

# Effects of Infection with *Toxoplasma Gondii* to the Levels of Thyroid Hormones

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## INTRODUCTION

The *Toxoplasma gondii* is a parasitic protozoan that can infect many types of hosts like: mammals, birds and humans causing toxoplasmosis (La Hoz et al., 2019) which forces intrusive intracellular. The infection is transmitted by the parasites of conic toxoplasts, in the form of parasite egg sacs in several ways, including drinking water, eating vegetables and fruits contaminated with parasite egg sacs, and contamination by the feces of feces that are infected with contaminated soil. Well, an important means of transmission is the occurrence of transplacental infection (Robert and Darde, 2012) placenta.

The parasite can attack different organs, for example, the thyroid gland, which is one of the most important endocrine glands in the body, as its hormones (T4, T3) have an important role in regulating the body's basic metabolic rate and the generation of heat, and contribute to fat metabolism by stimulating lipolysis, production Fatty acids as an energy source (Zhang, 2020).

Any dysfunction in the thyroid gland has many effects on the various metabolism processes in the body, and there are many cases for that. The most common of which are Hypothyroidism, including low levels of hormones (T4, T3) and a high level of TSH. It is a common disease in adults, especially in women, and most cases of hypothyroidism in adults are caused by immune destruction of the gland tissue, as in the case of Hashimoto's disease and other cases caused by Congenital children. It occurs as a result of a lack of iodine in the food or as a result of radioactive iodine gland treatment or after Gland surgeries (Wu, 2015). The purpose of this study is to confirm the relationship between levels of thyroid hormones, calcitonin, some electrolytes, and abortive toxoplasmosis in Samarra.

## ABSTRACT

The present study was designed to detect the effect of toxoplasmosis in the thyroid hormones level Samples were collected during the period from July2019 to January 2020. Where the separated serum was preserved at a temperature (-20) until use. The enzyme-linked immunosorbent technique (ELISA) was used to detect toxoplasmosis. Hormone levels (TSH, TSH, T3 and calcitonin) were also measured using ELISA technology, Hormonal study, the results of the current study showed significant increase (P <0.05) in TSH, T3, and calcitonin levels in the infected group compared with control group and significant decrease (P <0.05) in T4 levels compared with control group. On the other hand, there was an increase in TSH levels in the hypothyroidism group compared with control group, with a significant decrease in the levels of T4, T3 and calcitonin compared with control group. A significant decrease (P <0.05) was found in TSH levels in the hyperthyroid group. Hyperthyroidism group showed significant increase (P <0.05) in the levels of T4, T3 and calcitonin compared with control group.

**Keywords:** Hyperthyroidism, Hypothyroidism, Calcitonin, Toxoplasmosis

## MATERIALS AND METHODS

### Collection of samples

The current study included the collection of 300 serum samples, which collected during the period from July 2019 to January 2020. Serum samples was obtained by withdrawing 5 cm<sup>3</sup> of venous blood by using a disposable syringe and placed in sterilize plain tubes with a cover tightly without anticoagulants, centrifuge for 10 minutes at a speed of 3000 rpm, after the tubes were left at room temperature 25° C until coagulation. After that the serum was pulled by the micropipette and placed in clean, sterile tubes and kept in a freezing state at -20° C until performing the tests under study.

### Study design

The head groups were divided into four groups: (toxoplasma, hypothyroidism, hyperthyroidism, and control).

To investigate the class IgM antibody of the *Condylopaque* parasite, enzyme-linked immunosorbent technique (ELISA) was used by using standard method manufactured by (German Human), otherwise the determination of serum hormones were done by ELISA technique to measure the level of TSH, T3, T4 and calcitonin concentration Kits, provided from German Human Company.

### Statistical analysis

The results obtained from the current study were analyzed using the SPSS statistical program, and the Dunkin polynomial test was used to compare four groups at the level of significance (P≤0.05) to identify the degree of significance of the differences between the groups rates.

## RESULTS AND DISCUSSION

### Thyroid hormone levels

The results of the current study showed an increase in the levels of TSH, T3, and calcitonin ( $11.13 \pm 0.05$  and  $6.18 \pm 0.63$  and  $93.5 \pm 4.2$  respectively) in the CTD group compared to the control group ( $3.194 \pm 1.37$ ,  $3.06 \pm 0.81$  and  $\pm 71.3 \pm 6.32$ , respectively) with a significant decrease ( $P < 0.05$ ) in T4 levels ( $4.8 \pm 1.582$ ) compared to the control group ( $6.39 \pm 1.771$ ). On the other hand, there was an increase in TSH levels ( $11.17 \pm 6.05$ ) in the group of hypothyroidism compared to the control group, with a significant decrease in the levels of T4, T3, and calcitonin ( $4.02 \pm 1.01$ ,  $1.68 \pm 0.58$  and  $48.3 \pm 5.17$ ) compared to the control group. Significant decrease was found ( $P < 0.05$ )

In TSH levels ( $20.13 \pm 7.65$ ) in the hyperthyroidism group with a significant increase ( $P < 0.05$ ) in the levels of T4, T3 and calcitonin (4-9) compared to the control group and in Table (2) and figures (M -1, 2, 3 and 4). Regarding the differences between groups with toxoplasma and normal performance of the thyroid gland compared to two groups affected by *Toxoplasma*, but the group of hypothyroidism and the group of hyperthyroidism found the results that the parasite infection increased to levels of TSH and T3 with low levels of T4, which showed significant difference compared to the group Hypothyroidism & *Toxoplasma* with a decrease in high Compared to the *Toxoplasma* group with normal thyroid performance in T4 levels, there were no differences between the two groups in TSH and T3 levels while significant differences were found in TSH and T3 levels between *Toxoplasma* group and Hyperthyroidism & *Toxoplasma* group as shown in the table below.

Table 1: Mean+S.D. of thyroid hormones levels in sera of groups under investigations

Parameters	TSH (ng/ml)	T4 (ng/ml)	T3 (ng/ml)	CT. (ng/ml)
Control	3.19±1.37	6.39±1.771	3.06±0.81	71.3±6.32
Toxoplasma	11.13±1.05	4.8±1.582	6.18±0.63	93.5±4.2
Hypothyroidism	11.17±3.05	2.02±1.01	1.68±0.58	48.3±5.17
Hyperthyroidism	20.13±0.65	7.41±1.14	10.24±4.57	86.8±7.5
Hypothyroidism & Toxoplasma	13.25±2.51	4.95±0.86	3.28±0.37	41.9±6.28
Hypothyroidism & Toxoplasma	7.13±1.9	6.18±1.73	9.4±2.53	101.8±9.4

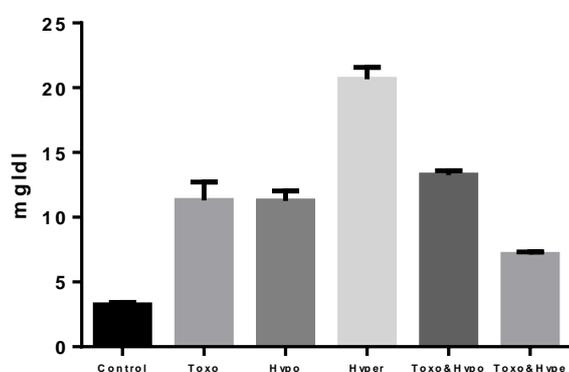


Figure 1: TSH levels in all study groups

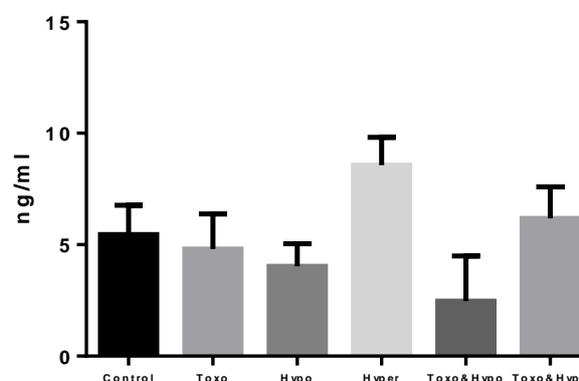


Figure 2: T4 hormone levels in all study groups

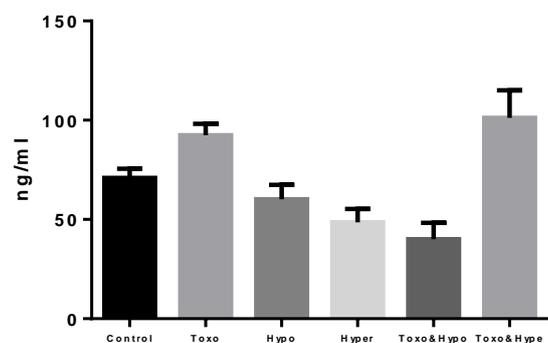


Figure 3: T3 hormone levels in all study groups

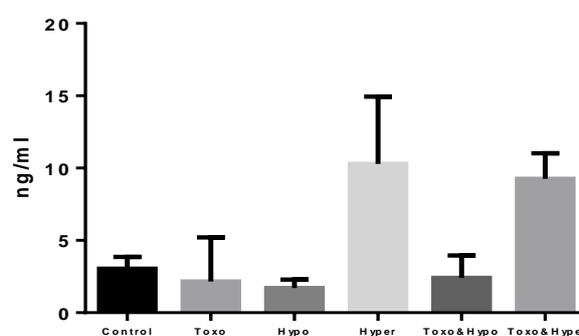


Figure 4: calcium hormone levels in all study groups

The results of the current study showed a direct effect of the *Toxoplasma gondii* parasite on the mechanism of the thyroid gland and the levels of hormones produced by the thyroid gland. A study conducted in the city of Kirkuk showed that the cause of increased infection with toxoplasmosis parasites was the continuous power outages, one of the reasons that affect the storage of food and water supplies in addition to the absence of pesticides of approved quality to eliminate mechanical carriers. All of these factors may have played an important role in highlighting the reason for the high incidence of toxoplasmosis in the province (Salman and Mustafa, 2014). Liu and his group (1994) have confirmed in their study the diagnosis of *T. gondii* phases in the thyroid gland. The infection of the CDI parasite is associated with autoimmune thyroid disease (Shapira et al., 2012), which causes a slight rise in the levels of thyroid hormones (Wasserman et al., 2009) and this corresponds to the results of the current study.

The results of the current study did not coincide with a study conducted by Alvarado-Esquivel and his group (2019) who indicated the negative relationship between the thyroid gland and *T. gondii* infection as no defect was detected in the work and levels of thyroid hormones and the researcher instructed the cause as follows: that these Infection has no role in hypothyroidism, or it has a protective role against hypothyroidism. If the researcher indicated that it is possible that *T. gondii* may affect the thyroid gland in a very small number of individuals with this parasite and therefore any inflammation or damage to the thyroid tissue is rarely discovered. On the other hand, it is not clear whether the CBD parasite has a protective role against thyroid dysfunction (Alcantara-Neves et al., 2012)

In another study conducted by researcher Al-Khamesi (2016) he found a high positive relationship between elevated thyroid hormones and infection with the toxoplasmosis of Kennedy toxoplasmosis. The researcher found there is a direct relationship between the thyroid tissue breakdown as a result of the infection with the Kennedy toxoplasmic parasite, as this parasite has the ability to activation and division within the thyroid tissue, which causes an imbalance in the gland's work and high levels of hormones. If the researcher finds that the levels of T3 and TSH hormones are high by ( $12.74 \pm 0.53$  and  $11.64 \pm 0.58$  mIU / L, respectively) compared to the control group ( $1.49 \pm 0.16$  and  $2.29 \pm 0.25$ , respectively), this corresponds to the results of the current study .

And Al-Khamesi (2016) indicated that the incidence of toxoplasmosis toxoplasmosis leads to an increase in TSH levels, which is reflected in the performance of the parathyroid gland which causes high levels of the hormone calcitonin. That explains the results of the current study. On the other hand, it was found that infection with parasitic diseases leads to deficiency and disorder of parathyroid gland hormones, where schistosomiasis and fascioliasis work on excessive levels of calcium hypercalcemia with high levels of the hormone and parathyroid protein PTH-related protein with low levels of the hormone calcitonin (Kilany et al., 2009; Yasri and Wiwanitkit 2018).

On the other hand, in a study conducted by Wu and his group (2016), the researcher found that infection with parasites in general is protozoal and worms that led to a defect in thyroid hormones and a thyroid disorder in its work if it found a decrease in calcite levels and an increase in the thyroid hormone, and this corresponds to the results of the study The current in that the parasitic infection leads to an imbalance in the functioning of thyroid hormones and low levels of the hormone calcitonin. .

In the current study, a significant increase in TSH levels was found with a decrease in the levels of T4, T3 and calcitonin compared to the control group in hypothyroidism patients and these results are consistent with the results of the study conducted by Hashim and his group (2018), which indicate a significant increase in TSH levels with a decrease In T4 and T3 levels compared to the control group. Furlanetto and his group (1991) indicated a decrease in the levels of the hormone calcitonin in patients with hypothyroidism and this corresponds to the results of the current study .

With regard to the incidence of *Toxoplasma* and its relationship to the condition of Hypothyroidism, the results showed an increase in the levels of T4 and T3 in the Hypothyroidism & *Toxoplasma* group compared to the Hypothyroidism group only, and what may explain the reason for this result in the current study is that infection with the parasitoid toxoplasmosis motivates the nervous system causes the stimulation of hypothalamus-pituitary thyroid axis and this leads to an increase in TSH levels and thus an increase in the secretion of triiodothyronine (T3) (Barrett et al., 2010). This enhances the results of the current study in terms of the high levels of calcitonin T3 and TSH in the current study. On the other hand, Eisa and his group (2019) indicated that the infection of the KCl parasite leads to high levels of T4 and T3 in Hypothyroidism patients, and the researcher stated that the mechanism is not clear until this moment .

In addition, a significant decrease in TSH levels was found with an increase in the levels of T4, T3 and calcitonin compared to the control group in patients with hyperthyroidism. These results are consistent with the results of the study conducted by Adday (2014), which indicated significant decrease in TSH levels with high In T4 and T3 levels compared to the control group. Ferreira-Valbuena and his group (1991) indicated higher calcitonin levels ( $193.6 \pm 8.62$  pg / ml) compared to the control group ( $7.61 \pm 116.7$ ) in people with hyperthyroidism and this corresponds to the results of the current study .

## CONCLUSIONS

A disorder of thyroid hormones in people with toxoplasmosis; The presence of a correlation between infection with the parasitoid toxoid plasma and a decrease in the hormone calcitonin in patients with Hypothyroidism; Combating rodents as intermediate hosts and cats as intermediate and final hosts, and destroying tissue residues in reed stores in a healthy manner ensuring that cats do not reach them.

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