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SERUM CHOLESTEROL LEVELS IN RELATION TO SERUM THYROID STIMULATING HORMONE

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ABSTRACT

Objective: To evaluate the relation between serum thyroid stimulating hormone (TSH) and cholesterol (CHL). **Patients and methods:** This is an interventional study on 100 patients from the period of January 2017 to December 2017. All patients completed a questionnaire including age, sex, occupation, residence, present symptoms and duration, previous medical and drugs history, previous surgical history, vaccination. Clinical and physical examination were done to all patient. Completed all investigation including laboratory and radiological investigation. **Results:** One hundred patients were studied, 63 female (63%) and 37 male (37%) and female to male ratio was (1.7: 1). The age ranged from 25 years to 70 years, with a mean age of 40 years + 5 years. The majority being in the fifth decade of life constituting 38 patients (38%). Also our study showed that the lower level of CHL is 177mg /dl and the higher level is 402mg/ dl and the mean level is 258.5mg/ dl. The lower level of TSH is 4.5 miu /ml and the higher level is mor than 100 miu /ml and the mean level is 32.4 miu/ml. **Conclusions:** There is an association between serum cholesterol and TSH levels.

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INTRODUCTION

Thyroid-stimulating hormone (also known as thyrotropin, thyrotropic hormone, TSH, or hTSH for human TSH) is a pituitary hormone that stimulates the thyroid gland to produce thyroxine (T_4), and then triiodothyronine (T_3) which stimulates the metabolism of almost every tissue in the body (Merck, 2006). It is a glycoprotein hormone thyrotrope cells in the anterior pituitary gland, which regulates the endocrine function of the thyroid (The American Heritage Dictionary of the English Language, 2006; Sacher *et al*., 2000). In 1916, Bennett M. Allen and Philip E. Smith found that the pituitary contained a thyrotropic substance (Magner, 2014). TSH (with a half life of about an hour) stimulates the thyroid gland to secrete the hormone thyroxine (T_4), which has only a slight effect on metabolism. T_4 is converted to triiodothyronine (T_3), which is the active hormone that stimulates metabolism. About 80% of this conversion is in the liver and other organs, and 20% in the thyroid itself (Merck Manual of Diagnosis and Therapy).

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TSH is secreted throughout life but particularly reaches high levels during the periods of rapid growth and development, as well as in response to stress. The hypothalamus, in the base of the brain, produces thyrotropin-releasing hormone (TRH). TRH stimulates the pituitary gland to produce TSH. Somatostatin is also produced by the hypothalamus, and has an opposite effect on the pituitary production of TSH, decreasing or inhibiting its release. The concentration of thyroid hormones (T_3 and T_4) in the blood regulates the pituitary release of TSH; when T_3 and T_4 concentrations are low, the production of TSH is increased, and, conversely, when T_3 and T_4 concentrations are high, TSH production is decreased. This is an example of a negative feedback loop (Estrada *et al*., 2014). Any inappropriateness of measured values, for instance a low-normal TSH together with a low-normal T_4 may signal tertiary (central) disease and a TSH to TRH pathology. Elevated reverse T_3 (RT_3) together with low-normal TSH and low-normal T_3, T_4 values, which is regarded as indicative for euthyroid sick syndrome, may also have to be investigated for chronic subacute thyroiditis (SAT) with output of subpotent hormones. Absence of antibodies in patients with diagnoses of an autoimmune thyroid in their past would always be

suspicious for development to SAT even in the presence of a normal TSH because there is no known recovery from autoimmunity. For clinical interpretation of laboratory results it is important to acknowledge that TSH is released in a pulsatile manner (Greenspan *et al*., 1986; Brabant *et al*., 1990; Samuels *et al*., 1990) resulting in both circadian and ultradian rhythms of its serum concentrations (Hoermann *et al*., 2015). TSH is a glycoprotein and consists of two subunits, the *alpha* and the *beta* subunit (Lalli *et al*., 1995). The TSH receptor is found mainly on thyroid follicular cells (Parmentier *et al*., 1989). Cholesterol (from the Ancient Greek chole- (bile) and stereos (solid), followed by the chemical suffix -ol for an alcohol) is an organic molecule. It is a sterol (or modified steroid) (Hanukoglu, 1992), a type of lipid molecule, and is biosynthesized by all animal cells, because it is an essential structural component of all animal cell membranes and is essential to maintain both membrane structural integrity and fluidity. Cholesterol allows animal cells to function without a cell wall (which in other species protects membrane integrity and cell viability); this allows animal cells to change shape rapidly.

In addition to its importance for animal cell structure, cholesterol also serves as a precursor for the biosynthesis of steroid hormones, bile acid (Hanukoglu, 1992) and vitamin D. Cholesterol is the principal sterol synthesized by all animals. In vertebrates, hepatic cells typically produce the greatest amounts. It is absent among prokaryotes (bacteria and archaea), although there are some exceptions, such as Mycoplasma, which require cholesterol for growth (Razin, 1970). François Poulletier de la Salle first identified cholesterol in solid form in gallstones in 1769. However, it was not until 1815 that chemist Michel Eugène Chevreul named the compound "cholesterine (Chevreul, 1816; Olson, 1998)". Since cholesterol is essential for all animal life, each cell is capable of synthesizing it by way of a complex 37-step process, beginning with the mevalonate pathway and ending with a 19-step conversion of lanosterol to cholesterol. Furthermore, it can be absorbed directly from animal-based foods (National Health and Nutrition Examination Survey, 2012). A human male weighing 68 kg (150 lb) normally synthesizes about 1 gram (1,000 mg) per day, and his body contains about 35 g, mostly contained within the cell membranes. Typical daily cholesterol dietary intake for a man in the United States is 307 mg.[18] Cholesterol, given that it composes about 30% of all animal cell membranes, is required to build and maintain membranes and modulates membrane fluidity over the range of physiological temperatures. The hydroxyl group on cholesterol interacts with the polar heads of the membrane phospholipids and sphingolipids, while the bulky steroid and the hydrocarbon chain are embedded in the membrane, alongside the nonpolar fatty-acid chain of the other lipids. Through the interaction with the phospholipid fatty-acid chains, cholesterol increases membrane packing, which both alters membrane fluidity (Sadava *et al*., 2011) and maintains membrane integrity so that animal cells do not need to build cell walls (like plants and most bacteria). The membrane remains sTable and durable without being rigid, allowing animal cells to change shape and animals to move. The structure of the tetracyclic ring of cholesterol contributes to the fluidity of the cell membrane, as the molecule is in a trans conformation making all but the side chain of cholesterol rigid and planar (Ohvo-Rekilä *et al*., 2002).

In this structural role, cholesterol also reduces the permeability of the plasma membrane to neutral solutes (Yeagle, 1991), hydrogen ions, and sodium ions (Haines, 2001).

Objective: To evaluate the relation between serum thyroid stimulating hormone (TSH) and cholesterol (CHL).

Patients and methods:-This is an interventional study on 100 patients from the period of January 2017 to December 2017. All patients completed a questionnaire including age, sex, occupation, residence, present symptoms and duration, previous medical and drugs history, previous surgical history, vaccination. Clinical and physical examination were done to all patient. Completed all investigation including laboratory and radiological investigation.

RESULTS

One hundred patients were studied, 63 female (63%) and 37 male (37%) as shown in Table 1, and female to male ratio was (1.7: 1). The age ranged from 25 years to 70 years, with a mean age of 40 years $\pm$ 5 years. The majority being in the fifth decade of life constituting 38 patients (38%) as shown in Table 2. Also our study showed that the lower level of CHL is 177mg /dl and the higher level is 402mg/ dl and the mean level is 258.5mg/ dl. The lower level of TSH is 4.5 miu /ml and the higher level is mor than 100 miu /ml and the mean level is 32.4 miu/ml. as shown in Table 3.

Table 1. SEX distribution of patients

SEX	TOTAL	%
FEMALE	63	63%
MALE	37	37%

Table 2. AGE distribution of patients

Age group (Years)	No of patient	%
1 – 10	0	0
11 -20	0	0
21 - 30	11	11%
31 – 40	7	7%
41- 50	38	38%
51-60	15	15%
61-70	29	29%
Total	100	100%

Table 3. CHL & TSH level

		Normal value
LOWER CHL LEVEL	177mg/dl	150-200mg/dl
HIGHER CHL LEVEL	402mg/dl	150-200mg/dl
LOWER TSH LEVEL	4.5miu/ml	0.38-4.3miu/ml
HIGHER TSH LEVEL	More than 100 miu/ml	0.38-4.3miu/ml

DISCUSSION

This is an interventional study on 100 patients from the period of January 2017 to December 2017. All patients completed a questionnaire including age, sex, occupation, residence, present symptoms and duration, previous medical and drugs history, previous surgical history, vaccination. Clinical and physical examination were done to all patient. Completed all investigation including laboratory and radiological investigation. 63 female (63%) and 37 male (37%) as shown in Table 1, and female to male ratio was (1.7: 1).

The age ranged from 25 years to 70 years, with a mean age of 40 years ± 5 years. The majority being in the fifth decade of life constituting 38 patients (38%) as shown in Table 2. Also our study showed that the lower level of CHL is 177mg /dl and the higher level is 402mg/ dl and the mean level is 258.5mg/ dl. The lower level of TSH is 4.5 miu /ml and the higher level is mor than 100 miu /ml and the mean level is 32.4 miu/ml. as shown in Table 3. Our study showed that 94 patients (94%) with elevated level of CHL they have elevated level of TSH so there is relation between hypercholesteremia and hypothyroidism.

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