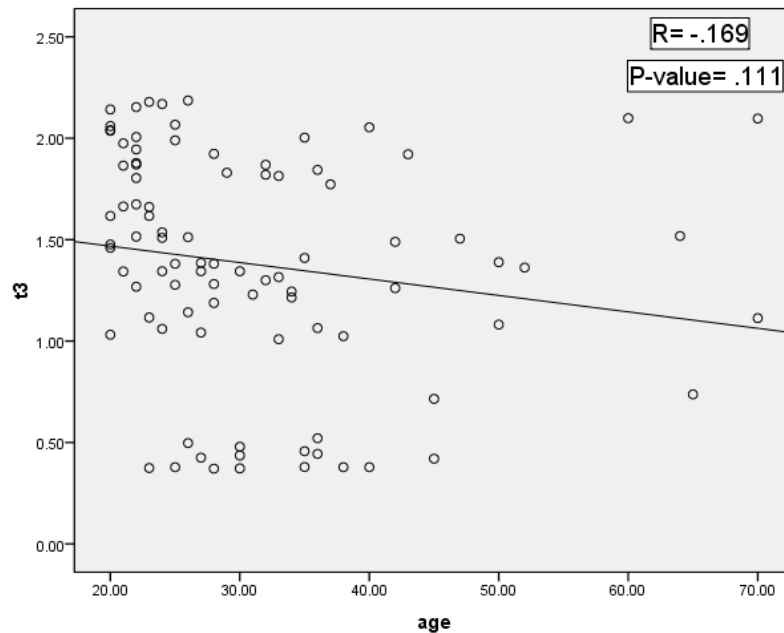


Figure 1:- Correlation between t3 level and BMI, ($r=-0.500$, $P value=0.000$).



Finger (2): correlation between serum T3 level and Age,($r=-0.169$, P value= 0.111).

IV. Discussion

The association between thyroid function and BMI in euthyroid adult individuals has been given a great medical concern.⁽⁹⁾ Therefore, the present study aimed to assess serum t3 hormones level among euthyroid and to correlate serum levels of T3 hormones with their grades of BMI. As the thyroid hormones especially T3 regulate both the resting metabolic rate and thermogenesis and lead to lipolysis ,changes in thyroid hormones could also point to an adaptation process in obesity⁽¹⁰⁾.From the finding of this study it appears that , 73.3% of patients were females while 26.7% of patients were males. Serum tri-iodothyronine (T3) level was significantly increase in underweight group compared to normal weight group (p, value= 0.024). The result showed that, there was significant decrease in serum tri-iodothyronine (T3) level in overweight compared with normal weight group. This result in agreement with another study reported that, the serum T3 concentration was significantly low in overweight subjects in comparison with normal weight subjects⁽¹¹⁾.

This result disagreed with another result which showed, T3 concentration in over-weight subjects was significantly higher than that of normal weight subjects.⁽⁶⁾ Also the findings of this study showed that, there was significant negative correlation between t3 and BMI. $r=-0.500$, P value= 0.000 . This result disagreed with another result which showed there was positive correlation between t3 and BMI.⁽¹⁰⁾ The study also disagreed with another study which reported that, there was positive correlation between T3 and BMI.⁽¹⁾ Also the study disagreed with another study which found that, T3 level was positively correlated with BMI.⁽¹²⁾.

The causal relationship between BMI and variations in t3 could be explained by the process of thermogenesis. Thyroid hormones increase thermogenesis through an increase in cellular activity to produce ATP.⁽⁷⁾ The exact mechanism has not been determined. variations of normal thyroid function are accompanied by differences in BMI perhaps due to the changes in the resting energy consumption. The high incidence of the pathological disorders in thyroid function combined with the strong influence of various environmental factors (diet, exercise, etc.) can increase weight with an unknown biological mechanism and lead to obesity. Also the findings of this study showed that, there was significant negative correlation between t3 and age ($r= -0.169$, p, value= 0.00).

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