

OBESITY & IMPACT ON THYROID HORMONE & SUBCLINICAL HYPOTHYROIDISM

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Abstract

Obesity is a metabolic disorder due to physical inactivity associated with increased consumption of calories. The excess calorie is stored as fat in adipose tissue, the fat loaded adipose tissue stimulates inflammatory pathway. The secreted inflammatory cytokines influence the sodium iodide transporter on the surface of thyroid gland. It causes decreased Thyroid hormone (TH) secretion & elevated Thyroid Stimulation Hormone (TSH). The energy metabolism of the body is regulated by TH, decreased TH secretion in obesity disturbs energy metabolism. The BMR & RMR even though similar, TH dysfunction might be helpful to know the exact role of TH in obese people.

Key Words: Obesity, adipose tissue, Subclinical Hypothyroidism (SH), inflammatory cytokines, energy metabolism, Thyroid hormone dysfunction (TH)

Introduction

The obesity is a metabolic disorder and is considered as growing epidemic worldwide. It significantly challenges the health of public around the globe. The adverse effects on health of public increases the risk of diabetes, heart diseases & cancer(1). The metabolic consequences seen in Obesity leads to endocrine dysfunction including thyroid gland. The energy metabolism of the entire body is regulated by thyroid hormone (TH) (2). The thermogenic effect of food and maintenance of body temperature is mediated by TH. The thermogenic effect of food and maintenance of body temperature is mediated by TH. The body weight and energy expenditure correlate with the thyroid status of the individual (3,4). The TH influences energy stores and expenditure by regulating metabolic pathway that are involved in energy balance of the body (5). The role of TH on body weight regulation is due to its control on basal metabolic rate (BMR) & adaptive thermogenesis, also plays an important role in lipid, glucose metabolism, food intake & fat oxidation (6,7). In a normal healthy condition adaptive thermogenesis occurs on exposure to cold due to sympathetic nerve activation in adipose tissue, stimulates the enzyme 'Deiodinase 2' which converts T4 to T3. Thus, thermogenesis raises TH which has effects on other tissues also (8). Obesity increases basal lipolysis (lipolysis occurs without any stimulus) which also participates in thermogenesis, influencing TH secretion. The aim of the present study is to know the effect of thyroid hormone secretion in obese population of central India.

Materials & Methods

The study population are the patients attending OPD of medicine a tertiary hospital in Bhopal, Madhya Pradesh (Central India). Total 25 patients are selected for the study based on their anthropometric measurements (Weight, Height, BMI) confirmed them as obese. Of them 16 are males and 9 are females aged >35 years and are compared with equal number of age matched control population.

Inclusion criteria

- Age - > 35 years
- Body mass Index (BMI) – more than 30
- BP -> 130/90 mm/Hg
- Increased blood lipids (Total Cholesterol, Triglycerides, VLDL, LDL)

Exclusion criteria –

Renal diseases, Jaundice, Stones in kidney or gallbladder

Blood samples are collected under aseptic environment dispensed into sample tube. The samples are allowed to clot at room temperature for 30minutes and then serum is separated after centrifugation at 3000 rpm (rotations per minute) for 15 minutes. The samples are analyzed for thyroid hormone profile (TSH, T3, T4) in a hormone analyser ARCHITECT company by chemiluminescence assay. Similarly, healthy control samples matching the age group are also analyzed.

Results

The values obtained after investigation of various parameters of study as well as control is analysed using SPSS software. The obtained mean, SD values of these parameters are as follows (table 1)

Parameter	Control (Mean \pm SD)	Cases (Mean \pm SD)	P value
TSH	1.80 \pm 0.86	6.92 \pm 0.74	< 0.0001
T3	1.14 \pm 0.34	4.36 \pm 15.34	= 0.29
T4	8.2 \pm 1.5	8.3 \pm 2.1	= 0.80

Table 1: The comparison of Thyroid profile Mean \pm SD between Controls & Cases

The thyroid profile between control & cases shows a significant change especially for TSH levels than T3 & T4. The values of TSH is elevated significantly in Obese in accordance to weight shows an association of TSH level with body weight.

Discussion

The elevated TSH values in obese group compared to control is an indication that hormonal fluctuation has initiated in the study. Increased TSH alone is considered as ‘Subclinical hypothyroidism (SH)’ suggesting a mild impairment in function of thyroid hormone at tissue level (9). There are controversial studies showing an association between body weight and thyroid disorders (10,11). The meta-analysis done by Song et al. in 2019 found that the risk of obese people developing hypothyroidism is 1.86 folds and it may be overt or subclinical hypothyroidism. The SH in obese people with elevated TSH shows a change in energy utilisation by uncoupling oxidative phosphorylation of mitochondria leading to futile cycles of metabolic processes. This futile cycle further decreases the formation of reactive oxygen species (ROS), thus TH acts as antioxidants even through increases energy expenditure (13).

The SH indicates a decreased TH function which further creates a stressed environment as production of ROS is not under control of TH. The obesity also triggers inflammation by increases in macrophages & immune cells in adipose tissue loaded with fat (14). The increased release of inflammatory cytokines (Interleukin (IL) -1, IL-12, IL-18, Tumour Necrosis Factor alpha (TNF- α), Interferon gamma (IFN) etc., from overloaded adipose tissue influences expression of sodium/ iodide transporter on the surface of thyroid cells (15) & also induce vasodilation. The iodide uptake activity of thyroid cells and functional changes in the thyroid gland (16) can be evident from inflammatory activity of obesity.

Leptin hormone released from adipose tissue involved in a maintenance of weight is also secreted in higher levels from adipocytes which further aggravates the inflammatory responses associated with obesity along with inflammatory cytokines(17). This study does not measure the Leptin levels in obese people which might have also contributed to changes in functions of thyroid gland. The chronic inflammatory status of obese people may also modulate the activity of the enzyme 'Deiodianase' affecting its function (18). The SH is also associated with Grave's disease (thyroid autoimmunity) and there is an association between obesity and increased risk of thyroid autoimmunity (19). Several studies found that dysfunction of adipokines (Signal molecules of adipose tissue) has a role in thyroid autoimmunity (20). The SH observed in present study may be endogenous or exogenous cause of thyroid function. It emphasises the risk of obesity with thyroid function and associated problems. hence early evaluation of thyroid function in obesity helps in prevention of associated metabolic changes of the body.

Conclusion

The obesity due to excessive calorie intake with low physical activity deposits more fat into adipose tissue. The fat loaded adipocytes not only increases blood lipids but also aggravates inflammatory pathways. The secreted inflammatory cytokines (IL-1, 12,18, TNF- α , IFN influences thyroid function by a change in iodide transport across the thyroid gland. It causes decreased TH secretion and a rise in TSH levels in blood creating a stressed environment, increased ROS & decreased antioxidant defense body. The TH controls body energy metabolism, and imbalanced energy status especially BMR, RMR (Resting Metabolic Rate) may have role in further deteriorated TH secretions in obesity. Further detailed studies to know how energy status has an effect on metabolism and TH function may helpful.

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