

Frequency of Intestinal Protozoa in Patients Receiving Treatment at Van Special Fizyoaktif Special Education and Rehabilitation Center

Van Özel Fizyoaktif Özel Eğitim ve Rehabilitasyon Merkezinde Tedavi Alan Hastalarda İntestinal Protozoonların Görülme Sıklığı

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ABSTRACT

Objective: The aim of this study is to determine the frequency of intestinal protozoa in disabled patients attending a rehabilitation center, thereby highlighting the significance of intestinal protozoa in individuals with disabilities.

Methods: The study included a total of 300 individuals, comprising 200 disabled patients and 100 non-disabled individuals. Stool samples were collected from all participants and examined using the native-Lugol and modified acid-fast methods.

Results: In the study, intestinal protozoa were detected in 41% of disabled individuals and in 9% of individuals in the control group ($p=0.001$). *Blastocystis* was detected in 18% of patients, *Cryptosporidium* spp. in 15%, *Giardia intestinalis* in 9%, *Cyclospora cayetanensis* in 5%, and *Entamoeba coli* in 4%. Among the subgroups, spina bifida patients had a protozoan infection rate of 83.3%, while the rates in other groups were lower. A significant relationship was detected between the presence of parasites and diarrhea, constipation, and loss of appetite ($p<0.05$).

Conclusion: Disabled individuals, especially those with spina bifida, are at risk for intestinal protozoa, and regular screening for opportunistic protozoa is essential for these patients.

Keywords: Down syndrome, disability, intestinal protozoa, rehabilitation, spina bifida

ÖZ

Amaç: Bu çalışmanın amacı, bir rehabilitasyon merkezine devam eden engelli hastalarda intestinal protozoonların sıklığını belirleyerek intestinal protozoonların engelli bireylerdeki önemini ortaya koymaktır.

Yöntemler: Çalışmaya, 200 engelli hasta ve 100 engelsiz birey olmak üzere toplam 300 kişi dahil edildi. Çalışmaya dahil edilen tüm bireylerden dışkı örnekleri alınarak, nativ-Lugol ve modifiye asit fast yöntemleriyle incelendi.

Bulgular: Çalışmada, engelli bireylerin %41'inde ve kontrol grubundaki bireylerin %9'unda bir ya da daha fazla intestinal protozoon saptandı ($p=0.001$). Hastaların %18'inde *Blastocystis*, %15'inde *Cryptosporidium* spp., %9'unda *Giardia intestinalis*, %5'inde *Cyclospora cayetanensis* ve %4'ünde *Entamoeba coli* saptandı. Hasta alt gruplarından spina bifida hastalarının %83,3'ünde intestinal protozoon bulunurken diğer gruplardaki oranlar daha düşük bulundu. Ayrıca engelli bireylerde protozoon varlığı ile ishal, kabızlık ve iştahsızlık arasında anlamlı bir ilişki olduğu belirlendi ($p<0,05$).

Sonuç: Engelli bireylerin, özellikle de spina bifida hastalarının intestinal protozoonlar açısından risk altında olduğu ve bu hastaların özellikle fırsatçı protozoonlar yönünden düzenli olarak taranması gerektiği kanaatine varıldı.

Anahtar Kelimeler: Down sendromu, engelli, intestinal protozoonlar, rehabilitasyon, spina bifida

INTRODUCTION

Intestinal parasitic infections constitute a significant global health issue, with widespread prevalence. Particularly common in developing nations, these infections can lead to high rates of morbidity and

mortality. They are more prevalent in tropical and subtropical regions worldwide, affecting an estimated two billion individuals. The widespread occurrence of these infections underscores the need for increased efforts in their prevention and healthcare improvement on a global scale (1-3).

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Intestinal protozoa, common intestinal parasites, are phylogenetically diverse and are widely distributed across human and animal populations (4). Geographical disparities, socio-economic conditions, education levels, climate, and environmental factors play pivotal roles in the transmission of intestinal protozoan infections. Factors such as inadequate infrastructure, poor sanitation, and malnutrition particularly facilitate the spread of these infections (5-7). The prevalence of intestinal protozoan infections is notably high among individuals with gastrointestinal complaints. Intestinal parasites are associated with various symptoms, including diarrhea, abdominal pain, nausea, vomiting, weight loss, indigestion, bloating, and constipation (8).

Intestinal protozoa pose a significant risk to specific groups of people, including children, immunocompromised patients, and individuals with disabilities. However, due to the limited inclusion of disabled individuals in research related to intestinal protozoa, there remains insufficient information and awareness in this regard. Motor and/or cognitive developmental disorders observed in disabled individuals can adversely affect the neuromotor function of the digestive system, leading to insufficient digestion and malabsorption. Additionally, learning and comprehension difficulties, weaknesses in personal care skills, and challenges related to personal hygiene increase the susceptibility of disabled individuals to intestinal protozoan infections. Therefore, it is essential for disabled individuals to receive education on healthcare and personal hygiene and undergo regular screening tests (9,10).

The aim of this study is to determine the frequency of intestinal protozoa in disabled patients attending a rehabilitation center, thereby highlighting the significance of intestinal protozoa in individuals with disabilities.

METHODS

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval for this study was obtained from the Non-Invasive Clinical Research Ethics Committee of Van Yüzüncü Yıl University (date: 14.10.2022, number: 2022/10-09).

The study was conducted between November 10, 2022, and April 25, 2023. A total of 300 participants were included in the study: 200 patients receiving treatment at the Van Special Fizyoaktif Special Education and Rehabilitation Center, and 100 individuals without intellectual or physical disabilities who visited the Parasitology Research Laboratory of Van Yüzüncü Yıl University Medical Faculty. Informed consent forms were obtained from all participants. For each collected sample, gender, age, and address information of the patient were recorded. Furthermore, the patient's gastrointestinal complaints, physical development status, and disability information were documented.

The collected stool samples were first examined macroscopically. Subsequently, a rice grain-sized portion of stool was taken from each sample using a stick, and these samples were microscopically examined for intestinal protozoa using the native-Lugol method. Preparations were examined under a 40X objective to identify protozoan cysts and trophozoites. Following this, the samples

were stained using a modified acid-fast staining method to detect *Cryptosporidium* spp. and *Cyclospora cayetanensis*, and they were then examined under a light microscope using a 100X objective.

Statistical Analysis

The comparison of proportions for categorical variables was conducted using the Z (t) test. Additionally, the chi-square test was employed to determine the relationship between categorical variables. A statistical significance level of 5% was utilized for calculations, and the SPSS (version 21) and MINITAB (version 14) statistical software packages were employed for these calculations.

RESULTS

Demographic Findings

Out of the 200 participants included in the study, 50 had cerebral palsy (25%), 40 had hemiplegia (20%), 24 had spina bifida (12%), four had multiple sclerosis (2%), four had Parkinson's disease (2%), 20 had autism (10%), 20 had Down syndrome (10%), 28 had other physical disabilities (14%) including amputations, congenital hip dislocation, scoliosis, burns, and fractures, and 10 had other intellectual disabilities (5%) including learning disabilities, mental retardation, and attention deficit disorders.

The participants included in the study ranged in age from 2 to 65 years, with a mean age of 20.1 ± 21.3 . Among the patients, 136 (68%) were under 18 years of age, while 64 (32%) were 18 years or older. Among the patients aged 18 and above, 59.3% were found to have hemiplegia. Regarding the living locations of the patients, four lived in rural areas, eight lived in urban centers, and the remaining 188 lived in suburban neighborhoods. It was determined that the patients generally had low to moderate income levels.

Parasitic Findings

Out of the 200 patients included in the study, intestinal protozoa were detected in 82 individuals (41%), while among the 100 individuals in the control group, 9 (9%) had one or more intestinal protozoa. A statistically significant difference was observed in the statistical evaluation of parasite frequency between the patient group and the control group ($p=0.001$). The frequency of intestinal parasites was highest among spina bifida patients (83.3%), and the positivity rates for other patient groups are provided in Table 1.

In the patient group, one intestinal protozoa was detected in 62 patients (31%), while two intestinal protozoa were found in 20 patients (10%). Among the patient group, *Blastocystis* was identified in 36 patients (18%), *Cryptosporidium* spp. in 30 patients (15%), *Giardia intestinalis* in 18 patients (9%), *C. cayetanensis* in 10 patients (5%), and *Entamoeba coli* in 8 patients (4%). The distribution of parasites detected in patient subgroups is presented in Table 2.

In the control group, one intestinal protozoa was detected in seven (7%) individuals, while two intestinal protozoa were found in two (2%) individuals. Among the control group, *Blastocystis* was detected in six (6%) individuals, *E. coli* in three (3%) individuals, *G. intestinalis* in one (1%) individual and *Cryptosporidium* spp. in one (1%) individuals.

When examining protozoa frequency according to age groups, intestinal parasites were detected in 60 out of 136 patients

(44.1%) who were under 18 years old and in 22 out of 64 patients (34.4%) who were 18 years and older. There was no statistically significant difference in protozoa frequency between the two age groups ($p=0.182$) (Table 3). Additionally, there were no significant differences in the frequency of *Blastocystis* ($p=0.537$), *Cryptosporidium* spp. ($p=0.480$), *G. intestinalis* ($p=0.311$), and *E. coli* ($p=0.324$) between the two age groups based on statistical evaluation. However, since *C. cayetanensis* was only detected in patients under 18, a significant difference was observed in the frequency of this parasite among age groups ($p=0.001$).

When analyzing parasite frequency by gender, intestinal protozoa were identified in 38 out of 106 male patients (35.8%) and in 44 out of 94 female patients (46.8%). Statistical evaluation did not reveal a significant difference between gender and parasite frequency ($p=0.114$) (Table 3).

When examining the distribution of protozoa presence in patients according to clinical symptoms, statistical evaluation

revealed significant relationships between parasite frequency and diarrhea ($p=0.046$), constipation ($p=0.035$), and loss of appetite ($p=0.034$) for each respective symptom. However, no significant associations were found between protozoa presence and symptoms such as weakness, abdominal pain, fever, nausea, vomiting, growth retardation, and weight loss based on the statistical analysis (Table 4).

DISCUSSION

Parasitic diseases can adversely impact the health of billions of people worldwide, leading to serious health problems. Intestinal parasites continue to pose a threat to public health in underdeveloped and developing countries. Factors such as low socio-economic status, inadequate or unbalanced dietary habits, crowded living environments, lack of clean water and safe food sources, poor environmental hygiene, and inadequate infrastructure contribute to the spread of parasites. Environmental

Table 1. Prevalence of intestinal protozoa in patient and control groups

Group	Positive patients (%)	Negative patients (%)	p
Control group (n=100)	9 (9.0)	91 (91.0)	0.001
Patient group (n=200)	82 (41.0)	118 (59.0)	
Cerebral palsy (n=50)	14 (28.0)	36 (72.0)	0.001
Hemiplegia (n=40)	16 (40.0)	24 (60.0)	
Spina bifida (n=24)	20 (83.3)	4 (16.7)	
Multiple sklerosis (n=4)	0 (0)	4 (100)	
Parkinson (n=4)	2 (50.0)	2 (50.0)	
Other physical disabilities (n=28)	14 (50.0)	14 (50.0)	
Autism (n=20)	4 (20.0)	16 (80.0)	
Down syndrome (n=20)	8 (40.0)	12 (60.0)	
Other intellectual disabilities (n=10)	4 (40.0)	6 (60.0)	

Table 2. Distribution of detected parasites among patient subgroups

Subgroup	<i>Blastocystis</i> (%)	<i>Cryptosporidium</i> spp. (%)	<i>C. cayetanensis</i> (%)	<i>E. coli</i> (%)	<i>G. intestinalis</i> (%)
Cerebral palsy (50)	6 (12.0)	6 (12.0)	2 (4.0)	-	2 (4.0)
Hemiplegia (40)	8 (20.0)	4 (10.0)	-	2 (5.0)	4 (10.0)
Spina bifida (24)	6 (25.0)	6 (25.0)	8 (33.3)	4 (16.7)	2 (8.3)
Multiple sklerosis (4)	-	-	-	-	-
Parkinson's (4)	2 (50.0)	-	-	-	2 (50.0)
Other physical disabilities (28)	4 (14.3)	8 (28.6)	-	-	4 (14.3)
Autism (20)	4 (20.0)	2 (10.0)	-	-	2 (10.0)
Down syndrome (20)	4 (20.0)	4 (20.0)	-	-	2 (10.0)
Other intellectual disabilities (10)	2 (20.0)	-	-	2 (20.0)	-

Table 3. Distribution of parasite frequency by age and gender

Group		Positive case count (%)	Negative case count (%)	p
Age	≤18 (n=136)	60 (44.1)	76 (55.9)	0.182
	>18 (n=64)	22 (34.4)	42 (65.6)	
Gender	Male (n=106)	38 (35.8)	68 (64.2)	0.114
	Female (n=94)	44 (46.8)	50 (53.2)	

Table 4. Distribution of parasite presence in patients according to symptoms

Group		Positive case count (%)	Negative case count (%)	p
Weakness	Absent (n=146)	62 (42.5)	84 (57.5)	0.488
	Present (n=54)	20 (37.0)	34 (63.0)	
Diarrhea	Absent (n=192)	76 (39.6)	116 (60.4)	0.046
	Present (n=8)	6 (75.0)	2 (25.0)	
Abdominal pain	Absent (n=162)	66 (40.7)	96 (59.3)	0.878
	Present (n=38)	16 (42.1)	22 (57.9)	
Fever	Absent (n=150)	58 (38.7)	92 (61.3)	0.245
	Present (n=50)	24 (48.0)	26 (52.0)	
Nausea	Absent (n=192)	78 (40.6)	114 (59.4)	0.597
	Present (n=8)	4 (50.0)	4 (50.0)	
Vomiting	Absent (n=186)	76 (40.9)	110 (59.1)	0.884
	Present (14)	6 (42.9)	8 (57.1)	
Growth retardation	Absent (n=126)	52 (41.3)	74 (58.7)	0.919
	Present (n=74)	30 (40.5)	44 (59.5)	
Weight loss	Absent (n=108)	48 (44.4)	60 (55.6)	0.283
	Present (n=92)	34 (37)	58 (63)	
Constipation	Absent (n=120)	42 (35)	78 (65)	0.035
	Present (n=80)	40 (50.0)	40 (50.0)	
Loss of appetite	Absent (n=104)	50 (48.1)	54 (51.9)	0.034
	Present (n=96)	32 (33.3)	64 (66.7)	

factors such as temperature, precipitation, humidity, and soil type also influence the prevalence of parasites (11,12).

The immune system plays a significant role in the frequency and clinical course of intestinal parasitic infections. While some parasites may not cause any issues in individuals with intact immune systems, they can lead to various symptoms and life-threatening severe infections in individuals with compromised or suppressed immune systems (13).

Numerous studies have been conducted to investigate parasite prevalence in immunocompromised patients. In Indonesia, a study found that 76% of 318 HIV/AIDS patients with chronic diarrhea were infected with parasites (14). In Iran, among 265 patients including hemodialysis patients, kidney transplant recipients, cancer patients, and HIV/AIDS patients, the prevalence of parasites was 11.7% (15). In Brazil, 61.6% of 73 cancer patients undergoing chemotherapy were found to be infected with parasites (16). In Egypt, 30% of 100 patients with diagnoses of malignancy, diabetes mellitus, or chronic kidney failure were infected with parasites (17). In Türkiye, among 80 children diagnosed with leukemia and with an absolute neutrophil count below 1000/mm³, 41.2% had one or more intestinal parasites (15). Studies involving immunocompromised or immunosuppressed patients consistently reveal that intestinal parasites remain a significant health concern. It is believed that intestinal parasites could also pose a substantial health problem for intellectually and physically disabled individuals whose immune systems are compromised for various reasons, and who may not adhere to hygiene practices. It has been suggested that intellectual disability could directly affect hygiene habits, potentially facilitating the transmission of intestinal parasitic infections (18). However, there is a limited number of studies on the prevalence of intestinal parasites in

intellectually and physically disabled individuals, and no studies related to this topic were found in Türkiye.

In Iran, three separate studies conducted in institutions with mentally disabled patients yielded the following results: In the first study, intestinal parasites were detected in 20.4% of 225 patients (19). In the second study, 26.1% of 119 mentally disabled patients were found to have intestinal parasites (20). In the third study, 54.7% of 126 mentally disabled patients were found to have one or more intestinal parasites (21). Similar findings were reported in other countries: In Egypt, 43.5% of 200 mentally disabled individuals had intestinal parasites (22), while in Thailand, 57.6% of 1086 mentally disabled individuals were affected (23). In Korea, the prevalence was 35.7% among 112 mentally disabled individuals (24), and in Italy, it was 23% among 550 mentally disabled individuals (25). In Ethiopia, 56.7% of 104 mentally disabled children had one or more intestinal parasites (26).

In a study conducted in Iran involving both physically and mentally disabled individuals, intestinal protozoa were detected in 12.3% of 196 participants. The prevalence of parasites was 9.2% among mentally disabled individuals and 2.5% among physically disabled individuals (27). Similar trends were observed in other regions: In Thailand, 38.46% of 52 physically disabled individuals were affected (28), while in Brazil, 8.3% of 156 physically disabled children had intestinal parasites (29).

This study investigated 200 patients with either mental and/or physical disabilities, with 41% showing the presence of intestinal protozoa. This rate aligns with previous studies (19-22) highlighting the significant health concern posed by intestinal parasites in disabled individuals. The findings suggest a higher frequency of intestinal parasites among mentally disabled

individuals (20,21) compared to physically disabled individuals (27,29). Specifically, this study found a higher occurrence of intestinal parasites in physically disabled individuals who faced challenges in maintaining proper hygiene due to conditions like spina bifida and hemiplegia, which hindered their ability to use lavatories comfortably. Moreover, conditions such as urinary incontinence, bowel fullness, and absorption disorders resulting from bowel dysfunction in spina bifida patients could potentially weaken the immune system. This study, for the first time, identified an 83.3% frequency of intestinal protozoa among spina bifida patients, underscoring the need to investigate intestinal protozoa in disabled individuals, especially those with spina bifida.

According to studies conducted in Türkiye, *G. intestinalis* is one of the most common pathogenic parasites. This parasite exhibits a wide distribution from temperate regions to tropical zones. While it is generally observed at rates of 2-5% in industrialized countries, this rate can range from 9% to 20-30% in developing countries (30). The prevalence of *G. intestinalis* in communities influences the positivity rates in disabled individuals. In studies conducted on disabled individuals in Iran, the prevalence ranged from 1.6% to 6.2% (19-21,27), 8% in Thailand (23), 8.5% in Egypt (22), and 0.9% in Korea (24). In this study, *G. intestinalis* was detected in 9% of patients, which is higher than in other studies. Considering factors such as the low to moderate income levels of the included patients, their predominantly residing in peripheral neighborhoods, and the widespread presence of *G. intestinalis* in the Van Region, we believe that the prevalence of *G. intestinalis* is higher in this study compared to other studies.

Blastocystis is a widely prevalent parasite worldwide, particularly observed more frequently in developing countries (31). In developed countries, the prevalence of *Blastocystis* is generally between 5% and 20%. In developing countries, however, the prevalence is over 60% (32). The prevalence of *Blastocystis* among disabled individuals varies between 4% and 25.4% in previous studies (19-22,27). In this study, *Blastocystis* was detected in 18% of disabled individuals. While this rate might be considered normal for the general population, it should not be overlooked in immunocompromised disabled individuals.

Cryptosporidium spp. species are among the leading causes of diarrhea in both immunocompromised and immunocompetent individuals. The prevalence of cryptosporidiosis varies between developed countries, where it ranges from 1% to 2%, and developing countries, where it can be between 3% and 20% (33). Individuals living in areas with poor nutrition, inadequate nutrition, suppressed immune systems, and low sanitation are at greater risk for cryptosporidiosis (34). Similarly, such conditions are often observed among individuals with intellectual and physical disabilities. Therefore, determining the prevalence of *Cryptosporidium* spp. among disabled individuals is crucial. Studies conducted on disabled populations have reported a prevalence of *Cryptosporidium* spp. of 23.5% in Egypt (22) and 1.7% in Iran (20). In this study, *Cryptosporidium* spp. was detected in 15% of cases. This finding underscores the significance of *Cryptosporidium* spp., an opportunistic protozoan, as a serious health concern for disabled individuals, emphasizing the necessity to consider this pathogen within this specific patient group.

Another opportunistic protozoan, *C. cayetanensis*, causes severe gastroenteritis in both immunocompetent and immunosuppressed individuals (35). Although cases of cyclosporidiosis are sporadic,

they are reported worldwide and are particularly prevalent in tropical and subtropical countries (36). Given that it can lead to severe symptoms in individuals with weakened immune systems, determining the prevalence of *C. cayetanensis* among disabled individuals is of importance. In a study conducted on disabled patients, *C. cayetanensis* was detected at a rate of 7.5% in Egypt (22). In this study, a rate of 5% for *C. cayetanensis* was found, with 80% of the positive cases being spina bifida patients. This identified rate demonstrates that disabled individuals, especially those with spina bifida, are at risk for opportunistic protozoan infections.

Entamoeba coli has a global distribution and is commonly found in regions with inadequate sanitation conditions, particularly in rural areas (37). Various studies have investigated the prevalence of *E. coli* in disabled patients in different countries, and reports indicate varying rates of *E. coli* within this patient group. In a study conducted in Thailand, *E. coli* infection was detected at a rate of 23.1% (27), while in Iran, rates of 9.7%, 5.6%, and 10.1% were reported (19-21). In Egypt, the rate was 2.5% (22), and in Korea, it was 25% (24). In this study, a rate of 4% for *E. coli* was observed. Although *E. coli* is considered non-pathogenic, some studies suggest that it can disrupt the intestinal microbiota. Therefore, we believe that *E. coli* should not be overlooked, especially in disabled individuals who often have disrupted gut flora.

The studies conducted on disabled individuals have not found a statistically significant difference between parasite frequency and gender (19-23,28). Similarly, in this study, no statistically significant difference was observed between gender and parasite frequency.

Limited research conducted on disabled children indicates a higher risk of intestinal parasitic infection in this group. Particularly in cases of intellectual disability, these children may struggle to maintain proper personal hygiene practices, making them more susceptible to intestinal parasitic infections (29). In some studies involving disabled individuals, it has been reported that the frequency of intestinal parasites decreases with age (19,21,25). However, in a study conducted by Fentahun et al. (26), no significant difference was observed between age and intestinal parasite prevalence. Although the frequency of intestinal protozoa in patients under 18 years old was higher than in those over 18 years old in this study, the difference was not statistically significant. The lack of statistical difference between these two groups may be attributed to the fact that 59.3% of patients over 18 years old were individuals with hemiplegia who may not pay sufficient attention to personal hygiene.

Among the symptoms caused by intestinal parasites are nausea, vomiting, diarrhea, abdominal pain, growth retardation, loss of appetite, weight loss, and anemia. The long-term effects of these parasites can lead to serious complications. Especially in children, they can result in disturbances in nutrient absorption, inadequate nutrition, mental retardation, and irritability. These conditions can negatively impact the healthy growth and developmental processes of children, particularly causing deficiencies in both intellectual and physical development (38-40). However, it's worth noting that these symptoms are commonly observed in disabled individuals for various reasons. Consequently, attributing the symptoms in disabled individuals solely to intestinal parasites becomes challenging. In this study, a significant relationship was found between the presence of intestinal protozoa and symptoms such as diarrhea ($p=0.046$), constipation ($p=0.035$), and loss of

appetite ($p=0.034$). On the other hand, there was no significant relationship observed between the presence of protozoa and symptoms such as weakness, abdominal pain, fever, nausea, vomiting, growth retardation, and weight loss.

Study Limitations

This study has several limitations. The first is that only native-Lugol and modified acid-fast staining method of stool samples were performed. Another limitation is that only disabled individuals registered in a single centre were included in the study.

CONCLUSION

In conclusion, this study reveals a high prevalence of intestinal protozoa, reaching up to 41%, among individuals with intellectual and/or physical disabilities. This high frequency underscores that intestinal protozoa pose a serious health concern for this specific patient population. Furthermore, it emphasizes the necessity of considering intestinal protozoa such as *Blastocystis*, *Cryptosporidium* spp., *G. intestinalis*, and *C. cayetanensis*, especially in individuals with intellectual and/or physical disabilities. The elevated risk of transmission of *Cryptosporidium* spp. may contribute to its high prevalence in these populations. The findings of our study underscore the significance of cryptosporidiosis once again. Taking into account the risk factors that predispose to infection, it is imperative to educate disabled individuals, caregivers, and parents about intestinal parasites. Additionally, increased attention to hygiene measures is essential to prevent the transmission of parasitic diseases, especially among individuals with conditions like spina bifida and hemiplegia.

***Information:** The results of the current study were summarized from a Master thesis of MS.

*Ethics

Ethics Committee Approval: Ethical approval for this study was obtained from the Non-Invasive Clinical Research Ethics Committee of Van Yüzüncü Yıl University (date: 14.10.2022, number: 2022/10-09).

Informed Consent: Informed consent was obtained from all participants involved in the study. Participation in this study was completely voluntary and anonymous.

Footnotes

*Authorship Contributions

Concept: H.Y., M.S., Design: H.Y., M.S., S.A., Data Collection or Processing: M.S., S.A., A.E., Analysis or Interpretation: M.S., S.A., A.E., Literature Search: M.S., S.A., Writing: M.S., S.A., H.Y.

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