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Letter to the Editor

Investigating the Relationship between the Infection Caused by *Toxoplasma gondii* and the Rate of Infection with Covid-19 Disease and Its Severity

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Dear Editor-in-Chief

Toxoplasma gondii is a common intracellular protozoan estimated to infect about one-third of the world's population (1). It infects various vertebrates, especially felines, and causes toxoplasmosis. Its seroprevalence in the general population of Iran has been reported to be about 39% (2), and in certain groups such as pregnant women and people with cancer, it is 30–45% (3). SARS-CoV-2, the causative agent of COVID-19, has caused more than 7.6 million cases and 93,000 deaths in Iran since its emergence in 2019 (4).

SARS-CoV-2 has disrupted immune responses and trigger uncontrolled responses, known as a cytokine storm, in severe and critical COVID-19 patients (5). As both COVID-19 and toxoplasmosis are emerging intracellular pathogens, they may cause increased psychological and physical problems in people with suppressed immune systems (6). This protozoan is considered an opportunistic and potentially lethal parasite. Evidence also suggests that *T. gondii* can affect the incidence and severity of COVID-19 (7). Data collected in Ka-



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raj County in 1400 were used to examine this association.

Serum samples from COVID-19 patients with positive PCR results were collected and prepared after centrifugation. The samples were diluted 1:101 and placed in ELISA plate wells (Vircell, Spain) along with blank, positive, and negative controls. After incubation and washing, the conjugated enzyme was added,

followed by the dye solution. The reaction was then terminated with a stopping solution. Optical absorbance was measured at a wavelength of 450 nm. IgM and IgG titres ≥ 1.1 were considered positive; increased IgM indicated acute toxoplasmosis, while increased IgG indicated latent toxoplasmosis. The sensitivity and specificity of the test were 99.9% and 100%, respectively Tables 1 and 2.

Table 1: Clinical manifestations among COVID-19–infected individuals and the outcomes of *Toxoplasma* IgM serology

Sociodemographic features	Variable	All patients N (%)	Toxoplasma IgM (Positive) N (%)	Toxoplasma IgM (Negative) N (%)	P value
	Female	89(46.1)	13(14.6)	76(85.3)	0.750
	Male	85(47.5)	11(12.9)	74(14.8)	
	Age (Median)	61	57	52	0.25
	Contact with animals	65(37.3)	48(73.9)	17(26.1)	0.056
	No contact with animals	109(62.7)	47(43.1)	62(56.9)	
Clinical symptoms and signs	Fever >38 °C	19(10.9)	6(31.5)	13(68.5)	0.200
	Lung involvement above 50%	138(79.3)	91(65.9)	47(34.1)	0.387
	Myocardial Infarction	21(12)	9(42.9)	12(57.1)	0.899
Non-specific symptoms	Headache	20(11.49)	6(30)	14(70)	0.919
	Trembling	11(6.32)	3(27.2)	8(72.8)	0.387
Patient condition	Death	51(29.3)	31(60.8)	20(39.2)	0.066
	Recovery (alive)	123(70.6)	84(68.3)	39(31.7)	

Table 2: Clinical manifestations among COVID-19–infected individuals and the outcomes of *Toxoplasma* IgG serology

Sociodemographic features	Variable	All patients N (%)	Toxoplasma IgG (Positive) N (%)	Toxoplasma IgG (Negative) N (%)	P value
	Female	89(46.1)	34(38.2)	55(61.8)	0.23
	Male	85(47.5)	19(22.3)	66(77.6)	
	Age (Median)	61	62	56	0.26
	Contact with animals	65(37.3)	49(75.4)	16(24.6)	0.001
	No contact with animals	109(62.7)	9(8.3)	100(91.7)	
Clinical symptoms and signs	Fever >38 °C	26(14.9)	5 (19.2)	21(80.8)	0.856
	Lung involvement above 50%	138(79.3)	81(58.7)	57(41.3)	0.308
	Myocardial Infarction	21(12)	10(47.6)	11(52.4)	0.505
Non-specific symptoms	Headache	20(11.49)	7(35)	13(65)	0.081
	Trembling	11(6.32)	5(45.5)	6(54.5)	0.740
Patient condition	Death	51(29.3)	21(41.2)	30(58.8)	0.434
	Recovery (alive)	123(70.6)	48(39)	75(61)	

In this cross-sectional study conducted from May 2021 to December 2021 at Rajaei Hospital, Karaj, Iran 200 samples were collected, of which 174 RT-PCR positive samples were selected as the study group.

The study was approved by the Research Ethics Committee of Alborz University of Medical Sciences, Iran. The results showed no statistically significant association between *T. gondii* infection and the occurrence of specific symptoms, age, gender, or mortality rate from COVID-19. These findings indicate that acute and latent toxoplasmosis infections are common among COVID-19 patients. However, no significant or direct association was observed between *T. gondii* infections and the severity of COVID-19. Therefore, toxoplasmosis is not considered a risk factor for COVID-19.

Conflict of interest

The authors declare no conflict of interests.

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