

ARAŞTIRMA MAKALLES/ RESEARCH ARTICLE

A retrospective evaluation of the prevalence of anti- *Echinococcus granulosus* in patients with suspected cystic echinococcosis at İnönü University Faculty of Medicine Turgut Özal Medical Center between 2018 and 2022

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Abstract

Objective: Cystic echinococcosis (CE) is a common zoonotic disease in the world, caused by the larval form of *Echinococcus granulosus* got lodged in various organs in both animals and humans. This study aimed to retrospectively examine ELISA test results in patients who applied to Inonu University Faculty of Medicine Parasitology Department with the suspicion of cystic echinococcosis.

Methods: The study was performed via ELISA to detect the presence of anti - *E. granulosus* immunoglobulin G (IgG) antibodies in the patients who came to the Parasitology Department with the suspicion of CE between January 2018 and June 2022.

Results: It was observed that *E. granulosus* antibody was detected as positive in 1353 (63.7%) and negative in 772 (36.3%) of the serum samples of 2128 patients admitted with the suspicion of hydatid cyst. Of 1353 cases with positive anti-*E. granulosus* IgG antibodies, 700 (51.74%) were females and 653 (48.26%) were males.

Conclusion: The retrospective study presented is intended to raise awareness of public health. As in Turkey, it is necessary to inform the public about CE in Malatya region, to draw the attention of the authorities to this issue, and to establish protection and control programs quickly. And it is recommended that these retrospective studies should be repeated to determine the importance of prevalence from time to time.

Key Words: Cystic Echinococcosis, *Echinococcus granulosus*, ELISA, Malatya

İNÖNÜ ÜNİVERSİTESİ TIP FAKÜLTESİ TURGUT ÖZAL TIP MERKEZİNE 2018-2022 YILLARI ARASINDA KİSTİK EKİNOKOKKOZİS ŞÜPHESİ İLE GELEN HASTALARDA ANTI - *Echinococcus granulosus* PREVELANSININ RETROSPEKTİF OLARAK DEĞERLENDİRİLMESİ

Özet

Amaç: Kistik ekinokokkozis (KE), *Echinococcus granulosus*'un larva formunun hem hayvanlarda, hem insanlarda çeşitli organlara yerleşmesiyle oluşan, dünyada yaygın olarak görülen zoonotik bir hastalıktır. Bu çalışma da, İnönü Üniversitesi Tıp Fakültesi Parazitoloji Anabilim dalına kistik ekinokokkozis şüphesi ile başvuran hastalarda ELISA test sonuçlarının geriye yönelik olarak incelenmesi amaçlanmıştır.

Yöntem: Çalışma 2018 Ocak - 2022 Haziran tarihleri arasında Parazitoloji ABD'na KE şüphesi ile gelen hasta anti - *E. granulosus* immunoglobulin G (IgG) antikorlarının varlığını saptamak için ELISA yöntemi ile çalışılmıştır..

Bulgular: Kist hidatik şüphesi ile gelen 2128 hastanın serum örneklerinden 1353'ünde (%63.7) *E. granulosus* antikorunun pozitif olarak tespit edildiği 772'sinde (%36.3) ise negatif olarak saptandığı gözlemlenmiştir. Anti - *E. granulosus* IgG antikor pozitif olan toplam 1353 olgudan 700'ü (%51.74) kadınlardan, 653'ü (%48.26) ise erkeklerden oluşmaktadır.

Sonuç: Sunulan retrospektif çalışma halk sağlığına yönelik bir farkındalık yaratmak amacıyla düşünülmüştür. Türkiye'de olduğu gibi Malatya yöresinde halkın KE hakkında bilgilendirilmesi, yetkililerin konuya dikkatlerinin çekilmesi, koruma ve kontrol programlarının hızlı bir şekilde oluşturulması gerekmektedir. Bu retrospektif çalışmaları prevalansın önemini belirlemek için tekrar edilmesi önerilmektedir.

Anahtar Kelimeler: Kistik Echinococcosis, *Echinococcus granulosus*, ELISA, Malatya

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INTRODUCTION

Cystic echinococcosis (CE) is a disease caused by the larval forms (metacestode) of *Echinococcus granulosus* and the development of larvae in all tissues and organs, including the liver and lungs, as a result of the accidental ingestion of eggs by humans (1). CE is an important public health problem that is more common in societies where agriculture and animal husbandry are common all over the world. Humans are accidental intermediate hosts for this parasite, where dogs and canines are the definitive hosts (2).

The disease is seen worldwide, being endemic in countries dealing with animal husbandries, such as Mediterranean countries, South America, Central Asia and Russia. It is more common in Central Anatolia and Eastern Anatolia regions in our country. Carnivores are definitive hosts, and humans and some mammals (sheep, goats, camels, horses) are intermediate hosts for *E. granulosus*(3). The clinic of the patients varies according to the size of the cyst, the organ in which it is located, the eruption of the cyst and the immunological response. Small, well-encapsulated cysts may

calcify and remain asymptomatic for years. While liver and lung are most commonly involved, it may rarely be involved in organs such as muscles, bones, kidneys, brain, and spleen. Most of the cysts are asymptomatic and may regress spontaneously (4,5). Currently, four options are recommended for cyst treatment.

1. Percutaneous treatment of hydatid cysts with PAIR technique, 2. Surgery, 3. Anti-infective drug treatment, 4. Watch and wait (6).

The exact prevalence is unknown because most of CE cases are asymptomatic, clinical signs are uncharacteristic, and the cyst development is very slow. When serological methods such as enzyme-linked immunosorbent assay (ELISA), indirect fluorescent antibody test (IFAT), indirect hemagglutination test (IHA), and Western blot (WB) and DNA-based molecular methods are combined with non-invasive imaging techniques, they have been the preferred approaches for monitoring and surveillance in diagnosis and treatment as well as during control programs (7).

This study was performed to retrospectively evaluate the distribution of anti-*E. granulosus* antibodies in patients who came to the parasitology laboratory with the suspicion of CE between January 2018 and June 2022.

METHODS

The study was conducted with the retrospective evaluation of the data by taking blood samples

from the patients who came to the Inonu University Faculty of Medicine Parasitology laboratory with the suspicion of CE between January 2018 and June 2022.

Anti-*E. granulosus* antibodies were analyzed by ELISA (Enzyme-linked immunosorbent assay) method in serum samples of 2128 patients who came to the laboratory. The blood taken from the patients was first centrifuged and separated into serum. ELISA method was studied following the kit procedure of the manufacturer (NOVATEC). The results were read in ELISA reader at a wavelength of 450 nm, and the values obtained were analyzed according to the ratios given in the kit's user manual and evaluated as positive and negative.

Statistical analysis

Data were presented as median (min-max), mean (standard deviation), and number (percent). Compliance with the normal distribution was tested using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Pearson Chi-square and Mann Whitney U test were used where appropriate for statistical analysis. A value of $p < 0.05$ was considered statistically significant. IBM SPSS Statistics 26.0 program was used in the analysis.

RESULTS

The study evaluated the presence of anti-*E. granulosus* IgG antibody in the serum samples of 2128 patients who applied to Turgut Özal Medical Center Parasitology Laboratory with suspicion between January 2018 and June 2022. It was

observed that *E. granulosus* antibody was detected as positive in 1353 (63.7%) and negative in 772 (36.3%) of the serum samples of the subjects analyzed within the scope of the study. The distribution of the variables in the study was given in Table 1.

The distribution of the subjects in the study by years was presented in Table 2 and Figure 1. When Table 2 was analyzed, it was observed that 232 (30.05%) were negative and 450 (33.26%) were positive in 2018, 164 (21.24%) were negative and 356 (26.31%) were positive in 2019, 149 (19.30%) were negative and 184 (13.60%) were positive in 2020, 146 (18.91%) were negative and 247 (18.26%) were positive in 2021, and 81 (10.49%) were negative and 16 (8.57%) were positive in 2022. When the distribution of anti-*E. granulosus* IgG antibodies by years was examined, it was detected that the highest positivity rate was in 2018, and the lowest positivity rate was in 2022. Moreover, there is a statistically significant association with respect to anti-*E. granulosus* IgG antibody by years ($p < 0.05$).

The distribution of the presence of anti-*E. granulosus* IgG antibody by gender was given in Table 3 and Figure 2. When the results in Table 3 were examined, 700 (51.74%) were women and 653 (48.26%) were men of 1353 patients with positive anti-*E. granulosus* IgG antibodies. Moreover, there was no statistically significant association with gender in terms of the presence of anti-*E. granulosus* IgG antibody ($p > 0.05$). When

the distribution of the positivity rate over the years was analyzed, the positivity rate showed a decreasing trend over the years but started to rise again in 2021.

The distribution of the presence of anti-*E. granulosus* IgG antibodies according to different departments was given in Table 4 and Figure 3. Of the subjects who were positive for anti-*E. granulosus* IgG antibody, 41 (3.03%) were in infection, 350 (25.87%) were in gastroenterology, 517 (38.21%) were in general surgery, 45 (3.33%) were in hepatology, 157 (11.60%) were in liver transplantation, 22 (1.63%) were in proctology, 11 (0.81%) were in examination and 210 (15.52%) were in pediatrics department. Accordingly, the anti-*E. granulosus* IgG antibody positivity rate was the highest in patients who come to the general surgery department. Moreover, there was a statistically significant correlation according to the

departments in terms of the presence of anti-*E. granulosus* IgG antibody ($p<0.05$).

The results of the analysis according to the age and the presence of anti-*E. granulosus* IgG antibody were presented in Table 5. There was a statistically significant difference in age in terms of the presence of anti-*E. granulosus* IgG antibody ($p<0.05$).

The distribution of years by gender in case of positive anti-*E. granulosus* IgG antibody was given in Table 6. According to the findings in the table, the year with the highest positivity rate in both women and men was 2018, and the year with the lowest was 2022.

The distribution of years by departments in case of positive anti-*E. granulosus* IgG antibody was given in Table 7.

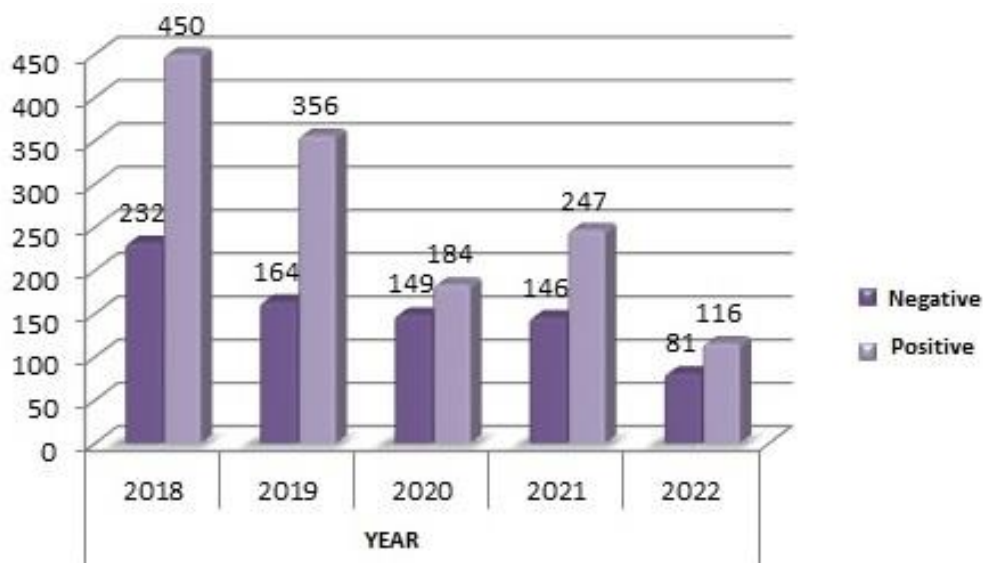


Figure 1. Distribution graph of the presence of anti- *E. granulosus* IgG antibody by years

Table 1. Variables in the study

Variables	Categories	Number	Percentage (%)
Value	Negative	772	36.3
	Positive	1353	63.7
Year	2018	682	32.0
	2019	520	24.4
	2020	335	15.7
	2021	393	18.5
	2022	198	9.3
Gender	Female	1122	52.7
	Male	1006	47.3
Department	Infection	92	4.3
	Gastroenterology	510	24.0
	General surgery	759	35.7
	Hepatology	105	4.9
	Liver Transplantation	234	11.0
	Proctology	31	1.5
	Examination	17	0.8
	Pediatrics	380	17.9

Table 2. Distribution of anti-*E. granulosus* IgG antibody by years

		Negative [n(%)]	Positive [n(%)]	p value*
Years	2018	232 (30.05)	450 (33.26)	0.001
	2019	164 (21.24)	356 (26.31)	
	2020	149 (19.30)	184 (13.60)	
	2021	146 (18.91)	247 (18.26)	
	2022	81 (10.49)	116 (8.57)	

*Pearson Chi-square test

Table 3. Distribution of anti-*E. granulosus* IgG antibody by gender

		Negative [n(%)]	Positive [n(%)]	p value*
Gender	Female	420 (54.40)	700 (51.74)	0.236
	Male	352 (45.60)	653 (48.26)	

*:Pearson Chi-square test

Table4. Distribution of anti-*E. granulosus* IgG antibody by departments

		Negative [n(%)]	Positive [n(%)]	p value*
Department	Infection	51 (6.61)	41 (3.03)	<0.001*
	Gastroenterology	158 (20.47)	350 (25.87)	
	General Surgery	242 (31.35)	517 (38.21)	
	Hepatology	59 (7.64)	45 (3.33)	
	Liver Transplantation	77 (9.97)	157 (11.60)	
	Proctology	9 (1.17)	22 (1.63)	
	Examination	6 (0.78)	11 (0.81)	
	Pediatrics	170 (22.02)	210 (15.52)	

*Pearson Chi-square test

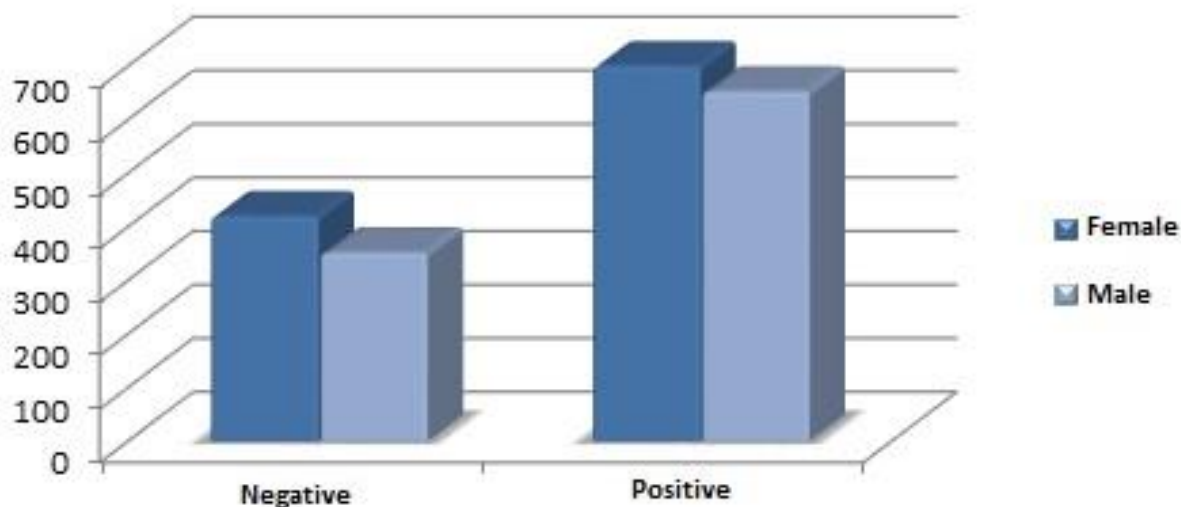


Figure 2. Distribution graph of the presence of anti-*E. granulosus* IgG antibody by gender

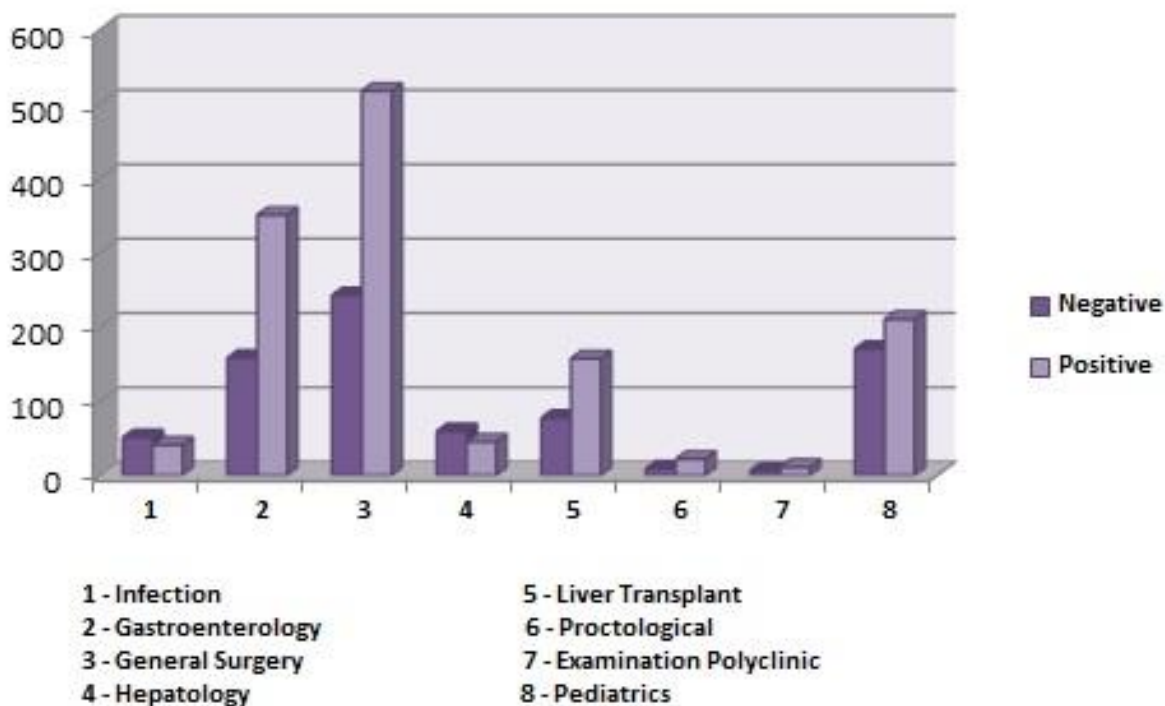


Figure 3. Distribution graph of the presence of anti-*E. granulosus* IgG antibody by departments

Table 5. Analysis table of age according to presence of anti- *E. granulosus* IgG antibody

	Value		p value*
	Negative	Positive	
	Median (Minimum-Maximum)	Median (Minimum-Maximum)	
Age	46(1-98)	39(3-90)	0.003

*: Mann Whitney U test

Table 6. Distribution of years by gender in case of positive anti-*E. granulosus* IgG antibody

Variables		Gender			
		Female		Male	
		Number	Percentage (%)	Number	Percentage (%)
YEAR	2018	254	36.3	196	30.0
	2019	171	24.4	185	28.3
	2020	93	13.3	91	13.9
	2021	122	17.4	125	19.1
	2022	60	8.6	56	8.6

Table 7. Distribution of years by departments in case of positive anti-*E. granulosus* IgG antibody

Variables		Department							
		Infection [n(%)]	Gastroenterology (n[n(%)])	General Surgery [n(%)]	Hepatology [n(%)]	Liver Transplantation [n(%)]	Proctology [n(%)]	Examination [n(%)]	Pediatrics [n(%)]
Year	2018	7 (17.07)	110 (31.43)	219 (42.36)	14 (31.11)	37 (23.57)	6 (27.27)	7 (63.64)	50 (23.81)
	2019	10 (24.39)	85 (24.29)	154 (29.79)	12 (26.67)	30 (19.11)	2 (9.09)	4 (36.36)	59 (28.10)
	2020	9 (21.95)	107 (30.57)	2 (0.39)	2 (4.44)	27 (17.20)	5 (22.73)	0 (0.00)	32 (15.24)
	2021	14 (34.15)	29 (8.29)	97 (18.76)	7 (15.56)	46 (29.30)	7 (31.82)	0 (0.00)	47 (22.38)
	2022	1 (2.44)	19 (5.43)	45 (8.70)	10 (22.22)	17 (10.83)	2 (9.09)	0 (0.00)	22 (10.48)

DISCUSSION

CE is one of the important zoonotic infections that cause serious health problems and deaths as well as economic losses in humans. It is common in underdeveloped and developing countries due to factors such as hygiene rules, cultural level of the people, uncontrolled and illegal slaughter of butchery animals, the high number of stray dogs, and the discharge of infected internal organs into the environment without destruction (8).

According to serological data in studies conducted in our country, the probability of CE is 3.45% in İzmir (9), 14.6% in Ayon (10), 0.4% in Manisa (11) and 54.1% in Ankara (12). In a retrospective study conducted by Yazar et al. across the country, the rates of CE were reported

13.13% in the Marmara region, 16.94% in the Aegean region, 16.09% in the Mediterranean region, 38.57% in the Central Anatolia region, 5.70% in the Black Sea region, 6.80% in the Eastern Anatolia region, and 2.75% South-Eastern Anatolia region (13).

In our study, anti-*E. granulosus* antibodies were observed in 1353 (63.7%) of 2128 patients admitted with the suspicion of CE between 2018 and 2022, according to serological data.

An important finding in the studies is that the infection is seen higher in women. A higher prevalence was reported in women in previous studies on CE (8, 14). In another study, in which blood samples from 2642 patients were evaluated for CE with ELISA method, 31.9% of men and

29% of women were positive out of 801 (30.3%) seropositive patients (15). It was observed in a study evaluating CE according to hospital records in Kayseri between 1999 and 2004 that 699 subjects were positive, of whom 330 (42.2%) were male and 369 (57.8%) were female (16).

In our study, when the results were assessed with respect to gender, 700 (51.74%) were female and 653 (48.26%) were male, of 1353 patients with positive anti-*E. granulosus* IgG antibody. In addition, there is no statistically significant association with gender in terms of the presence of anti-*E. granulosus* IgG antibody ($p>0.05$).

In a study in which patients admitted with a pre-diagnosis of CE in Çorum were evaluated radiologically, biochemically and serologically, it was found that most of the patients who were found to be seropositive were from the general surgery outpatient clinic and were followed by the infection and gastroenterology outpatient clinics (14). In a study conducted in Kayseri, it was observed that they applied to general surgery, gastroenterology, chest diseases, infectious diseases, urology, pediatrics and other polyclinics, respectively. (7).

The distribution of the presence of anti-*E. granulosus* IgG antibodies according to different clinics in our study was that 41(3.03%) of positive subjects were in infection, 350(25.87%) were in gastroenterology, 517(38.21%) were in general surgery, 45(3.33%) were in hepatology, 157(11.60%) were in liver transplantation,

22(1.63%) were in proctology, 11(0.81%) were in examination and 210(15.52%) were in pediatrics. Accordingly, the positivity rate of anti-*E. granulosus* IgG antibody in patients who come to the general surgery department is the highest. Moreover, there is a statistically significant association according to the departments in terms of the presence of anti-*E. granulosus* IgG antibody ($p<0.05$).

When the publications made in our country were analyzed, Karaman et al. (17) detected the anti-*E. granulosus* IgG antibody positivity rate as 40.5% by IFA and indirect hemagglutination (IHA) method in Malatya and its surroundings between 1999 and 2002. Karaman et al. (18) evaluated the positivity rate as 34.6% in Kars city center and its villages in 2005, using IHA and IFA methods. Çetinkaya et al. (19) assessed the positivity rate as 24.7% with at least one of IHA, IFA and western blot methods between 1999 and 2010. Beyhan et al. (8) evaluated the positivity rate as 22.7% in Ankara and its surroundings between 2009 and 2013. Ertabak et al. (20) determined the positivity rate as 32% using ELISA method in Aydın province between 2005 and 2017.

In our study, the distribution of anti-*E. granulosus* IgG antibodies according to years in the patients who came to Turgut Özal Medical Center Parasitology laboratory between 2018 and 2022 and analyzed with ELISA method was examined, it was observed that the highest positivity rate was in 2018 (30.05%), and the lowest positivity rate

was in 2022. Moreover, there was a statistically significant association in terms of anti-*E. granulosus* IgG antibody by years ($p<0.05$).

Ethics Committee Approval: Approval was obtained from the İnönü Universty scientific research and publication ethics committee (Health sciences non-invasive clinical research ethics committee) for the study to be carried out.

Peer-review: Externally peer-reviewed.

Author Contributions:

Concept: TMY Design: TMY, TA. Literature search: TMY, TA. Data Collection and Processing: TMY, TA, MA, İBÇ. Analysis or Interpretation: İBÇ. Written by: TMY, MA

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