

The Impact of COVID-19 Pandemic on Intestinal Parasite Frequency: A Retrospective Study

Selahattin Aydemir^{1*}, Milad Torkamanian Afshar¹, Maksut Şahin¹, Zeynep Taş Cengiz¹, Sadi Elasan², Fethi Barlık¹, Nuriz Ateş¹, Ahmed Galip Halidi³, Hasan Yılmaz¹

¹Department of Parasitology, Faculty of Medicine, Van Yüzüncü Yıl University, Van, Türkiye

²Department of Biostatistics, Faculty of Medicine, Van Yüzüncü Yıl University, Van, Türkiye

³Bulanik Vocational School, Muş Alparslan University, Muş, Türkiye

ABSTRACT

During the COVID-19 pandemic, countries have closed their borders, banned travel, and restricted human mobility even outdoors in order to control the infection. It is not known whether the measures taken to control the pandemic in Türkiye affect the prevalence of intestinal parasitic infections. This study was conducted to evaluate the effect of the COVID-19 pandemic on the prevalence of intestinal parasites. In the study, the parasitological data of 18,204 patients who applied to Dursun Odabaş Medical Center between June 2018 and December 2021 and whose stool samples were sent to the parasitology laboratory were evaluated retrospectively. Intestinal parasites were detected in 1214 (9.89%) of 12270 patients in the pre-COVID-19 period and in 866 (14.59%) of 5934 patients during the COVID-19 period. In the statistical evaluation, it was observed that there was a significant difference between the positivity rate in the pre-COVID-19 period and the positivity rate in the COVID-19 period. On species basis, there was a decrease in the rates of pathogenic parasites *G. intestinalis* and *E. histolytica*, but an increase in the rate of *B. hominis*, which is discussed to be pathogenic. It has been concluded that the decrease in the rate of pathogenic parasites transmitted by fecal-oral route is since the general hygiene rules and the decrease in human-to-human contact are effective in the COVID-19 period.

Keywords: COVID-19, Parasite, Van/Türkiye

Introduction

Due to intestinal parasitic infections, more than two billion people are affected globally. The main ones among these parasites are *Entamoeba histolytica*, *Giardia intestinalis*, *Blastocystis hominis* and *Cryptosporidium* spp. from protozoa and *Ascaris lumbricoides*, hookworms, *Trichuris trichura*, *Enterobius vermicularis*, *Taenia saginata* and *Hymenolepis nana* from helminths (1-2).

Inadequate infrastructure, insufficient clean-water supply, climate changes, malnutrition, lack of hygiene, overpopulation, ignorance, and unconsciousness are risk factors for intestinal parasite infections, besides the impairment of the immune system (3). Suppression or deterioration of the immune system increases the pathogenic effects of parasites, particularly affected by the cellular immune response and paves the way for the emergence of clinical symptoms that could lead to death (4).

Diarrhea, abdominal pain, nausea, vomiting, anorexia, weight loss, retarded development, and anemia are frequently encountered symptoms in intestinal parasite infections, which mostly affect the pediatric age group, and cause malnutrition, malabsorption, mental retardation, adjustment disorder and important complications that reduce productivity (5-6).

Corona virus disease-2019 (COVID-19) emerged in December 2019 and spread rapidly all over the world (7). During this process, the increasing number of cases reported by the countries prompted the health authorities to take timely measures to control the speed of the infection. Countries had to close their borders, ban travels, and restrict human mobility, even in the open air (3); which caused considerable changes in individual and social behaviors. The frequency of intestinal parasite infections is also closely related to these changes (8).

The COVID-19 pandemic also had a negative effect on parasitological diagnosis; many hospital

*Corresponding Author: Name: Selahattin Aydemir, Department of Parasitology, Faculty of Medicine, Van Yuzuncu Yil University, Van, Türkiye

E-mail: saydmr23@gmail.com

ORCID ID: Selahattin Aydemir: 0000-0002-0941-2779, Milad Torkamanian Afshar: 0000-0003-1978-4127, Maksut Şahin: 0000-0002-0875-4654, Zeynep Tas Cengiz: 0000-0002-5247-5644, Sadi Elasan: 0000-0002-3149-6462, Fethi Barlık: 0000-0003-2012-7255, Nuriz Ateş: 0000-0001-9734-1554, Ahmed Galip Halidi: 0000-0002-1780-6671, Hasan Yılmaz: 0000-0001-6947-4499

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laboratories have had to suspend or reduce the routine parasitological testing in order to complete the results of COVID-19 testing results in time (9).

This study was performed in order to evaluate the effect of the COVID-19 pandemic on the frequency of intestinal parasites.

Materials and Methods

In this study, the parasitological data of 18,204 patients whose stool samples were sent to the Parasitology Laboratory from various polyclinics of Dursun Odabas Medical Center, between the dates of June 2018 and December 2021, were evaluated retrospectively. The stool samples were examined under a light microscope with the native-Lugol method in the Parasitology Laboratory, and the *E. histolytica* suspected samples were evaluated *E. histolytica*-specific adhesin antigen with ELISA methods.

Between the dates of 1.06.2018 and 11.03.2020, were considered as pre-COVID-19 pandemic; while 1.04.2020 and 31.12.2021 were considered as COVID-19 pandemic process, the stool samples sent to the parasitology laboratory between the dates of 12.03.2020 and 31.03.2020 were not evaluated because they were too few.

Statistical Analysis: Categorical variables were presented as numbers (n) and percentages (%). The “two proportions Z-test and Fisher’s exact” test of the ratios were used for categorical variables. The statistical significance level was considered as 5% ($p < 0.05$) and the MINITAB (ver:17) statistical package program was used for the calculations.

Results

In this study, intestinal parasites were detected in the stool samples of 866 (14.59%) of 5934 patients during the COVID-19 period, and 1214 (9.89%) of 12270 patients in the pre-COVID-19 period. The distribution chart of parasite positivity by months were given in Figure 1. In the statistical evaluation, it was observed that there was a significant difference between the positivity rate in the pre-COVID-19 period and the positivity rate during the COVID-19 period. It was observed that the increase in the frequency of intestinal parasites were present in individuals over 19 years of age and there was no statistically significant increase in individuals between the ages of 0-18 (Table 1).

The parasite species detected in the patients were given in Table 2. Compared to the pre-COVID-19 period, there was an increase in *B. hominis* ($p=0.001$) and *E. vermicularis* (0.002) rates, and a decrease in *G. intestinalis* ($p=0.001$) rates during the COVID-19 period (Figure 2).

It was determined that the decrease in the rate of *G. intestinalis* was only in the 0-18 age group ($p=0.001$).

Discussion

Today, intestinal parasites are frequently encountered in many societies and these parasites still maintain their importance. The incidence of intestinal parasites varies differs according to the education level, cleanliness and eating habits of the societies, socioeconomic status, demographic characteristics of the regions and geographical conditions (2-10).

In the literature, there are studies investigating the effect of the COVID-19 pandemic on the prevalence of intestinal parasites. Studies conducted in Iran (2) and Saudi Arabia (3) reported a decrease in the prevalence of intestinal parasites during the COVID-19 period, compared to the pre-COVID-19 period. A study conducted in Iran was stated that personal hygiene and health education can be effective in reducing parasitic infections in the COVID-19 period (2). In a study conducted in Saudi Arabia, it was stated that the quarantine measures taken by the Saudi government to control the pandemic may play a role in the reduction of parasitic infections (3). In this study, unlike the above mentioned other-two studies, it was determined that there was an increase in the prevalence of general intestinal parasites during the COVID-19 period compared to the pre-COVID-19 period. It was determined that the increase was in individuals aged 19 and over, and there was no statistical change in the age group of 18 and below. In addition, although there was an increase in the general prevalence rate during the pandemic process, it was remarked that there was a proportional decrease in the frequency of pathogenic parasites *G. intestinalis* and *E. histolytica* when evaluated at the species level.

Although intestinal parasite infections maintain their importance in Türkiye, it has been observed that there is a gradual decrease in the incidence of intestinal parasites in studies conducted in different cities (11-13). In this study, it was observed that there was a decrease in the incidence of intestinal parasites compared to the

Table 1. Comparison of Intestinal Parasites Frequency Between Before and During The COVID-19 Pandemic

Characteristics	Categories	Pre-COVID-19 period		COVID-19 period		#p.
		Number of patients examined	Positive patients (%)	Number of patients examined	Positive patients (%)	
Age (years)	0-18	8479	873 (10.30)	3048	317 (10.40)	0.871
	≥19	3833	342 (8.92)	2886	549 (19.02)	0.001
Sex	Female	5957	552 (9.26)	2941	430 (14.62)	0.001
	Male	6321	662 (10.47)	2993	436 (14.57)	0.001
Total		12270	1214 (9.89)	5934	866 (14.59)	0.001

#Two proportions Z-test

Table 2. Type of Intestinal Parasite Detected

Type of intestinal parasite	Pre-COVID-19			COVID-19 process		#p.
	Age (years)	Positive patients	Positivity rate (%)	Positive patients	Positivity rate (%)	
<i>B. hominis</i>	0-18	535	6.31	353	11.58	0.001
	≥19	231	6.03	351	12.16	0.001
	Total	766	6.24	704	11.86	0.001
<i>G. intestinalis</i>	0-18	310	3.66	58	1.90	0.001
	≥19	50	1.30	36	1.25	0.836
	Total	360	2.93	95	1.60	0.001
<i>E. histolytica</i> *		99	64.7	124	60.78	0.447
<i>E. coli</i>		175	1.43	108	1.82	0.053
<i>Iodamoeba butschlii</i>		12	0.10	4	0.07	0.640
<i>Chilomastix mesnili</i>		10	0.08	7	0.12	0.479
<i>Endolimax nana</i>		9	0.07	1	0.02	0.057
<i>Hymenolepis nana</i>		6	0.05	0	0.00	0.187
<i>Taenia</i> spp.		4	0.03	1	0.02	0.995
<i>E. vermicularis</i> **		17	0.14	25	0.42	0.002

* The number of patients who were carried out *E. histolytica* Adhesion tests was taken into account (Pre-COVID-19 period: 153, COVID-19 period: 204) ** Detected in stool examination #Two proportions Z-test and Fisher's exact

retrospective studies (13-15) conducted in the province of Van, but an increase in the prevalence of general parasites was determined with the COVID-19 pandemic.

It is known that one of the most common parasites seen in stool examinations in developing countries is *B. hominis* (16). It has been reported that the prevalence of *B. hominis* in Türkiye varies between 4.38% and 51% (17). In retrospective studies conducted to investigate the frequency of intestinal parasites in patients admitted to Dursun Odabaş Medical Center in Van, the prevalence of *B. hominis* was determined as 26,5% between 1997 and 2007 (13), 16,5% in 2008 (15) and 14,9% in 2009 (14). When the studies are evaluated according to years, it is seen that the prevalence of

B. hominis is gradually decreasing. In this study, the prevalence of *B. hominis* in the pre-COVID-19 period was determined as 6.24% and it was observed that a decrease in the prevalence continued compared to previous years. However, it was noted that there was an increase (11.86%) in the prevalence of *B. hominis* with the COVID-19 period.

Having a cosmopolitan distribution, *G. intestinalis* is one of the ten most common intestinal parasites in humans (13). In retrospective studies evaluating hospital data in Türkiye, the prevalence of *G. intestinalis* was reported to be between 0.3% and 25.9% (11,17). In retrospective studies conducted to investigate the frequency of intestinal parasites

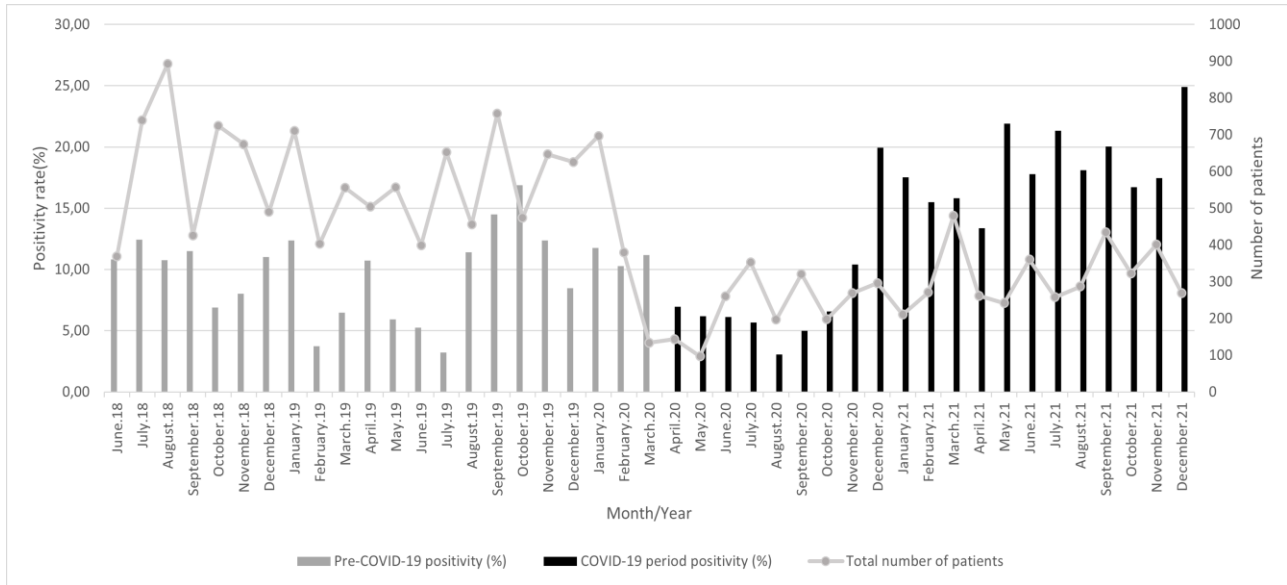


Fig. 1. The Number of Patients Examined and The Distribution of Positivity Rates By Months

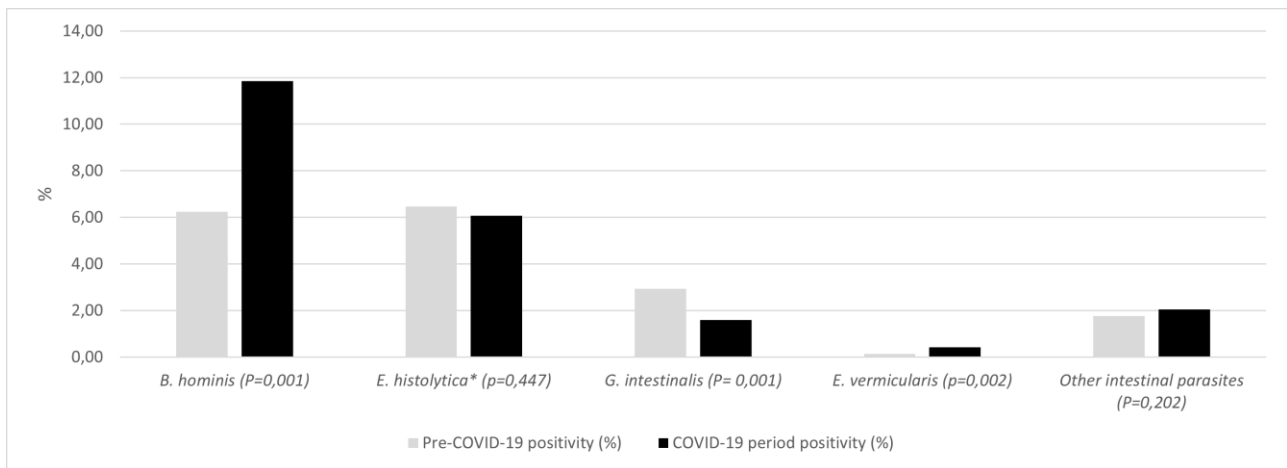


Fig. 2. Comparison of the incidence of parasite species in the pre-COVID-19 period and the COVID-19 process
 * Ratios must be multiplied by 10, The p-value was calculated with the Two-proportional Z-test

in patients admitted to Dursun Odabaş Medical Center in Van province.

The prevalence of *G. intestinalis* was determined as 9.4% between 1997-2007 (13), 9.3% in 2008 (15), and 9.4% in 2009 (14). In this study, the prevalence of *G. intestinalis* in the pre-COVID-19 period was determined as 2.93%, and it was determined that there was a decrease in the prevalence compared to previous years. It was also determined that this decrease (1.6%) continued during the COVID-19 period. It is known that there will be a decrease in the prevalence of *G. intestinalis*, especially with attention to personal hygiene (18). In our study, it was observed that there was a decrease in the frequency of *G. intestinalis* especially in the 0-18 age group during the COVID-19 period. We believe that this situation can be explained by the fact that schools

interrupt face-to-face education and continue education online during the pandemic process, and that contact is reduced due to the pandemic process after the schools are opened and more attention is paid to hygiene rules.

E. vermicularis is one of the first parasites detected in school-age children (19). To determine the true prevalence of this parasite, the cellophane tape method should be applied. In this study, only the results of the examined stool samples were evaluated and *E. vermicularis* positivity was found at a rate of 0.42%. Although an increase in the incidence of *E. vermicularis* was observed in our study during the COVID-19 period, it would not be healthy to consider the frequency rates we determined for comparison, since cellophane tape method was not applied to all patients before and after the pandemic.

During the COVID-19 pandemic, while an increase was determined in the frequency of *B hominis*, the pathogenicity of which is controversial, a decrease was determined in the frequency of intestinalis and other intestinal parasites which are pathogenic parasites transmitted fecal-oral. It was concluded that this decrease, which we determined on the basis of species, was due to the fact that the general hygiene rules were observed much more during the COVID-19 period and that the decrease in interpersonal contact was effective.

Ethics Committee Approval: Non-interventional Clinical Research Ethics Committee of Dursun Odabaş University approved the study protocol (Decision no: 2021/07-01. Date: 18.06.2021).

Conflict of Interest: The authors declare that they have no conflict of interest

References

1. Wolday D, Tasew G, Amogne, et al. Interrogating the impact of intestinal parasite-microbiome on pathogenesis of covid-19 in sub-saharan africa. *Front Microbiol* 2021; 16: 614522.
2. Teimouri A, Alimi R, Farsi S, et al. Intestinal parasitic infections among patients referred to hospitals affiliated to shiraz university of medical sciences, southern iran: a retrospective study in pre-and post-covid-19 pandemic. *Environ Sci Pollut Res* 2022; 1-9.
3. Hawash Y, Ismail KH, Abdel-Wahab M. Shift in parasitic infections during the corona pandemic: a hospital-based retrospective study. *Tropical biomedicine* 2021; 38: 94-101.
4. Vanathy K, Parija SC, Mandal J, et al. Detection of *Cryptosporidium* in stool samples of immunocompromised patients. *Trop Parasitol* 2017; 7: 41-46.
5. Karakuş İ, Cengiz ZT, Ekici A. Evaluation of intestinal parasites and some clinical symptoms in children with diarrhea. *Turkish Society for Parasitology* 2022; 46: 39-44.
6. Bozkurt YT, Cengiz ZT, Ekici A, et al. Frequency of intestinal parasites in substance abusers. *Turkish Society for Parasitology* 2022; 46: 45-49.
7. Meo SA. COVID-19 pandemic: Saudi Arabia's role at national and international levels. *J Diabetes Sci Technol* 2020; 14: 758-759.
8. Feleke BE, Beyene MB, Feleke TE, et al. Intestinal parasitic infection among household contacts of primary cases, a comparative cross-sectional study. *Plos One*. 2019; 14: e0221190.
9. Gluchowska K, Dzieciatkowski T, Sędzikowska A, et al. The new status of parasitic diseases in the covid-19 pandemic-risk factors or protective agents? *Journal of Clinical Medicine* 2021; 10: 2533.
10. Güler E, Sürer K. Epidemiology of intestinal parasites in a university hospital in northern cyprus: A 4-year retrospective experience. *Turkish Society for Parasitology* 2021; 45: 128-132.
11. Gürbüz CE, Gülmez A, Özkoç S, et al. Distribution of intestinal parasites detected between september 2011-2018 at Dokuz Eylül University Medical Faculty Hospital. *Turkish Society for Parasitology* 2020; 44: 83.
12. Uysal HK, Akgül Ö, Purisa S, et al. Twenty-five years of intestinal parasite prevalence in İstanbul University, İstanbul Faculty of Medicine: a retrospective study. *Turkish Society for Parasitology* 2014; 38: 97-101.
13. Cengiz ZT, Yılmaz H, Beyhan YE, et al. A Comprehensive retrospective study: intestinal parasites in human in Van province. *Turkish Society for Parasitology* 2019; 43: 70-73.
14. Cengiz ZT, Beyhan Y, Çiçek M, et al. Intestinal and hepatic parasites determined in a university hospital parasitology laboratory. *Dicle Medical Journal* 2015; 42: 350-354.
15. Yılmaz H, Cengiz ZT, Ceylan A, et al. The distribution of intestinal parasites in people admitted to the Yüzüncü Yıl University Parasitology Laboratory of Health Research and Training Hospital, in 2009. *Turkish Society for Parasitology* 2012; 36: 105-108.
16. Chandramathi S, Suresh K, Sivanandam S, et al. Stress exacerbates infectivity and pathogenicity of *Blastocystis hominis*: in vitro and in vivo evidences. *Plos One* 2014; 9: e94567.
17. Köroğlu M, Yakupoğulları Y, Turhan R. A retrospective analysis of the results of a seven-year parasitological examination of stools from Malatya State Hospital. *Turkish Society for Parasitology* 2007; 31: 201-204.
18. Polat E, Özdemir S, Sirekbasan S. The distribution of intestinal parasites in patients presenting to a university hospital in İstanbul: a seven-year retrospective analysis. *Turkish Society for Parasitology* 2020; 44: 139-42.
19. Özdil K, Karataş N, Zincir H. Importance of public health practices to protect and control from *Enterobius vermicularis*. *Nevşehir Journal of Science and Technology* 2020; 9:1 54-163.