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Original Article

Prevalence and types of intestinal parasites in patients with heart failure

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Abstract

Aim: Heart failure (HF) is a systemic syndrome affecting multiple organ systems, and increasing evidence highlights the role of the gut–heart axis in its pathophysiology. Intestinal barrier dysfunction, chronic inflammation, and immune dysregulation in HF patients may increase susceptibility to intestinal parasitic infections. This study aimed to investigate the prevalence and types of intestinal parasites in patients with heart failure.
Materials and Methods: This case–control study included 130 patients aged ≥18 years diagnosed with HF who presented to the Cardiology Outpatient Clinic of Ordu University Faculty of Medicine. A control group without HF was also evaluated. Patients with malignancy, immunosuppressive diseases, immunosuppressive therapy, or recent antibiotic or antiparasitic drug use were excluded. Stool samples were examined using a combination of parasitological methods, including the cellophane tape method, native–Lugol direct microscopy, sedimentation technique, and modified Kinyoun acid-fast staining.
Results: Intestinal parasites were detected in 61.4% of HF patients and 64.7% of the control group, with no statistically significant difference between groups ($p>0.05$). The most frequently detected parasites in both groups were Cryptosporidium spp. and Blastocystis spp. In HF patients, Cryptosporidium spp. was detected in 36.4% of cases, followed by Blastocystis spp. (30.3%), Entamoeba coli (12.9%), Giardia intestinalis (4.5%), and Dientamoeba fragilis (5.3%). Although overall parasite prevalence did not differ significantly, opportunistic coccidian parasites were commonly detected, particularly in patients with multiple comorbidities such as diabetes mellitus.
Conclusion: In conclusion, intestinal parasite prevalence was high in both HF patients and controls, suggesting that regional environmental and socio-epidemiological factors play a more prominent role than heart failure itself. However, the high frequency of opportunistic parasites in HF patients highlights the importance of comprehensive parasitological evaluation and careful clinical monitoring in this vulnerable population. Further multicenter studies are needed to clarify the clinical impact of intestinal parasitic infections on HF progression.

Keywords: Heart failure, circulatory disorders, intestinal parasites

INTRODUCTION

Heart Failure (HF) is a complex and progressive clinical syndrome characterized by a reduction in cardiac output to a level insufficient to meet tissue metabolic demands, associated with high morbidity and mortality rates. The pathophysiology of this syndrome is not limited to myocardial dysfunction; all organ systems in the body are affected as a result of the impairment caused by decreased cardiac function on systemic circulation. Chronic HF causes functional loss in many organs, particularly the kidneys, liver, and gastrointestinal (GI) system, mainly through prolonged hypoperfusion and chronic venous congestion. The involvement of the gastrointestinal system in heart failure is an important clinical condition known as "Cardiac Enteropathy." This condition is characterized by impaired mucosal integrity, ischemia, and ultimately barrier dysfunction due to splenic venous congestion and intestinal edema. Mucosal damage can increase intestinal permeability (leaky gut), leading to serious malabsorption of nutrients, vitamins, and minerals that are vital for the immune system. This malabsorption further worsens the already poor nutritional status of HF patients and fuels the chronic inflammation cycle (1,2).

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The gut-heart axis has played a critical role in understanding the pathophysiology of HF in recent years. Impaired barrier function resulting from HF enteropathy allows bacterial products (particularly lipopolysaccharides-LPS) to enter the systemic circulation. This translocation exacerbates the pro-inflammatory state characteristic of HF, increases cytokine production, and may trigger myocardial damage. Against this backdrop of chronic inflammation and nutritional deficiencies, the immune system functions of HF patients should be carefully examined. Although chronic inflammation is present, HF patients may experience alterations in specific cellular immune responses that protect against parasitic infections, particularly in T-helper (Th) cell balance. Intestinal parasites are usually controlled by the Th2 response, but malnutrition, comorbidities (such as diabetes), and the systemic effects of HF can disrupt the Th1/Th2 balance, theoretically making patients more vulnerable to intestinal parasites. In addition to causing infection, intestinal parasites can further exacerbate malabsorption, irreversibly impairing the metabolic and immune status of HF patients (3).

This study aimed to determine the true prevalence of intestinal parasites and clinically significant parasite species in this high-risk, immunologically compromised patient population and to investigate the potential implications of these findings for patient management. In particular, given the potential for HF to develop into an immunosuppressive disease, it is crucial to assess whether the prevalence of opportunistic pathogens increases in HF patients.

MATERIALS AND METHODS

Prior to commencing the study, the necessary permissions were obtained from the Ethics Committee of Ordu University (Decision No. 11.04.2025/133) (Approval Date. 11.04.2025). The study was initiated after obtaining ethics committee approval, and patients who presented over a six-month period were included in the evaluation. The research was conducted at the Education and Research Hospital of the Faculty of Medicine, Ordu University, using a case-control design. The study included 132 patients aged 18 years and older with a diagnosis of HF who applied to the Cardiology Outpatient Clinic of Ordu University Faculty of Medicine Training and Research Hospital and agreed to bring samples to the Department of Parasitology. The control group consisted of 106 women and 33 men who visited the cardiology outpatient clinic and did not have HF. In the study, heart patients formed the experimental group, while patients who arrived during the same period and did not have heart disease formed the control group. Cancer patients, those with other immunosuppressive diseases, those receiving immunosuppressive treatment, and those using antibiotics and antiparasitic drugs were excluded from the study.

Clinical Data Collection

Within the scope of the study, sociodemographic data (age, gender, marital status, education, and occupation) and environmental risk factors (place of residence, primary source of drinking water, domestic animal ownership, and diet) were collected in detail. In addition, chronic disease histories were recorded, and comorbidities frequently associated with HF, such as asthma/COPD, thyroid diseases, diabetes mellitus (DM) and metabolic disorders, psychiatric and rheumatic diseases, were compared between groups.

Parasitological Diagnostic Methods

A multi-method approach that is accepted as standard in the Department of Parasitology and provides high sensitivity has been adopted for the diagnosis of parasites in stool samples. This approach encompasses four main methods:

1. **Cellophane tape method:** This is a mandatory method for the detection of parasites in the perianal region, primarily Enterobius vermicularis (pinworm) eggs.
2. **Native-Lugol method (Direct Stool Smear):** Used for rapid preliminary diagnosis of motile trophozoites and various cysts.
3. **Sedimentation technique (Concentration):** A standard concentration method that increases sensitivity for detecting parasite eggs and cysts in low-density infections.
4. **Modified Kinyoun Acid-Fast method:** A vital staining method for detecting oocysts of coccidian parasites such as Cryptosporidium, Cyclospora, and Isospora, which are of increasing clinical importance, especially in immunocompromised patients.

The combined use of these four different techniques demonstrates the methodological rigor of the study. In particular, the inclusion of the Modified Kinyoun Acid-Fast method ensured that opportunistic infections (immunodeficiency markers) in HF patients were not overlooked. After the samples were prepared and stained appropriately, they were examined under a microscope.

Statistical Analysis

Since the data consisted of categorical variables, comparisons between groups were performed using the Chi-square test. In Chi-square analysis, when the expected frequencies for cells were less than 5, the likelihood ratio Chi-square test was preferred. All statistical analyses were performed using IBM SPSS Statistics version 25.0 (IBM Corp., Chicago, IL, USA) software. Statistical significance was assessed at a 95% confidence level, and $p<0.05$ was considered significant.

RESULTS

The patient group (N=132) and control group (N=139) did not show any statistically significant differences in terms of basic sociodemographic variables such as age groups, gender, marital status, educational status, occupation, primary source of drinking water, domestic animal ownership, and diet (all p values>0.05). However, a significant difference was found when the groups were compared in terms of their place of residence (p=0.018). A significant majority of the patient group, 72.7% (n=101), lived in villages, while this rate was 60.6% (n=80) in the control group. This finding indicates that heart failure patients tend to reside in rural or less urbanized settlements and suggests that they are more exposed to potential environmental risk factors. Rural residency is known to be a primary risk factor for parasitic infections due to inadequate sanitation and the risk of environmental fecal contamination (Table 1).

Table 1. Comparison of the patient group and control group in terms of sociodemographic data

Variables	Control group n=139 (%)	Patient group n=132(%)	p
Age, n (%)			
18-39 year	-	11 (8.4)	
40-49 year	53 (38.1)	25 (18.9)	0.448
50 and above	86 (61.9)	69 (72.7)	
Gender, n (%)			
Female	106 (76.3)	92 (69.7)	0.225
Male	33 (23.7)	40 (30.3)	
Marital status, n (%)			
Single	2 (1.4)	3 (2.2)	
Married	117 (84.2)	100 (75.8)	0.183
Widowed	20 (14.4)	29 (22)	
Educational status, n (%)			
Illiterate	47 (33.8)	47 (35.6)	
Primary education	68 (48.9)	66 (50)	0.473
Secondary education	13 (9.4)	12 (9.1)	
Higher education	11 (7.9)	7 (5.3)	
Place of residence, n (%)			
Village	101 (72.7)	80 (60.6)	
District	10 (7.2)	9 (6.8)	**0.018**
City	28 (20.1)	43 (32.6)	
Occupation, n (%)			
Unemployed	104 (74.8)	91 (68.9)	
Worker	2 (1.4)	4 (3)	
Civil servant	5 (4.3)	7 (5.3)	
Private sector employee	1 (0.7)	0	0.623
Retired	15 (10.8)	20 (15.2)	
Tradesman	4 (2.9)	5 (3.8)	
Other	7 (5)	5 (3.8)	
Primary source of drinking water, n (%)			
Municipal tap water	69 (46.9)	67 (50.8)	
Bottled water	22 (15.8)	18 (13.6)	
Spring water	39 (28.1)	36 (27.3)	0.632
Purified water	1 (0.7)	9 (6.8)	
Spring + bottled water	5 (3.6)	1 (0.8)	
Tap + spring water	3 (2.2)	1 (0.8)	
Domestic animal ownership, n (%)			
Yes	17 (12.2)	12 (9.1)	0.405
No	122 (87.8)	120 (90.9)	
Diet, n (%)			
Meat-based	6 (4.3)	8 (6.1)	0.519
Vegetable-based	133 (95.7)	124 (93.6)	

Distribution of Comorbidities

In the comparison of chronic diseases, it was determined that the comorbidity burden of the patient group was significantly higher than that of the control group. The prevalence of the following chronic diseases was statistically significantly higher in the patient group: asthma/COPD (p<0.001), thyroid diseases (p<0.001), diabetes mellitus and metabolic disorders (p<0.001), psychiatric diseases (p=0.039), and rheumatic diseases (p=0.039).

In particular, DM and metabolic disorders are seen in half of the patient group (50%, n=66), while this rate is only 18% in the control group (n=25) (p<0.001). This finding clearly demonstrates that the diagnosis of HF brings comorbidities that cause a high rate of immune dysfunction and systemic inflammation. This high prevalence of DM should be considered an important confounding variable that weakens the defense against infections and facilitates parasitic persistence. No significant difference was found between the two groups in terms of digestive system diseases (p=0.448). The distribution of comorbidities between the groups is presented in Table 2.

Table 2. Comparison of chronic disease profiles between groups

Chronic disease	Control group n=139 (%)	Patient group n=132 (%)	p
Asthma/COPD	0	15 (11.4)	**<0.001**
Thyroid diseases	0	21 (15.9)	**<0.001**
Diabetes mellitus and metabolic disorders	25 (18.0)	66 (50.0)	**<0.001**
Rheumatic diseases	0	4 (3.0)	**0.039**
Other	0	17 (12.9)	**<0.001**

When comparing the groups in terms of parasite presence, the overall parasite prevalence in the patient group was found to be 61.4% (n=81). In the control group, this rate was 64.7% (n=90).

Statistical analysis revealed no significant difference between the two groups in terms of overall parasite presence (p=0.564).

This "zero finding" indicates that, contrary to expectations, patients with heart failure do not carry parasites at a higher rate than the general population, but it also indicates that the prevalence of intestinal parasites is quite high (above 60%) in both groups. This high baseline prevalence is strong epidemiological evidence of the prevalence of fecal-oral transmission and environmental contamination in the region where the study was conducted.

The study identified various parasite species considered both pathogenic and non-pathogenic. The two most common parasite species in both groups were Cryptosporidium spp. and Blastocystis spp., which is considered a controversial pathogen.

The prevalence of Cryptosporidium spp. was 36.4% (n=48) in the HF patient group and 31.2% (n=43) in the control group (p=0.366). The prevalence of Blastocystis spp. was 30.3% (n=40) in the HF group and 33.1% (n=46) in the control group (p=0.622). These rates indicate that both organisms are highly endemic to the region.

Other clinically significant pathogens included Entamoeba coli (HF: 12.9%; Control: 15.1%), Giardia intestinalis (HF: 4.5%; Control: 7.2%), and Dientamoeba fragilis (HF: 5.3%; Control: 2.2%). The numerically higher prevalence of Dientamoeba fragilis in the HF group (p=0.208) is noteworthy. Furthermore, an increasing numerical trend was observed in the HF group for Enterobius vermicularis (HF: 3.8%; Control: 0.7%) and Cyclospora cayetensis (HF: 3.0%; Control: 1.4%), but these increases did not reach statistical significance (p>0.05).

The prevalence of specific intestinal parasites in both groups is summarized in Table 3.

Table 4 below summarizes the positivity rates obtained by different methods used in parasite diagnosis and highlights the critical importance of the Acid-Fast method.

Table 3. Specific prevalence rates of intestinal parasites in the patient and control groups

Parasite type	Control group (n=139), (%)	Patient group (n=132), (%)	p value
General parasite presence	90 (64.7)	81 (61.4)	**0.564**
Cryptosporidium spp.	43 (31.2)	48 (36.4)	**0.366**
Blastocystis spp.	46 (33.1)	40 (30.3)	**0.622**
Entamoeba coli	21 (15.1)	17 (12.9)	**0.597**
Giardia intestinalis	10 (7.2)	6 (4.5)	**0.443**
Dientamoeba fragilis	3 (2.2)	7 (5.3)	**0.208**
Enterobius vermicularis	1 (0.7)	5 (3.8)	**0.114**
Cyclospora cayetensis	2 (1.4)	4 (3.0)	**0.439**

Table 4. Comparison of the positivity rates of methods used in parasite diagnosis

Diagnostic method	Control group positivity rate (n=139) (%)	Patient group positivity rate (n=132) (%)	Medical parasitological evaluation
Anal (Cellophane tape)	32 (23.0)	30 (22.7)	E.vermicularis screening. Indicator of infection in rural areas
Direct microscopy (Native-lugol)	63 (45.3)	55 (41.7)	Rapid detection of trophozoites and cysts
Sedimentation (Concentration)	57 (41.0)	50 (37.9)	Increases sensitivity forlow-load infections
Modified kinyoun acid fast	45 (32.4)	47 (35.6)	Critical: High detection rate of Cryptosporidium spp. and Cyclospora cayatensis oocysts

DISCUSSION

The most striking finding of this study is that, despite chronic congestion, malabsorption, and high comorbidity burden in the gastrointestinal system of HF patients, there was no significant difference in overall intestinal parasite prevalence compared to healthy controls. While an increase in parasite frequency is expected in immunocompromised individuals, as reported in the literature, the zero finding observed in this study suggests that the primary factor determining parasite spread is regional socio-epidemiological conditions rather than the physiological effects of HF (4). Furthermore, since HF does not cause dramatic immunodeficiency like severe immunosuppressive conditions such as HIV infection or organ transplantation but rather creates a state of chronic inflammation and dysregulation, the increase in susceptibility to parasitic infections may have been limited.

The role of environmental factors in parasite epidemiology is confirmed by the significantly higher proportion of the patient group living in rural settlements (villages) (p=0.018). Individuals living in rural areas generally have lower sanitation standards, use untreated source water, and have closer contact with farm animals. These environmental risks are key factors that facilitate the transmission cycle of parasites.

The importance of this socio-geographical factor is particularly evident in the distribution of Enterobius vermicularis and coccidian parasites. E. vermicularis is transmitted through direct contact and poor hygiene. The fact that the rate of E. vermicularis in the HF group was numerically higher than in the control group (3.8% vs. 0.7%) supports the idea that behavioral and hygienic transmission routes associated with rural life are more common among HF patients. The most critical finding identified in the study is the extremely high prevalence of Cryptosporidium in both the patient and control groups (HF: 36.4%, Control: 31.2%). This parasite can cause severe, prolonged, and life-threatening watery diarrhea, especially in individuals with weakened immune systems (such as those with DM or chronic diseases). In patients with DM, dehydration and electrolyte imbalances caused by Cryptosporidium infection have the potential to rapidly lead to cardiac decompensation, increasing the risk of mortality (5). The study by Yar et al. successfully demonstrated the multifactorial nature of Cryptosporidium spp. infections using machine learning models, showing that parasitic infections cannot be explained by a single risk factor. The application of multivariate and predictive modeling approaches used in Cryptosporidium spp. infections to risk assessment of intestinal parasitic infections in heart failure patients may contribute to the development of clinical decision support systems (6).

The inclusion of the modified Kinyoun acid-fast method used to detect this parasite demonstrates the methodological strength of the study. The high detection rate of Cryptosporidium not only indicates the endemic prevalence of this parasite but also clearly demonstrates that laboratories serving individuals with chronic diseases should not rely solely on routine screening methods. Similarly, the Cyclospora cayetensis rate is also numerically higher in the HF group (3.0% vs. 1.4%), but there is no statistical significance (p=0.439). The presence of both coccidian parasites indicates that HF patients are at high risk for GI complaints during clinical follow-up and may require intensive treatment in case of infection.

The high prevalence of Blastocystis spp., one of the most frequently detected parasites in the study (approximately 30%), confirms its global prevalence. Although the pathogenicity of Blastocystis spp. remains controversial, its potential to cause symptoms increases, particularly in the context of chronic GI inflammation and dysbiosis (a condition associated with CF enteropathy). Considering that malabsorption is more severe in HF patients, the contribution of Blastocystis spp. to chronic diarrhea and weight loss should not be overlooked (7,8).

Another protozoan of questionable clinical significance is Dientamoeba fragilis. The numerically higher prevalence of *D. fragilis* in the HF group (5.3%) compared to the control group (2.2%) suggests that this protozoan may be a cause of chronic abdominal disorders associated with HF enteropathy. HF enteropathy may facilitate the clinical manifestation of these normally tolerated organisms by causing mucosal damage and changes in the local immune system (9).

The high prevalence of chronic diseases in HF patients indicates that defense against parasitic infections is complicated. DM and metabolic disorders, present in 50% of the patient group, are the most prominent comorbidities (p<0.001). DM itself can suppress the immune system, particularly by weakening phagocytic activity and through uncontrolled blood sugar levels, thereby reducing defense against opportunistic infections such as Cryptosporidium (9-11).

It has been suggested that the chronic inflammatory burden of HF and the immune dysfunction of DM may create a synergistic effect, potentially increasing the severity of infection and the difficulty of its treatment at the individual patient level, even if this does not lead to a statistically significant increase. This clinical picture has determined that focusing solely on the cardiac condition in the management of heart failure patients is insufficient and that systemic comorbidities and infection risks must be assessed in an integrated manner.

The study suggests that intestinal parasitic infections may have indirect pathophysiological effects on heart failure. Chronic or recurrent parasitic infections may contribute to HF by increasing systemic inflammation, impairing intestinal barrier integrity, and causing malabsorption. Increased intestinal permeability may trigger the release of proinflammatory cytokines such as TNF-α and IL-6 by causing bacterial translocation and endotoxemia; these cytokines have been reported to play a role in myocardial remodeling and deterioration of cardiac function (12). Furthermore, prolonged diarrhea caused by parasites such as Cryptosporidium spp., fluid-electrolyte imbalances, and renal dysfunction may accelerate HF by increasing neurohormonal activation. No causal relationship was observed in this study. However, it is thought that these mechanisms may negatively affect clinical stability, particularly in KY patients with a high comorbidity burden.

This study also has some limitations. The fact that it was conducted at a single center limits the generalizability of the prevalence rates obtained to the entire heart failure population. Since stool samples were collected at a single point in time, no conclusions could be drawn regarding seasonal variations in the prevalence of intestinal parasites. It should be noted that the frequency of waterborne coccidian parasites may vary with rainfall and agricultural activities. Although microscopic diagnostic methods, including the Modified Kinyoun Acid-Fast staining method, were used in the study, it is noted that these methods have lower sensitivity compared to molecular diagnostic techniques (such as PCR). Therefore, it is possible that low-density parasites may be missed. Nevertheless, the use of standardized sampling and specific staining techniques is thought to have increased the experimental power of the study.

CONCLUSION

This study did not reveal a statistically significant difference in the overall prevalence of intestinal parasites between heart failure patients and healthy controls. However, the high prevalence observed in both groups suggests that regional socio-epidemiological factors play a more dominant role than disease-related immune alterations.

1. In all patients diagnosed with heart failure, a comprehensive parasitological examination, including the modified Kinyoun acid-fast staining method, must be included in the standard clinical practice protocol, in addition to routine stool examination, to rule out parasitic etiology. This is necessary for the early diagnosis of opportunistic parasites that can be life-threatening, such as Cryptosporidium spp. and Cyclospora cayetensis.
2. Cardiologists should consider the risk of intestinal parasites in their routine follow-up of HF patients due to the high prevalence of DM and rural residency factors and should evaluate patients with GI symptoms in a multidisciplinary manner with parasitology/ınfectious diseases specialists.
3. For health control in the region, water hygiene and sanitation measures should be reviewed, especially in rural settlements and areas where source water use is common, due to the high endemic spread of coccidian parasites. Recommendations have also been made to implement special education and awareness programs on personal hygiene and safe water consumption for individuals with chronic diseases (especially CHD and DM patients).

The strengths of this study include the presence of an experimental and control group, the use of the modified Kinyoun acid-fast staining method for parasite diagnosis, a comprehensive parasitological evaluation, and the inclusion of socio-demographic characteristics and comorbid diseases. The combined analysis of environmental, clinical, and laboratory data has provided a different perspective on the evaluation of intestinal parasitic infections in patients with heart failure and has made a meaningful contribution to the limited number of studies in the literature.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that there is no financial support.

Ethical Approval
The study protocol received approval from the Ethics Committee of Ordu University (Decision No. 11.04.2025/133) (Approval Date. 11.04.2025).

Patient Consent
Not necessary for this manuscript.

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