Intestinal Parasitic Infections Among Aqaba Population (Southern Jordan)

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Abstract
Intestinal parasitic infections (IPIs) are associated with anemia, malabsorption and retarded cognitive development these diseases are complicating the clinical picture of more serious infections like human immunodeficiency virus (HIV), tuberculosis (TB) and malaria.

Information about the laboratory results of stool examinations for the previous three years were collected from two private laboratories in Aqaba (Sultan medical Lab and Ayla medical Lab) to identify intestinal parasites in residents of the city of Aqaba, South Jordan.

The total number of stool samples in the two medical laboratories was 7192 and samples were collected from the beginning of 2020 to the end of October 2022. 908 intestinal parasites were detected, with a rate of 12.62%.

The types of parasites that were found are Entamoeba histolytica Cyst, Entamoeba histolytica trophozoite, Chilomastix mesnili Ova of Enterobius vermicularis, Taenia saginata, Giardia and Trichomonas hominis.

The results that IPIs are common health problems in Aqaba.

Key words: Intestinal, parasite, infection, Entamoeba, stool.

1. INTRODUCTION

Many people in this world suffer from intestinal parasitic infections (IPIs) especially soil- transmitted helminthiasis (STHs) the main species are Ascaris lumbricoides, Trichuris trichiura and the hookworms [1]. In 2010 alone 464, 438 and 819 million people were infected with T. trichiura, hookworm and A. lumbricoides, respectively [2]. IPIs greatly affect the socio-economic development of communities in multiple ways [3], [4]. From health perspective, IPIs affect the physical and mental wellbeing of schoolchildren thereby leading to retarded cognitive increased absenteeism, and thus learning disabilities [5], [6] although the literature is inconclusive [7]. Mostimportantly, IPIs complicate the clinical picture of more serious diseases like HIV/AIDS [8], [9] andmalaria [10].

Eco-climatic conditions, geo-locality, environmental behavioral, socioeconomic, demographic and cultural factors influence the prevalence of infection with different types of intestinal parasites [11]–[15]. There is a need to continuously screen endemic communities to reduce the burden of IPIs as the WHO recommends periodic de-worming of IPIs, twice per annum if prevalence is over 50% and once if prevalence exceeds 20% [16]. Especially, more vulnerable groups, because of various additional socioeconomic, political or behavioral factors, require special attention. The risk of acquiring infectious or noninfectious diseases, including poor mentalhealth, or activation and aggravation of already existing illness.

Some poor people in high-density urban areas with existing health problems like IPIs do not receive proper medical attention [17]. Infectious diseases in general and IPIs in particular are concern of some residents in some areas in Aqaba because they are susceptible to disease through poor healthcare, overcrowding, demographics, high-risk behaviors, low-

level immunity due to stress and inadequate or poor nutritional quality, and overall low-living standards compared to the general population [19].

Aqaba is a district town (southern of Jordan) 330 km south of Amman. The city has some very poor and density populated neighborhoods are at a greater risk of exposure to intestinalparasites because of occupational risk [27].

A little information is available on the magnitude of intestinal parasites problem in Aqaba. Thus, the objective of the current study was to bridge this gap. The study is expected to help healthcare providers and concerned administrators make informed decision in resource mobilization and design of appropriate control strategies.

2. MATERIALS AND METHODS

Study area and population Study setting: Aqaba city Area.Study population:
People suffer from symptoms related to intestinal infections like abdominal pain, diarrhea, weight loss, etc., whom were referred by their doctors to private laboratories in Aqaba city during2020 to 2022 for stool analyses.

Data collection
Data related to the results of the stool investigations for IPIs during 2020 to 2022 (7192 samples)were collected from the records of Sultan medical Lab and Ayla medical Lab. Fresh stool samples were collected in sterile containers and examined using light microscopy for the presence of ova, larvae or cysts of intestinal parasites by direct smear and formalin-ethyl acetate sedimentation techniques [31].

Ethics Statement
Institutional ethical clearance was obtained from the former Department of Biology Bioethics Review Committee, Jordan University/ Aqaba branch. In general, the authors have followed bestpractices in publication and research ethics.

3. RESULTS

As shown in table No.1, the analysis of 7192 stool samples at Sultan and Ayla Medical Laboratories during the last two years, indicated that the total number of samples containing intestinal parasites (Ips) was 707 with an average of 9.83 %. The most two frequent types of parasites were *Entamoeba histolytica Cyst and Entamoeba histolytica trophozoite* (66.3% and 31.4% of all diagnosed Ips and 6.52% and 3.09% of stool samples respectively). The presence rateof other Ips as *Entamoeba histolytica trophozoite, Giardia, Trichomonas hominis, Enterobius vermicularis, Chilomastix mesnili Ova Taenia saginata* was vey low ranging from 1.4% of all diagnosed Ips to 0.1%.

Table I : Number of Samples Containing Intestinal Parasites (Ips) According to Type of Parasiteas Diagnosed by Sultan and Ayla Medical Laboratories in Aqaba During 2021-2022 (N= 7192)

Parasite type	**No.**	**% IPs**	**% Stool Samples**
Entamoeba histolytica Cyst	469	66.3	6.52
Entamoeba histolytica trophozoite	222	31.4	3.09
Giardia	9	1.4	0.13
Trichomonas hominis	3	0.4	0.04
Enterobius vermicularis	2	0.3	0.03
Chilomastix mesnili Ova	1	0.1	0.01
Taenia saginata	1	0.1	0.01
Total	**707**	**100%**	**9.83**

4. DISCUSSION

Since Sultan and Ayla Medical Laboratories are among the largest private medical laboratories in Aqaba and the stool specimens were taken from adult people live in different locations of thecity, the results of the existing study could be generalized to Aqaba population. As revealed by this study, intestinal parasite infections that constitutes about 10% of the examined stool samples should be considered as an important health problem in Aqaba.

Intestinal parasite Entamoeba histolytica is an important health problem worldwide. It causes Amebiasis with about 500 million cases worldwide, and estimated 70 000 deaths annually.

Amebiasis is the third leading parasitic cause of death worldwide. It is an important health problem, especially in developing countries (40).

The higher rate of feco-orally transmitted infections like E. histolytica/dispar/moshkovskii indicates dissemination of these infections under institutional conditions. Once infected, individuals may indefinitely propagate the protozoa unless treated. This may explain the mostcommon occurrence of entamoeba among the Aqaba populations as revealed by the present study. Contamination of drinking water with Entamoeba species has been increasingly recognized as a cause of water-borne human disease worldwide [33].

Some Aqaba Area lack basic healthcare facilities including proper record systems. So, it was difficult to cross-check the self-reported data. When intestinal discomforts are felt it is not uncommon to take metronidazole or mebendazole/albendazole, by some aware and financially able people, from private drug vendors. The likelihood of losing the detail of an infection and itstreatment is present because laboratory data was missing this information [34].
Although confounding factors may not always be corrected for, IPIs showed significant variation between different ethnic or tribal groups in certain settings [35]. However, the current study could not reveal association between presence of IPIs and ethnicity suggesting lack of genetic predisposition for the examined parasites. Differences in the method of stool detection, climateof the study area, study season, experience of screening technicians and overall quality control procedures may account for the differences in the prevalence of intestinal parasites in Aqaba compared to other cities in Jordan.

Nowadays there are significant improvements in the level of community awareness about personal and environmental hygiene and parasite transmission. Enhanced outreach strategy and extensive health extension services including periodic deworming schemes have contributed towards decline of IPIs in the general population. Changing patterns are being noticed in the prevalence of intestinal parasites as it is the case elsewhere in Jordan [39].

In general, the detection of intestinal parasites in the study population is a reflection of the poor environmental sanitation and personal hygienic practices. Sanitary facilities in the homes/workplaces may be inadequate to the majority of the people. Equally, the migration ofpeople from central and northern parts of Jordan and Egypt to Aqaba seeking for jobs may be identified as an important epidemiological factor for the introduction of a wide range of intestinal parasites in Aqaba.

5. LIMITATIONS OF THE STUDY

This study included only 2 main private laboratories; it would have been better if it could includemore laboratories in various regions including public and private health sectors of Aqaba city to be a multicenter study. However, the numbers of stool investigations represented a quite sufficient representative sample of the population in Aqaba city. A study of the immunological and socioeconomic factors and genetic analysis would have been of value to explain the possibleunderlying mechanisms of severity of Entamoeba Histolytica infection in Aqaba.

6. CONCLUSIONS

Intestinal parasitism in general is a public health problem in Aqaba. The most commonly encountered parasites in the study have the potential to cause anemia and malabsorption and other complications. Therefore, routine examination of stool samples and treatment of infected individuals on regular basis would significantly contribute towards improving the health condition of Aqaba population, thereby reducing the burden of IPIs in the wider population. Intervention strategies including health education on personal hygiene are required. A comprehensive investigation of intestinal parasites in the region is highly recommended.

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REFERENCES

1. Brooker S (2010) Estimating the global distribution and disease burden of intestinal nematodeinfections: adding up the numbers–a review. Int J Parasitol 40: 1137–1144. [PMC free article] [PubMed] [Google Scholar]
2. Pullan LR, Smith LJ, Jasrasaria R, Brooker JS (2014) Global numbers of infection and disease burden of soil transmitted helminth infections in 2010. *Parasit Vectors* 7: 37. [PMC free article] [PubMed] [Google Scholar]
3. Hotez P (2008) Hookworm and poverty. *Ann N Y Acad Sci* 1136: 38–44. [PubMed] [GoogleScholar]
4. King CH (2010) Parasites and poverty: the case of schistosomiasis. *Acta Trop* 113: 95–104. [PMC free article] [PubMed] [Google Scholar]
5. Stephenson LS, Latham MC, Adams EJ, Kinoti SN, Pertet A (1993) Physical fitness, growth andappetite of Kenyan school boys with hookworm, Trichuris trichiura and Ascaris lumbricoides infections are improved four months after a single dose of albendazole. *J Nutr* 123: 1036–1046. [PubMed] [Google Scholar]
6. Koroma MM, Williams RAM, LaHave RDB R, Hodges M (1996) Effects of albendazole on growth of primary schoolchildren and the prevalence and intensity of soil-transmitted helminths in Sierra Leone. *J Trop Pediat* 42: 371–372. [PubMed] [Google Scholar]
7. Dickson R, Awasthi S, Williamson P, Demellweek C, Garner P (2000) Effects of treatment for intestinal helminth infection on growth and cognitive performance in children: systematic review ofrandomised trials. *BMJ* 320: 1697–1701. [PMC free article] [PubMed] [Google Scholar]
8. Alemu A, Shiferaw Y, Getnet G, Yalew A, Addis Z (2011) Opportunistic and other intestinal parasites among HIV/AIDS patients attending Gambi higher clinic in Bahir Dar city, North West Ethiopia. *Asian Pac J Trop Med*

4(8): 661–665. [PubMed] [Google Scholar]
9. Wokem GN, Chuku C, Nwachukwu BC (2008) Prevalence of intestinal parasites seen in HIV sero-positive subjects in Port Harcourt, Nigeria. *Nig J Parasit* 29(2): 115–120. [Google Scholar]
10. Degarege A, Animut A, Legesse M, Erko B (2010) Malaria and helminth co-infections in outpatients of Alaba Kulito Health Center, southern Ethiopia: a cross sectional study. *BMC research notes* 3: 143. [PMC free article] [PubMed] [Google Scholar]
11. Mahfouz AAR, El-Morshedy H, Farghaly A, Khalil A (1997) Ecological determinants of intestinal parasitic infections among pre-school children in an urban squatter settlement of Egypt. *J Trop Pediat* 43: 341. [PubMed] [Google Scholar]
12. Östan İ, Kilimcioğlu AA, Girginkardes Ņ Özyurt BC, Limoncu ME, et al. (2007) Health inequities: lower socio-economic conditions and higher incidences of intestinal parasites. *BMC Public Health* 7: 342. [PMC free article] [PubMed] [Google Scholar]
13. Rayan P, Verghese S, McDonnell PA (2010) Geographical location and age affects the incidence of parasitic infestations in school children. *Indian J Pathol Microbiol* 53: 498–502. [PubMed] [GoogleScholar]
14. Pullan RL, Brooker SJ (2012) The global limits and population at risk of soil-transmitted helminth infections in 2010. *Parasit Vectors* 5: 81. [PMC free article] [PubMed] [Google Scholar]
15. Nasr NA, Al-Mekhlafi HM, Ahmed A, Roslan MA, Bulgiba A (2013) Towards an effective control programme of soil-transmitted helminth infections among in rural Malaysia. Part 1: Prevalence and associated key factors. *Parasit Vectors* 6: 27. [PMC free article] [PubMed] [Google Scholar]
16. WHO (2006) "Neglected Tropical Diseases, hidden successes, emerging opportunities".44 p. Available: http://whqlibdoc.who.int/hq/2006/WHO_CDS_NTD_2006.2_eng.pdf. Accessed 2014 Apr15.
17. WHO website. Available: http://www.euro.who.int/en/health-topics/health- determinants/prisons-and-health/who-health-in-prisons-programme-hipp. Accessed 2014 Apr 10.
18. Wikipedia website. Available: http://en.wikipedia.org/wiki/Prison. Accessed 2014 Apr 10.
19. Fraser A (2007) Primary health care in prisons. In: Møller L, Gatherer A, Jürgens R, Stöver H, Nikogosian H, editors.Health in Prisons: A WHO Guide to the Essentials in Prison Health. WHO Regional Office Europe. pp. 21–31. [Google Scholar]
20. Weisbuch JC (1992) Prison health. In: Last JM, Wallace RB, editors.Public health and preventive medicine, 13rd ed.California: Appleton and Lange. pp. 1159–62. [Google Scholar]
21. Kyrönseppä H, Pettersson T (1976) The occurrence of human intestinal parasites in Finland. *Scand J Infect Dis* 8(3): 199–202. [PubMed] [Google Scholar]
22. Mecroritch E, Eaton RD (1965) Outbreak of amoebiasis among Indian inmates in North Western Sackatchewan, Canada. *Am J Trop Med Hyg* 4: 719–723. [Google Scholar]
23. Alonso-Sanz M, Chaves F, Dronda F, Catalán S, González-López A (1995) Intestinal parasitoses in the prison population in the Madrid area (1991-1993). *Enferm Infecc Microbiol Clin* 13(4): 228. [PubMed] [Google Scholar]
24. Okolie N (2008) Intestinal parasites distribution among inmates of Owerri prison. *The Internet J Parasitic Dis* 4(1). [Google Scholar]
25. Addis Fortune News Paper (2012 Nov 06, vol 12 no 601). Available: http://addisfortune.com/. Accessed 2013 Feb 10.
26. Wikipedia website. Available: en.wikipedia.org/wiki/Shewa_Robit. Accessed 2012 Nov 05.
27. Dejenie T, Petros B (2009) Irrigation practices and intestinal helminth infections in Southern and Central Zones of Tigray. *Ethiop J Health Dev* 23(1): 48–56. [Google Scholar]
28. Kloos H, Tesfayohannes TM (1993) Intestinal parasitism. In: Kloos H & Zein AZ, editors.The ecology of health and disease in Ethiopia.Oxford: West View Press. pp. 223–235. [Google Scholar]
29. Mamo H, Esen M, Ajua A, Theisen M, Mordmüller B, et al. (2013) Humoral immune response to Plasmodium falciparum vaccine candidate GMZ2 and its components in populations naturally exposed to seasonal malaria in Ethiopia. *Malar J* 12: 51. [PMC free article] [PubMed] [Google Scholar]
30. Munyekenye OG, Githeko AK, Zhou G, Mushinzimana E, Minakawa N, et al. (2005) Plasmodium falciparum spatial analysis, Western Kenya Highlands. *EID* 11(10): 1571–1577. [PMC free article] [PubMed] [Google Scholar]
31. World Health Organization (1991) Basic Laboratory Methods in Medical Parasitology, World Health Organization, Geneva, Switzerland.
32. Amuga G, Usman D, Onwuliri OCE (2006) Human intestinal parasites among inmates of Keffi Prison, Nasarawa State, Nigeria. *Int J Nat Appl Sci* 2(1): 7–11. [Google Scholar]
33. World Health Organization (1987) Prevention and control of intestinal parasitic infections. *WHO Tech Rep Ser* 749: 7. [PubMed] [Google Scholar]
34. FEM Wiki website. Available: https://wiki.ecdc.europa.eu/fem/w/fem/information- measurement-bias.aspx. Accessed 2014 Apr 21.
35. Sugunan AP, Murhekar MV, Sehgal SC (1996) Intestinal parasitic infestation among different population groups of Andaman and Nicobar islands. *J Commun Dis* 28(4): 253–259.[PubMed] [Google Scholar]
36. Colman S, Mangoro ZM, Isa L (2013) Incidence of intestinal and urinary parasites among prison inmates. *AJMR* 1(1): 11–15. [Google Scholar]
37. Jemaneh L (1998) Comparative prevalence of some common intestinal helminth infections in different altitudinal

regions in Ethiopia. *Ethiop Med J* 36(1): 1–8. [PubMed] [Google Scholar]
38. Tedla S (1989) Helminthiasis in Ethiopia: review. *Sinet: Ethiop J Sci* 12: 25–48. [Google Scholar]
39. Knopp S, Mohammad KA, Rollinson D, Stothard R, Khamis IS, et al. (2009) Changing patterns of soil-transmitted helminthiases in Zanzibar in the context of national helminth controlprograms. *Am J Trop Med Hyg* 81: 1071–1078. [PubMed] [Google Scholar]
40. Hegazi M.,Patel T., and El-Deek B. Prevalence and characters of Entamoeba histolytica infection in Saudi infants and children admitted with diarrhea at 2 main hospitals at south Jeddah: a re-emerging serious infection with unusual presentation. Braz J Infect Dis 17 (1). Feb 2013. https://doi.org/10.1016/j.bjid.2012.08.021).