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Study the Effect of IL-1beta on Thyroid Hormones Levels in Women with Hypo- and Hyperthyroidism in the City of Ramadi

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ABSTRACT: Thyroiditis is a medical condition of particular concern due to its diverse causes, including autoimmune factors, drug-induced inflammatory causes or fibrotic process, the most common of which is thyroiditis and includes hypothyroidism and hyperthyroidism .The study aimed to measure interleukin 1 beta (IL-1β) and compare it with the studied groups and the hormones TSH, T3, T4 and their relationship with IL-1β.

The study included investigating the relationship between IL-1β and thyroid patients in females aged between (18-60) in the city of Ramadi as well as knowing the relationship between thyroid hormones (TSH, T4, T3) and IL-1β. 45 samples were collected from Ramadi Teaching Hospital .The current study showed that there was a significant increase in the level of IL-1β compared to the control group in hypothyroid patients at a significant level (P≤0.05), which was (2.3497ng/dl). There were no significant differences in the level of IL-1β in patients with hyperthyroidism at a significant level (P≤0.05), which was (ng/dl 2.0690) compared to the control group. The study showed that there is an inverse relationship between TSH and IL-1β (0.858) and a positive relationship between T4 and IL-1β (0.809). We conclude from the study that interleukin 1 beta (IL-1β) has an effect on the thyroid gland, especially hypothyroidism, as it showed a highly significant increase in IL-1β in patients with hypothyroidism and no significant differences in IL-1β, as IL-1β affects thyroid hormones

Keywords: Thyroid gland; T4; T3; TSH; Interleukin-1β

1. INTRODUCTION

The endocrine system played an important and major role in maintaining internal balance and was one of the most important ways of communication between body organs. This system consisted of a group of endocrine glands, which were organs rich in blood vessels responsible for secreting hormones directly to the blood after they were synthesized by the epithelial cells of these glands due to the absence of channels to transport these hormones after their secretion (1) .

The thyroid gland is one of the most important endocrine glands in the body, located at the front of the neck below the larynx, where it surrounds the trachea on both sides. The thyroid gland consists of two conical lobes or wings, called the acute lobes (right lobe and left lobe), which are connected by a thin tissue called the isthmus. Each lobe contains 20 to 40 follicles of epithelial origin(2). The thyroid gland secretes the hormones triiodothyronine (T3) and thyroxine (T4). T4 was converted to T3 by enzymes found in glial cells, where an iodine molecule was removed from T4 to convert it to active T3. These hormones contribute to cellular differentiation, growth, and the regulation of basic

metabolism in the body. (3). Thyroid stimulating hormone (TSH) was the main hormone that regulated thyroid function. TSH is secreted from thyrotroph cells in the anterior lobe of the pituitary gland and consists of alpha and beta units. TSH stimulates the release of thyroxine and triiodothyronine from the thyroid gland (4). Triiodothyronine (T3) was a hormone with strong metabolic activity that affects all vital activities in the body and was the most potent of the thyroid hormones. T3 increases protein synthesis and metabolic rate (5), Thyroxine (T4) deficiency can significantly affect the ability of growth hormone to stimulate RNA synthesis and amino acid uptake, and affect organ development, especially in the central nervous system (6), Interleukin 1 beta (IL-1β) can bind to the thyroid gland through its effect on inflammation and immune response in the body (7,8). IL-1β is mainly secreted by immune cells during inflammation and injury, and thyroid inflammation may be part of the inflammatory diseases in which IL-1β is involved. Interleukins are a group of cytokines that affect all activities of the body (9), including the metabolic, cardiovascular, nervous and endocrine systems (10). Their influence may lead to the development of many diseases such as autoimmunity, diabetes, neurological diseases, kidney diseases and cancers (11,12). The study aimed to determine the relationship of interleukin 1 beta with the level of thyroid hormones in patients with hypothyroidism and hyperthyroidism.

2. PATIENTS AND METHODS

2.1 Specimens Collection

The comparative study was conducted in Ramadi Teaching Hospital for the period from 10-9-2023 / 25-3-2024 and their ages ranged between (18-60) and they were females only

2.2 Patients

Blood samples were collected from (45) people divided into three groups

Group (1): Healthy people were used as a control group (n=15)

Group (2): Patients with hypothyroidism (n=15)

Group (2): Patients with hyperthyroidism (n=15)

2.3 Samples treatments

Blood (5 ml) was drawn from the Median Cubital Vein through Disposable Syringes and then the sample was placed in a gel tube used to separate the serum and freeze it to measure the studied hormones and interleukins

2.4 Measurement of IL-1B and thyroid hormones

Interleukin 1beta was measured by ELISA method using a special kit from Wuhan Feiyue Biotechnology Co .Wuhan Feiyue Biotechnology Co., LTD. Thyroid hormones were measured using the Wuhan Feiyue Biotechnology Co.LTD.

2.5 Ethics approval

This study was conducted based on the ethical standards stipulated in the Declaration of Helsinki. Before taking the sample, The patient's informed written and verbal agreement was obtained, after the review and approval of the study protocol and subject's information by the local ethics committee according to the document number 45 in (11/3/2024)

2.6 Statistical analysis

Statistical analysis was performed using a ready-made program (SPSS 2009) and the t test to compare between hypo- and hyperthyroid patients, and the Pearson test was used to determine the relationship between thyroid hormones and interleukin 1 beta (13.)

3. RESULTS AND DISCUSSION

3.1 Interleukin (IL-1β) measurement in thyroid patients

The results of the current study shown in Figure (1) for the level of interleukin 1 beta in hypothyroid patients at a probability level (0.05>P) using the ELISA test showed a significant increase in the level of interleukin 1 in the serum of hypothyroid patients (2.3497 ng/dl) with the control group (1.671 ng/dl) and no significant increase for hyperthyroid patients (2.069 ng/dl) with the control group (1.671 ng/dl).The results showed a significant increase in the level of interleukin 1 in hypothyroid patients (1.671ng/dl).

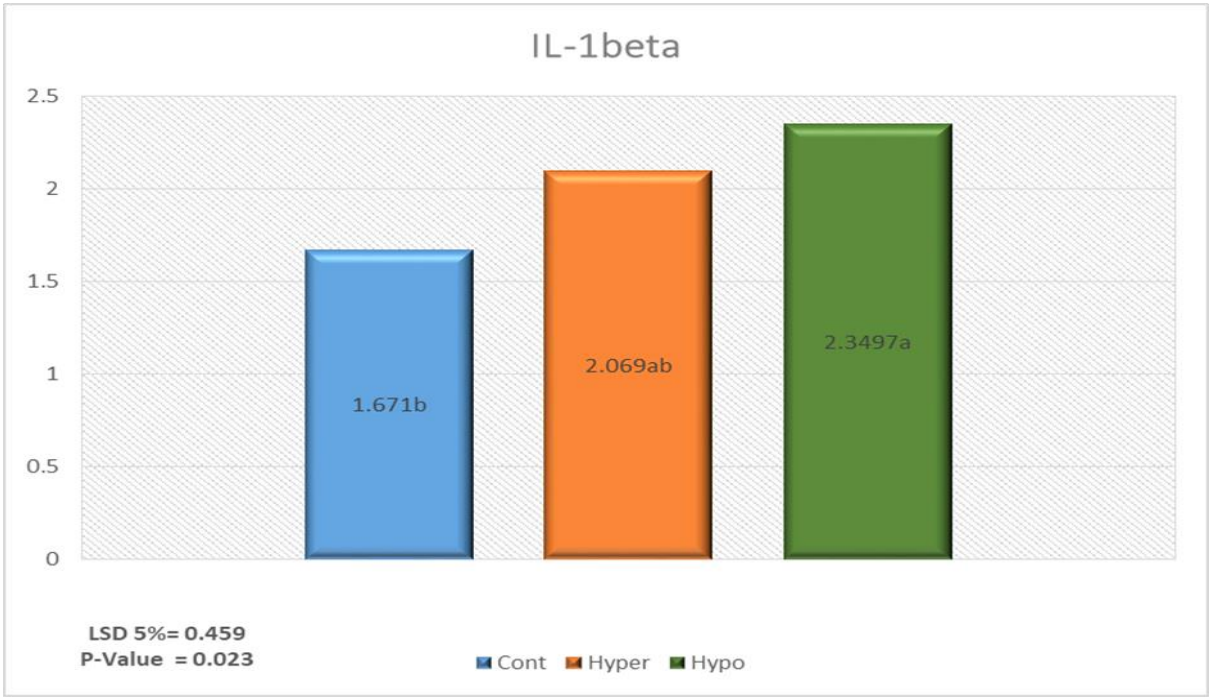

Figure 1 Interleukin (IL-1β) in thyroid patients

Interleukin-1β (IL-1β) is a key cytokine in the inflammatory response. It is produced by immune cells such as macrophages and monocytes, and plays a role in coordinating immune responses. Hypothyroidism is a condition characterized by underproduction of thyroid hormones, leading to multiple effects on body functions. It illustrates how IL-1β affects patients with hypothyroidism,

explaining the different mechanisms and overlapping biochemical and molecular interactions (14). IL-1β promotes an inflammatory response in the thyroid gland, leading to inflammation and destruction of gland cells. This inflammation can partly be the cause of autoimmune disorders such as Hashimoto's thyroiditis, in which the immune system attacks thyroid cells (15). IL-1β increases the activity of type 1 (Th1) helper T cells that play a role in autoimmune responses. This can increase the immune cells' attack on thyroid tissue, leading to further destruction of the gland and decreased hormone production. IL-1β can alter the balance between Th1 and Th2 cells, promoting autoimmune responses against the thyroid (16).

IL-1β affects fat and glucose metabolism, which can lead to weight gain and insulin resistance. These metabolic changes can further exacerbate symptoms related to hypothyroidism. IL-1β can affect the conversion of T4 to T3 in peripheral tissues, leading to lower levels of active T3, thus exacerbating the symptoms of hypothyroidism (17). Interleukin 1 beta can cause inflammation in the central nervous system, leading to symptoms such as fatigue, depression, and poor concentration, which are common in patients with hypothyroidism. and disrupting the hypothalamic-pituitary-thyroid axis (HPT Axis): IL-1β can affect the interaction of this axis, leading to reduced secretion of thyroid-stimulating hormone (TSH) from the pituitary gland, thus reducing thyroid stimulation to produce hormones (15). As for hyperthyroid patients and the control group, there is a significant increase but no statistically significant differences at the probability level ($P \leq 0.05$).

3.2 Relationship of interleukin IL-1β to thyroid hormones in hypothyroid patients

The present study showed that there is a relationship between TSH and IL-1β (0.858 ulU/ml) and a relationship between IL-1β and T4 (0.809 ug/dl). As for age, there is no significant difference in hypothyroid patients at probability ($p<0.01$).

Table 1 Relationship of IL-1β to hormones in patients with hypothyroidism

Correlations						
Hypo		TSH	T4	T3	age	IL-1beta
TSH	Pearson Correlation	1	*-0.667-	-0.482-	0.214	**-0.858-
	Sig. (2-tailed)		035.	158.	552.	001.
T4	Pearson Correlation		1	0.507	0.108	**0.809
	Sig. (2-tailed)			135.	766.	005.
T3	Pearson Correlation			1	0.224	0.466
	Sig. (2-tailed)				534.	175.
age	Pearson Correlation				1	-0.117-
	Sig. (2-tailed)					747.
IL-1beta	Pearson Correlation					1
	Sig. (2-tailed)					

.Correlation is significant at the 0.05 level (2-tailed) .*
.Correlation is significant at the 0.01 level (2-tailed) .**

Hypothyroidism is a condition that occurs when the thyroid gland fails to produce sufficient amounts of hormones necessary to regulate metabolism, growth, and development. Interleukin 1 beta (IL-1β) plays an important role in the body's inflammatory response. Recent studies have shown that IL-1β can affect levels of thyroxine (T4) and thyroid-stimulating hormone (TSH), leading to hypothyroidism. Thyroid cells contain special receptors for IL-1β. When IL-1β binds to these receptors, it initiates a signaling cascade within the cell that affects many cellular processes (18)

IL-1β can inhibit the functional activity of thyroid cells (follicular cells), leading to reduced production of T4 and T3. These hormones are essential for regulating metabolism, growth and development. Inhibiting the production of these hormones leads directly to a decrease in their levels in the blood.[14 IL-1β leads to an increase in the production of nitric oxide (NO) in thyroid cells. Nitric oxide can have toxic effects on cells, leading to a reduction in their functional activity. In addition, IL-1β can affect the expression of genes responsible for the synthesis of thyroid hormone (19). IL-1β interleukin relationship with thyroid hormones in patients with hyperthyroidism.

The study showed that hyperthyroid patients and the control group had no statistically significant differences at a probability level (0.05>P) and no relationship between interleukin and hyperthyroid patients due to the difference in biological and pathological mechanisms as both play a role in different body systems without a clear overlap between them .

Table 2 Relationship of IL-1β to thyroid hormones in patients with hyperthyroidism

Correlations						
Hyper		**TSH**	**T4**	**T3**	**age**	**IL-1beta**
TSH	Pearson Correlation	1	-0.211-	-0.229-	0422.	-0.333-
	Sig. (2-tailed)		559.	524.	224.	347.
T4	Pearson Correlation		1	-0.185-	-0327.-	-0.313-
	Sig. (2-tailed)			610.	356.	379.
T3	Pearson Correlation			1	-0.192-	*0.685
	Sig. (2-tailed)				594.	029.
age	Pearson Correlation				1	-0.369-
	Sig. (2-tailed)					294.
IL-1beta	Pearson Correlation					1
	Sig. (2-tailed)					
.Correlation is significant at the 0.05 level (2-tailed) .*						

The body may develop mechanisms to cope with chronic inflammation and thus minimize The body may develop mechanisms to cope with chronic inflammation and thus minimize the effect of IL-1β on the thyroid gland. The body may modify interleukin receptors or produce natural cytokine antagonists (20). The interaction between interleukin and thyroid hormones is a complex process and interleukin may not have a clear direct effect due to the involvement of other factors in this process(21) .

4. CONCLUSION

We conclude from the study that interleukin 1 beta (IL-1β) has an effect on the thyroid gland, especially hypothyroidism, as it showed a highly significant elevation of IL-1β in hypothyroid patients and no significant differences in IL-1β, as interleukin (IL- 1β affects thyroid hormones and if there is a confirmed relationship between interleukin and hypothyroid patients, it can be utilized to diagnose and follow-up hypothyroid patients and can be used in therapies that target interleukin or its associated inflammatory pathways to treat hypothyroidism and can also benefit from an elevated interleukin indicator in hypothyroid patients to an autoimmune component of the disease such as Hashimoto's disease where the immune system attacks the thyroid dysfunction leading to hypothyroidism.

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