

Estimating the effectiveness of the enzyme lipase and some life variables in patients with hypothyroidism associated with hyperlipidemia

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ABSTRACT

Hypothyroidism is a widespread disease all over the world and occurs as a result of a defect in the mechanism of the thyroid gland or in the work of the gland itself, where the level of its hormones in the blood decreases. The cause of this imbalance may be the lack of production of thyroid-stimulating hormone from the pituitary gland, damage to thyroid cells, or an autoimmune disease that leads to partial or complete damage to thyroid cells, which causes a lack of thyroid hormones in the blood, where This leads to slow metabolism of fats and carbohydrates and a direct negative impact on the rest of the body organs and tissues such as the pancreas, brain, heart and liver and has a clear impact on the growth process. One of the most important effects of hypothyroidism that has currently been studied is a significant rise in blood lipids, as well as the effect of thyroid hormones on the work of the enzyme lipase is clear, as there is an increase in the enzyme lipase in the blood serum with a clear delay in lipolysis, in addition to the high level of triglycerides, cholesterol, LDL, VLDL, and a disorder in HDL. In this study, the level of thyroid-stimulating hormone and the presidential hormones secreted by the thyroid gland thyroid thyronine triiodine and thyroxine were evaluated, as well as the measurement of The level of the enzymeLipin G, measuring the level of lipids, determining the relationship between them, and determining the correlation between the enzyme Lipase and some other variables. Where these variables were measured for 90 samples, 60 samples diagnosed by the doctor as having hypothyroidism associated with hyperlipidemia and 30 samples from healthy people. The measurements were carried out in the specialized laboratories for pathological analysis in Mosul city, Iraq. The study found that there was an increase in the level of thyroid-stimulating hormone compared to the control group. A decrease in the level of triiodine threonine and thyroxine compared to the control group in addition to a high level of lipi G enzyme compared to the control group in addition to a high level of triglycerides, cholesterol, very low density protein, low-density lipoprotein and a disorder in the level of high-density lipoprotein as was conducted in this study linear correlation relations between the enzyme lipase and the rest of the biochemical variables, where there was a positive linear correlation between the enzyme lipase and T3 T4, triglycerides, VLDL and a negative linear correlation between lipase enzyme, TSH, cholesterol, HDL and LDL.

Keywords: VLDL, LDL, TSH, hypothyroidism, enzyme.

INTRODUCTION

The thyroid gland is one of the large endocrine glands that are found in the body and its location is in the center of the neck under the larynx and in front of the thyroid cartilage, which is called the Adam's apple ⁽¹⁾, where it has a role in maintaining the body's metabolism ⁽²⁾ through its effect on regulating the metabolism of carbohydrates and fats as it works to regulate many organs and tissues such as the pancreas, brain, heart, liver and fatty tissue and have a clear impact on the energy balance in The body has a clear role in the growth process ⁽³⁾ The weight of the thyroid gland ranges about 20 g and is 4-5 cm high and 2-4 cm wide ⁽⁴⁾ It is two lobes connected to each other by a butterfly-shaped connector tissue This tissue gives a kind of flexibility when swallowing food, as the thyroid tissue contains a large number of vesicles that contain large numbers of epithelial cells, which contain globulin inside ⁽⁵⁾ Its main function is the storage of thyroid hormones ⁽⁶⁾.

The thyroid gland is stimulated by other central glands such as the hypothalamus gland and the thyroid gland, where the hypothalamus gland secretes the hormone (TRH), which stimulates the pituitary gland to secrete (TSH), which is key to the work of the thyroid gland ⁽⁷⁾ The thyroid gland secretes several

hormones, the most important of which are thyroxine (T₄) and thyronine triiodine (T₃)⁽⁸⁾ T₃ was produced from the thyroid gland by 20% and T₄ by 80%, but the percentage of the effect of T₃ on tissues is greater, meaning that the effectiveness of T₃ is four times greater than the effectiveness of T₄⁽⁹⁾ The role of thyroid hormones T₃ and T₄ appears in the process of activating oxidation in the body, as it works to increase the consumption of fat because it is a source of energy in the body and also activates the process of vital construction, as the thyroid gland works to stimulate four processes Metabolism in fats, namely fat building and fat oxidation, fatty acid formation and cholesterol regulation⁽¹⁰⁾ Any thyroid defect directly affects most of the body's tissues and causes several changes in bioactivity⁽¹¹⁾ These disorders can be classified according to clinical symptoms and measurement of the level of TSH, T₃ and T₄ in blood serum⁽¹²⁾ Hypothyroidism is one of the most prevalent endocrine diseases around the world, where women are about 10 times more likely to be affected than men, and the probability of developing the disease increases with age⁽¹³⁾ This disease causes a malfunction in the thyroid gland, which leads to a decrease in the secretion of its hormones T₃ or T₄ or both together⁽¹⁴⁾ There are several causes of this disease, such as damage to thyroid cells due to treatment or treatment with radioactive iodine, thyroid cancer, or sometimes genetic.⁽¹⁵⁾ One of the most common causes of iodine deficiency⁽¹⁶⁾ is primary thyroid disease, where this disorder is related to the thyroid gland itself, meaning that there is damage to the thyroid cells and therefore the percentage of TSH is high, while the levels of T₃ and T₄ are relatively low or secondary thyroid lazy disease, where this disease occurs when there is a defect in the secretion of TSH from the pituitary gland, and thus TSH, T₃ and T₄ decrease. Or it may be tertiary thyroid disease, and this is rare, as there is an imbalance in the secretion of thyrotropin hormone from the hypothalamus gland, thus not stimulating the pituitary gland to secrete TSH,⁽¹⁵⁾ Hashimoto's disease: One of the most famous and most common thyroid diseases globally and is classified as an autoimmune disease, where the body's immune system produces antibodies to the thyroid gland such as anti-thyroid peroxidase (TPOAb) The antibodies to TgAb attack thyroid cells, destroying them completely or partially.⁽¹⁷⁾ This disease affects a person's daily life such as weight change, fatigue, lethargy and depression⁽¹⁸⁾ There are many clinical manifestations of hypothyroidism including weight gain, fatigue, memory impairment, depression, muscle pain, irregular menstruation and constipation⁽¹⁹⁾ Roughness of hair and skin Slowing down metabolism, slow speech and cold intolerance Swelling of the face, enlarged tongue and hoarseness I said identification⁽²⁰⁾ There is a direct relationship between the decrease in the concentrations of thyroid hormones and the increase in the amount of fat in the body, where the concentration of total cholesterol and LDL rises, and that the increase in the concentrations of thyroid hormones leads to increased cholesterol breakdown and increased decomposition of fatty acids.⁽²¹⁾ In recent years, the relationship between obesity and thyroid dysfunction has attracted increasing attention, and it has been suggested that obesity may cause disruption in the functioning of the thyroid gland as several studies have shown that obese populations have an increased risk of developing clinical hypothyroidism and hypothyroidism⁽²²⁾ The increase in LDL-C is the most powerful consequence associated with hypothyroidism.⁽²³⁾ Total cholesterol concentrations also increase with hypothyroidism due to low concentrations of hydroxymethylglutaryl coenzyme (HMG-CoA) and this is due to the effect of thyroid hormones on the transcription factor called sterol protein SREBP-2 and recent studies have shown that there is a relationship between hypothyroidism and heart disease due to increased cholesterol and triglycerides and protein fats due to hypothyroidism⁽²⁴⁾ in addition to an increase in the level of VLDL.⁽²⁵⁾ Lipase enzymes are also closely related to the breakdown of water-insoluble lipid molecules, such as triglycerides, phospholipids, and lactolipids. These enzymes are found everywhere in nature and are found in humans, animals, insects, plants, fungi and microorganisms⁽²⁶⁾ Lipase enzymes are the most commonly used in biological processes. Lipase belongs to a class of hydrolase (EC 3.1.1.3; triglycerol acyl hydrolase) which is capable of degrading ester bonds in the form of i-supratic found in the tripartite Glycerides, thus forming diglycerol (DG), monocyline (MG) and free fatty acids (FFA) These enzymes are also found naturally in the organism of the stomach and pancreatic juice. Its function is to digest fats, which helps maintain proper gallbladder function,⁽²⁷⁾ One of the most important features of lipase enzymes is the high stability and ability to stimulate⁽²⁸⁾ Pancreatic lipase was discovered for the first time, which has a prominent and major role in the absorption of dietary fats, because it works on the breakdown of triglycerides and the generation of free amino acids in human cells, and the pancreas secretes Lipase, which is called a hairline pancreatic releases these enzymes in the digestive system in the human body, cells cannot benefit from triglycerides found in food, as well as secrete pancreatic lipase, which returns from the main enzymes in the body, after that gastric lipase is secreted in the stomach, where fat is completely digested, any imbalance in the enzyme causes 50% to 60% of the fat in the body not to be absorbed.

Practical

90 samples were collected for people with hyperlipid-related hypothyroidism after an accurate diagnosis by a doctor and 30 samples for healthy people (as a control group) from the first of November 2023 to the first of February 2024, at the Noon Specialized Laboratory for Pathological Analysis in Mosul / Iraq where their age ranges between (67) years. 13 males, 47 females from the patient group and 15 of males and 15 females for the control group, after that many measurements were made on samples of patients and healthy people respectively, where the level of (TSH, T3, T4) was measured using the ready-made analysis kit (Kit) prepared by the company (VEDALAB-France) where the method of estimating hormones T4 and T3 in blood serum depends on the competition between hormone antigens in blood serum and antigens in the pits of strips used to bind to antibody-dye antibodies to produce a pink color commensurate with the intensity of absorption with the concentration of the hormone in the blood serum ^(30,31) as well as measured (Lipid profile) using the ready-made analysis kit (kit) and equipped by the French company (BIOLABO) ^(32,33,34,35) as well as the enzyme lipase was measured using the Winkler and Stickman method, where this method includes the decomposition of the base material, which is paranitrophenyl acetate by catalysis by the enzyme lipase to paranitrophenol, whose absorption is measured at 36-410nm After that, the results were analyzed statistically using the statistical analysis program SPSS-2018 Through this program, the values were represented through tables (SD± Mean) and the use of (T-test) to analyze the results of patients and healthy people, and then they were compared at the level of probability and graphs were drawn using Excel (2021).

RESULTS AND DISCUSSION

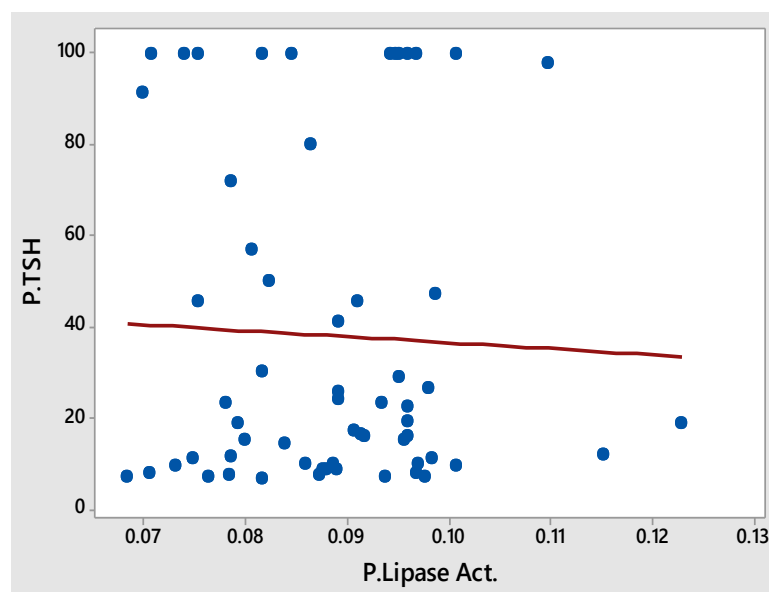
The results of the current study showed a significant increase in the level of probability ($P \leq 0.05$) in the level of TSH concentration in patients with hypothyroidism (38.1 ± 8.9) compared to the concentration of the control group (1.822 ± 0.543) and the reason for this increase is due to a defect in the mechanism of work of the gland and its secretions in addition to there are several reasons for high TSH Such as Hashimoto's autoimmune disease, which represents an autoimmune inflammation, where anti-body antibodies attack thyroid cells and then break them down, where these bodies have the ability to bind to TSH receptors, leading to an increase in its concentration in the blood, which is secreted by the pituitary gland. This study agreed with the studies of ^(37 38 39) The current study also showed a significant difference in the level of probability ($P \leq 0.05$) in the average concentration of T3 in patients with hypothyroidism (1.219 ± 0.878) compared to the control group (1.45 ± 0.161) and there was also a significant difference in the level of probability ($P \leq 0.05$) in T4 concentration in patients with hypothyroidism (64.3 ± 33.3) compared to the control group (87.8 ± 17.7) due to several reasons; the most common of which is disease Hashimoto's due to the presence of antibodies to thyroid cells ⁽⁴⁰⁾ and the removal of the thyroid gland by surgery, as well as iodine deficiency, especially in the regions of the Middle East ⁽⁴¹⁾, where this study showed a decrease in the level of T3 somewhat compared to T4, and the decrease in the concentrations of the hormone T3 is also attributed to several reasons, including the production of the thyroid gland of T3 by 20% and T4 by 80% ⁽⁴²⁾ and there is also a possibility of a deficiency in the enzyme Deiodinase, which works to extract an atom of iodine in the liver and kidney, which works to convert T4 to T3 according to the study ^(43 44) The current study also showed a significant increase at the level of probability ($P \leq 0.05$) in the average concentration of lipase enzyme in patients with hypothyroidism, as it was (0.0884 ± 0.0110) compared to the control group (0.03842 ± 0.00442), where the results of the study showed a high level of lipase enzyme in the blood serum in conjunction with hypothyroidism associated with high lipids, as the reason for this is that the thyroid gland does not produce T3 and T4 hormones Enough to stimulate the lipase enzyme to break down fats, the pancreas, in turn, works to produce the enzyme lipase naturally and continuously, thus increasing its concentration in the blood with a slow process of burning fat, which leads to a rise in the level of lipids in the blood This study is consistent with a previous study ⁽⁴⁵⁾, where the study showed an increase in the activity of the enzyme lipase by about 55% with a moderate increase in T3 hormones and T4 respectively increased activity of lipase enzyme was associated with increased levels of the hormones T3 and T4. The current study also showed a significant difference at the level of probability ($P \leq 0.05$), in the level of cholesterol in patients with hypothyroidism, as it was (211.6 ± 57.9) in patients compared to the group of Control (157.3 ± 30.6) The reason is due to the low levels of thyroid hormones T3 and T4 and the increase in TSH reduces the manufacture and destruction of cholesterol at the same time, but the rate of its catabolism is always lower than its composition, which leads to its accumulation and increase its levels in the blood serum ⁽⁴⁶⁾ The results in the table also showed a significant increase ($P \leq 0.05$) in the concentration of triglycerides in the blood serum of patients with hypothyroidism associated with high lipids, as it was (172.6 ± 82.3) compared to the control group (84.2 ± 32.4). In this study, it was shown that triglycerides rise

with high lipase enzyme, and the main reason for this increase is due to the lack of secretion of T3 and T4 by the thyroid gland, meaning that the effect of gland hormones is clear on metabolic processes, especially fat catabolism. The high level of triglycerides can be attributed to the metabolic differences that affect patients with hypothyroidism, so the body depends on the analysis of fat from adipose tissue as a source of energy as it does not benefit from glucose, thus increasing the concentration of triglycerides in the blood. ⁽⁴⁷⁾ The results of the current study showed a significant increase in the patient group and the control group at the level of probability ($P \leq 0.05$) in the concentration of low-density lipoprotein, where the results were (134.2 ± 51.4) (89.1 ± 25.8) for patients and healthy people respectively and the high level of low-density protein lipids may be attributed to LDL being the main carrier of cholesterol from the liver to other tissues it contains cholesterol in a high proportion can also be observed high concentration of LDL-C with increased deposition of fats in the blood vessels and therefore patients with hypothyroidism are susceptible to atherosclerosis and heart disease ⁽⁴⁸⁾ The results of the current study showed a significant decline in the level of high-density lipoprotein at the probability level ($P \leq 0.05$) in the serum of patients with hypothyroidism associated with hyperlipidemia, it was (42.3 ± 8.11) compared to the control group (59.4 ± 6.9) and the reason for the decrease in HDL-C may be attributed to patients with hypothyroidism associated with high lipid levels, high levels of fatty acids and not converting them into esters will increase triglyceride levels and reduce HDL-C, as it has been shown that the level of HDL is uneven in patients with hypothyroidism. The results of the current study also showed a significant increase ($P \leq 0.05$) in the concentration of low-density lipoprotein cholesterol in patients with hypothyroidism, as it was (34.4 ± 16.5) compared to the control group (16.84 ± 6.48) . A significant difference ($P \leq 0.05$) in the concentration of LDL cholesterol in patients with hypothyroidism, (34.4 ± 16.5) compared to the control group (16.84 ± 6.48) , due to the high levels of VLDL-C in patients with hypothyroidism associated with hyperlipidemia to reduced control of metabolic processes or alteration of serum lipid distribution pattern in patients with hypothyroidism ⁽⁴⁹⁾.

Correlation relationships

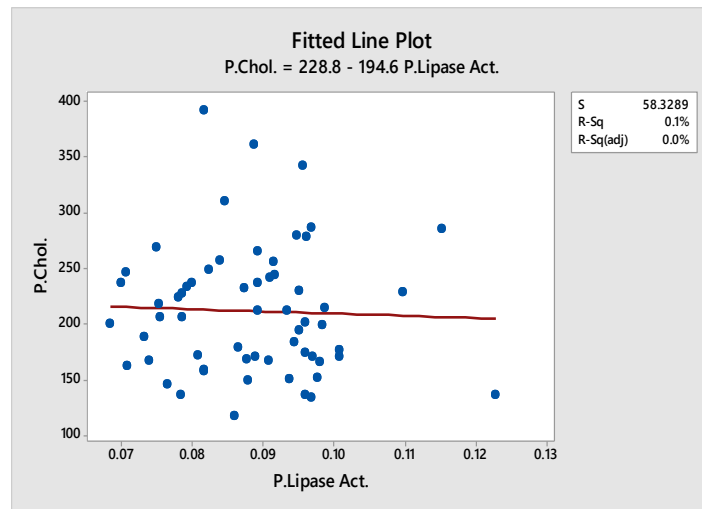
The correlation between lipase enzyme and biochemical variables has been studied

1. Lipase enzyme binding relationship with TSH



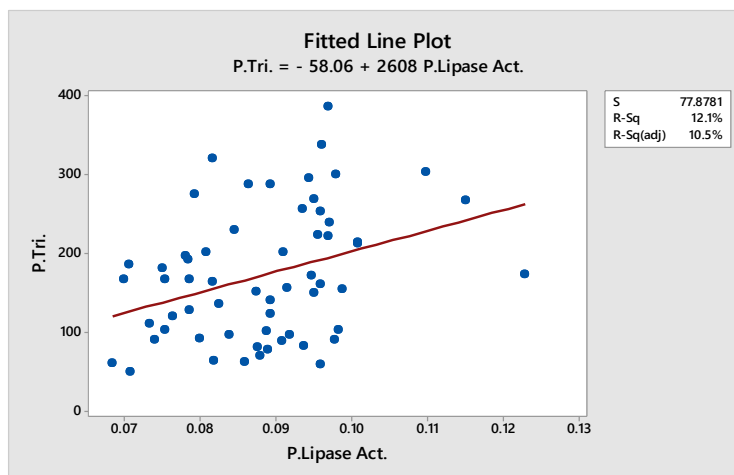
The results showed that there is a correlation (negative linear) between the activity of the enzyme TSH in patients with hypothyroidism and the value of the correlation coefficient was ($r = -0.040$).

2. Relationship of association between the enzyme lipase and cholesterol



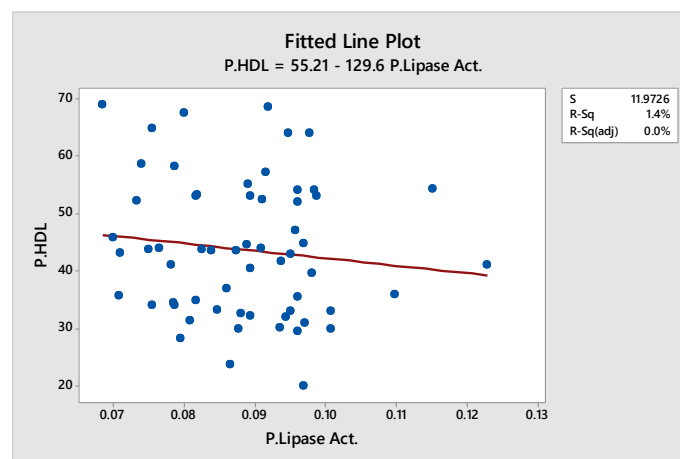
The results showed that there is a correlation (negative linear) between the activity of the enzyme lipase and cholesterol in patients with hypothyroidism and the value of the correlation coefficient was ($r = -0.037$).

3. The relationship of association between the enzyme lipase and triglycerides



The results showed that there is a correlation (linear positive) between the activity of the enzyme lipase and in the disease with hypothyroidism associated with high fat and the value of the art coefficient was ($r = 0.347$).

4. The relationship of association between the enzyme lipase and HDL



The results showed that there is a correlation (negative linearity) between the activity of lipase and HDL in patients with hypothyroidism associated with high lipids and the value of the correlation coefficient ($r = -0.119$)

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