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Body Mass Index and Thyroid Functions in Euthyroid male adults in Mosul city

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KEYWORDS
FT3 , FT4 , TSH , BMI , ATPO

ABSTRACT:
The relationship between thyroid gland and body mass index (BMI) is a subject of growing interest. Thyroid hormones' impact on metabolism directly affects energy expenditure which is in turn affect weight balance . ***subjects and Methods*****:** This study occurred in Mosul city in the north of Iraq, between December 2022 - June 2023, and it comprised one hundred adult males ranging in age from 20 - 60 years. Participants had to be apparently healthy men with appropriate thyroid functions, according to the inclusion criteria. Individuals who used specific medicines known for altering thyroid functions were excluded, Those who have positive anti thyroid peroxidase antibodies (ATPO), a personal or familial history of thyroid diseases, and medical illnesses such as hypertension, diabetes, and cardiac, renal, and liver diseases. The thyroid parameters that's measured to the subjects were triiodothyronine (FT3), thyroxine (FT4) using immuno-enzymatic competitive assays and Thyroid stimulating hormone (TSH) by two-site immuno-enzymatic (sandwich) method. ***Results***: found no significant relationships between BMI and other thyroid function FT3 no significant increase TSH, on the contrary increased across BMI classes , moreover FT4 decreased. ***Conclusion*** : this work showed that the thyroid function of the different BMI groups under investigation showed no significant change .

Introduction

The thyroid gland is a vital endocrine organ has a central role in regulating vital physiological processes, including hormone synthesis, and regulation. Its hormones, and their relationship with Body Mass Index (BMI) will be discussed in this study. Thyroid hormones, (T4) and (T3) play a major role in regulating metabolism (1). These hormones modulate cellular respiration, energy expenditure, and overall metabolic rate, impacting nearly every tissue and organ in the body, modulating gene transcription, and influencing various cellular functions (2).

Additionally, (TSH) level often reflects the state of thyroid functions, which have been linked to BMI variations. Exploring the Thyroid-BMI connection, researchers suggested a complex relationship between thyroid functions and BMI. Hypothyroidism which characterized by reduced thyroid hormone levels, can lead to weight gain due to slow metabolic rate (3), Conversely, hyperthyroidism marked by excessive hormones production which may result in weight loss (4). TSH levels within the normal range are associated with stable BMI. Accurate assessment of thyroid functions through hormones assay are essential for diagnosis and management of thyroid disorders and potentially weight-related complications(5)

Materials and Methods Materials

The study encompassed a diverse range of participants, including out-patients, clinic attendees, and individuals visiting a private medical laboratory situated on the left bank of Mosul. This medical laboratory typically received a daily influx of 60-70 subjects with a varying medical conditions. An ethical approval from the committee of Ethics at Nineveh Health Directorate was obtained.

Mosul is a culturally diverse city located in the northern region of Iraq, bisected by Tigris River. The population relies on water of Tigris river for consumption, yet Mosul has been identified as an area with state of iodine deficiency(6).

This study was carried out between December 2022-June 2023, it included one hundred adult males with age ranged from 20 - 60 years. The inclusion criteria dictated that participants seem to be apparently healthy men with normal thyroid functions. The exclusion criteria encompassed individuals using specific drugs known to affect thyroid functions (e.g., amiodarone, lithium, steroids, non-steroidal anti-inflammatory drugs), those with positive ATPO, with a family or personal history of thyroid disorders, and with medical conditions such as

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diabetes mellitus, hypertension, cardiac, renal, and hepatic disorders.

A thorough interviews with participants to collect general information. A comprehensive examination for each subjects, including thyroid gland assessment, height, weight, BMI calculation, and blood pressure measurement. The information was then stored in a computerized system for subsequent analysis.

Body Mass Index was calculated by = Kg / m2 (7). The World Health Organization's (WHO) classified BMI into different category : normal(18.5-23.9), over weight(24.0-27.9), and obese(≥28) (8).

Methods

Five milliliters of venous blood were collected in a plain tube, centrifuged for fifteen minutes at 3000 rpm, then incubated for ten minutes at 37 C°. The TSH level was assessed using a hypersensitive TSH (hTSH) assay that employs a two-site immuno-enzymatic (sandwich) method. Free T3 (FT3) and Free T4 (FT4) measurements were carried out using immune-enzymatic competitive assays (9).

Statistical analysis was carried out using SPSS software version 26.0,Chicago,IL to calculate different descriptive statistics . The normality of data was evaluated using the Kolmogorov-Smirnov test . TSH , FT3 and FT4 were found

to be normally distributed. Analysis of variance (ANOVA) is used to compare the means of different groups. Pearson's correlation was used to explore the relationship between different variables (10).

Results

Table (1) shows the mean ± SD of age, TSH, FT3, and FT4 of different BMI groups ,concerning the age which is statistically not significant (p=0.2) among different BMI groups .Moreover as the age increase the BMI is significantly increased (p=0.001).

No significant (P>0.05) increase in meanTSH and (P>0.05)was found among mean FT3 of different BMI classes.FT4 was not significantly (P>0.05) decrease among BMI groups .Table (1) , Figure (1).

Figure (2) shows no significant (r=-0.04, p=0.7) inverse relationship between TSH and BMI . FT3 was also inversely related to BMI (r=-0.01 , p=0.9) Figure (3). Moreover, FT4 was inversely but not significantly (r=-0.17, p=0.08) related to BMI. Figure (4)

Table (1); Thyroid hormone according to BMI classes

Variables	Normal weight N=12	Overweight N=47	Obese N=41	P-value
Age year	34.50±11.80	37.95±10.82	40.51±11.20	0.2
BMI	22.05±1.43	26.08±1.05	29.93±1.85	<0.001
TSH mIU/L	1.81±1.05	2.23±1.29	2.01±1.07	0.4
FT3 pmol/L	5.41±0.54	5.47±0.52	5.39±0.58	0.7
FT4 pmol/L	11.06±2.27	11.22±1.63	10.48±1.57	0.1

*P value by ANOVA test

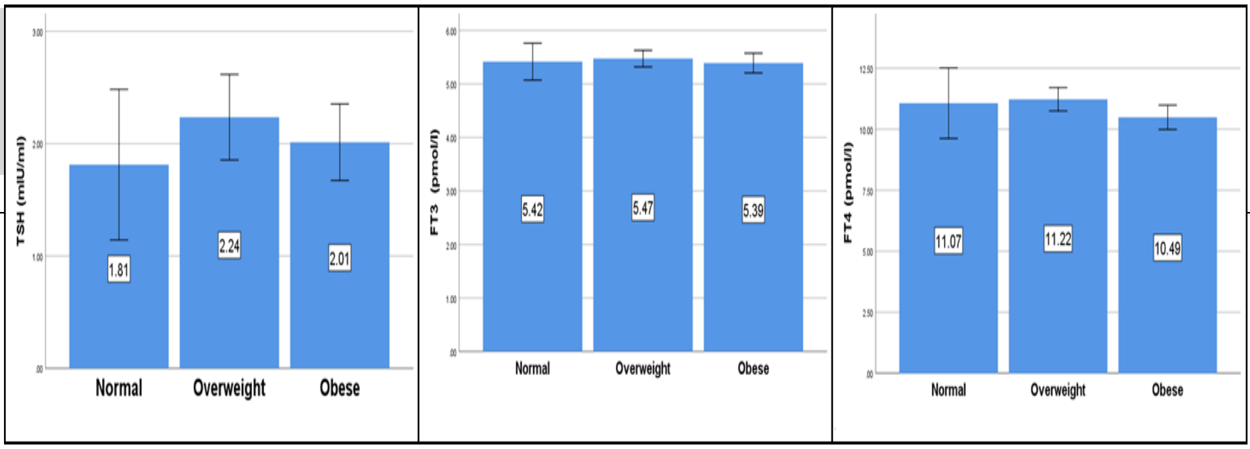

Fig (1) Thyroid hormones among BMI classes

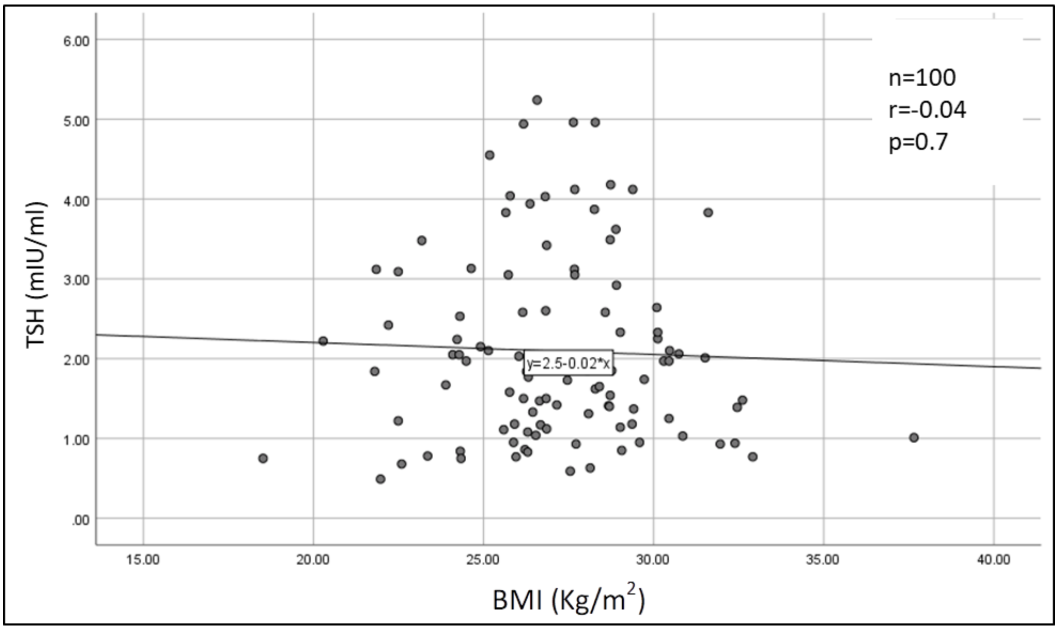

Fig (2) BMI in relation to TSH

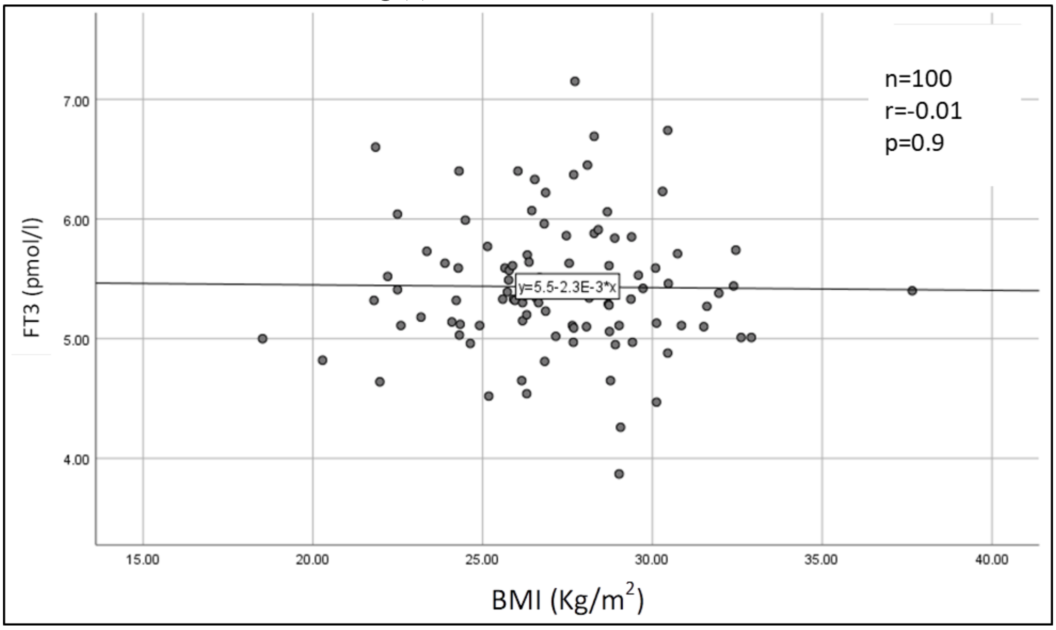

Fig (3) relationship between BMI and FT3

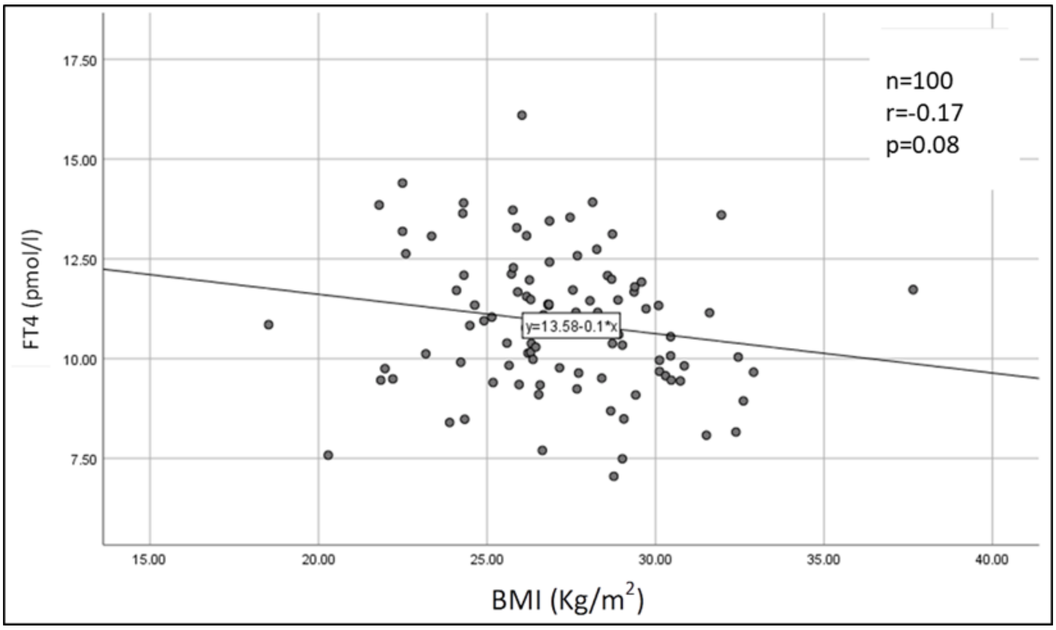

Fig (4) relationship between BMI and FT4

Discussion

Many researches try discuss the thyroid functions and relation to age, race, ethnic background and BMI. BMI cannot measure the location of fat accumulation, muscle, or bone density (11).

This study aimed to define the relationship between BMI and thyroid functions in euthyroid adult males in Mosul city . Results showed no significant associations between BMI and different thyroid function parameters .FT3 was not significantly increase (P >0.05).On the other hand FT4 slightly decreased among BMI (P >0.05) groups , while TSH increased among BMI classes (P>0.05) as shown in Figures (2,3 and 4).

A prospective cohort study in Spain was carried out by (Soriguer) enrolled 305 male adults age ranged between 18-65 years .They reported no significant mean difference of TSH ,FT3and FT4 between obese and normal weight subjects (12).

A cross-sectional study of Bakiner in Turkey included both sexes age and ,102 male subjects with age ranged 18-65years .They recorded no significant difference between the mean TSH among BMI classes , moreover non-significant positive correlation found between TSH and BMI (13).

The Italian study by Muscogiuri involved both sex , the male subjects number was 24 with mean age 52.4±15.4 years they showed significant increase in mean TSH level in over weight and obese subjects. No significant mean difference of FT3and FT4 among different BMI groups. Moreover positive correlation between TSH with BMI (r=0.46, P=0.02)(14).

In Greece a cross-sectional study by Milionis, of 118 male adult with mean age 52.5±15.4 years reported an increase of 1ng/dl of FT4 resulted in decrease obesity chance of 22.4% (15).

A Tunisian cross-sectional Kouidhi research recruited 108 euthyroid subjects of both sexes (male =56).They found decrease in mean FT4 and increase in mean TSH as BMI increased. Negative correlation of FT4 with BMI and positive correlation between TSH and BMI (16).

According to our results were in agreement with studies Soriguer, Bakiner, Muscogiuri, Milionis , and in contrast with Kouidhi.

There are a number of potential explanations for this relationship. One explanation is that excess weight or obesity can be due to increased levels of leptin. Leptin with thyroid hormones have the same stimulation actions on energy expenditure, so they play important roles in the control of energy balance. Leptin's primary activity is to adjust the fat content in the body, resulting in a decrease in hunger and food consumption(17)(18).

Another explanation is that Obese and overweight subjects develop insulin resistance and persistent low-grade systemic inflammation.. Insulin resistance can reduce the body's ability to utilize insulin properly. Studies had shown that insulin resistance can affect thyroid function(14)(19)(20).

Finally, it is also possible that there is a genetic linkage

between increase in weight or obesity and hypothyroidism. For example, people who have a genetic predisposition to excess weight or obesity may also be more likely to develop hypothyroidism(21)(22).

Conclusion

To sum up, this work showed that the thyroid function of the different BMI groups under investigation showed no significant change

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Ethics Statements

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