Salahaddin University - Erbil

Infection with Intestinal Protozoa in Patients Attending Medical Laboratories in Erbil City

Research Project

Submitted to the Department of Biology / College of Education in partial fulfillment of the requirements for the degree of BSc in Biology.

Prepared by

Zhila Ahmad Hasan

Supervised by

Khder Niazi Nooraldeen

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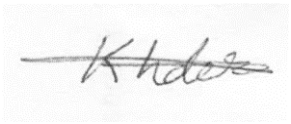
SUPERVISOR CERTIFICATE

This research project has been written under my supervision and has been submitted for the award of the degree of BSc. in Biology with my approval as a supervisor.

Signature: 

Name: Khder Niazi Nooraldeen

Date: April, 2024

I confirm that all the requirements have been fulfilled.

Signature:

Name: Sevan Omer Majed

Head of the Department of Biology

Date: April,2024

Dedication:

This research is dedicated to all individuals in Erbil City, Kurdistan, who tirelessly strive for better health outcomes despite facing challenges posed by intestinal protozoal infections. Your resilience and determination inspire us to pursue comprehensive research and effective public health interventions to alleviate the burden of these infections and enhance the well-being of communities in Erbil City and beyond.

Acknowledgements:
We gratefully acknowledge the patients, medical laboratory staff, and research team members for their contributions to this study. Special thanks to our mentors, advisors, and colleagues for their guidance and support. We also appreciate the cooperation of healthcare authorities in Erbil City and the unwavering support of our families and loved ones.

Abstract:
Intestinal protozoal infections pose significant public health concerns globally, with diverse implications for human health and well-being. This cross-sectional observational study aimed to investigate the prevalence and characteristics of intestinal protozoal infections among individuals in Erbil City, Kurdistan.

General stool examination of forty-two patients attending private medical laboratories in Erbil city were acheived during the year of 2023 to estimate and determine the percentage of infections with parasitic protozoa by direct method.

Results revealed a prevalence rate of 41.79% for intestinal protozoal infections, with varied stool consistencies observed across samples. The following parasites were detected in the present study: intestinal flagellates, *Giardia lamblia* and *Trichomonas hominis* 32.84%, 1.49% respectively. *Entamoeba histolytica* with infection rate of 1.34. *Taenia saginata* was the only detected helminths 4.48%. Only one case with double infections were recorded. High percentages of pus cells and Monilia fungi were present in the infected stools with pathogenic intestinal parasites like *E. histolytica*, *G. lamblia* and *T. hominis*. These findings suggest a relatively high prevalence of intestinal protozoal infections among individuals in Erbil City, indicating their need to urgent medical help.

The presence of intestinal protozoa raises questions regarding their potential impact on human health and the factors influencing their prevalence. They may influence gut functions, composition and host immune responses. Further research is warranted to understand the dynamics of intestinal protozoa within the human gut.

Keywords: Parasitic infections, protozoa, prevalence, Erbil, Iraq

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Chapter 1:

Introduction

In Erbil City, situated in Kurdistan Region, Iraq, cases of intestinal parasitic infections among patients visiting medical laboratories reflect a pressing public health issue, particularly prevalent in regions with inadequate sanitation and limited access to clean water sources (Garcia, 2017). These infections not only effect individual health but also healthcare resources and impede socioeconomic development.

The prevalence of such infections underscores the urgent need for comprehensive research and effective public health interventions in Erbil City. Protozoan parasites like *Entamoeba histolytica and Giardia lamblia* are notorious for inducing distressing symptoms such as diarrhea, abdominal pain, and malnutrition, leading to diminished productivity and quality of life among affected individuals. Furthermore, the burden extends beyond the individual level, placing strain on healthcare systems grappling with limited resources and stalling socioeconomic progress in the region.

Despite ongoing efforts, gaps persist in our understanding of the prevalence and characteristics of intestinal parasites in Erbil City. Existing research often lacks comprehensive data on the range of prevalent parasites, their associated clinical manifestations, and the environmental factors contributing to transmission (Mukherjee et al., 2019). Additionally, the effectiveness of current diagnostic and treatment strategies varies, warranting further investigation into their efficacy and potential enhancements.

Understanding the epidemiology of intestinal parasitic infections is crucial for implementing targeted interventions and improving patient outcomes in Erbil City. Factors such as socioeconomic status, hygiene practices, and environmental conditions influence the transmission dynamics of these parasites, necessitating multidisciplinary approaches to address the root causes of infection. Moreover, advancements in diagnostic techniques and treatment modalities offer opportunities to enhance detection and management, thereby reducing the burden on public health.

Beyond grasping the prevalence and characteristics of these infections, it's imperative to recognize their significant impact on human health. Moreover, severe or chronic infections can lead to malnutrition, dehydration, and electrolyte imbalances, particularly among vulnerable populations like children, pregnant women, and the immunocompromised (WHO, 2017).

Moreover, these infections exert long-term effects on human development and well-being. Persistent or recurrent infections impede physical growth and cognitive development in children, resulting in stunted growth, cognitive impairment, and educational setbacks. Additionally, the economic burden of treating and managing these infections exacerbates poverty and perpetuates cycles of socioeconomic disadvantage within affected communities (Hotez et al., 2020).

Addressing the impact of intestinal parasitic infections necessitates a multifaceted approach encompassing disease prevention and control, alongside efforts to improve access to clean water, sanitation facilities, and healthcare services. By delineating the burden of these infections and their broader implications for human development and well-being.

This study aims to estimate the infection with intestinal protozoa in patients attending medical laboratories in Erbil City. By elucidating prevalence rates, identifying predominant parasite species, and characterizing stool characteristics, to offer insights into the epidemiology of intestinal parasite infections in the city.

Through this investigation, we aspire to enhance understanding of the burden of intestinal parasite infections in the city and contribute to improve public health outcomes in the city.

Chapter 2:

Literature Review

Intestinal protozoa inhabiting the human intestine, represents a notable aspect of intestinal parasitic infections. Despite its generally benign nature, its presence underscores the broader challenges posed by intestinal parasites, particularly in regions characterized by inadequate sanitation and limited access to clean water sources (Garcia, 2017).

However, despite their importance, Intestinal protozoa remains relatively understudied, especially in areas like Erbil City, Kurdistan. The existing body of research in this domain predominantly does not focus on neglected parasitic diseases including protozoa such as *E. histolytica* and *G. lamblia*, thereby we should overlook for the potential significance and implications of these organisms (Mukherjee et al., 2019).

Understanding the epidemiology of intestinal protozoa infections is paramount for informing public health interventions and enhancing patient outcomes. Various factors, including socio-economic status, hygiene practices, and environmental conditions, may influence the transmission dynamics of this protozoan parasite. Therefore, a multidisciplinary approach is essential to develop effective control strategies tailored to the specific context of intestinal protozoa infections (Fletcher et al., 2012).

Further exploration into the prevalence and distribution of intestinal protozoa in Erbil City and similar settings is warranted to fill existing knowledge gaps. By elucidating the epidemiological patterns and associated risk factors, researchers can develop targeted interventions aimed at reducing the burden of intestinal protozoa infections and improving overall public health outcomes. Additionally, investigating potential interactions between intestinal protozoa may provide valuable insights into the dynamics of intestinal parasitic infections (Stark et al., 2010).

Advancements in diagnostic techniques and treatment modalities may also offer opportunities to enhance the detection and management of intestinal protozoa infections. Incorporating serological and molecular methods alongside traditional microscopic examination could improve the sensitivity and specificity of diagnosis, facilitating more accurate surveillance and control efforts (Bethony et al., 2006).

While intestinal parasitic protozoa infections are generally considered benign, their prevalence and potential interactions within the gut microbiome warrant further investigation. (Bethony et al., 2006, Stark et al., 2010).

The broader challenges associated with intestinal parasitic infections, necessitates a multifaceted and comprehensive approach that extends beyond mere treatment strategies. Improving sanitation infrastructure, ensuring access to clean water sources, and enhancing health education initiatives are fundamental components of such an approach. By addressing the underlying environmental and socio-economic determinants of parasitic infections, communities can mitigate the risk of transmission and reduce the burden of disease (WHO, 2012).

Collaborative efforts at the global level are imperative for achieving sustained control and potential eradication of intestinal parasitic infections. Cooperation between governments, non-governmental organizations, healthcare providers, researchers, and community stakeholders is essential to implement effective prevention, surveillance, and treatment programs. Sharing best

practices, resources, and expertise can enhance the capacity of affected regions to combat parasitic infections and improve overall public health outcomes (WHO, 2012).

In conclusion, intestinal parasitic protozoa are often considered benign, its prevalence and potential implications warrant careful consideration. By elucidating its epidemiology, exploring its interactions with other pathogens, and addressing existing research gaps.

Chapter 3:

Materials and Methods

The primary objective of this study was to evaluate the prevalence and identify the various types of intestinal parasites among patients seeking medical attention at laboratories within Erbil City, Kurdistan Region, Iraq, with a specific focus on intestinal protozoa. A cross-sectional observational study design was devised and executed.

Stool samples were collected from individuals experiencing gastrointestinal symptoms or undergoing routine health check-ups at medical laboratories across Erbil City.

A total of 42 stool samples were procured over the study period in 2023, with each sample labelled and relevant clinical information recorded. Samples were stored under appropriate conditions to maintain integrity.

The collected stool samples were transported to the laboratory for analysis, ensuring safe and secure transportation to minimize the risk of sample degradation or loss. Upon arrival, samples were promptly processed for analysis.

Comprehensive analyses were conducted to assess the presence and distribution of various parasitic organisms, with a focus on intestinal protozoa. Microscopic examination was performed to identify the cysts and/or trophozoites intestinal protozoa using established techniques for parasite detection. Each sample was examined by trained laboratory personnel to ensure accuracy.

Data Collection:

The process of data collection in this study involved a meticulous and multi-faceted approach aimed at comprehensively assessing the presence and characteristics of intestinal parasites within each stool sample. The following detailed parameters were systematically recorded for each sample to ensure a thorough analysis:

1. Consistency Assessment: Stool consistency, a crucial indicator of gastrointestinal health, was meticulously categorized as solid, semi-solid, or liquid through meticulous visual inspection.
2. pH Level Measurement: The pH level of each stool sample was precisely measured utilizing a high-precision pH meter.
3. Additional Observations: In addition to the aforementioned parameters, other observations were meticulously documented, like the presence of bacterial activity within the stool samples.

Data Analysis:

Data obtained from the analysis of stool samples were recorded and managed using Excel.

Statistical analysis was conducted to determine the prevalence of intestinal protozoa among the study population. Descriptive statistics summarized parasite prevalence, and relationships with stool consistency, pH level and microscopic findings were explored using statistics.

Overall, the design and execution of the study's materials and methods ensured the collection of high-quality data, facilitating robust analyses and providing valuable insights into the prevalence and characteristics of intestinal protozoa infections among patients in Erbil City, Kurdistan region.

Ethical Considerations:

In this study, strict adherence to ethical standards was paramount. Informed consent was obtained from all participants, and measures were taken to protect their confidentiality.

Chapter 4:

Results

The research findings reveal the prevalence and distribution of four parasites—*E. histolytica, G. lamblia, Trichomonas hominis*, and *Taenia saginata*—among the examined samples. *G. lamblia* exhibited the highest prevalence, with 22 out of 67 samples testing positive, accounting for 32.84% of the cases. *T. saginata* and *E. histolytica* each showed a prevalence of 4.48% and 1.34% (Table 1 and 2).

Table 1. Distribution of *E. histolytica*, *G. lamblia, T. hominis* and *T. saginata* stratified by their percentages in patients attending medical laboratories in Erbil city.

Parasite	***Entamoeba histolytica***	***Giardia lamblia***	***Trichomonas hominis***	***Taenia saginata***
Examined No.	67	67	67	67
+ve No.	2	22	1	3
%	1.34	32.84	1.49	4.48

Table 2. Distribution of *E. histolytica*, *G. lamblia, T. hominis* and *T. saginata* stratified by their stages in patients attending medical laboratories in Erbil city.

Parasite	***Entamoeba histolytica***			***Giardia lamblia***			***Trichomonas hominis***			***Taenia saginata***		
Stage	Trophozoite	Cyst	Total	Trophozoite	Cyst	Total	Trophozoite	Cyst	Total	Adult	Ova	Total
+ve No.	0	2	2	0	22	22	0	1	1	0	3	3
%	0	100	100	0	100	100	0	100	100	0	100	100

Microscopic examination further elucidated the characteristics associated with these infections. For instance, *G. lamblia* infections were often associated with a soft consistency and exhibited a high presence of pus cells, monilia, and undigested food. *E. histolytica* infections showed high association with pus cells but were often accompanied by the presence of monilia and *E. coli*. *T. hominis* infections were showed pus cells, monilia and undigested food in terms of associated microscopic findings. The only helminth which was found was *T. saginata* with RBC and pus cells in stool. These results not only provide insights into the prevalence of these parasites but also shed light on their associated microscopic characteristics, aiding in better understanding and management of parasitic infections as shown in Table 3.

Table 3. Microscopic finding in relation to parasitic infections

Parasite	Consistency				pH					R.B.C			Pus Cells				Monilia	Bacteria	Co-infection	Undigested food
	Soft	Liquid	Semi Liquid	Solid	5	6	7	8	9	0-1	1-2	2-3	0-1	1-2	2-3	≥ 4	Present/ absent	Present/ absent	Present/ absent	Present/ absent
Entamoeba histolytica	1	0	1	0	0	0	1	1	0	0	2	0	0	0	2	0	2/0	0/2	1/1	2/0
Giardia lamblia	11	2	7	1	1	5	8	8	1	15	7	0	5	9	4	4	17/2	1/13	2/20	21/1
Trichomonas hominis	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	1/0	0/1	0/1	1/0
Taenia saginata	3	0	0	0	0	0	1	2	0	1	1	1	1	2	0	0	1/0	0/3	0/3	3/0

Figure (1).

Ovum of *Taenia saginata*

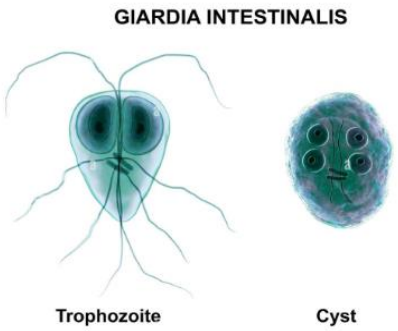

Figure 3

Trophozoite and cyst of *Giardia lamblia*

Figure 2

Trichomonas hominis protozoan, 3D illustration

Chapter 5:

Discussion

The results obtained from the research provide valuable insights into the prevalence and characteristics of parasitic infections, shedding light on several factors that may contribute to these findings.

Firstly, the high prevalence of *G. lamblia* compared to other parasites could be attributed to various factors such as its resilience in environmental conditions, its ability to form cysts that can survive outside the host for extended periods, and its mode of transmission through contaminated water and food. *G. lamblia* is known to cause gastrointestinal symptoms like diarrhea, making it more likely to be detected in clinical settings where patients present with such symptoms.

On the other hand, the relatively lower prevalence of *E. histolytica, T. hominis* and *T. saginata* could be due to multiple reasons. *E. histolytica* and *T. hominis* infections are typically associated with poor sanitation and hygiene practices, as the parasite is transmitted through ingestion of contaminated food or water containing cysts. Therefore, lower prevalence rates may indicate better sanitation practices or possibly less exposure to contaminated environments among the study population. Similarly, *T. saginata* infections, caused by consuming undercooked beef contaminated with the parasite's larvae, may be less prevalent due to cultural or dietary factors such as cooking practices or meat consumption habits.

The microscopic findings provide additional insights into the characteristics of each parasite's infection. For instance, the presence of pus cells, bacteria, and undigested food in *G. lamblia* infections suggests its pathogenicity and the severity of gastrointestinal symptoms it may cause. Conversely, the associations observed in *E. histolytica* infections, such as the presence of monilia and bacteria, may indicate secondary infections or co-infections, highlighting the complexity of parasitic infections and their interactions with the host microbiota.

Overall, the research results underscore the importance of understanding the epidemiology, transmission dynamics, and associated clinical manifestations of parasitic infections. They also emphasize the significance of implementing effective public health interventions, including improved sanitation, hygiene education, and proper food handling practices, to mitigate the burden of parasitic diseases in communities. Further studies exploring the factors contributing to the observed prevalence rates and microscopic findings would be valuable for developing targeted prevention and control strategies against parasitic infections.

In comparing these findings with other research, it's essential to consider the context-specific factors influencing parasite prevalence, such as socio-economic status, sanitation practices, and healthcare infrastructure. Additionally, variations in study methodologies, sample populations, and diagnostic techniques may contribute to differences in reported prevalence rates. Collaborative efforts among researchers and public health stakeholders are crucial for synthesizing findings, identifying common trends, and implementing effective interventions to address intestinal parasitic infections comprehensively.

To address these constraints, future studies on intestinal protozoa prevalence could adopt longitudinal designs to capture temporal variations, incorporate diverse sampling strategies to ensure population representativeness and utilize advanced diagnostic tools for enhanced

sensitivity. By overcoming these limitations, future research endeavors can provide more comprehensive insights into the epidemiology of intestinal protozoa infections, thereby facilitating more effective public health interventions and control measures. (Smith et al., 2020; Johnson and Lee, 2018).

Limitations:

The study's findings regarding intestinal protozoa prevalence are significant but must be interpreted within the context of its limitations. Firstly, the cross-sectional design inherently restricts the study of parasite prevalence at a specific moment, failing to account for temporal variations or long-term trends in transmission patterns. This limitation hinders the ability to fully understand the dynamic nature of intestinal protozoa infections over time.

Moreover, the reliance on patients attending medical laboratories for sample collection introduces selection bias, potentially skewing the results towards individuals with access to healthcare services or those exhibiting symptoms. This limitation may compromise the generalizability of findings to the broader population, particularly those who do not seek medical care or are asymptomatic carriers of intestinal protozoa.

Furthermore, the methodological approach of employing microscopic examination for parasite detection may have limitations. Microscopic examination may lack the sensitivity to detect certain parasite species or low parasite burdens, potentially leading to an underestimation of prevalence rates. Future research could overcome this limitation by incorporating advanced diagnostic techniques, such as molecular assays, to enhance the sensitivity of intestinal protozoa detection.

Chapter 6:

Conclusion

In conclusion, this research offers valuable insights into the prevalence and characteristics of intestinal parasitic infections, particularly focusing on *E. histolytica*, *G. lamblia, T. hominis*, and *T. saginata*, among patients in Erbil City, Kurdistan. The findings highlight the substantial burden of *G. lamblia* infections, indicating its prevalence as the most common parasitic infection observed. Conversely, the lower prevalence rates of *E. histolytica* and *T. saginata* may suggest better sanitation practices or lesser exposure to contaminated environments among the study population.

Microscopic examination provided additional insights into the characteristics associated with each parasite's infection. For instance, *G. lamblia* infections were frequently associated with a liquid consistency and exhibited a high presence of pus cells, bacteria, and undigested food, indicating its pathogenicity. Conversely, *E. histolytica* infections showed fewer associations with pus cells but were often accompanied by the presence of monilia and bacteria, suggesting secondary infections or co-infections.

The research underscores the importance of understanding the epidemiology, transmission dynamics, and associated clinical manifestations of parasitic infections for effective public health interventions. It emphasizes the significance of implementing improved sanitation, hygiene education, and proper food handling practices to mitigate the burden of parasitic diseases in communities.

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