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The Prevalence of Amoebiasis in Children Admitted to Gastro Department at Children's Hospital of Benghazi.

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Original Research Article

Abstract

Background: Amoebiasis, caused by the protozoan parasite Entamoeba histolytica, remains a major public health concern, particularly in less developed and developing regions where sanitation standards are inadequate.

Aim: To investigate the role of E. histolytica as a primary cause of gastroenteritis and to assess infection rates among children admitted to the Gastroenteritis Department at Benghazi Children's Hospital over a one-year period.

Method: A cross-sectional study was conducted by using records from the Parasitology Department between January and December 2023. A total of 1,443 stool samples were examined microscopically and categorized into four age groups: 1–3, 4–6, 7–9, and 10–14 years.

Results: The overall prevalence of E. histolytica/dispar was 35.3%. Giardia lamblia infections accounted for 2.8%, while other microbial infections—including fungal organisms such as Candida spp.—represented 1.2%. The highest infection rate was recorded in the Gastroenteritis Department (59.0%), compared to 30.1% in the Outpatient Department. Seasonal trends showed a peak prevalence of 5.5% in August and the lowest rate of 1.3% in April.

Conclusion: The study highlights the substantial burden of E. histolytica infections among children in Benghazi, emphasizing the urgent need for improved sanitation, enhanced public health strategies, and continuous monitoring to reduce infection rates.

Keywords: Parasites, Amebiasis, Entamoeba histolytica, Gastroenteritis.

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INTRODUCTION

Amoebiasis, caused by the protozoan parasite Entamoeba histolytica, constitutes a major human intestinal disease with significant public health implications, particularly in regions with inadequate sanitation. As a primary contributor to severe diarrheal illness, amoebiasis is responsible for an estimated 40,000–100,000 deaths annually worldwide [1]. The clinical presentation varies widely, encompassing asymptomatic carriage, mild gastrointestinal disturbances, and severe outcomes such as amoebic colitis and amoebic liver abscess (ALA), which can progress to invasive extra-intestinal disease [2]. The public health importance of amoebiasis is further magnified by its role in childhood diarrhea and its classification as a reportable disease in systems like Libya's National Notifiable Disease Reporting System (NNDRS) [3].

Transmission occurs primarily through the fecal-oral route via the ingestion of contaminated food or water containing resilient Entamoeba cysts (10–18 μm), which are resistant to standard chlorination [4]. Upon ingestion, these cysts undergo excystation in the small intestine, releasing motile trophozoites that colonize the large intestine and penetrate the intestinal mucosa, leading to the formation of characteristic flask-shaped ulcers [5]. Given its low infectious dose and environmental stability, E. histolytica is classified as a Category B priority biodefense pathogen by the NIAID [5]. Clinically, amoebic colitis typically presents with symptoms such as colicky abdominal pain, frequent bowel movements, and diarrhea often containing visible blood and mucus [1].

Globally, the prevalence of E. histolytica infection is highly disparate, with reported rates in Africa reaching 12.4% in South Africa and 58.3% in Kenya [6]. High regional prevalence is often attributed to risk factors such as inadequate sanitation and poor hygiene [6].

International studies have confirmed seasonal patterns in E. histolytica infections; for instance, 65.5% of documented cases in China occurred between May and October, peaking in June [7]. Additionally, a large-scale study in northern Jordan, examining 21,906 patients, found the highest prevalence of both G. lamblia and E. histolytica during the summer months [8].

Local epidemiological data from Libya highlight significant gaps in understanding the prevalence and impact of E. histolytica infections. A study conducted in Sebha and Mourzak reported an overall intestinal parasite infection rate of 16.0% in children, with E. histolytica/dispar (12.8%) being significantly more prevalent than Giardia lamblia (3.2%) (p=0.004) [9]. This study also noted a non-significant trend toward higher infection rates in males (18.6%) compared to females (12.9%) (p=0.401), while identifying a significant association between prevalence and seasonal variation (p=0.027), with peaks observed in March [9].

Supporting these findings, a separate survey in Zella City reported an overall parasitic prevalence of 87%, with E. histolytica dominating at 65%, particularly during the autumn and spring seasons [10]. These results underscore the persistent challenge of intestinal parasitic infections in Libya, despite improvements in cultural and social awareness.

Given these local and regional insights, the current study aims to address knowledge gaps regarding E. histolytica infections among children in Libya. Specifically, this study sought to determine the prevalence and seasonal trends of E. histolytica among children admitted to the Gastroenteritis Department at Benghazi Children's Hospital over one year. Furthermore, it aimed to investigate associations with age, gender, and the hospital department, thereby contributing valuable data to enhance understanding and management of amoebiasis in the local context.

METHOD

Study Setting

This cross- sectional study was carried out at Benghazi Children's Hospital in Benghazi, Libya, following formal approval from the hospital administration. Data was collected over a 12-month period, from January to December 2023. Cases of Entamoeba histolytica infection were identified through the examination of records obtained from

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the medical laboratories of the hospital's Parasitology Department.

Study Subjects

The study comprised stool samples primarily referred from the gastroenteritis department, while samples from other hospital departments were also included for comprehensiveness. Training in parasite detection, laboratory diagnosis, information collection, sample acquisition procedures, and necessary precautions was provided under the supervision of parasitology specialists. This included observation within the hospital's gastrointestinal tract department. Suspected cases of parasitic infection were categorized into four age groups for analysis: 1-3 years, 4-6 years, 7-9 years, and 10-14 years.

Stool Examination

Parasitological examination was conducted using direct wet mount microscopy on all referred samples, processed immediately after collection. A small fecal aliquot was mixed with iodine solution and examined under low (×10) and high (×40) power magnification to identify E. histolytica. Positive cases were defined by the presence of trophozoites or cysts, but microscopy cannot differentiate between E. histolytica and E. dispar. To enhance diagnostic accuracy, normal saline wet mounts were prepared, and concentration techniques were employed. Multiple slides were examined by trained technicians in a blinded manner to minimize bias, with inter-observer agreement assessed to ensure consistency. These considerations are crucial for accurately diagnosing E. histolytica infections and understanding the limitations of the microscopy techniques used.

Limitations of the Study

Several limitations were encountered in this study. Some cases were excluded due to missing or unrecorded patient age and gender data, along with ambiguous documentation of parasitic infections. Operational challenges arose during technician training, impacting consistency in sample processing. Additionally, logistical constraints in collaboration between the gastrointestinal department and the laboratory affected research activities. There was also insufficient information regarding patient residence, whether local to Benghazi or from external areas. It is important to note that the samples collected were from patients admitted to the hospital or attendees of the departments during their illness, which explains the difficulties in obtaining comprehensive information. These factors highlight the constraints imposed by the available data from Benghazi Children's Hospital.

Statistical Analysis

Collected data were coded, tabulated, and analyzed using the Statistical Package for the Social Sciences (SPSS 25) software. Descriptive statistics, employing counts and percentages, were used to summarize quantitative data. Analytical statistics involved the application of the Chi-square test to compare groups based on qualitative variables.

RESULTS

Analysis of 1,443 stool samples from children admitted to the gastroenteritis department revealed the following age distribution among participants (aged 1-14 years): the 1-3year age group comprised 395 cases (27.4%), the 4-6year group had 589 cases (40.8%), the 7-9year group included 441 cases (30.6%), and the 10-14year group accounted for 18 cases (1.2%) The results are presented in Table (1).

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Table 1. Distribution of participating according to age.

Age in years	Frequency	Percent	Valid Percent	Cumulative Percent
1-3	395	27.4	27.4	27.4
4-6	589	40.8	40.8	68.2
7-9	441	30.6	30.6	98.8
10-14	18	1.2	1.2	100.0
Total	1443	100.0	100.0	

Table 2 detail gender distribution, identifying 804 males (55.7%) and 639 females (44.3%). Table shows the age group between 4-6 years had the highest participation rate, where the percentage of boys was (22.5%) and girls (18.4%), followed by the age group between 7-9 years that was (18.2%) for boys and (12.3%) for girls While the lowest participation rate was in the age groups of 10-14 years and was (1.2%).

Table 2. Frequency and percentage of participating according to gender.

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Boy	804	55.7	55.7	55.7
Girl	639	44.3	42.9	100.0
Total	1443	100.0	100.0	

Table 3. Distribution of participating according to age and gender.

Age group Boy		Gender		Total
		Girl		
1-3	Count	210	185	395
	Total	14.6	12.8	27.4
4-6	Count	324	265	589
	Total	22.5	18.4	40.8
7-9	Count	263	178	441
	Total	18.2	12.3	30.6
10-14	Count	7	11	18
	Total	0.5%	0.8%	1.2
Total	Count	804	639	1443
	Total	55.7	44.3	100.0

No significant difference was identified between both groups ($p > 0.05$)

Pathogen distribution is shown in Table 4. Entamoeba histolytica/dispar was detected in 35.3% of samples, while Giardia spp. was found in 2.8%. Other microbial infections (including Candida spp.) accounted for 1.2%, with 60.7% of samples negative for the targeted parasites.

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Table 4. Distribution of participating according to type of parasites.

Type of parasite & other microbial.	Frequency	Percent	Valid Percent	Cumulative Percent
Candida spp.	17	1.2	1.2	1.2
E. histolytica/dispar	510	35.3	35.3	36.5
Giardia lamblia	40	2.8	2.8	39.3
Nil	876	60.7	60.7	100.0
Total	1443	100.0	100.0	

Table 5 illustrate the distribution across hospital departments. The gastroenteritis department contributed the majority of samples (59.0%), followed by the Outpatient Department (OPD) (30.1%), Medical Unit (MU) (6.2%), Intensive Care Unit (ICU) (3.0%), and Hematology (0.4%)

Table 5. Distribution of participating according to department.

Department	Frequency	Percent	Valid Percent	Cumulative Percent
Gastroenteritis	852	59.0	59.0	59.0
Hematology	6	.4	.4	59.5
ICU	44	3.0	3.0	62.5
MU	90	6.2	6.2	68.7
Nephron	16	1.1	1.1	69.9
OPD	435	30.1	30.1	100.0
Total	1443	100.0	100.0	

Seasonal variation in case presentation is displayed in Table 6. August recorded the highest caseload (14.3%), followed by October (10.9%). The lowest incidence was observed equally in March and April (5.5%).

Table 6. Distribution of participating according to months of years.

Months of the year	Frequency	Percent	Valid Percent	Cumulative Percent
January	125	8.7	8.7	44.8
February	98	6.8	6.8	36.1
March	80	5.5	5.5	62.5
April	80	5.5	5.5	5.5
May	123	8.5	8.5	71.0
June	94	6.5	6.5	57.0
July	82	5.7	5.7	50.5
August	207	14.3	14.3	19.9
September	126	8.7	8.7	100.0
October	157	10.9	10.9	91.3
November	135	9.4	9.4	80.4
December	136	9.4	9.4	29.3
Total	1443	100.0	100.0	

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The relationship between age and parasite infection is presented in Table 7. The 4–6-year age group exhibited the highest E. histolytica/dispar infection rate (15.0%), followed by the 7–9-year group (10.6%). The 10-14year group had the lowest rate (0.6%). The overall Giardia infection rate remained 2.8%.

Table 7. Distribution of participating according to relationship between age groups and types of parasites.

Age group and Type Cross-tabulation						
Age group Candida spp.		Type				Total
		E. histolytica/dispar	Giardia spp.	Nil		
1-3	Count	5	131	12	247	395
	Total	0.3	9.1	0.8	17.1	27.4
4-6	Count	2	217	15	355	589
	Total	0.1	15.0	1.0	24.6	40.8
7-9	Count	10	153	13	265	441
	Total	0.7	10.6	0.9	18.4	30.6
10-14	Count	0	9	0	9	18
	Total	0.0	0.6	0.0	0.6	1.2
Total	Count	17	510	40	876	1443
	Total	1.2	35.3	2.8	60.7	100.0

No significant difference was identified between both groups. P=.236 (p> 0.05)

Table 8 describe the association between gender and department. Males had higher admission rates to the gastroenteritis department (33.0% vs. 26.1% for females). Similarly, OPD presentation was higher in males (17.3%) compared to females (12.9%), potentially reflecting behavioral differences.

Table 8. Participating according to relationship between gender and department.

Department and Gender Cross-tabulation					
			Gender		Total
			boy	Girl	
Department	Gastro	Count	476	376	852
		Total	33.0	26.1	59.0
	Hematology	Count	4	2	6
		Total	0.3	0.1	0.4
	ICU	Count	21	23	44
		Total	1.5	1.6	3.0
	MU	Count	47	43	90
		Total	3.3	3.0	6.2
	Nephron	Count	7	9	16
		Total	0.5	0.6	1.1
	OPD	Count	249	186	435
		Total	17.3	12.9	30.1
Total		Count	804	639	1443
		55.7	44.3	100.0	

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No significant difference was identified between both groups. P=.666 (p> 0.05)

Table 9 represent the relationship between age groups and department. Children aged (4-6) years recorded the highest percentage of admission to the gastrointestinal ward with a percentage (24.5%). While the percentage was close in the same ward in the age groups (7-9, 1-3) the percentage was (17.7%, 16.2. respectively). As for the OPD, the age group (4-6) had the highest percentage was (12.0%). While the nephron department has the lowest admission rate among the age groups (1.1%). There is statistically significant difference was identified between groups (P≤ 0.05).

Table (9). Distribution of participating according to relationship between age group and department.

Department 1-3		Age group				Total
		4-6	7-9	10-14		
Gastro	Count	234	353	255	10	852
	Total	16.2	24.5	17.7	0.7	59
Hematology	Count	0	2	3	1	6
	Total	0.0	0.1	0.2	0.1%	0.4
ICU	Count	23	11	8	2	44
	Total	1.6	0.8	0.6	0.1	3.0
MU	Count	20	47	23	0	90
	Total	1.4	3.3	1.6	0.0	6.2
Nephron	Count	4	3	9	0	16
	Total	0.3	0.2	0.6	0.0	1.1
OPD	Count	114	173	143	5	435
	Total	7.9	12.0	9.9	0.3	30.1
Total	Count	395	589	441	18	1443
	Total	27.4	40.8	30.6	1.2	100

Finally, Table10 demonstrate the seasonality of E. histolytica/dispar infections. The peak infection rate occurred in August (5.5%), followed by September (4.2%), with the lowest rate in April (1.3%). The cumulative prevalence of E. histolytica/dispar infection over the study period was 35.3%.

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Table (10). Distribution of participating according to relationship between months and E. histolytica/dispar.

Months	E. histolytica/dispar Frequency (%)
January	35 (2.4)
February	30 (2.1)
March	29 (2.0)
April	19 (1.3)
May	45 (3.1)
June	31 (2.1)
July	44 (3.0)
August	79 (5.5)
September	60 (4.2)
October	54 (3.7)
November	45 (3.1)
December	39 (2.7)
Total	510 (35.3)

There is statistically significant difference was identified between months ($P \leq 0.05$).

describe the association between gender and department. Males had higher admission rates to the gastroenteritis department (33.0% vs. 26.1% for females). Similarly, OPD presentation was higher in males (17.3%) compared to females (12.9%), potentially reflecting behavioral differences.

DISCUSSION

The findings of this study provide critical insights into the demographic, seasonal, and clinical patterns of parasitic infections, particularly E. histolytica/dispar and Giardia lamblia, among children admitted to Benghazi Children's Hospital. The results underscore significant associations between age, gender, seasonal factors, and healthcare utilization, which align with broader epidemiological trends while highlighting region-specific risk factors.

Compared to recent international studies, the prevalence of Entamoeba histolytica/dispar in our cohort of children at Benghazi Children's Hospital (35.3%) is substantially greater than the 13.0% infection rate documented by Uchejeso et al in Nigeria, where differences are attributed to sanitation standards and sample characteristics [11]. In Kabul, Afghanistan, Mamozai et al described a lower infection prevalence in young children, emphasizing disparities linked to urban health resources and public health infrastructure [12]. Methodologically, our work utilized retrospective microscopy of stool samples throughout one year, whereas other studies applied more advanced molecular diagnostics, such as PCR and ELISA, offering greater sensitivity and species differentiation [13]. Seasonal variation found in our dataset aligns with Ethiopian findings, where peaks in amoebiasis prevalence have been connected to climate influences on transmission [14]. Overall, these international comparisons reinforce the significance of local sanitation conditions, diagnostic approaches, and healthcare systems in shaping regional prevalence rates and highlight the need for targeted public health interventions.

Demographic and Gender Disparities

The age distribution of cases revealed a pronounced vulnerability among children aged 4–6 years, who constituted the largest proportion of infections (40.8%) and exhibited the highest prevalence of E. histolytica/dispar (15.0%). This aligns with global evidence indicating heightened exposure to fecal-oral pathogens in early childhood due to exploratory behaviors, inadequate hygiene practices, and increased environmental interaction. Notably, the sharp decline in cases among older children (10–14 years: 1.2%) may reflect improved immunity or reduced exposure as children age. Gender disparities were evident, with boys (55.7%) disproportionately affected, particularly in high-risk departments like gastroenterology (33.0% boys vs. 26.1% girls). This aligns with the hypothesis that boys' outdoor activities in unsanitary environments elevate their exposure to contaminated water or soil, a phenomenon documented in low-resource settings with limited public health infrastructure.

Infection Patterns and Seasonal Trends

The dominance of E. histolytica/dispar (35.3%) over Giardia lamblia (2.8%) underscores the endemicity of amebiasis in the region, likely exacerbated by socioeconomic factors such as contaminated water sources, overcrowded housing, and poor hygiene practices. The high proportion of negative

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results (60.7%) suggests potential underdiagnosis, non-parasitic etiologies, or the influence of unmeasured variables like viral or bacterial pathogens. Seasonal variation in infections, peaking in August (14.3%) and October (10.9%), correlates with warmer temperatures and potential fluctuations in water quality or increased outdoor activity during summer months. The low April prevalence (1.3%) may reflect cooler weather reducing pathogen survival or seasonal hygiene campaigns, though further investigation is warranted.

Clinical and Public Health Implications

The predominance of gastroenteritis admissions (59.0%) highlights the burden of diarrheal diseases in this population, consistent with global data linking poverty and inadequate sanitation to gastrointestinal infections. The statistically significant age-department association ($p \leq 0.05$), particularly the high gastroenterology admissions among 4–6-year-olds (24.5%), reinforces the need for targeted interventions in this age group. Conversely, the minimal hematology involvement (0.4%) suggests parasitic infections in this cohort primarily manifest as acute gastrointestinal illness rather than systemic complications.

Limitations and Future Directions

While this study offers valuable insights, its hospital-based design limits generalizability to community settings, where asymptomatic or mild cases may go undetected. The reliance on hospital records may introduce selection bias, and the lack of granular socioeconomic data (e.g., household income, water source details) restricts the ability to fully elucidate risk factors. Future research should incorporate community-based longitudinal studies to capture broader epidemiological trends and evaluate interventions such as water purification programs, hygiene education, and routine deworming. Additionally, molecular diagnostics could clarify the prevalence of E. histolytica versus non-pathogenic Entamoeba dispar and Giardia lamblia, refining clinical management. Potential contributing factors to the high prevalence (e.g., socioeconomic conditions, water source quality, hygiene practices) were noted.

CONCLUSIONS

This study underscores the interplay of demographic, environmental, and seasonal factors in shaping the burden of parasitic infections among children in Benghazi. Addressing these challenges requires multisectoral efforts to improve sanitation infrastructure, promote hygiene education, and strengthen healthcare capacity for early diagnosis and treatment. Prioritizing high-risk groups—particularly young children and boys—could mitigate morbidity and reduce the strain on pediatric healthcare services.

From the present study, it could be concluded that amoebiasis remains one of the most significant enteropathogenesis worldwide. Most of the cases that were admitted to the gastroenteritis department, at the Benghazi Children's Hospital accounted for (35.3%) of the disease rate in this department.

RECOMMENDATIONS

The relatively uncomplicated lifecycle of Entamoeba species facilitates efficient transmission between human hosts, thereby ensuring their continued persistence as commensal-like organisms. Despite ongoing research, no effective vaccine is currently available, and treatment options remain limited to a single major class of drugs. These constraints make prevention particularly difficult and emphasize the urgent need for greater public health awareness, as well as the development of innovative therapeutic and preventive measures to control amoebic infections. Amoebiasis constitutes a health problem among children in Benghazi city. Therefore, the study recommended the following:

It has become clear to us from the current study and previous studies in Libya that the Entamoeba parasite is widespread, so we recommend combating the parasite in cooperation with the Ministry of Health.

Efforts should be made to raise clinicians' awareness of this parasitic diseases.

Technicians must be trained on how to detect parasites in multiple ways and not limited to the routine method.

Personal hygiene should to be promoted in the region through campaigns by the government.

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There is a need for continuous stool examination of children suffering from diarrhea in hospital and treatment given as infection rate was high to control the disease.

Illegal immigrants and expatriate workers may be one of the reasons for the spread of the disease, and we recommend conducting routine examinations to avoid the transmission of any diseases.

Avoid eating street foods especially in public places.

Parasitology is neglected in many laboratories, so we recommend that it be in the first ranks and that cooperation with the Ministry of Health be done in this so that parasitic diseases do not spread.

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