



Prevalence of Parasitic Intestinal Infestation and Associated Factors Among Primary School Children of Hodeidah , Yemen

Abdo Obaid AL Namari ¹ , Mohammed Amood AL Kamarany ^{2,3,*} , Ali Bannawi AL_Zubaidy ^{3,4}

¹Department of Community Medicine – Faculty of Medicine and Health Sciences , Hadhrmout University , Mukalla, Yemen

²Center of Tropical Medicine and Infectious Diseases (CTMID) – Authority of Public AL Thawara Hospital ,Hodiedah, Yemen

³Center of Tropical Medicine and Epidemiology Studies (CTMES - HU), Faculty of Clinical Pharmacy , Hodeidah University , Hodeidah, Yemen

⁴Faculty of Medicine and Health Sciences , Hodeidah University , Yemen

*Corresponding author E-mail: alkamarany@gmail.com ; alkamarany2022@hoduniv.net.ye

Received: 09 June 2026 . Accepted: 25 June 2026 . Published: 30 June 2026.

Abstract

Background : Intestinal parasitic infestations (IPIs) Worldwide endemic illness especially in tropical and sub-tropical countries. Parasitic infestation are regarded as serious public health problem **Objectives:** To determine the prevalence and associated risk factors of intestinal parasites among primary school children in Hodeidah , Yemen. **Methodology:** A cross-sectional descriptive study , a total of 421 stool samples were collected from students , aged 6 – 14 years , 268 males and 153 females .This specimens were examined by direct microscopic technique for the presence of intestinal parasites and using the validated questionnaire. **Results:** Revealed that out of the 421 stool samples collected from schools children in in Hodeidah city in Yemen, 338 cases were found positive for gastrointestinal parasites with an overall prevalence rate of 80.28 %. The study revealed that the prevalence of gastrointestinal parasites was 64 % of males and 36% of females. The highest prevalence rate (47.92%) was reported among the 12-14 years age group. Overall, protozoa infections were higher than the helminthes infections namely 191 cases (45.3%) of *Entamoeba histolytica* and 107 (25.4%) of *Giardia lamblia* that were the commonest IPI identified. On the other hand , major risk factors were recorded that seem to have effect in the transmission of IPI . 84.32 % (n: 355) , 76.96 % (n:324) of children in primary schools had sewage at home and school respectively. The Knowledge Attitude and Practices (KAP) for prevention of IPI in children were assessed, 46.08 % of children had hand washing before eating , 41.33% had hand washing before and after log in bathroom. On the other hand , 11.08 % had lesson of IPI prevention from schools radio. On the other mean , a high prevalence rate of IPI was reported amongst 421 primary school children, with varying prevalence of protozoa depending on geographical locations of the district (p – value < 0.001). There was statistical association between IPI and the age and sex categories that have been sampled for this study ($\chi^2= 9.72$; p - value = 0.0077), there were environmental factors that contributed greatly to the prevalence of the disease, especially proximity to the sewage system. **Conclusion:** confirmed that drinking untreated water, not washing hands after defecation and contact with animals was a significant risk factor with parasitic infections.

Keywords: Intestinal parasitic infection, risk factors, Hodeidah , Yemen

1. Introduction

IPIs are known to be one of the most prevalent global diseases, especially in tropical and sub-tropical areas [1]. The reason why IPIs have been categorized under a major health concern is that they may result in iron deficiency anemia, weight loss, malnutrition, and a variety of other health problems [2]. When it comes to protozoal parasite, the most predominant one among the two is *Giardia lamblia*, which affects about 200 million people worldwide [3].

The occurrence of IPIs is very much linked to lack of sanitary conditions, unsafe drinking water, and poor personal hygiene [4]. According to epidemiologic studies, proper hygiene and sanitation facilities as well as safe drinking water can effectively prevent IPIs. Apart from being diseases, the impact of such infections is also felt in the realm of economics.

It has been established that there exists a connection between gut parasites and nutrition status, whereby both infection prevalence and intensity are affected by malnutrition [6]. Direct-cycling parasites are spread through feco-orally, using nutrients from their hosts, leading to tissue and organ damage. In addition to all these harmful effects, IPIs have been associated with increased risks of anemia, malnutrition, weight loss, behavioral

problems, and physical and cognitive impairment depending on the health status of the host [7].

On a global level, over two billion cases of intestinal parasite infections have been reported, and around one-third are affected by severe morbidities from these infections. There are about 300 mil-lion people with severe illnesses related to these infections, with at least half being school-aged children. While IPIs may affect people of any age, children are the most susceptible, especially in tropical and sub-tropical environments. Factors associated with IPIs include poverty, unhygienic habits, low maternal education, many family members, and past intestinal infections within the family [8,9].

Among other causes, IPIs are the top causes of illnesses in developing countries, like Yemen, where Hodeidah governorate experiences such cases frequently. School-age children form the group most vulnerable to such diseases [10]. It has been proven through research that school-aged children living in poorer and middle-income countries are highly vulnerable to initial IPIs [11]. For instance, in Yemen, IPIs are directly associated with insufficient sanitation, unclean water sources, poor hygiene practices, illiteracy, tropical weather, and poverty. Despite their prevalence, there is still very little information about the epidemiology of IPIs

in Yemen. It is for this reason that the aim of this study was to establish the prevalence rates of IPIs and the associated risk factors among primary school children living in rural and urban settings of Hodeidah, Yemen. More specifically, the study intended to: To identify the social determinants, environmental determinants, and risk factors of IPIs in Hodeidah, Yemen. To investigate the existing knowledge, attitude and practice (KAP) on prevalence, prevention, and control of IPIs among age school in Hodeidah, Yemen.

2. Methodology

2.1. Study area

This study was conducted in three districts of the center governorate, namely: (Al-Hali, and Al-Hawk) and three schools of all districts. And selected six districts of outside the governorate, namely: (Al-Dahi, Zabid, Al-Garahi, Al-Zuhra, Al-Marrawa and Bajel) and two schools of all districts and all school. 22 questionnaire who have age 7 to 13 years will be division of the questionnaire on a total of males and females to be determine the percentage affected disease. This area also had several outbreak in acute watery diarrhea (AWD) namely induced by cholera that causes co-infection with IPIs [12,13]

2.2. Study design

A cross-sectional survey from urban and rural was conducted on the primary school children who are selected the simple random sample from urban and rural of the primary school children from 6 to 14 years. The study used a validated questionnaire and stool test.

2.3. Ethical consideration

A request for approval of a scientific research concerning the prevalence intestinal parasitic infection among school children in the Hodeida governorate center and directorates was submitted by the education office. Approval was also obtained from the head teachers of all selected school and from parents or guardians of the children. The participants were given adequate information about purpose and importance of study. The written consent was obtained from the study participants and also their personal information was kept confidential, the end of the laboratory examination and all infected children were treated with appropriate medications like Albendazole for nematodes and metronidazole for protozoan infection, as prescribed by physician.

2.4. Sample Size

The sample size was determined using the Cochran formula with estimated prevalence of 50%

$$n_0 = (Z^2 \times p \times (1 - p)) / d^2 \quad \text{Equation (1)}$$

d2 Where; N - Minimum number of sample required Z - Standard normal distribution at 5% significance level (1.96), P - Estimated prevalence of (50%, 0.5). D- Design effect (1). d- Degree of precision (5%, 0.05), $N = \frac{1.96^2(0.5)(1-0.5)}{0.05^2}$, N = 421 [14,15].

2.5. Data collection and questionnaire

Data collection was carried out by self-administer questionnaire from students and the parents of students, included the infected about socio-demographics, environmental condition, previous history of intestinal parasitic infection and behavior Ural sanitary habits.

2.6. Laboratory Analysis

Students or mothers were asked to collected the stool specimen for analysis. Material for examination was collected in the morning before defecation. Stool specimens were collected from all students and keep in a labeled plastic container. This specimens were examined by direct wet mount, Lugol's Iodine techniques for the presence of intestinal parasites [16].

2.6. Statistical analysis

After the data were collected, they were coded and transferred into specially designed formats to be suitable for computer feeding. Verification processes were carried out to avoid any errors during data entry. Data were fed to the computer and analyzed using Excel software 22. Descriptive analysis was used to make comparisons among categorical variables.

3. Results

3.1. Age and sex of subjects

An in period from January 2019 to May 2019 was reported in collaboration with Education Office of Hodeidah, Ministry of Education, Yemen. 421 children of primary schools aged from 6 to 14 years. The age range of children was 8 years. In terms of gender, the respondents were mainly male (64%; n=268) compared to females, (36%; n=153). (Table 1 and Figure1).

Table 1. Distribution age of subjects (N : 421)

Age	Male	Female	Total
6- 8 Year	30	22	52
9 - 11 Year	97	79	176
12 - 14 Years	141	52	193
Total	268 (64%)	153 (36%)	421

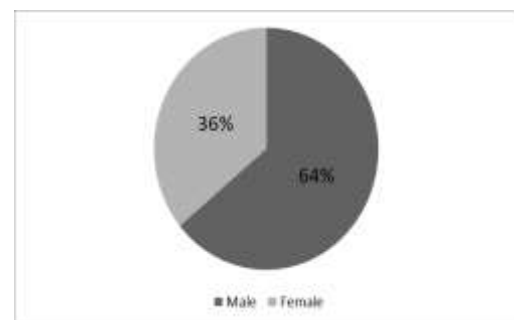


Figure 1. Sex distribution of subjects (N: 421)

3.2. Prevalence of IPIs in children of primary schools

IPIs according to the general characteristics of subjects are showed in Table 2 and Figure 2. Males 211 children (62.42%) were more than to have IPI infection than females 127 children (37.58%). However, children aged from 12-14 years were more susceptible to have IPI of in 162 children (47.92%). There was statistical association between IPI and the age and sex categories that have been sampled for this study ($\chi^2 = 9.72$; p value = 0.0077). As noted earlier, this is primarily driven by the disproportionate number of males in the 12-14 age range compared to females.

3.3. Effect of Residence on IPIs

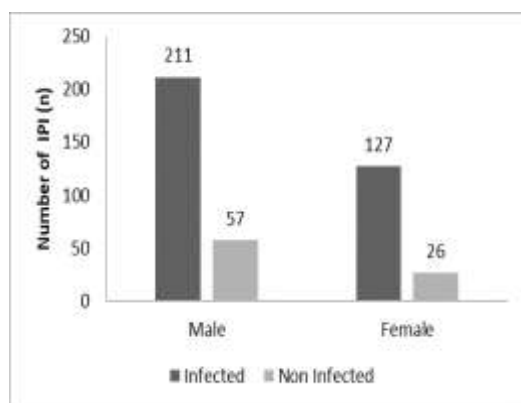
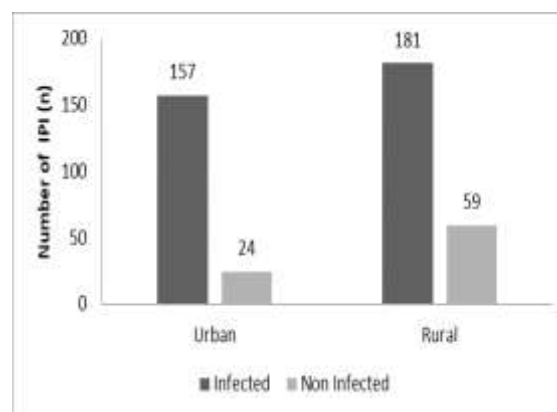
The relationship between presence of the IPI and accommodation in urban and rural was summarized in Table 3. 46.44% (n : 157) of IPI were from school of urban area; whereas 53.55% (n: 181) were from rural area, 56.7% were from rural area (Table 3 and Figure 3). There exists a statistically significant (p - value = 0.00076) relationship between the district and the kind of protozoal infection in the primary school children. This means that there is no random occurrence of these particular protozoa, and thus it can be assumed that some geographical elements have an effect on their presence.

Tables 2. IPIs in primary school children according to sex and ages (n: 338)

IPI		IPI Positive (n : 338)				χ^2	<i>p</i> – value
Sex		Male		Female			
Ages (Year)	n		%	n	%		
6- 8	23		6.80	19	5.62	9.72	0.0077
9 - 11	73		21.60	61	18.05		
12 - 14	115		34.02	47	13.91		
Total	211		62.42	127	37.58		

Table 3. Distributions of protozoa in primary school children of different districts

Districts	Hymenolepis nana		Entamoeba histolytica and Giardia lamblia		Entamoeba histolytica		Giardia lamblia		Total		χ^2	p – value
	Male	Female	Male	Female	Male	Female	Male	Female	n	%		
Bajel	1	1	0	0	12	10	11	0	35	10.4	47.69	0.00076
Al-Marrawa	1	1	0	0	5	10	8	0	25	7.4		
AL Dihi	2	1	2	0	19	10	2	2	38	11.2		
AL Zohra	0	1	0	0	10	4	2	2	19	5.6		
Zabid	1	1	0	0	4	3	5	4	18	5.3		
AL Garrahi	0	0	2	2	15	15	3	0	37	10.9		
AL Hali	1	0	2	4	9	17	9	11	53	15.7		
AL Hawak	0	0	4	0	23	0	23	0	50	14.8		

**Figure 2.** IPI infected and non – infected in primary children schools according to sex**Figure 3.** IPIs in primary children schools according to residency

3.4. Symptoms of IPIs in children of primary schools

In addition, the clinical findings were diagnosed and recorded as usually in some children primary schools (Table 5) , 23 % (98 cases) of abdominal pain , 4.28 % (18 cases) of bloody diarrhea , 9.26 % (39 cases) of stomach cramp and nausea . On the other hand , 10.93 % (46 cases) of absent from schools because abdominal pain . 17.43 % (73 cases) visited medical doctor with above symptoms . There exists a statistically significant difference (p value < 0.0001) in the response rate frequency distribution for each of the five symptoms questioned. In other words, there are differences in the pattern of experiencing these symptoms by the children, either directly or through its effects such as missing school. It is because "Pain/Loss of appetite" or "School absence," for instance, was answered "Sometimes" or "Usually" much more frequently than "Diarrhea/Blood/Itching," where the number of "Never" and "Rarely" were higher.

3.5. Knowledge , attitude , practices and for IPIs prevention

The knowledge , attitude , practices (KAP) were assessed and recorded in (Table 6) , 46.08 % of children had hand washing before eating , 41.33% had hand washing before and after log in bathroom. On the other hand , 11.08 % had lesson of IPI prevention from schools radio . There is a highly statistically significant

variance (p value < 0.0001) regarding how the children have described their engagement with these behaviors. There is an organized distribution of the answers and not a random one since there is a marked difference between those who follow the habits and those who do not. For example, behaviors such as "Vegetable washing" and "Hand washing before eating" have very high percentages of "Usually" while "Swimming pool" and "Parasite awareness" have much higher percentages of "Never."

3.6. Risk factors of IPIs in children of primary schools

Major risk factors were recorded that seem to have effect in the transmission of IPI (Table 7) . 84.32 % (n: 355), 76.96 % (n:324) of children in basic schools had sewage at home and school respectively ; of those children 81 % had IPI namely protozoa and helminthes . The difference between "Yes" and "No" responses among these risk factors is significantly statistically different (p value < 0.0001). It suggests that there is a lack of uniformity regarding the reporting of these risk factors by the children from the sample under investigation. Certain risk factors like "Sewage near safe water" and "Sewage near school" have extremely high numbers of "Yes" responses as opposed to factors like "Eating with friends at school."

Table 5. Common symptoms of IPI in primary children schools

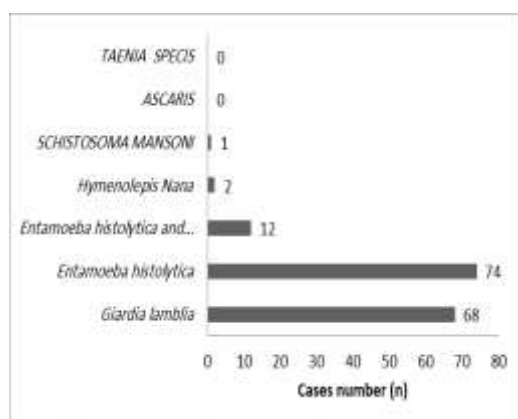
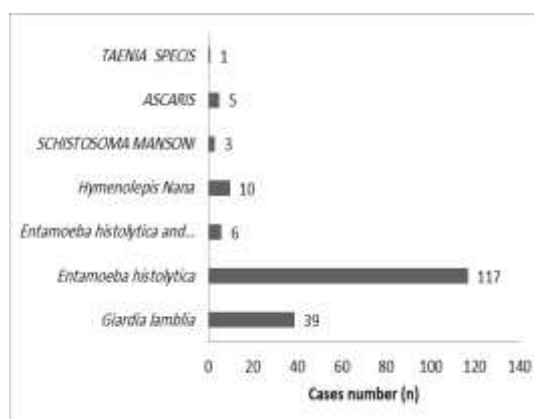
Questions	Studied sample (N=421)								χ^2	p – value
	Never		Rarely		Sometimes		Usually			
	No.	%	No.	%	No	%	No	%		
1. Do you complain of pain at abdominal region and loss of appetite?	15	3.56	75	17.81	233	55.34	98	23.28	271.22	< 0.0001
2. Do you complain of diarrhea accompanied by the blood ,secretion mucosa and anal itching	147	34.92	112	26.60	144	34.20	18	4.28		
3. Do you go to the doctor when you have severe diarrhea intermittently?	47	11.16	135	32.07	166	39.43	73	17.43		
4. How many times you wake up suddenly and have stomach cramps and nausea?	57	13.54	119	28.68	206	48.93	39	9.26		
5. Do you absent from school because of pain in the abdomen or diarrhea?	57	13.54	93	22.09	225	53.44	46	10.93		

Table 6. KAP of primary children schools for IPIs prevention (N:421)

Questions	Studied sample (N=421)							
	Never		Rarely		Sometimes		Usually	
	No.	%	No.	%	No	%	No	%
1. Do you go to the school Bathroom to spend your need?	102	24.23	107	25.24	146	34.68	66	15.68
2. During the school years have you ever received lessons or heard on school radio about parasitic diseases?	166	39.43	122	28.98	83	19.17	50	11.88
3. Do you the family at home you wash vegetables before eating?	3	0.71	40	9.50	116	27.55	262	62.23
4. Do you the family at home you wash hands before eating ?	7	1.66	66	15.68	154	36.58	194	46.08
5. Do you are keen on the hand washing before and after log in the bathroom.	14	3.33	97	23.04	136	32.30	174	41.33
6. How many times a week dealt with meal with family member of the family in restaurants outside the home.	161	38.24	146	34.68	84	19.95	30	7.13
7. How many times I went to pool or swimming ?	193	45.84	125	29.69	92	21.85	11	2.61

Table 7. Common risk factors of IPI in primary children schools (N : 421)

Variables	Yes		No	
	No.	%	No.	%
Do you sewage near to the sources ,safe drinking water in your home?	355	84.32	66	15.68
Do you live in the neighborhood surrounded by sewage where about of wheat?	237	56.29	184	43.71
Do you eaten together with your friends in the scissors school?	132	31.35	289	68.65
Do your friends are keen on the hand washing before and after eating?	306	72.32	115	27.32
Do you sewage near or its surrounded to the school?	324	76.96	97	23.04
Have you ever heard for parasitic diseases?	233	55.34	188	44.66
Have you ever I was infected by parasitic	197	46.79	224	53.21
Do you have friends in the neighborhood or school infected with parasitic diseases? ?	240	57.01	181	42.99
Do you a family member infected with parasitic diseases?	222	52.73	199	47.27
Do you know how or by any methods the parasitic are transmitted to human?	284	67.46	137	32.54

**Figure 4.** Common causative agents of IPI in primary children schools in urban**Figure 6.** Common causative agents of IPI in primary children schools in rural

4. Discussion

IPIs are endemic throughout the world and have been identified as one of the major concerns affecting the public health sector, especially in many tropical and sub-tropical nations. This is due to their association with poor sanitation measures, lack of access to clean drinking water and poor personal hygiene. Variations exist among the prevalence of these factors in different areas [17]. Protozoans parasites, especially *Entamoeba histolytica* and *Giardia lamblia* are the most common causes of these infections in the study sample. Fecal-oral transmission either through direct human contact or consumption of contaminated foods and water constitutes the mode of transmission [18]. The prevalence rate of gastrointestinal parasites infections among school children in Al-Hodeida city was found to be 80% which is higher when compared with prevalence rates in Taiz city (38.2%; Talal Al-Harazi et al., 2016) [19] and Sana'a city (40%; Alyousefi et al., 2011) [20]. This variation could be due to various factors like diagnostic methods used, health consciousness, standard of living, geographic position, environmental sanitation, source of water, season, educational background of the families, and so forth.

Further, it was noted that boys exhibited greater prevalence rate for gastrointestinal parasites (64%), while females showed lesser rate (36%). This was similar to the work of Muhajir et al. (2017) at Al-Kalkala, where the prevalence rate among boys (16.5%) was higher than in girls (13.5%) [22]. Contrary to this, Hala et al. (2017) found the prevalence rate among females (38.8%) to be higher compared to that among males (32.8%) [23]. The other important predictor associated with parasitic infection was age, which showed maximum prevalence (47.92%) in age group 12-14 years. This observation supports Hala et al. (2017) who recorded maximum prevalence rates in age group 10-1. On the other hand, Magambo et al. (1998) observed that maximum prevalence was seen among children aged 6-10 years. The reason behind this observation could be the behavior and lack of awareness regarding transmission of IPIs [24].

More protozoa infections were reported than helminthic infections in this research. The main intestinal parasites in school children included *Entamoeba histolytica* (n = 191) and *Giardia lamblia* (n = 107) which is consistent with earlier works done on Yemeni children [19]. Variation in the prevalence rate of intestinal protozoa might be due to differences in water quality, toilet facilities, personal hygiene habits, and the consumption of uncooked vegetables. Increased incidence of infection was recorded among younger children aged 6–14 years and among rural children (n = 181, 53.55%) compared to urban children (n = 157; 46.44%). These findings are supported by multiple studies [25 - 27] and has been well documented.

On the other hand, some research has been noted about IPIs co-infection. Among *Entamoeba*, *E. histolytica* is the primary species responsible for the infection. In a systematic review of 227 research studies conducted across 30 countries in America between 1990 and 2022, it was noted that *Entamoeba* infection is common, with *E. coli* being the most prevalent species (21%). *E. histolytica* was recorded in 22 countries with a prevalence rate of 9%. Most studies depended on microscopical diagnosis, and nearly half of the studies could not identify the species [28].

Co-infections from other microorganisms, such as cholera [29-31], should also be considered since the effects of the treatment on one particular organism will probably not be enough to alleviate symptoms and stop the spread. Preventative methods, such as education, sanitation, clean water supply, and regular deworming campaigns, are necessary in order to decrease both mono- and poly-parasitism in this group.

This issue, among others, is undoubtedly influenced by behavioral factors, such as playing in soil and water that have been contaminated, little understanding of how IPI can be acquired, and poor environmental cleanliness. The other contributory factors are the non-use of toilet facilities, lack of adequate water sources, insufficient knowledge and hygiene measures, as well as lower standards of living. They are often identified as key factors responsible for the prevalence of intestinal parasites among rural communities over urban areas.

5. Conclusion

This study demonstrates a very high prevalence of intestinal parasitic infestations (80.2%) among primary school children in Hodeidah, Yemen, confirming that IPIs remain a major public health problem in this setting. Infections were more frequent among males and were highest in the 12–14-year age group. Protozoan parasites predominated over helminths, with *Entamoeba histolytica* and *Giardia lamblia* being the most commonly identified species. The high burden of infection was closely associated with environmental and behavioral risk factors, including the use of untreated drinking water, inadequate hand hygiene practices after defecation, and contact with animals, as well as poor sanitation facilities at home and in schools. The low level of knowledge, attitude, and practices regarding IPI prevention among school children further highlights gaps in health education and preventive measures. The study recommended "Improvement of Water and Sanitation; School-Based Health Education; Promotion of Hygiene Practices; Periodic Screening and Treatment; Community and Parental Involvement and Further Research".

Author Contributions

Obaid A. contributed in the research idea, methodology and critically reviewed the article; **Al Kamarany, M.A.** supervision, critically, analyzed the data and reviewed the final manuscript. **Al-Zubaidy A.B.** supervision, critically, analyzed the data and reviewed the final manuscript. All authors have read and agreed to the published version of the manuscript.

Data Availability

The data that support this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

We would like to thank Professor Mohammed Al Kamarany for supporting this work.

How to Cite : AL Namari A.O., AL Kamarany M.A, Al-Zubaidy A.B. (2026). Prevalence of Parasitic Intestinal Infestation and Associated Factors Among Primary School Children of Hodeidah, Yemen, *Abhath Journal of Basic and Applied Sciences*. 5(1), 20–25.

References

- 1) World Health Organization (WHO), (2006) GS graphical distribution and useful facts and states, Geneva. <https://www.who.int/docs/default-source/gho-documents/world-health-statistic-reports/whostat2006-erratareduce.pdf>
- 2) United Nations (UN), Department Of Economic And Social Affairs, Population Division (2007) World urbanization prospects: the 2008 revision, working paper No. ESA/P/WP/ZOO. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Jan/un_2006_world_population_prospects-2006_revision_volume-i.pdf
- 3) Turck, D., Michaelsen, K. F., Shamir, R., Braegger, C., Campoy, C., Colomb, V., Decsi, T., Domellöf, M., Fewtrell, M., Kolacek, S., Mihatsch, W., Moreno, L. A., & van Goudoever, J. (2013). World Health Organization 2006 child growth standards and 2007 growth reference charts: A discussion paper by the committee on Nutrition of the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition. *Journal of pediatric gastroenterology and nutrition*, 57(2), 258–264. <https://doi.org/10.1097/MPG.0b013e318298003f>
- 4) Glickman, L. T., Camara, A. O., Glickman, N. W., & McCabe, G. P. (1999). Nematode intestinal parasites of children in rural Guinea, Africa: prevalence and relationship to geophagia. *International journal of epidemiology*, 28(1), 169–174. <https://doi.org/10.1093/ije/28.1.169>
- 5) Nematian, J., Nematian, E., Gholamrezanezhad, A., & Asgari, A. A. (2004). Prevalence of intestinal parasitic infections and their relation with socio-economic factors and hygienic habits in Tehran primary school students. *Acta tropica*, 92(3), 179–186. <https://doi.org/10.1016/j.actatropica.2004.06.010>
- 6) AL-Suhali, F., Dabwan, A., Jabreel, A., Hadi, M., & AL Kamarani, M. (2025). Impact of Cholera on Children with

- Malnutrition under 5 Years in Hodeidah , Yemen . *Abhath Journal of Basic and Applied Sciences*, 4(1), 46–49. <https://doi.org/10.59846/ajbas.v4i1.740>
- 7) Steketee , R. W. (2003). Pregnancy, nutrition and parasitic diseases. *The Journal of nutrition*, 133(5 Suppl 2), 1661S–1667S. <https://doi.org/10.1093/jn/133.5.1661S>
 - 8) Shegal, R., Verweij, J. J., & Rao, A. (2010). Prevalence of intestinal parasitic infections among school children and pregnant women in low socio-economic areas, Chandigarh, North India. *RIF*, 1(2), 100–103.
 - 9) Mehraj, V., Hatcher, J., Akhtar, S., Rafique, G., & Beg, M. A. (2008). Prevalence and factors associated with intestinal parasitic infection among children in an urban slum of Karachi. *PloS one*, 3(11), e3680. <https://doi.org/10.1371/journal.pone.0003680>
 - 10) Babakhani, M., Safari, R., Rajati, F., Salimi, S., & Omidian Doost, A. (2017). *Prevalence and risk factors associated with intestinal parasitic infections among school children in Gashky, West of Iran. International Journal of Pediatrics*, 5(7), 5263–5273. <https://doi.org/10.22038/ijp.2017.23173.1949>
 - 11) Sehgal, R., Reddy, G. V., Verweij, J. J., & Rao, A. V. S. (2010). Prevalence of intestinal parasitic infections among school children and pregnant women in a low socio-economic area, Chandigarh, North India. *RIF*, 1(2), 100–103.
 - 12) Shawk, B., Othman, M., Bokhait, A., Jaber, osama, Alturki, T., Ghaleb, H., ... Al-Kamarany, M. A. (2025). Epidemiological Features of Cholera in Hodeidah, Yemen 2017: A Retrospective Study. *Abhath Journal of Basic and Applied Sciences*, 4(1), 12–15. <https://doi.org/10.59846/ajbas.v4i1.691>
 - 13) Al Kamarany, M. ., & Ghouth, A. S. B. . (2024). The Ice Berge of Cholera in Hodeidah , Yemen : The Contact Exposure. *Studies in Medical and Health Sciences*, 1(1), 32–35. <https://doi.org/10.48185/smhs.v1i1.1169>
 - 14) Bartlett, E., Kotlik, J. W., & Higgins, C. C. (2001). Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, 19(1), 43–50.
 - 15) Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). New York, NY: John Wiley & Sons, Inc.
 - 16) , J. A. (2012). Principles of diagnosis. In *Medical microbiology* (4th ed., Chapter 10). McGraw-Hill.
 - 17) Washington, D. A., Khodari, Y. A., Othman, R. A., & Farooq, M. U. (2011). Prevalence of intestinal parasites and bacteria among food handlers in a tertiary care hospital. *Nigerian medical journal : journal of the Nigeria Medical Association*, 52(4), 266–270. <https://doi.org/10.4103/0300-1652.93802>
 - 18) Zagloul, N., Al-Jesmi, H., Al-Zarouni, M., & Panigrahi, D. (2010). *Prevalence of intestinal parasitic infections in the Ministry of Health Hospitals in Sharjah, UAE: 2-year retrospective study. International Journal of Infectious Diseases*, 14 (Supplement 3), e102–e106. [https://doi.org/10.1016/S1201-9712\(10\)02169-7](https://doi.org/10.1016/S1201-9712(10)02169-7)
 - 19) Talal AL-Harazi. 2016. “Prevalence and Risk Factors Associated With Intestinal Parasitic Infection Among Patients in Taiz City, Yemen”. *Microbiology Research Journal International* 16 (3):1–7. <https://doi.org/10.9734/BMRJ/2016/28317> .
 - 20) Alyousefi, N. A., Mahdy, M. A., Mahmud, R., & Lim, Y. A. (2011). Factors associated with high prevalence of intestinal protozoan infections among patients in Sana'a City, Yemen. *PloS one*, 6(7), e22044. <https://doi.org/10.1371/journal.pone.0022044>
 - 21) Shrihari M, Kumudini T S, Mariraj. J, Krishna S. The Prevalence of Intestinal parasitic infestation in a tertiary care hospital-a retrospective study. *J Pharm Biomed Sci*. 2011;12(8):13–7.
 - 22) Muhajir, A., Sadiq, M. S., & Abdullahi, K. (2017). Prevalence of intestinal parasitic infections and associated risk factors among school-aged children. *Journal of Parasitology Research*, 2017, 1–7. <https://doi.org/10.1155/2017/9372045>
 - 23) Hala, S. A., Khalifa, R. M., Abou-Shady, O. A., & El-Nadi, N. A. (2017). Prevalence of intestinal parasitic infections among schoolchildren in rural areas. *Journal of Parasitic Diseases*, 41(2), 534–539. <https://doi.org/10.1007/s12639-016-0833-9>
 - 24) Magambo ,J. K., Zeyhle, E., & Wachira, T. M. (1998). Prevalence of intestinal parasites among children in southern Sudan. *East African Medical Journal*, 75(5), 288–290.
 - 25) Abdi, M., Nibret, E., & Munshea, A. (2017). Prevalence of intestinal helminthic infections and malnutrition among school-children of the Zegie Peninsula, northwestern Ethiopia. *Journal of infection and public health*, 10(1), 84–92. <https://doi.org/10.1016/j.jiph.2016.02.009>
 - 26) Ayalew W 2014. Prevalence and risk factors associated with intestinal parasitic infection among school children in Wogeda town, north-west Ethiopia. Msc. Thesis Bahir Dar University, Ethiopia;.
 - 27) Sitotaw, B., Mekuriaw, H., & Damtie, D. (2019). Prevalence of intestinal parasitic infections and associated risk factors among Jawi primary school children, Jawi town, north-west Ethiopia. *BMC infectious diseases*, 19(1), 341. <https://doi.org/10.1186/s12879-019-3971-x>
 - 28) Sitotaw, A., Helman, E., Iglesias, M. D. R., Panti-May, J. A., Zonta, M. L., & Navone, G. T. (2022). Prevalence of Human Intestinal *Entamoeba* spp. in the Americas: A Systematic Review and Meta-Analysis, 1990–2022. *Pathogens (Basel, Switzerland)*, 11(11), 1365. <https://doi.org/10.3390/pathogens11111365>
 - 29) Alesary, K., Obadi , N. A., AL-Surabi , S. A., Haij , G. A., Fakerah , Z., Abdulkareem , T., & Al Kamarany, M. A. (2025). Outbreak Investigation of Cholera in Kamaran Island, Hodeidah, Yemen: Ecological study. *Abhath Journal of Basic and Applied Sciences*, 4(1), 16–19. <https://doi.org/10.59846/ajbas.v4i1.716>
 - 30) Zohairy, A., Bin Ghouth, A., & Al Kamarany, M. A. (2025). Social and Environmental Determinants of Cholera in Hodeidah , Yemen : A Cross Sectional Study . *Abhath Journal of Basic and Applied Sciences*, 4(1), 20–27. <https://doi.org/10.59846/ajbas.v4i1.725>
 - 31) Suhail, K., Hanbosh, M., Shawk , B., & Al Kamarany , M. A. (2025). Incidence of Cholera Outbreak in Hodeidah, Yemen , 2024 : A Technical Report . *Abhath Journal of Basic and Applied Sciences*, 4(1), 28–31. <https://doi.org/10.59846/ajbas.v4i1.746>