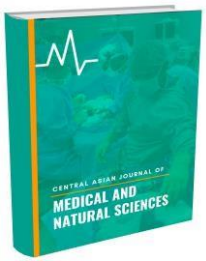

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Article

The Effect of Toxoplasmosis on Some Physiological Parameters

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Abstract: The incidence of toxoplasmosis was 65.3%, by collecting 101 samples of toxoplasmosis parasite from women visiting Al-Dujail Hospital and some private laboratories in Al-Dujail District, for the period from July 2023 to December 2023, and the ages of all samples were between (21-31) years. The current study showed that there were highly significant differences in both LH from sex hormones and T4 from thyroid hormones 4.120±1.720 and 7.75±1.01 in the infected group compared to the control group, and significant differences for T3 1.377±0.246 in the infected group, and no significant differences for each of FSH, TSH 1.83±0.44 and 2.07±0.69 in the infected group. The present study showed that there were highly significant differences according to age for thyroid hormones for each T3, T4, as well as a highly significant difference in the sex hormones FSH, LH between the infected groups when compared to the uninfected, and a significant difference in TSH between the infected group.

Keywords: Toxoplasmosis, Some physiological parameters, Iraq

1. Introduction

Toxoplasmosis is a zoonotic disease caused by an intracellular protozoan parasite that infects humans and warm-blooded animals as intermediate hosts, while several members of the cat family act as definitive and intermediate hosts for the parasite [1]. The parasite *Toxopasma gondii* belongs to the Apicomplexa division, which includes a number of intracellular parasites, class Sporozoasida [2]. The parasite infects humans through eating food or water contaminated with egg sacs excreted in the feces of infected cats, or through eating raw or poorly cooked meat containing tissue sacs, and can be transmitted congenitally from an infected mother to the fetus [3].

Congenital toxoplasmosis occurs in pregnant women, and congenital transmission of the parasite occurs mostly during the first time during pregnancy, as infection with the parasite can lead to fetal malformations and changes in placental tissue, leading to miscarriage. The parasite can attack various organs, for example the thyroid gland, which is one of the main sources of treatment. The most important endocrine glands in the body, as its hormones T3, T4 play an important role in regulating the basal metabolic rate in the body and generating heat [4]. Several studies were conducted in Iraq to determine the seroprevalence rates of toxoplasmosis. Among these studies, in Baiji district, the infection rate reached 30% [5].

Kadhim conducted a study in Babil Governorate on some pregnant women in 2013. He found that the infection rate was 18.09%, while the IgG antibody was 9.79%, and the

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IgG and IgM antibodies were 1.75%. The infection rates also varied in the rest of the governorates. Baghdad recorded a rate of 31.3%, and in Basra 79.1% [6]. Toxoplasmosis is one of the most important opportunistic parasitic diseases of animal origin, and depends on different risk factors, including first, the geographical area and hot and cold climatic conditions, second, age, the most affected group is all newborns of older ages, third, raising cats and exposure to their feces, fourth, dietary habits, fifth, the condition Immunocompromised, most vulnerable group, all immunocompromised patients, those with cancer, and those with autoimmune diseases [7].

The thyroid gland is one of the most important endocrine glands in the body as it produces hormones, stores them, and releases them into the bloodstream. It directly affects the effectiveness of the body's cells. Thyroid cells modify the only cells in the body that absorb iodine. It is one of the largest endocrine glands. The weight in adults usually ranges from 15 to 25 grams of iodine. The weight and size of the gland vary with age from one person to another. In some of the previous cases, the size of the gland increases significantly.

The thyroid gland secretes two types of hormones: hormones that contain iodine and hormones that do not contain iodine. The hormones that contain iodine are Triiodothyronine (T3) and Tetraiodothyronine (T4) or what is called thyroxine, in addition to the ionized thyronine and tyrosine compounds, including Monoiodotyrosine MIT and Dioiodotyrosine DIT. As for the hormones that do not contain iodine, such as Calcitonin CT [8].

(T3) Triiodothyronine: It is one of the effective metabolic hormones. It is stimulated by the thyroid gland and its function is related to all vital activities in the body, as it is considered the strongest hormone among the thyroid hormones, as its function is related to body temperature, growth and the heart, compared to other hormones. T4, although its secretion is usually in small quantities and contains a small number of iodine atoms [9].

T4 (Tetraiodoth) or thyroxine: It is one of the thyroid hormones. T4 increases the basal metabolic rate, energy, and heat production. T4 regulates the production of an energy-rich compound, ATP [10]. It also helps regulate the adrenal gland and plays an important role in growth, development, tissue differentiation, and metamorphosis in amphibians. T4 also regulates fat metabolism.

To maintain a normal level of metabolic activity in the body and an adequate number of thyroid hormones, secretion must occur at all times. This is done through specialized reactions through the secretion of the hypothalamus and the anterior lobe of the pituitary gland to control the secretion of thyroid hormones [11].

(TSH) Thyroid Stimulating Hormone: Also called Thyrotrpin, it is the main hormone that stimulates and regulates the function of the thyroid gland. It is a glycoprotein hormone secreted by the thyroid cells located in the anterior lobe of the pituitary gland. It consists of two lobes, alpha and beta. This hormone works to increase the secretion of T3 and T4 hormones from the thyroid gland by increasing the breakdown of Thyroglobulin found in the follicles. Then it increases the process of releasing thyroid hormones into the bloodstream, and TSH is under the influence of the releasing hormone, thyroid stimulating hormone (TRH), which is secreted from the hypothalamus and is determined by the negative feedback of the thyroid hormone, which in turn also affects the secretion of TRH [12].

The study aimed to investigate the prevalence of toxoplasmosis among aborted women in Dujail District and to evaluate the extent of the effect of infection with the parasite on the thyroid gland and its hormones T3, T4, TSH in women infected with toxoplasmosis.

2. Materials and Methods

Collection Samples

Samples were collected from Salah al-Din Governorate / Dujail District randomly from pregnant and aborted women who came to the government hospital and some private medical clinics whose ages ranged between 20 to 31 years for a period of 6 months. The number of collected samples was 101 blood samples from the women under study. Blood was drawn from the vein using a sterile medical syringe with a capacity of 5 ml, then placed in gel tubes and separated the serum from them using a centrifuge at 300 rpm for 10 minutes. Then, the serum was placed in Eppendorf tubes, and information was recorded on them, such as: name, age, and whether the sample was positive or negative. After that, the samples were frozen at a temperature of (-20 C) until hormonal tests were performed (FSH, LH, T3, T4, TSH).

Hormonal Tests

Estimation of FSH concentration: The concentration of ((FSH was estimated using the analysis kit (Kit) produced by Mindray, Germany, on the CL-900i device and according to the steps attached to it.

Estimation of LH concentration: The concentration of ((LH was estimated using the analysis kit (Kit) produced by Mindray, Germany, on the CL-900i device and according to the steps attached to it.

Estimation of T3 Triiodothyronine concentration)): The concentration of ((T3 was estimated using the analysis kit (Kit) produced by Mindray, Germany, on the CL-900i device and according to the steps attached to it.

Estimation of T4 (Tetraiodoth) or thyroxine concentration)): The concentration of ((T4 was estimated using the analysis kit (Kit) produced by Mindray, Germany, on the CL-900i device and according to the steps attached to it. Attached with it.

Estimation of TSH (Thyroid Stimulating Hormone) concentration: The concentration of (TSH) was estimated using the analysis kit produced by Mindray, Germany, on the CL-900i device and according to the steps attached to it.

Statistical Analysis

The results were statistically analyzed using the statistical program Minitab. Ver 17. According to the t-test and the (ANOVA) F test. The arithmetic means were compared to determine the significant differences using Duncan's multiple range test at a probability level of 0.05.

3. Results and Discussion

101 samples of toxoplasmosis parasite were collected from Dujail Hospital in Dujail District and some private laboratories. The sample collection period was six months from July 2023 to December 2023. The number of samples infected with toxoplasmosis was 66 positive samples out of 101 samples, with an infection rate of 65.3%.

The reason for the high percentage in our current study on toxoplasmosis may be that most of women who visited hospitals and private clinics for care during pregnancy, and the reason for the increase is also due to the large number of stray cats in homes as well as raising cats in homes which are considered the main carrier of the disease and the poor health conditions as well as the low level of health education and health conditions and food contamination, or the lack of clear signs for those infected or what are called subclinical signs are considered one of important factors in the spread of infection with the

parasite due to the difficulty of diagnosing it in early stages after conducting the necessary clinical examinations. The present study showed that there were highly significant differences of 0.01 in both LH of sex hormones and T4 of thyroid hormones 4.120±1.720 and 7.75±1.01 in the infected group compared with control group, and significant differences of 0.05 for T3 1.377±0.246 in infected group compared with control group and no significant differences for FSH, TSH 1.83±0.44 and 2.07±0.69 in infected group compared with control group as shown in Table 1.

The results of this study showed a decrease in FSH levels and agreed with [13] in Baghdad and [14] who found that men infected with toxoplasmosis had equal concentration of FSH compared to the control group. While another study conducted by Boepple (2008) on toxoplasmosis showed different results with the current study as there was an increase in FSH and LH levels and prolactin levels and a decrease in total and free testosterone levels in men infected with toxoplasmosis compared to the control, and explained that the reason for the increase led to weak feedback to the anterior pituitary gland by Leydig cells. As for thyroid hormones, the results of the current study showed a direct effect of toxoplasmosis on the mechanism of the thyroid gland and on the levels of its hormones T3, T4, TSH.

A study in Kirkuk province showed that the reason for the increase in toxoplasmosis infection was the continuous power outage, which was one of the reasons that affected the storage of food, as well as the lack of high-quality insecticides to eliminate mechanical carriers. In (1994), Liu and his group diagnosed the stages of *T. gondii* in the thyroid gland. It was also shown that toxoplasmosis infection is associated with autoimmune diseases of the thyroid gland [15], which causes a slight increase in thyroid levels [16], which is consistent with the results of the current study.

The results of the current study differed from Alvrado-Esquivel and his group in 2019 [17], where they indicated that there is no relationship between toxoplasmosis and the thyroid gland, as no abnormalities in the function and levels of thyroid hormones were detected. The researcher attributed the reason: This infection has no role in thyroid dysfunction, or that this infection has a protective role against thyroid dysfunction. The researcher indicated that it is possible that toxoplasmosis. The thyroid gland may be affected by a very small number of individuals infected with this parasite, and therefore any inflammation or damage to the thyroid tissue is rarely detected. The current study showed that there are highly significant differences of 0.01 according to age for thyroid hormones for each T3, T4, as well as a highly significant difference of 0.01 in the sex hormones FSH, LH between the groups of infected when compared to those not infected, and a significant difference of 0.05 in TSH between the group of infected when compared to those not infected, as shown in Table 2.

The results of the current study agreed with [13] which showed the average concentration of FSH for patients with toxoplasmosis according to age group and hair abundance, as the age group (18-25) years was the highest age group in terms of high FSH levels and was characterized by the absence of hair from the faces of all patients. It also agreed with [18] which showed high levels of FSH, LH and low levels of testosterone, due to hormonal irregularity due to the effect of toxoplasmosis on the function of the reproductive glands. These results differed from [19] which showed a non-significant difference in the level of FSH and the effect of the age of patients with toxoplasmosis compared to the control. These disagreement results may be related to the limits of the different age groups or the limits of the different hormonal groups.

Table 1. Hormonal parameters rate according to toxoplasmosis infection

Group	TSH Mean ± D. S	T4 Mean ± D. S	T3 Mean ± D. S	LH Mean ± D. S	FSH Mean ± D. S
Infected	±2.07 0.69	±7.75 1.01	±1.377 0.246	± 4.120 1.720	± 1.83 0.44
Control	±1.917 0.743	±10.27 2.27	±1.888 0.672	±0.959 0.298	± 2.85 0.20
P-value	ns 0.694	** 0.005	* 0.033	** 0.001	ns 0.336

ns indicates no significant differences

* Indicates differences at the 0.05 level

** indicates highly significant differences at the 0.01 level

Table 2. Hormonal parameters of toxoplasmosis patients according to age groups

Group Age	TSH Mean ± D. S	T4 Mean ± D. S	T3 Mean ± D. S	LH Mean ± D. S	FSH Mean ± D. S
Infected 21-25	±1.597 0.098 ab	±6.7983 0.3318 c	±1.3508 0.2993 b	±9.860 1.3720 a	±4.006 0.470 b
26-31	±2.363 0.942 a	±8.3460 0.8140 b	±1.3937 0.2134 b	±0.2995 0.0873 c	±0.457 0.350 d
Control 21-25	±0.879 0.020 b	±9.9267 0.0513 a	±1.4300 0.1000 b	±7.0400 0.0265 b	±7.7167 0.118 a
26-31	±2.307 0.391 a	±10.3960 2.7220 a	±2.0600 0.7200 a	±0.8140 0.6340 c	±1.0250 0.806 c
p-value	* 0.024	** 0.0006	** 0.001	** 0.00006	** 0.00002

*Similar letters indicate no significant differences at 0.05 probability level

*Different letters indicate significant differences at 0.05 probability level

4. Conclusion

The study's conclusions show that the infected and uninfected groups differed significantly in a number of physiological indicators, such as thyroid and sex hormones. In particular, there were notable variations in T3 hormone levels and increased levels of luteinizing hormone (LH) and T4 thyroid hormone in the infected group. The age-related

differences in these hormones among the affected people were also emphasized by the study.

REFERENCES

[1] S. I. Mahmood, N. A. H. A. Saeed, and L. Q. Ali, "Rubella Virus and Toxoplasma gondii Infection with Immune Antibodies Diagnosis Among Bad Obstetric and Primigravida Pregnant Women in Baghdad City," *World Bulletin of Public Health*, vol. 12, pp. 78-85, 2022.

[2] D. E. Hill and J. P. Dubey, *Toxoplasmosis*, Reston, VA: U.S. Geological Survey Circular 1389, 2014, p. 84.

[3] S. O. Addo, T. O. Asare, C. Arthur, K. Amoateng, K. Addo, and J. A. Larbi, "Toxoplasma gondii Among Pregnant Women Attending Antenatal Care in a District Hospital in Ghana," *Public Health Challenges*, vol. 2, no. 2, p. e82, 2023.

[4] W. Zhang, Y. Wang, Z. Wei, G. Chang, Q. Luo, N. Abudusailamu, and Y. Chen, "Endocrine Hypertension," in *Secondary Hypertension*, Singapore: Springer, 2020, pp. 249-347.

[5] M. AL-Jebouri, M. AL-Janabi, and H. Ismail, "The Prevalence of Toxoplasmosis Among Female Patients in AL-Hawija and AL-Baiji Districts in Iraq," *O. J. Epidemiol.*, vol. 3, pp. 85-88, 2013.

[6] A. K. Ibadi and T. R. Hamedon, "The Sociodemographic Characteristics of Pregnant Women with Toxoplasmosis in Al-Qadisiyah-Iraq," *International Journal of Public Health and Clinical Sciences*, vol. 2, pp. 59-67, 2015.

[7] M. S. Tahir and I. A. Mughal, "Thyroid Gland Surgical Anatomy," *Independent Review*, vol. 19, pp. 1-6, 2017.

[8] S. Garasto, A. Montesanto, A. Corsonello, F. Lattanzio, S. Fusco, G. Passarino, and F. Corica, "Thyroid Hormones in Extreme Longevity," *Mechanisms of Ageing and Development*, vol. 165, pp. 98-106, 2017.

[9] L. Brinkmann, M. Gerken, C. Hambly, J. R. Speakman, and A. Riek, "Thyroid Hormones Correlate with Field Metabolic Rate in Ponies, Equus Ferus Caballus," *Journal of Experimental Biology*, vol. 219, no. 16, pp. 2559-2566, 2016.

[10] A. C. Guyton and J. E. Hall, *Textbook of Medical Physiology*, 11th ed., Elsevier Saunders, China, 2016, pp. 404-931-942, 1014-1073.

[11] K. Ikegami and T. Yoshimura, "The Hypothalamic–Pituitary–Thyroid Axis and Biological Rhythms: The Discovery of TSH's Unexpected Role Using Animal Models," *Best Practice & Research Clinical Endocrinology & Metabolism*, vol. 31, no. 5, pp. 475-485, 2017.

[12] S. H. M. Al-Saadii, "The Effect of Toxoplasmosis on the Level of Some Male Sex Hormones in Samples from National Blood Center/Baghdad," M.S. thesis, College of Science, University of Baghdad, Iraq, 2013.

[13] K. Makker, A. Agarwal, and R. Sharma, "Oxidative Stress and Male Infertility," *Indian Journal of Medical Research*, vol. 129, pp. 357-367, 2009.

[14] S. Ghosh, *Paniker's Textbook of Medical Parasitology*, 8th ed., Jaypee Brothers Medical Publishing, India, 2018, p. 256.

[15] Y. Shapira, N. Agmon-Levin, C. Selmi, J. Petríková, O. Barzilai, R. Matucci-Cerinic, M. Valentini, G. Anaya, J. M. Katz, and Y. Shoenfeld, "Prevalence of Anti-Toxoplasma Antibodies in Patients with Autoimmune Diseases," *Journal of Autoimmunity*, vol. 39, no. 1-2, pp. 112-116, 2012.

[16] E. E. Wasserman, K. Nelson, N. R. Rose, C. Rhode, J. P. Pillion, E. Seaberg, M. V. Talor, L. Burek, W. Eaton, A. Duggan, and R. H. Yolken, "Infection and Thyroid Autoimmunity: A Seroepidemiologic Study of TPOaAb," *Autoimmunity*, vol. 42, no. 5, pp. 439-446, 2016.

[17] C. Alvarado-Esquivel, R. Agar, A. G. Carlos, S. M. Carlos, A. R. Perez, S. Estrada, and V. D. Gonzalez, "Association Between Toxoplasma gondii Infection and Thyroid Dysfunction: A Case-Control Seroprevalence Study," *BMC Infectious Diseases*, vol. 19, pp. 826-831, 2019.

[18] M. Khan, I. Ali, A. Khattak, F. Tahir, F. Subhan, B. Kazi, J. Aurakzal, and N. Usman, "Role of Estimating Serum Luteinizing Hormone and Testosterone in Infertile Males," *Gomal Journal of Medical Sciences*, vol. 3, no. 2, pp. 61-65, 2005.

[19] A. R. AL-Karboli, "Immunological and Physiological Study of Women Infected with Toxoplasma," M.S. thesis, College of Science, University of Baghdad, Iraq, 2011.

[20] R. A. K. Kadhim, "The Relationship Between Some Physiological and Biochemical Aspects in Persons Infected with Toxoplasmosis," Ph.D. dissertation, College of Science, University of Babylon, Iraq, 2013, p. 193.

[21] I. A. Khan, S. Y. Thomas, M. M. Moretto, F. S. Lee, S. A. Islam, C. Combe, and A. D. Luster, "CCR5 Is Essential for NK Cell Trafficking and Host Survival Following Toxoplasma gondii Infection," *PLoS Pathogens*, vol. 2, no. 6, p. e49, 2006.

[22] D. C. Liu, C. S. Lin, and V. Seshan, "AIDS Complicated with Disseminated Toxoplasmosis: A Pathological Study of 9 Autopsy Cases," *Zhonghua Bing Li Xue Za Zhi*, vol. 23, no. 3, pp. 166-169, 1994.