Interrelationships between leptin and thyroid profile in overweight/obese urban population of Manipur

ABSTRACTS

Aims: The goal of this study was to determine the relationship between leptin and thyroid profile in overweight/obese Manipur individuals.

Materials and Methods: A total of 250 people (of either gender) between the ages of 20 and 65 were included in the study. The body mass index (BMI) was computed using the height and weight of the individual. Blood samples were used to assess serum leptin, thyroxine (T4), and thyroid stimulating hormone (TSH) levels. Significant variations between the groups were examined, as well as leptin and thyroid associations with various BMIs.

Findings: Leptin levels were significantly higher in the overweight/obese group (12.73 ± 9.93 ng/ml) than in the control group (6.85 ± 6.49 ng/ml), (P <0.01). T4 levels did not differ significantly between normal (7.83 ± 1.51 µg/dl) and overweight/obese individuals (8.49 ± 2.00 µg/dl) whereas, TSH levels differed significantly between normal (2.79 ± 2.72 µIU/ml) and overweight/obese subjects (2.32 ± 1.54 µIU/ml), (P <0.05). A positive significant correlation was found between BMI and leptin (r = 0.38; P = 0.00) as well as between BMI and T4 (r = 0.14; P = 0.02). BMI and TSH did not have any correlations. Furthermore, there were no significant relationships between leptin and T4 or TSH.

Conclusion: The leptin and thyroid hormone are strongly linked in those who are overweight/obese.

Keywords: Leptin, T4, TSH, Obese, Manipur

INTRODUCTION

Obesity is a major general medical condition that affects people all over the world, and its prevalence rate has reached epidemic proportions. More than a third of the world's adult population is overweight or obese, according to the World Health Organization (WHO).[1] The mortality rate is increased by 30% when a person has a severe case of obesity with comorbidities.[2,3] Leptin is a hormone produced by adipocyte, the product of the *ob* gene identified as single chain proteohormone with a molecular mass of 16 kDa located in chromosome 7q31.3.[4] It convey information about energy reserves of the body to the central nervous system, particularly the hypothalamus, regulates the food intake and energy expenditure.[5,6] It activates Proopiomelanocortin (POMC)/Hypothalamic Cocaine- and Amphetamine-Regulated Transcript (CART) neurons in the hypothalamus and inhibits Neuropeptide Y (NPY)/Agouti-Related Protein (AgRP) neurons in the hypothalamus, resulting in the inhibition of feeding and an increase in energy expenditure.[7,8] Thyroid hormones play a vital role in regulation of energy store, energy consumption, thermogenesis, enzymes activity involved in metabolism of lipid and other body metabolic reactions.[9,10] Changes in thyroid hormones level alters in basal metabolic rate, oxygen consumption, appetite and body weight.[11] Disturbance of thyroid function is associated with marked changes in both energy expenditure and body weight, it therefore assumed that thyroid

hormones and leptin plays an important mutual role.[12] Although, studies regards leptin and thyroid hormone levels in relation to overweight/obese have reported variations in different population and inconclusive. The study's goal was to determine the interrelationships between serum leptin and thyroid hormone levels in Manipur's overweight/obese urban population.

MATERIALS AND METHODS

The present study was conducted in department of Physiology, Regional Institute of Medical Sciences, Imphal from March, 2019 to April, 2021. A total of 250 (aged 20 to 65 years) subjects were involved from the urban population of Manipur, India. After approval from the Institutional ethics committee of this research work, subjects were recruited without chronic history of metabolic diseases for the study. Informed consent was obtained from all the subjects. The participant's height and weight were measured with a portable stadiometer and a Tanita weighing scale, and the BMI was determined. Based on different grades BMI, overall study population categorized as normal (BMI < 25 kg/m^2) and overweight/obese (BMI ≥ 25 kg/m^2). Blood samples were collected under aseptic conditions from the antecubital vein in plain vial. Serum was separated after centrifugation at 3000 rpm for min. Separated Serum was estimated leptin, T4 and TSH levels by using ELISA Microplate Reader, Multiskan FC, Thermoscientific. Diagnostics Biochem Canada leptin kit and Avantor T4, TSH kit were used for the study. Statistical analysis was performed using SPSS software version 26. All data were presented as mean ± S.D. Student *t* test was used to compare the results of different groups. In addition, the Pearson correlation coefficient (*r*) was used for correlation analysis. *P* value < 0.05 was considered significant.

RESULTS

Normal and overweight/obese subjects accounted for 118 and 132 of the total 250 participants, respectively. Table 1 shows the demographic profile and biochemical parameters in normal and overweight/obese groups. Mean BMI were found significant differences between normal and overweight/obese group ($P < 0.01$). Serum leptin levels were increased significantly in overweight/obese than normal group ($P < 0.01$). TSH levels were also significantly higher in overweight/obese group compared to normal group ($P < 0.05$), although T4 levels did not differ.

Table 1: Demographic and biochemical parameters in normal and overweight/obese

Groups	BMI (kg/m^2) (mean ± S.D.)	Leptin (ng/ml) (mean ± S.D.)	T4 (µg/dl) (mean ± S.D.)	TSH (µIU/ml) (mean ± S.D.)
Normal (n = 118)	21.89 ± 2.10	6.85 ± 6.49	7.83 ± 1.51	2.79 ± 2.72
Overweight/obese (n = 132)	28.29 ± 3.01	12.73 ± 9.93	8.49 ± 2.00	2.32 ± 1.54
P- value	0.00**	0.00**	0.09	0.02*

Significance at $^{**}P < 0.01$, $^{*}P < 0.05$

As demonstrated in Figure 1, there was a strong positive connection between BMI and leptin levels ($P < 0.01$). Figure 2 demonstrates a strong positive relationship between BMI and T4

levels ($P < 0.05$), but no significant correlations were found between BMI and TSH, leptin and T4, or leptin and TSH [Table 2].

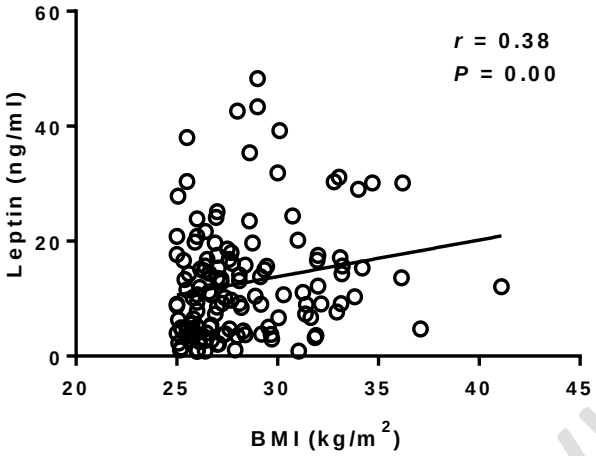

Figure 1. Correlation between leptin and BMI

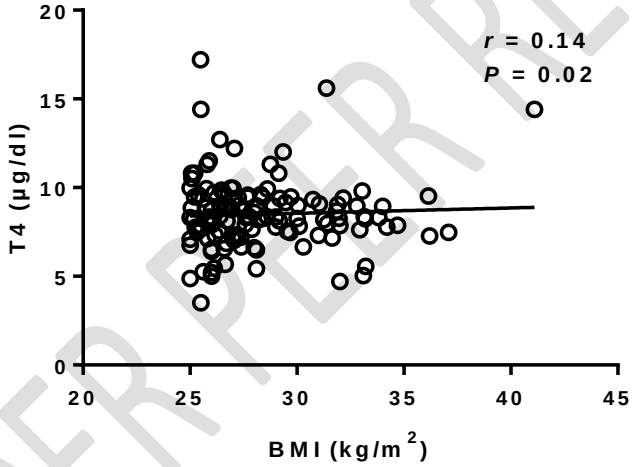

Figure 2. Correlation between T4 and BMI

Table 2. Pearson's correlations

BMI vs TSH	r = -0.00 P = 0.90
Leptin vs T4	r = -0.03 P = 0.58
Leptin vs TSH	r = 0.12 P = 0.05

r = correlation coefficient, P = P-value

DISCUSSION

In Asia, obesity problem is increasing with improving in economic development and westernization food habit transition.[13,14] Present study provides data regards leptin and

thyroid levels in relation to overweight/obese in this population of Manipur. Leptin levels were increased significantly with respect to higher BMI, because of adiposity increases leptin levels, thereby strongly correlate with BMI in the present study. Similar findings in the studies of Al Maskari MY *et al.*[15] and Considine *et al.*[16] showed positive correlations between leptin and BMI. The main differences with these studies that mean leptin levels in the normal BMI groups (< 25 kg/m^2) were 7.5 ng/ml and 10.6 ng/ml, respectively whereas in our study mean leptin level was 6.85 ng/ml. Leptin levels were much lower in our study in the same normal range of BMI and increasing proportion of leptin levels in higher BMI were also much more in their studies, may be the difference genetics background and environment factors in different population, regards influencing of adipogenesis and adiposity varies. T4 levels showed no significant changes between normal and overweight/obese, but presents significant positive correlations with BMI in our study, suggest that minor changes in thyroid hormone might associate with significant changes in body weight, that could be an impact of risk factor in obesity.[17] However, establishing of cause-effect relationship is inconclusive, as more incidence of abnormal thyroid does not mean to cause the obesity.[18] Moreover, significant changes were observed in TSH levels among normal and overweight/obese. The plausibility could be direct stimulation of TSH in differentiation of preadipocyte and adiposity. Studies of Figurosa *et al.*[19] and Bieler *et al.*[20] demonstrated that BMI had no significant relationship with TSH level in euthyroid and hypothyroid subjects, despite no association with weight gain. Recently, one of the studies conducted in the population of Manipur reported that there were no correlations between BMI and TSH, thereby concludes *"there is unlikely to be any benefit in maintaining TSH in the lower half of the normal range with regard to weight loss"*.[21] In corroborating with this finding, there was no correlation between BMI and TSH in the present study. Participants in their study populations were among euthyroid, subclinical hypothyroidism and hypothyroidism individuals while our study participants in normal and overweight/obese without metabolic disorders. In contrast, Solanki *et al.*[22] reported that BMI significantly correlates with TSH, that implies direct linked with TSH stimulates in expansion of preadipocyte and resulting adipose tissue cell.[23] In between leptin and T4, negative correlations were observed insignificantly in this study, may be the result of deviation of leptin can alter T4 levels relating to adiposity, infers that leptin effect on circulating bioactive thyroid hormones, without the effects of circulating TSH level, express that leptin stimulates T4 release directly from the thyroid gland.[24] These findings were supported with previous study of Ozata *et al.*[25] gave negative correlation but not significant between Serum Leptin and T4. One study reported significant negative correlation between Serum Leptin and Serum T4,[26] may be due to the affect of leptin in thyroid deiodinase activities by activating conversion of T4 to T3.[27,28] Menendez *et al.*[29] reported that circulating TSH stimulates leptin secretion significantly in adipose tissue, suggest a new mechanism in the correlations of adipose tissue and thyroid axis. In the studies of Iacobellis *et al.*[30] and Siemienska *et al.*[31] positive correlations were found significantly between Serum leptin and TSH levels. Another study also claimed to found TSH receptors in adipose tissues and TSH directly involve in the regulation of leptin gene expression.[32] Although, inverse relation of leptin and TSH could indicate the changes in adipose tissue metabolism, thereby altering the circulating leptin levels resulting from the changes in

thyroid levels.[33] In contradictory, there were no significant relationships between leptin and TSH levels in our study that could be the independent role between leptin and TSH.

The limitation of the present study was lack of study size population and needs to add certain parameters related to define overweight/obesity to elucidate distribution of adiposity in this population study. However, current study findings may thus contribute towards changing serum leptin and thyroid levels in overweight/obese urban population of Manipur, India. Thus, it may be beneficial in early detection of metabolic disorder, since it provides dependent determinants to each other.

CONCLUSIONS

In this preliminary study, overweight/obese is strongly associated with higher leptin level and T4, would influence the underlying mechanisms of adiposity. We conclude that maintaining body weight would be a major role to overcome the complications of predispose metabolic disorders due to overweight. Further analysis will be required in interlinking mechanisms with more study population size based on Asian BMI cut off for better understanding, since Manipuri population is a racial Asian mongoloid group.

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