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Assessment of the Community Awareness on Transmission and Control Practices towards Gastrointestinal Parasites in Vegetables in Aden Governorate, Yemen

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Abstract:

In Aden Governorate, Yemen, the prevalence of gastrointestinal parasite infections is alarmingly high due to insufficient community awareness and preventive actions. Our research adopted a descriptive and analytical cross-sectional design, utilizing structured questionnaires to evaluate the understanding of 400 local market vendors and consumers regarding the etiology, symptoms, transmission, and prevention of gastrointestinal parasites. The findings indicated a moderate level of awareness, with 73% of respondents aware of intestinal parasitosis. However, knowledge concerning transmission methods (67.8%) and preventive measures was notably lower, pointing to significant educational gaps. Despite some level of awareness, the detailed knowledge necessary for effective prevention and control was generally lacking. This highlights the urgent necessity for targeted public health initiatives in Yemen aimed at increasing awareness and implementing comprehensive strategies to mitigate the spread of gastrointestinal parasites. This study underscores the critical need for enhancing community knowledge and preventive practices against these infections.

Keywords: awareness, community, gastrointestinal parasites, vegetables, Yemen

INTRODUCTION

Intestinal parasites pose a significant global public health challenge, particularly in tropical and subtropical regions. Worldwide, an estimated 3.5 billion individuals are affected, with approximately 450 million people contracting foodborne parasites annually, resulting in around 200,000 deaths each year [1, 2]. Yemen, characterized by underdevelopment, poverty, disease, and social unrest, is particularly vulnerable. With much of its population residing in rural areas, the risk of intestinal parasite infections is heightened [3].

Vegetables are an essential component of the human diet; however, if not cleaned thoroughly, they can serve as vectors for transmitting intestinal parasites [4].

Understanding the risk factors associated with intestinal parasite transmission requires assessing the community's knowledge, attitude, and practices regarding the consumption of contaminated raw vegetables.In this case, strong awareness of the communities related to transmission and control of gastrointestinal parasites is highly needed [5].

In Yemen, it has been reported that all examined vegetables were contaminated with intestinal parasites [6]. A lower contamination rate was observed in Aden [7]. However, to the best of our knowledge, no published data exist for Aden Governorate regarding the assessment of community awareness concerning the etiology, clinical signs, transmission, and control practices related to gastrointestinal parasite contamination in vegetables. Therefore, this study was designed to address this knowledge gap.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Aden governorate. Aden is the economic and commercial capital of the Republic of Yemen. Located at coordinates 12°47'N, 45°1'E, Aden is a port city situated in the southern part of the Arabian Peninsula, positioned near the eastern approach to the Red Sea. It is approximately 170 km (110 mi) east of the Bab-el-Mandeb strait and north of the Gulf of Aden. As of 2022, Aden City has a population of approximately 1,152,643 residents. The city spans an area of 760 km2 (290 square miles) [8].

The Aden governorate is divided into the following eight directorates: Al Buraiqeh, Dar Sad, Ash Shaikh Outhman, Al Mansura, Khormaksar, Al Mualla, Crater, and Attawahi.

Study Design

A descriptive and analytical cross-sectional study design was adopted for this research. The study period spanned four months, from July 1st to the end of October 2023

Sample Size Determination

For the assessment of community awareness and knowledge about intestinal parasites, the sample size of respondents to be interviewed was determined using Slovin’s formula equation with a 95% Confidence Interval (95%CI).

$n=N/ (1 + Ne^2)$ [9].

$$n = \frac{N}{(1 + Ne^2)} = \frac{1152643}{(1 + 1152643 \times 0.05^2)} = 399.99 \cong 400$$

Where:
n = The estimated sample size.
N = The size of the Aden population (1,152,643) based on the 2022 census.
e^2 = The acceptable error, which was 5% (0.05) [2].
Therefore, the estimated sample size is 399.85, which was approximated to 400 respondents.

Sampling Procedures and Data Collection

For the assessment of community awareness and knowledge about intestinal parasites in Aden, a structured questionnaire was administered to 400 respondents, including both vendors and consumers of vegetables.

The vendors and consumers were selected randomly using stratified random sampling from the most common local and public markets in the 8 districts of the Aden governorate. The sample size for each district was determined using the following equation:

Stratified random sampling = (Number of category) / Total = sample size of each district

The distribution of the 400 respondents to be interviewed across the 8 districts of the Aden governorate was as follows: Ash-Shaikh Outhman district (72), Al-Buraiqeh district (51), Crater district (52), Al-Mualla district (32), Attawahi district (36), Khur-Maksar district (30), Al-Mansura district (69), and Dar Sad district (58).

The collected data included demographic characteristics of the respondents and their awareness of the etiology, clinical signs, transmission, and control practices related to intestinal parasites.

Data Analysis

The data were inputted, coded, validated, and stored within the Microsoft Excel Window 2019 spreadsheet. Analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 20. Chi-square testing was employed to ascertain any statistically significant variances between respondents' awareness and their demographic characteristics, with a significance level set at $p \leq 0.05$. Descriptive data analysis, including means, frequencies, and proportions, was also undertaken.

Ethical Consideration

Ethical approval for the study was granted by the Ethics Review Committee at the University of Aden, Faculty of Medicine & Health Sciences, Graduate Studies & Scientific Research. Verbal consent was obtained from all participants after explaining the purpose of the study

RESULTS

Demographic Characteristics of the Study Respondents

The 400 vendors and consumers were selected randomly from the most common local and public markets in the 8 directorates of Aden Governorate, Yemen. A total of 26 questions were included in the questionnaire: ten questions to assess the knowledge of the vendors and consumers regarding intestinal parasites and their relation to the consumption of contaminated raw and fresh vegetables, and six and ten questions to assess both the attitude and practices, respectively.

The sociodemographic data obtained by interviewing the vendors and consumers in all eight directorates of Aden Governorate, Yemen, to assess the community's awareness of intestinal parasites and their relation to the consumption of contaminated fresh and raw vegetables, is presented in Table 1.

Table 1: The Sociodemographic Characteristics of the Study Respondents

Category	**No.**	%	**Category**	**No.**	%
Age of Respondent					
Mean±SD 34.1±13.8 **years** Min-**max 15-78years**					
Sex			**Directorates**		
Male	295	73.8	Crater	52	13
Female	105	26.3	Khur-Maksar	30	7.5
Marital Status			Al-Mualla	32	8.0
Single	147	36.8	Attawahi	36	9.0
Married	239	59.8	Ash-Shaikh Outhman	72	18.0
Widowed	9	2.3	Dar Sad	58	14.5
Divorced	5	1.3	Al-Buraiqeh	51	12.8
Education Level			Al-Mansura	69	17.2
Illiteracy	34	8.5	**Number of family members**		
Primary School	96(%)	24.0	One	5	1.3
Secondary School	124	31.0	Two	24	6.0
High Grade School	146	36.5	Three	45	11.3
Family Income/month			More than three	326	81.5
< 60$	155	38.8%	**Type of Respondent**		
> 60$	245	61.2%	Vendor	118	29.5
			Consumer	282	70.5

The mean age was 34.1 years ± 13.8 standard deviation. This large standard deviation was attributed to the minimum and maximum age of respondents, which were 15 years and 78 years, respectively.
The total frequency and percentage of vendors and consumers were 118 (29.5%) and 282 (70.5%), respectively.

Table 2: Frequency and Percentage of Respondents' according to their age group.

Grouped Age	No	%
15-22	94	23.5
23-30	115	28.7
31-38	53	13.2
39-46	54	13.5
47-54	44	11.0
55-62	23	5.8
≥ 63	17	4.3
Total	**400**	**100.0**

Assessment of Knowledge about Intestinal Parasites among Respondents

Regarding the knowledge of vendors and customers, 292 (73%) were aware of intestinal parasites. The sources of this knowledge varied, with most having obtained their information from health facilities 127(31.8%), schools (76, 19%), friends 39 (9.8%), and social media 31 (7.8%), respectively. Out of the respondents, 247 (61.8%) could mention some intestinal parasites, while 153 (38.2%) did not know any type of intestinal parasites. Among the 247 respondents, 95 (23.8%) mentioned only one intestinal parasite, while 92 (23%) mentioned two types, and 60 (15%) mentioned three or more types. A total of 271 respondents (67.8%) had knowledge about the modes of transmission, whereas 129 (32.2%) were unaware of how transmission occurs. Those who mentioned only one method of transmission (such as eating contaminated food, consuming raw contaminated food, playing with soil, using a dirty water supply, or contact with flies) contrasted with others who mentioned three methods (flies, contaminated food and raw vegetables; playing in river water, dirty water supply, eating contaminated food) and those who mentioned more than three methods (playing with soil, playing in infested river water, dirty water supply, by flies, and eating contaminated food and raw vegetables). Among the respondents, 271 (67.8%) knew about the methods of transmission, while 129 (32.2%) did not. Of 400 respondents, 200 (50%) were able to describe four or more methods of transmission, whereas 42 (10.5%) mentioned three methods, and 29 (7.3%) mentioned only one method, as shown in Table 3. The number of respondents who knew symptoms of intestinal parasites was higher than those who did not; 277 (69.3%) vs. 123 (30.8%), respectively. The most frequently mentioned symptoms were abdominal pain and diarrhea 76 (19%), followed by weakness, abdominal pain, bloody diarrhea 51 (12.8%), and abdominal pain alone 31 (7.8%). Concerning whether intestinal parasites are treatable/preventable, 276 respondents (69%) were aware, while 115 (28.8%) did not know, and nine cases (2.3%) reported that intestinal parasites were neither treatable nor preventable. The frequency and percentages of respondents who noted that intestinal parasites are a serious disease were 200 (50%), while 108 (27%) did not know whether it was a serious disease or not, and 92 (22.1%) believed it was not serious or only sometimes so.

Table 3: Assessment of Knowledge about Intestinal Parasites among Respondents

Category	No.	%	Category	No.	%
Knowledge of Intestinal Parasites			**Symptoms of Intestinal Parasites Mentioned by Respondents**		
No	108	27.0	Not knowledgeable	123	30.8
Yes	292	73.0	Mention One Symptom	37	9.3
Sources of knowledge about intestinal parasites			Mention two and three Symptoms	130	32.5
Not knowledgeable about Intestinal Parasitosis at all	108	27.0	Mention Four or More Symptoms	110	27.5
From Health Facilities	127	31.8	**Knowledge About Transmission of Intestinal Parasites**		
From Schools	76	19.0	Mention only One Methods of Transmission	29	7.3
From Friends	39	9.8	Mention Three Methods of Transmission	42	10.5
From Social Media	31	7.8	Mention Four or More Methods of Transmission	200	50.0
From Family	16	4.0	Total Knowledgeable about Methods of Transmission	271	67.8
From Schools & Health Facilities	2	0.5	Not Knowledgeable about Methods of Transmission	129	32.2
Other sources	1	0.3	**Are Intestinal Parasites treatable?**		
Most Frequently Mentioned Intestinal Parasites			Not Known	115	28.8
Mention One Type of Intestinal Parasites	95	23.8	Yes	276	69.0
Mention Two Types of Intestinal Parasites	92	23.0	No	9	2.3
Mention Three and More Types of Intestinal Parasites	60	15.0	**Did Intestinal Parasites Preventable disease?**		
Total Respondents able to Mention Types	247	61.8	Not Known	115	28.8
Not knowledgeable about Intestinal Parasites	153	38.2	Yes	276	69.0
			No	9	2.3

Attitudes Toward Intestinal Parasites: Frequency and Percentage of Responses

The frequency and percentage of questionnaire responses regarding the attitudes of respondents towards intestinal parasites is shown in table 4.

Table 4: Frequency and Percentage of Questionnaire Responses Regarding the Attitudes of Respondents Towards Intestinal Parasites

Question	Not Known		Yes		No		Total	
	No.	%	No.	%	No.	%	No.	%
Do you think intestinal parasites are a serious disease?	123	30.8	200	50.0	77	19.3	400	100.0
Do you think taking medication against intestinal parasitosis is important?	108	27.0	280	70.0	12	3.0	400	100.0
Do you think going to a health facility is important when you feel abdominal discomfort?	108	27.0	267	66.8	25	6.2	400	100.0
Do you think taking traditional therapy is good for treating intestinal parasites?	108	27.0	175	43.8	117	29.2	400	100.0
Do you think playing in soil can cause intestinal parasites?	108	27.0	193	48.3	99	24.8	400	100.0
Do you think eating raw vegetables can cause intestinal parasites?	108	27.0	257	64.3	35	8.7	400	100.0

Respondent Practices: Frequency and Percentage of Questionnaire Responses

The frequency and percentages of responses to the questionnaire regarding the practices of respondents were described in Table 5. Generally, the practices of respondents toward intestinal parasites showed the lowest percentages.

Associations Between Respondent Characteristics and Understanding of Transmission Methods

The association between respondent types and their knowledge of the methods of transmission of intestinal parasites was evaluated using the Chi-Square Test (X^2-Test), as shown in Table 6. There was a highly statistically significant association observed in $p < 0.001$.

Table 5: Frequency and Percentage of Questionnaire Responses Regarding the Practices of Respondents

Question	Sometimes		Yes		No		Total	
	No.	%	No.	%	No.	%	No.	%
Did you eat raw meat?	109	27.2	8	2.0	283	70.8	400	100.0
Did you eat raw vegetables?	109	27.2	277	69.3	14	3.5	400	100.0
Did you wash the vegetables before eating?	109	27.2	288	72.0	3	0.8	400	100.0
Did you wash your hands before meals?	109	27.2	274	68.5	17	4.3	400	100.0
Did you go to a health facility when you felt abdominal discomfort?	109	27.2	264	66.0	27	6.8	400	100.0
Did you take medication for intestinal parasitosis?	109	27.2	247	61.8	44	11.0	400	100.0
Did you cut your nails periodically?	109	27.2	238	59.5	53	13.3	400	100.0
Do you cut your nails with your teeth?	109	27.2	74	18.5	217	54.3	400	100.0
Did you use filtered water to drink?	109	27.2	221	55.3	70	17.5	400	100.0
Did you wear shoes when walking on soil?	109	27.2	244	61.0	47	11.8	400	100.0

Table 6: The Association of Respondents to the Methods of Transmission and the Seriousness of Intestinal Parasites

Type of Respondent	Transmission methods				*P*	Seriousness parasites						*P*
	Not Known		Known			Not Aware		Serious		Not Serious		
	No.	%	No.	%		No.	%	No.	%	No.	%	
Vendors (n=118)	53	44.9	65	55.1	***0.001***	50	42.4	46	39.0	22	18.6	***0.003***
Consumers (n=282)	76	27.0	206	73.0		73	25.9	154	54.6	55	19.5	
Total (n=400)	**129**	**32.2**	**271**	**67.8**		**123**	**30.8**	**200**	**50**.0	**77**	**19.2**	

Assessment of Attitudes Toward the Severity of Intestinal Parasites

The respondents' attitudes toward the severity of intestinal parasites were assessed using a Chi-Square Test (X^2-Test), as depicted in Table 6, revealing a statistically significant association ($p = 0.003$).

Correlation of Sociodemographic Factors with Knowledge on Transmission Methods

The assessment of knowledge regarding the methods of transmission, in relation to the sociodemographic data of vendors and consumers, was evaluated using the Chi-Square Test (X^2-Test). The results are presented in Table 7. All methods of transmission and the sociodemographic data showed statistically significant associations, except for marital status and family income.

Table 7: Knowledge of the Methods of Transmission in Relation to Sociodemographic Data of Respondents (n=400)

Variable	Know the Methods of Transmission				
	Know		Not know		
	No.	%	No.	%	
Age Grouped (Years)					
15-29	118	43.5	73	56.6	0.04
30-44	79	29.2	32	24.8	
45-59	58	21.4	15	11.6	
≥60	16	5.9	9	7.0	
Sex					
Male	182	67.2	113	87.6	0.001
Female	89	32.8	16	12.4	
Education Level					
Illiteracy	8	3.0	26	20.2	0.001
Primary School	43	15.9	52	40.3	
Secondary School	92	33.9	32	24.8	
High School/Higher Education	128	47.2	19	14.7	

Relationship Between the Number of Intestinal Parasites Mentioned and Sociodemographic Profiles

The relationship between the number of intestinal parasites mentioned and the sociodemographic profiles of the respondents—including age groups, gender, type of respondent, location of directorates, marital status, and education levels—was analyzed using the Chi-Square Test (X^2-Test), as illustrated in table 8.

Table 8: Relationship Between the Number of Intestinal Parasites Mentioned and Sociodemographic Data (n=400)

Number of Types of Intestinal Parasites Mentioned by studied group											
Variable	**No any**		**One Type**		**Two Types**		**>three Types**		**Total**		***p***
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Age Group (Years)											
15-29	82	53.6	48	50.5	38	41.3	23	38.3	191	47.8	0.2
30-44	39	25.5	28	29.5	27	29.3	17	28.3	111	27.8	
45-59	20	13.1.	16	16.8	23	25.0	**14**	**23.3**	**73**	**18.2**	
≥60	12	7.8	3	3.2	4	4.3	6	10.0	25	6.2	
Total	153	100.0	95	100.0	92	100.0	60	100.	400	100.0	
Sex											
Male	122	79.7	73	76.8	66	71.7	34	56.7	295	73.8	0.006
Female	31	20.3	22	23.2	26	28.3	26	43.3	105	26.2	
Total	153	100.0	95	100.0	92	100.0	60	100.0	400	100.0	
Type of Respondent											
Venders	56	36.6	29	30.5	21	22.8	12	20.0	118	29.5	0.04
Consumers	97	63.4	66	69.5	71	77.2	48	80.0	282	70.5	
Total	153		95		92		60			100.0	
Education Level											
Illiteracy	27	17.6	2	2.1	2	2.2	3	5.0	34	8.5	0.001
Primary School	57	37.3	19	20.0	14	15.2	5	8.3	95	23.8	
Secondary School	37	24.2	38	40.0	37	40.2	12	20.0	124	31.0	
High School/ Higher Education	32	20.9	36	37.9	39	42.4	40	66.7	147	36.8	

DISCUSSION

This study represents the first attempt to evaluate community awareness of the etiology, clinical signs, transmission, and control practices concerning gastrointestinal parasites in the Aden governorate, Yemen. Our findings indicated a substantial level of knowledge about intestinal parasitosis, with 292 out of 400 respondents (73%) demonstrating awareness. This is comparable to a study by Ahmed et al. [10] in Asmara, Eritrea, which also reported a 73% awareness level. Conversely, a study by Yusof and Isa [11] in Malaysia showed slightly lower awareness (67.6%), whereas research conducted in Addis Ababa, Ethiopia, found the highest level of knowledge (96.4%)[12]. In Saudi Arabia, a study identified that a significant proportion (92.7%) of participants lacked awareness about intestinal parasites and how to prevent them [13].

In our cohort, 23.8% could identify one type of intestinal parasite, 23% could identify two types, and 15% could identify three or more types. Furthermore, 247 out of 400 respondents (61.8%) could name specific intestinal parasites, whereas 153 (38.2%) had no knowledge of such parasites, as detailed in Table 3. The transmission of intestinal parasites can occur through contaminated food, including fresh and raw vegetables, with awareness levels influenced by education, geographic location, and cultural practices. Our study's awareness level was lower than that found in a Tanzanian study, where 75.5% of participants were aware of gastrointestinal parasites [5].

Regarding the spread of intestinal parasitosis, 292 respondents (73%) had heard about the condition, aligning with the findings of Ahmed et al. [10] in Asmara. However, a study by Tesfaye Taye [12] reported a higher awareness rate of 96.1%. In the present study, knowledge about the transmission methods of intestinal parasites was identified in 271 respondents (67.8%), significantly higher ($P < 0.001$) than the knowledge among vendors. This contrasts with a study in Ethiopia by Tesfaye Taye [12], which found that 325 out of 337 participants (96.4%) had a good understanding of transmission methods, while only 12 (3.6%) had poor knowledge.

Awareness of the severity of intestinal parasites was found to be low with consumers more informed than vendors (54.6% vs. 39%, P=0.003). This suggests that individuals with greater knowledge are more likely to appreciate the potential complications associated with these infections, despite a conflicting report by Tesfaye Taye [12], indicating higher awareness (96.4%).

Concerning symptoms, 277 respondents (69.2%) were knowledgeable about symptoms associated with intestinal parasites, such as abdominal pain, diarrhea, weight loss, and fatigue. The relationship between methods of transmission knowledge and sociodemographic data was analyzed using the Chi-Square test, revealing that knowledge decreases with age, with a significant difference ($P = 0.04$). The highest awareness was among individuals aged 15-29 years (43.5%), with the lowest in those aged 60 years and above (5.9%). This discrepancy may be attributed to younger individuals' easier access to information through schools and the internet, and their involvement in social networks that actively disseminate health-related information. Additionally, high school-educated respondents showed a higher understanding of transmission methods (47.2%, $P < 0.001$).

Male participants exhibited greater knowledge about transmission methods than females (67.2% vs. 32.8%, $P < 0.001$), potentially reflecting traditional gender roles in health information dissemination within households and communities.

Regarding attitudes towards intestinal parasites, half of the respondents (50%) viewed them as a serious disease, and 48.3% believed that playing in soil could lead to parasitosis. This study showed a higher inclination towards raw vegetable consumption as a perceived cause of intestinal parasites (64.3%) compared to a study in Ethiopia (56.7%) [12]. Regular nail-cutting and seeking healthcare for abdominal discomfort were practices reported by 59.5% and 66% of our respondents, respectively, which are lower than the figures reported in the Ethiopian study (77.7% and 95.5 %, respectively). Such attitudes and practices highlight a generally lesser degree of knowledge and a more positive attitude towards managing intestinal parasites compared to the Ethiopian study [12].

The prevalence of inadequate knowledge, attitudes/perceptions, and improper practices in relation to intestinal parasitism contributes significantly to the high prevalence levels, making control or eradication challenging [14]. To reduce mortality and morbidity, especially in children under five, it's crucial to assess the knowledge, attitudes, and practices of parents/guardians towards intestinal parasites. Understanding the prevalence of these parasites and identifying associated factors are essential for planning and implementing successful community-based control interventions [15].

CONCLUSION

The majority of the participant exhibited a commendable level of knowledge and a positive attitude towards intestinal parasites, underlining the necessity for public health education focused on transmission pathways and prevention strategies for intestinal parasitosis.

A substantial proportion of participants demonstrated good knowledge of intestinal parasitosis. However, this level of awareness was not as high as that observed in Addis Ababa, Ethiopia. Similarly, the overall awareness among our study's respondents about gastrointestinal parasites was moderately high, yet this too falls short of the awareness levels reported in Addis Ababa.

Our findings indicate a significant gap in knowledge regarding the methods of transmission of intestinal parasites, with vendors exhibiting considerably less understanding than consumers. This difference was statistically significant. Furthermore, knowledge and awareness concerning the seriousness of intestinal parasites remained low, with consumers again showing more understanding than vendors.

An interesting demographic trend emerged regarding knowledge levels and age; knowledge decreased significantly with age, with the highest awareness found among those aged 15-29 years and the lowest in individuals aged 60 years and above. Despite the presence of higher knowledge levels among high school graduates, these figures still represented the lower end of awareness percentages.

Regarding perceptions of intestinal parasitosis, half of the respondents considered intestinal parasites a serious disease, and less than half of them believed that soil contact could lead to parasitosis. Nevertheless, these percentages are still on the lower side, indicating a gap in perception and awareness.

The study also revealed that the majority of participants lacked comprehensive knowledge yet held a positive attitude towards managing intestinal parasites. Practices such as washing vegetables and hands—critical to preventing faeco-oral transmission of infections—were reported at the lowest percentages.

In conclusion, while there is a foundation of good knowledge and positive attitudes towards intestinal parasitosis among the study cohorts, there remains a substantial need for targeted public health education. This education should emphasize the transmission and prevention of intestinal parasites, especially given the gaps in awareness and practices crucial for minimizing the risk of infection.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript

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