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Investigation of Antioxidants and Some Biochemical Parameters in Sheep and Cattle Infected With Toxoplasmosis

Investigasi Antioksidan dan Beberapa Parameter Biokimia pada Domba dan Sapi yang Terinfeksi Toksoplasmosis

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Abstract

The current study aimed to evaluate the effect of infection with *Toxoplasmosis gondii* in the serum and milk of sheep and cows on some enzymes and biochemical parameters. 200 samples from sheep and 125 samples from cows that suffered from miscarriages at different stages of pregnancy and were suspected of being infected with toxoplasmosis were collected from different areas of Salah Governorate. Using the latex agglutination test, it was found that the percentage of infection with toxoplasmosis in sheep is 47.5% and 33.6% in cows. According to the statistical results of biochemical tests, sheep and cows exposed to Toxoplasma showed an increase in glutathione peroxidase levels (GSH-PX) in their serums, whereas infection did not significantly affect the activity of creatine phosphokinase in sheep or cows, as did creatine phosphokinase. As a result of this infection, zinc levels in sheep and cows' serum were significantly decreased, which resulted in a significant increase in copper and phosphorus levels. Toxoplasma infection resulted in a decrease in milk parameters including protein and fat, as well as lactose in cow's milk, while it did not significantly change in sheep's milk compared to the control group.

Highlights:

Effect of Toxoplasma gondii on serum and milk biochemical parameters in livestock. Infection impact: Increased GSH-PX, decreased zinc, increased copper and phosphorus levels.

Malk quality decline: Reduced protein, fat, and lactose in cows; minimal change in sheep.

Keywords: toxoplasmosis, toxoplasmosis in sheep,Oxidation enzymes.

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Introduction

Toxoplasmosis is regarded as one of the most widespread disease conditions in the world since it was first discovered in 1908 by researchers (1) Toxoplasma gondii infects field animals and all warm-blooded animals. It is also transmitted to humans. It is an obligate parasite. Intracellular parasite that infects all cells with a nucleus in the host's central body, divides and multiplies within them, and usually causes the death of the cell it infects and, as a result, damage to the affected tissue (32). Toxoplasmosis infection in ruminants such as sheep, goats, and cattle is common and is the main cause of abortions worldwide, leading to significant economic losses. In sheep and goats (4). It is estimated that toxoplasmosis is involved in approximately 15-30% of abortions in sheep and cattle, and in the United Kingdom alone, the cost of economic losses due to abortions caused by toxoplasmosis was estimated at approximately 12 million pounds sterling in 2011. Toxoplasma in sheep generally occurs after primary infection with sporulating oocysts or through Placenta to the fetus (5). Sheep and cow milk are important sources of biologically active substances that have functions that enhance the health of the body. The valuable composition of sheep milk contains a high content of fatty acids, immune globulin, proteins, hormones, vitamins, and minerals. Many of the vital peptides found in milk have antibacterial, antiviral, and anti-inflammatory properties (6). Sheep milk and its products are also an important source of fatty acids, calcium, and phosphorus. Iron and magnesium (7), As a result of the damage to various tissues and organs of the body resulting from toxoplasmosis, it may result in a change in the values of many biochemical parameters, such as the enzyme glutathione peroxidase (GSH-PX), which is an antioxidant enzyme (8). This enzyme works to prevent oxidation in the cells of the organism's body. Live, as its normal level decreases in cases of oxidative stress. It has also been noted from previous studies that the level of this enzyme decreases with age in blood tissues and plasma. The reason is due to deficiencies in the manufacturing process. Protein in the organism's body (9) Another enzyme is the creatine phosphokinase enzyme, which catalyzes the reversible phosphorylation of creatine by adenosine triphosphate, which is found in striated muscle, the brain, and heart tissue (10). These enzymes are affected by injury to the organs in which they are concentrated, as the damage occurring in the tissues of these organs and the destruction of their cells lead to increased release and rise. Its level in the blood (11).

Methods

This study included examining (325) random blood samples from local sheep and cows, which included 200 sheep and 125 cows for the period from October 2021 to April 2022, from different areas of Salah al-Din Governorate. Blood samples were drawn from sheep and cows that had undergone miscarriage in Recently, blood was drawn from the jugular vein using blood draw needles and special vacuum test tubes for preserving the blood to be separated using a centrifuge and the samples were kept frozen at 20 degrees Celsius. After that, milk samples were collected from the sheep and cows that were confirmed to be infected for testing. With the Eco milk device for isolation and evaluation Milk ingredients.

Results and Discussion

The results of the examination of 200 sheep samples and 125 samples of aborted cows showed a high percentage of sheep infected with the *Toxoplasma gondii* parasite, reaching 47.5% compared to cows, which amounted to 33.6%, as shown in Table (1). The study agreed with the results of (12), which he conducted regarding the spread of *Toxoplasma gondii*. In the city of Ramadi, which included 138 samples of sheep, it was found that the infection rate reached 41.30%, which is higher than the infection rates. For the rest of the ruminants such as goats and chickens,

sheep	C ows	Total number of samples 325
200	125	
95	42	Positive samples
47.5%	33.6%	Percentage

 Table 1. Percentage of samples included in the study

It was found that the percentage of chronic infections represented by the group which showed a positive result for the IgG test was 68.4% and 73.8% in sheep and cows, respectively, as compared to acute infections that were represented by the group that showed a positive result for the IgM test, which was 31.5%. As the study included acute infections that were likely to result in miscarriage in the near future for sheep and cows, and chronic infections were excluded due to the length of time the animals were exposed to the parasite, thus reducing the effects caused by the parasite. Therefore, only acute infections were considered.. As shown in Table (2)

immunoglobins	She	eep	Cows		
	95		42		
Positive	Percentage	Positive	Percentage		

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Table D. noreantage of immune alabing IaC. DIAM						
IgM	3	30	31.5/%	11	26.1%	
IgG	e	65	68.4%	31	73.8%	

Table 2. percentage of immunoglobins $IgG \square IgM$

Based on the results of the current study, glutathione peroxidase levels in sheep infected with toxoplasmosis increased significantly at the level of 0.05, reaching 4.73 IU/ml c4ompared to 3.22 IU/ml in the control group. There was also a significant increase in infected cows, reaching 5.441 U/ml compared to the control group. Following, it reached 0.64 IU/ml.

glutathio		
C ows	Sheep	
5.19A	4.36 1.23 A	Infected
3.42 0.75 B	3.48 1.48 B	C ontrol
3.44	1.29	Т
0.006	0.218	P-value

Table 3. shows the effect of Toxoplasmosis on the level of the enzyme glutathione peroxidase In the serum of sheep and cows

Different letters vertically indicate a significant difference at (P < 0.05)

The increase in glutathione peroxidase is caused by an increase in radical compounds and peroxides, and this enzyme is responsible for removing toxins from lipid peroxides and hydrogen peroxides (H2O2). The results agreed with those obtained by (14) hgfhpe in which a high antidote was observed Oxidative stress in people infected with a parasite Entamoeba histolytica.

This increase in the enzyme antioxidants that occurred in sheep infected with the Toxoplasma gondii parasite is consistent with the findings of (15), which stated an increase in the concentration of the enzyme glutathione peroxidase and some lipid peroxides in women infected with the parasite Toxoplasma gondii, which was conducted on a group of women who had undergone miscarriages in the city of Mosul compared to the control group. In a similar study in the city of Mosul on a group of cats infected with the Toxoplasma parasite, the effect of the parasite on antioxidants, it was found that there was an increase in the state of oxidative stress, and thus an increase in the value of antioxidants in the serum of infected cats.Compared to control groups (16).

Two groups of cows were studied to observe the changes that occur in them during pregnancy. An increase in glutathione peroxidase concentration was observed, amounting to 6.3 mg/ml for pregnant cows. In this case, it was interpreted that they were under increased oxidative stress, which increased the concentration of glutathione in their blood. In both sheep and cows, infection with toxoplasmosis did not affect the effectiveness of creatine phosphokinase when compared to the control group, as shown in Table (3).

Creatine phospho		
Cows	Sheep	
21.41	20.22 1.33 A	Infected
21.05 1.84 A	20.13 1.52 A	C ontrol
0.32	0.11	Т
0.756	0.917	P-value

Table 4. shows the effect of Toxoplasmosis on the effectiveness of the enzyme creatine phosphokinaseIn the serum of sheep and cows

Different letters vertically indicate a significant difference at (P<0.05)

The result of no significant change in the activity of the enzyme creatine phosphokinase is consistent with the result of (18), which indicated that there was no significant difference in the effectiveness of this enzyme, and it also agreed with the study of (19), which indicated that there was no significant difference for this enzyme in infected ewes appeared.Toxoplasma.

Toxoplasmosis infection also affects some elemental standards in the serum of sheep and cows as shown in Table (4). The results indicate that there is a significant decrease at a level of 0.05% in the concentration of zinc in the serum of infected sheep and cows, and that copper concentrations have increased in the serums of infected sheep and cows. However, the phosphorus concentrations in the serum of sheep and cows increased significantly, while they did not significantly increase in the serums of infected cows

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phosphorus			C opper			Pure zinc	
Cows	Sheep Co		WS	ws Sheep Co		WS	Sheep
1.70±0.39	1.39 ± 0.59	132.55	± 4.19	129.21±4.46	76.89	±11.6	75.50±13.0
1.29 ± 0.70 A	0.99± 0.39 B	85.82 6	.82 ± B	83.82 ±4.77 B	119.41±	± 5.80 A	117.59±4.90 A
3.32	1.45	14.	30	15.54	9.2	29	7.99
0.0005	0.000	0.0	001	0.000	0.1	77	0.220

Table 5. shows the effect of infection with Toxoplasmosis on the concentrations of zinc, copper, phosphorus in the serum of sheep and cows.

Different letters vertically indicate a significant difference at (P < 0.05)

Hedecrease in the concentration of zinc in the serum of infected sheep and cows agreed with (20), which indicated a decrease in the concentration of zinc in sheep. Or could this decrease be attributed to the role of a number of inflammatory products in regulating the balance of this element, such as interlukine released by an activated phagocytosis that leads to a decrease in the concentration of zinc in the resulting increase Metallothioneine .

The reason for the high concentration of copper in both affected groups of sheep and cows may be due to the high level of ceruplasmine, which is the main carrier of copper, as the level of this carrier increases in response to the infections associated with the disease, it leads to an increase in the concentration of copper in the blood (21 and 20). This result agreed with (19) which indicated that there was no significant effect on the concentration of phosphorus in the serum of sheep infected with the disease '*Toxoplasma gondii*'.

The results in Table (4) showed a significant decrease in milk protein and milk fat in sheep and cows infected with *Toxoplasma gondii* compared to the control group, while lactose was not significantly affected by the infection in sheep milk, but it showed a significant decrease in cow's milk.

Lactose		Milk fat			Milk protein		
Cows	She	ep	Cows	She	eep	Cows	Sheep
3.70±0.84B	4.15±	0.76A	5.57±0.66B	4.20±	0.93B	5.58± 0.7B	4.33±1.01B
5.45±0.52A	4.05±	0.71A	6.67±0.72A	6.54±	1.04A	6.63±1.41A	5.76±0.61A
5.29	0.2	28	3.17	5.0	00	2.02	3.20
0.000	0.7	86	0.007	0.0	000	0.071	0.011

Table 6. shows the effect of Toxoplasmosis on the concentrations of milk protein, milk fat, and lactose in the milk of sheep and cows.

Different letters vertically indicate a significant difference at (P < 0.05)

The composition of milk may vary according to the age of the animal, body, weight, udder size, diet, stage of

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lactation, breed, management, and environment, as well as seasonal changes that may contribute to changes in fat concentration, according to (22). The chemical and mineral content of milk varies significantly between breeds in the case of infection. Additionally, it was confirmed by a study (23) that the infection affects the composition of milk, where infection with toxoplasmosis had a significant effect on milk protein, fat, and lactose in sheep's milk infected.

It is preferable in subsequent studies because of the need to know the possibility of detecting toxoplasmosis in milk using PCR and whether the infection can be transmitted through milk to young sheep or to Human .

Conlusion

The study revealed a significantly higher prevalence of Toxoplasma gondii infection in sheep (47.5%) compared to cows (33.6%), indicating a greater susceptibility of sheep to the parasite. Immunoglobulin analysis demonstrated that chronic infections (IgG positive) were more prevalent than acute infections (IgM positive) in both species, suggesting long-term exposure and persistence of the parasite. The enzymatic activity of glutathione peroxidase increased significantly in infected animals, highlighting oxidative stress as a key pathological mechanism. However, creatine phosphokinase levels remained unaffected, aligning with previous research. Additionally, infected animals exhibited decreased serum zinc levels, increased copper concentrations, and a notable reduction in milk protein and fat content, suggesting metabolic disruptions induced by the infection. These findings underscore the potential economic impact of toxoplasmosis on livestock production due to altered biochemical parameters and compromised milk quality. Further research is needed to explore the possibility of detecting T. gondii in milk using PCR and to assess the risk of transmission through milk to neonates and humans, which could have significant public health implications.

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