Research Article

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Knowledge, Attitude, and Practice Toward Intestinal Parasitic Infections among Internally displaced Persons in Saber Camp, Lahaj, Yemen.

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ABSTRACT

Background: Intestinal parasitic infections (IPIs) are considered a significant health problem in developing countries, especially economically disadvantaged communities. Understanding knowledge, attitude, and practices (KAP) are crucial for intervention strategies. Currently, there is insufficient data on the KAP towards IPIs among internally displaced persons in Yemen.

Objectives: To evaluate the knowledge, attitude, and practices (KAP)towards IPIs among internally displaced persons in Saber camp, Lahaj Governorate, Yemen, from May - November 2019.

Methods: A cross-sectional study was conducted among 126 households of internally displaced persons from Saber camp. A pre-tested structural questionnaire was used to determine the knowledge, attitudes, and practices. Data were analyzed using SPSS version 25.0 statistical software.

Results: A total of 350 participated voluntarily in this study. Of the 350 respondents, 120 (34.3%) were males, and 230 (65.7 %) were females. The age of respondents ranged from 18 to 71 years old. Overall, only 42 (33.3%) participants have heard about intestinal parasites without proper knowledge about the signs and symptoms, causes, and ways of transmission of IPIs. Regarding their attitude towards IPIs, out of the 42 participants who have heard about intestinal parasites, only 3(7.1%) considered intestinal parasites harmful to people's health. Regarding their practice, the study showed that there were no proper preventive measures such as hand washing habits, water consumption, and personal hygiene.

Conclusion and recommendations: The current study reported a high rate of inadequate KAP on IPIs infection. So, health authorities must take more efforts and vital actions to reduce these knowledge gaps, control the conditions, implement preventive measures such as good hygiene, provide safe water at home, and promote sanitation and education at the community level. The present study provides valuable data to health authorities that can be used to establish an evidence-based control strategy and implement adequate preventive measures.

Keywords : Intestinal parasites, displaced person, knowledge, attitude, practices, Saber camp.

INTRODUCTION

Helminths and protozoa are the leading cause of Intestinal parasitic infections (IPIs) that inhabit the gastrointestinal tract (GIT). The conditions are a worldwide concern, especially in rural areas of developing countries where many children live and pose significant public health problems. According to reports, IPIs are prevalent where poverty pre; sanitation is inadequate or non-existent, drinking water can be unsafe, human waste can't be disposed of properly, open defecations are common, unaffordable health care is scarce as well as geographic and socioeconomic factors, relatively humid regions, high population density (1-3).

Although the national data on the prevalence of intestinal parasites in Yemen is not available, several studies report intestinal parasitism in Yemen in some places and show a variation in the majority of IPIs from one area to another. The overall prevalence of intestinal parasite infections among outpatients at Al Jomhury hospital, Al-Kuwait hospital, and

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Alzahrawy clinical center in Sana'a city, Yemen, was 40.3 % (4). The overall prevalence among displaced persons was 44.6% (5), and 28.7 % among food handlers in Mukalla district (Hadhramout/ Yemen) (6).

Yemen was ravaged by civil war and political upheaval in March 2015. Many people have been displaced southward to live in displaced camps due to insecurity and civil war in northern Yemen. Since 2015, when international intervention in Yemen's civil war began, the numbers of people fleeing violence have increased sharply. Thus, due to armed conflicts between the government and insurgent groups, Yemen has been experiencing more internal displacement (IDPs). In Yemen, approximately 3.6 million people are internally displaced. As IDPs flood the cities, the social system has been strained because many end up in poverty. IDPs continue to live in deplorable conditions, lacking adequate housing, limited healthcare access, and lower levels of education for their children. There are many camps in Yemen for internally displaced people, the main one in Lahaj. As far as we know, this is the first study on intestinal parasites in Yemen regarding the KAP of IPIs among the internally displaced Yemeni population. The present study was conducted among internally displaced persons who have been driven out of their home provinces by war. Living in the camps has worsened the situation since no washing facilities and no access to clean water are available like in their homes. Thus, displacement camps contribute to the transmission of parasites and create many diarrheal cases, increasing the mortality rate among these people.

KAP studies are necessary to assess the community knowledge, benefits, and practices towards specific problems. However, data about KAP intestinal infections among internally displaced people is lacking in Yemen. Providing such baseline data is essential for planning and implementing effective control measures. Therefore, the present study is aimed to evaluate KAP towards IPIs among internally displaced people.

METHODS

The present study was conducted among internally displaced individuals from camps in Lahaj governorate, Yemen, from November 2019 to March 2020.

Selection of Study area

Out of two IDP camps, Al-Shawkani and Saber Camps in Lahaj governorate, Yemen. Saber Camp was selected based on the large population compared to Al-the Shawkani camp.

Subjects

This study was conducted within the Saber Camp in Lahaj governorate, Yemen, among internally displaced people. Displaced individuals are those who have fled their homeland but have not crossed an international border.

Selection of study subjects

The study includes the internally displaced people who reside in the study area, are willing to sign informed consent as a volunteer, accept to participate in the research, and are present during the data collection.

The study subjects were selected based on a simple random sample of households. The number of households required from the camp was calculated based on the information given by the head camp. At the center, every 3rd house was selected for the study. If the residents of the selected house were not available or rejected to participate, the next houses were selected and continued with the actual counting process. The household selection process continued within the camp until the required sample size was obtained.

Sample size calculation

The sample size for the present study was calculated by the following equation:

$$n = \frac{Z^2 pq}{d^2}$$

Where n is the sample size

Z = Z statistic for a level of confidence (for level of confidence of 95 %; z-value= 1.96

P= prevalence of intestinal infection based on the previous study conducted in Yemen (7), which was 90 % (p=0.9). Hence, the minimum sample size calculated was 376.

$$n = \frac{Z^2 pq}{d^2}$$

$$n = \frac{1.96^2 (0.57)(0.43)}{5^2} = 376$$

Data collection

For this cross-sectional study, a Pre-test structural questionnaire was used and answered by a household representative in each participating home to evaluate the socio-demographic profile of the household. Face-to-face contact was thought to encourage subjects to provide prompt and accurate information and to facilitate data collection from illiterate participants. After taking consent from each household under the study, they were subjected to a structured questionnaire to gather information regarding socio-demographics and KAP related to IPIs. The questionnaire was first developed in English and then translated into Arabic. The questionnaire consisted of four sections. Questions in these sections were designed to collect information on the participants' socio-demographic profile, KAP. The first section included questions about demographics such as age, education, material status, and latrine facility. The second section of Questions regarding knowledge of IPIs infestation among the participants. It comprised of some question open-

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ended and some multiple-choice questions. Third section Questions regarding the practice of IPIs infestation among the participants. At the same time, the fourth section contains practice questions.

Ethical Consideration

Formal permission was obtained before the conduct of the study from the scientific research ethical committee, faculty of medicine and health science, UST university. To have access to participants and data. Informed consent got from the study subjects after explaining the purpose of the study and assuring confidentiality of collected data. There was no ethical issue confronted while conducting the survey.

Statistical Analysis

Data were analyzed using SPSS version 25.0 statistical software. The demographic characteristics of the respondents were presented in percentages and frequencies.

RESULTS

Socio-demographic characteristics of participants

A face-to-face interview was conducted with 126 displaced people regarding their KAP towards parasite intestinal infections. Socio-demographic characteristics of study participants are shown in Table 1. The majority of participants were female, 98 (77.8 %), while the remaining 28 (22.2 %) were male; the mean age of participants was 37.98 ±14.6 years old (ranging from 18-70 years old) majority of the parent 102 (81.0%) were illiterate (could not write and read), 18 (14.3%) had a primary school and 6 (4.8%) had secondary school.

Regarding marital status, the results indicated that an overwhelming number of the participants, 119 (94.4 %), were married and 1 (0.8 %) were divorced, whereas 6 (4.8 %) of the participants were found to be widowers, as summarized in Table 1. Furthermore, close to 47 (37.3 %) participants came from family sizes of 5 and above. All 126 (100%) of the participants had public restrooms. The sole source of water is a water tank.

Table 1: Socio-demographic characteristics of study participants (n= 126).

Characteristic		Frequency	Percentage (%)
Gender	Male	28	22.2
	Female	98	77.8
Age	37.98 ±14.6 years old		
Marital status	Married	119	94.4
	Single	-	-
	Divorce	1	0.8
	Widower	6	4.8
Parent educational level	Illiteracy	102	81.0
	Primary School	18	14.3
	Secondary School	6	4.8
Availability of latrine	Private	0	0
	Public	126	100
Source of water	Well	0	0
	Government pipe	0	0
	A water tank	126	100
Family size	1	1	0.8
	2	27	21.4
	3	23	18.3
	4	28	22.2
	>4	47	37.3

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Knowledge of participants toward IPIs

The results showed that 42 (33.3%) participants had heard about intestinal parasites, whereas 84 (66.7 %) didn't hear about intestinal parasites. Of these 42 participants who heard about intestinal parasites, 14 (11.1 %) reported their information about Ips via the Newspaper as the primary source. However, 10 (7.9 %) of them mentioned that they had heard about it from school (Figure 1).

Only 12 (28.6%) of the participants knew about the type of intestinal, mentioned Amoeba, 9 (21.4%) mentioned Giardia, and 7(16.7 %) stated a worm. In contrast, 14 (33.3 %) didn't mention any type of parasite (Figure 2).

Figure 1: Source of information about IPs.

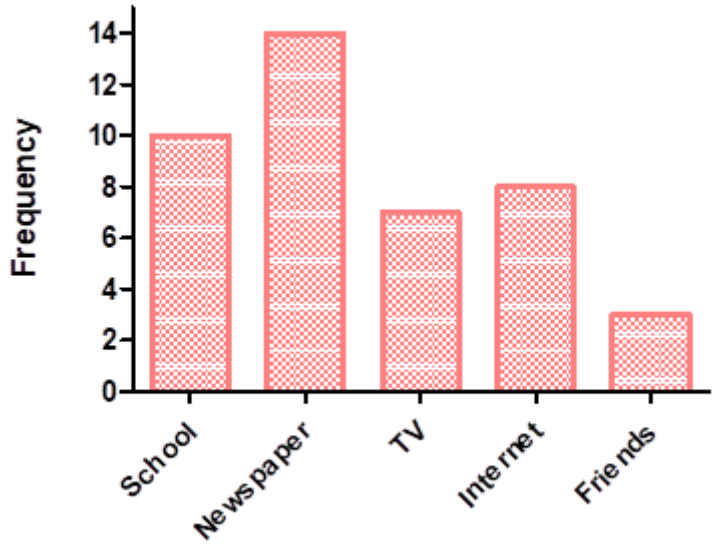
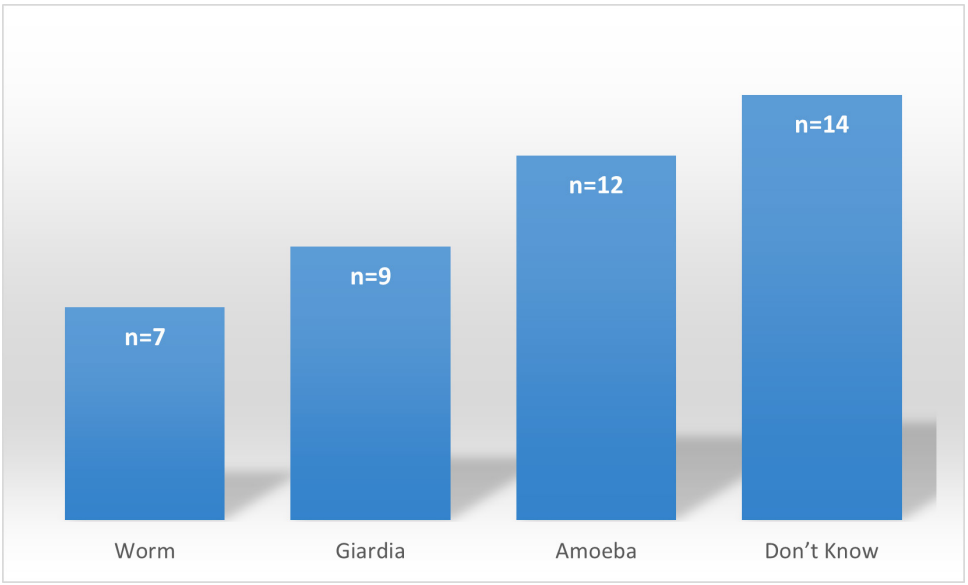


Figure 2: Type of intestinal the participants knew.



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Knowledge about the sign and symptoms of IPs infection

The results showed a lack of knowledge of the signs and symptoms of intestinal parasite infections among displaced people. Only 20 (47.6 %) participants had earlier knowledge where they mentioned at least one symptom of intestinal parasite infections. Of those, 5(11.9%) Abdominal pain and 10 (23.8 %) said diarrhea as a symptom, whereas 5(11.9%) stated both abdominal pain and diarrhea as the main symptom. The sign and symptoms mentioned by participants are depicted in Table 2.

Table 2: Knowledge of displaced participants about the mode of transmission of IPs infections (n=42).

Variable		Frequency (N)	Percent (%)
Mode of transmission	contaminated food and water	12	28.6
	Walking barefooted	2	4.8
	Dirty hand	3	7.1
Symptoms	Diarrhea	10	23.8
	Abdominal Pain	5	11.9
	Diarrhea and abdominal Pain	5	11.9
Prevention	hand washing before eating	10	23.8
	wearing shoes/slippers	5	11.9

Knowledge about the transmission of IPIs infection

This study revealed that 17(40.5 %) participants knew the mode of transmission of intestinal parasites and knew only one way of transmission. Table 2 shows the mode of transmission mentioned by the participants; a total of 12 (28.6 %) participants mentioned contaminated food and water, while 3 (7.1 %), 2(4.8 %) participants mentioned dirty hands and walking barefooted, respectively.

Knowledge about the prevention of IPs infection

Knowledge of displaced people about preventing intestinal parasites was found to be poor. Of 42 who heard about IPs, only 15(35.7 %) knew about prevention and mentioned one preventive measure. The preventative measure mentioned by the participants is illustrated in Table 3. Five (11.9%) participants mentioned wearing shoes or slippers when going outside the house, while ten (23.8%) mentioned hand washing before eating.

Table 3: Practice of displaced people participants towards IPs infections (n=126)

Variable	Yes, n(%)	No n(%)
Washing hands before eating	52 (41.3%)	74 (58.7 %)
Washing hands after defecation	53 (42.1%)	73 (57.9%)
Washing hands after outdoor activities	39 (31.0 %)	87 (69.0 %)
Wearing shoes/ slippers when outside the house	51 (40.5 %)	75 (59.5 %)
Cutting fingernails regularly	24(19.0 %)	102 (81.0 %)
Washing vegetables and fruit before eating	13 (10.7%)	113(89.7%)
Boiling drinking water	-	126 (100%)

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The attitude of displaced people toward IPs infections

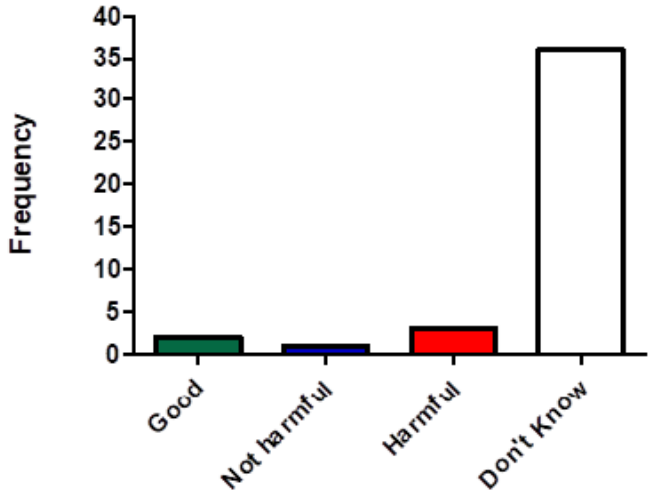
Out of the 42 participants who have heard about intestinal parasites, only 3(7.1%) indicated that intestinal parasites are harmful to people's health. In contrast, the majority, 36 (85.7 %), mentioned that they do not know whether intestinal parasites are harmful. Interestingly, two participants (4.8 %) agreed intestinal parasites are suitable for people's health.

Practices of displaced people to IPs infections

Results of displaced people's practices regarding intestinal parasites are shown in Table 3. The results revealed that more than half of the participants, 74 (58.7 %), don't wash their hands before eating their meals. Similarly, 73 (57.9 %) of the participants don't wash their hands after defecation, 87 (69.0 %) of them don't wash their hands after outdoor activities, and 75 (59.5 %) of them don't wear slippers and shoes when going outside the camp.

Moreover, 102 (81.0 %) of them don't cut their nails regularly. Washing fruits/vegetable before eating is an important habit to minimize the probability of getting infected; however, most of the participants, 113 (89.7%), don't wash vegetables and fruits before eating. Interestingly, all the participants, 126 (100%), do not boil drinking water.

Figure 3: Perception of participants about dangers of IPIs.



DISCUSSION

The prevalence of IPIs remains high in tropical and subtropical areas. It is more prevalent in developing or underdeveloped countries, though the majority of IPIs can also indirectly reflect local sanitation conditions and living conditions (8). In Yemen, the present study is considered one of the few studies concerning the KAP of IPs among people displaced and affected by parasites. Participants appear to have poor knowledge about intestinal parasites and are unaware of symptoms, mechanisms of transmission, and prevention measures.

The present study showed that only 33.3% of the participants had heard about intestinal parasites. Contrary to our findings study conducted in Eritrea among School Children, 73% of participants (7) had a good knowledge of intestinal parasites. In a study conducted in western Cote d'Ivoire (2), most participants are aware of common intestinal helminth infections. In contrast to our findings, a previous study on the knowledge of Orang Asli in Malaysia about soil-transmitted helminths showed that 61.4% of the participants knew about intestinal worms (9). A study conducted among university students in Selangor, Malaysia, indicated that most students had no idea about intestinal parasites (56.67%). However, a recent study among School Children in Taiz city, Yemen, reported a 59.5% of the participants had Previous knowledge of IPIs (10). According to a report in Kuantan, Pahang, Malaysia, 62.5% of parents of school children in peripheral schools and urban areas had heard about intestinal parasites. (11).

Regarding the source of information on intestinal parasite infections, the current study showed that about 11.1 % of those who had prior heard about the intestinal parasites indicated that their information about IPs was via the Newspaper as the primary source the main source. However, only ten participants (7.9%) were informed about it by their school. The previous study showed that most participants got information about parasitic intestine infection from clinics (11). Another study in Tanzania on parasitic disease, schistosomiasis, revealed that 34.5 % of participants got the information from school (12). Also, the most important source of information was the school (10). In this study, the results showed the school played a poor role in disseminating health information on the most common health problems of the communities and needs more attention as the school is considered one of the best places for positive change in any community.

The findings of this study showed that less than half of 20/42 (47.6 %) of the participants had earlier knowledge where they mentioned at least one symptom of intestinal parasite infections, mainly abdominal pain and diarrhea. In comparison, 29.3% of the participants from the Orang Asli tribe in Malaysia could mention at least one symptom of intestinal helminth infections (9). Also, our findings aligned with the previous study among mothers in Ethiopia; they mentioned diarrhea and abdominal cramps as the main clinical features of parasitic intestinal infections (13).

The study also revealed poor knowledge about intestinal parasite transmission, with only 17/42 (40.5 %) participants being knowledgeable about the mode of transmission and most of them only knowing a single way of transmission, mainly contaminated food and dirty hands. It is similar to earlier findings from Orang Asli communities, rural

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Bangladesh, and Eritrea (9, 10, 14). Therefore, not knowing the correct transmission mode almost always contributes significantly to getting infected, especially in areas where sanitary conditions are scarce or nonexistent. (10, 15).

Regarding preventive measures, only 15/42 (35.7 %) of the participants had knowledge about prevention and mentioned one preventative measure, mainly washing hands before eating. Only 5.8% of the participants in a recent study in Zimbabwe knew the proper way to protect themselves from STH (16). Contrary to our finding, 74.6%) of the students knew prevention methods for intestinal parasitic (10). There is a possibility that this could be explained by the fact that people are less likely to take preventive measures to avoid contracting or transmitting diseases they do not understand (16).

Regarding the perception of intestinal parasite infection, the present study showed that only 7.1% who had prior knowledge of intestinal parasites considered intestinal parasites harmful to people's health. Contrary to our finding, 72.1% of participants answered, "worms and protozoa are harmful to health (11). Current findings contrast with a study published in Brazil, where most participants were aware that intestinal helminths could harm their health (17). The lack of healthcare education by clinics or schools in camp areas could explain this controversy.

However, less than a third of the participants wash their hands with soap before eating or after defecating, while only 19.3% wash their hands with water. According to the findings, the personal hygiene practices of this population are poor. In Eritrea, 92.9% of students didn't wash their hands after defecation, as were most students in Orang Asli communities and other countries (9, 16). The results indicated that 41.3%, 42.1 %, and 31.0 % of the participants reported washing their hands before eating, after defecation, and after outdoor activities, respectively. Those with a low level of knowledge regarding the mode of parasitic transmission of intestinal parasites via bad practice as unwashed hands or no facilities for hand washing near to lavatory. However, hand washing is the main barrier against the fecal-oral transmission of parasitic diseases. So, hand washing must be done regularly as a regular habit before and after meals. Washing hands using a soap disinfectant is an important practice to avoid contaminated food and water with parasitic infection (18). It is a common phenomenon in the study area to see domestic animals such as cats, dogs, and sheep around the contaminated environment and mingle with the house members where they belong. These habits easily facilitate the dispersal of the worm's infective stage, thereby spreading the infections.

In the present study, all participants used untreated drinking water without boiling it before drinking (19). A previous study in Ethiopia found that only 14 percent of participants boiled their drinking water before drinking it. Untreated water is most likely contaminated with cysts and or/ eggs in polluted environments with inadequate sanitation. Therefore, drinking untreated water increases the chance of acquiring parasitic infections. Studies in several countries have found that the use of well water strongly predicts E. histolytica and Giardia infections (20-22).

The study's main limitation is that the results were limited to only internally displaced people in Saber camp, Lahaj; thus, the findings of this study may not reflect the awareness of the whole community; instead, they reflect only the awareness of those who included in the study. Therefore, the findings need to be interpreted within study limitations. Due to financial support and time constraints, those limitations did not allow the further investigation to evaluate KAP toward IPIs among residents in another camp.

CONCLUSION

The present study reported a high rate of inadequate KAP on IPIs infection. So, health authorities should take more efforts and vital actions to reduce these infections, implement preventive measures such as good hygiene, providing safe water at home, and promoting sanitation and IPIs education at the community level. The present study could serve as a valuable tool for the health authorities in planning and control strategies. It can help promote proper hygiene management and make baseline data that will help develop sustainable strategies and plan preventive and control measures.

Conflict Of Interest

The author has no conflicts of interest to declare

REFERENCES

1. Alsubaie ASR, Azazy AA, Omer EO, Al-Shibani LA, Al-Mekhlafi AQ, Al-Khawlani FA. Pattern of parasitic infections as public health problem among school children: A comparative study between rural and urban areas. Journal of Taibah University Medical Sciences. 2016;11(1):13-8.

2. Sitotaw B, Mekuriaw H, Damtie D. Prevalence of intestinal parasitic infections and associated risk factors among Jawi primary school children, Jawi town, north-west Ethiopia. BMC infectious diseases. 2019;19(1):341.

3. Sadeghi H, Borji H. A survey of intestinal parasites in a population in Qazvin, north of Iran. Asian Pacific Journal of Tropical Disease. 2015;5(3):231-3.

4. Alyousefi NA, Mahdy MA, Mahmud R, Lim YA. Factors

associated with high prevalence of intestinal protozoan infections among patients in Sana'a City, Yemen. PloS one. 2011;6(7):e22044.

5. Al-Abd N, Alharazi T, Bamaga OA. Cross sectional study on the prevalence of intestinal parasitic infections among displaced persons in Yemen. Electronic Journal of University of Aden for Basic and Applied Sciences. 2021;2(1):39-48.

6. Baswaid SH, Al-Haddad A. Parasitic infections among restaurant workers in Mukalla (Hadhramout/Yemen). Iranian Journal of Parasitology. 2008;3(3):37-41.

7. Alwabr GM, Al-Moayed EE. Prevalence of intestinal parasitic infections among school children of Al-Mahweet Governorate, Yemen. European Journal of Biological Research. 2016;6(2):64-73.

8. ABU-ZEID HH, Khan M, Omar M, Al Madani A. Relationship of intestinal parasites in urban communities in Abha to socioenvironmental factors. Saudi medical journal. 1989;10(6):477-80.

9. Nasr NA, Al-Mekhlafi HM, Ahmed A, Roslan MA, Bulgiba A. Towards an effective control programme of soil-transmitted helminth infections among Orang Asli in rural Malaysia. Part 2: Knowledge, attitude, and practices. Parasites & vectors. 2013;6(1):28.

10. Ahmed KS, Siraj NM, Fitsumberhan H, Isaac S, Yohannes S, Eman D, et al. Knowledge, Attitude and Practice (KAP) Assessment of Intestinal Parasitic Infection among School Children in Asmara, Eritrea. Health. 2016;9(1):57-68.

11. Yusof AM, Isa MLM. Knowledge, Attitude and Practices of Intestinal Helminths and Protozoa Infection Among Parents of School Children In Peripheral School and Urban School Area in Kuantan, Pahang, Malaysia. J Biotechnol Strateg Heal Res. 2017;1:75-82.

12. Mazigo HD, Waihenya R, Mkoji GM, Zinga M, Ambrose EE, Jahanpour O, et al. Intestinal schistosomiasis: prevalence, knowledge, attitude and practices among school children in an endemic area of north western Tanzania. J Rural Trop Public Health. 2010;9:53-60.

13. Kassaw MW, Abebe AM, Abate BB, Zemariam AB, Kassie AM. Knowledge, Attitude and Practice of Mothers on Prevention and Control of Intestinal Parasitic Infection in Sekota Town, Wag-Himra Zone, Ethiopia. 2020.

14. Mascie-Taylor C, Karim R, Karim E, Akhtar S, Ahmed T, Montanari R. The cost-effectiveness of health education in improving knowledge and awareness about intestinal parasites in rural Bangladesh. Economics & Human Biology. 2003;1(3):321-30.

15. Anderson RM, May RM. Infectious diseases of humans: dynamics and control: Oxford university press; 1992.

16. Midzi N, Mtapuri-Zinyowera S, Mapingure MP, Paul NH, Sangweme D, Hlerema G, et al. Knowledge attitudes and practices of grade three primary schoolchildren in relation to schistosomiasis, soil transmitted helminthiasis and malaria in Zimbabwe. BMC infectious diseases. 2011;11(1):169.

17. de Moraes Neto AHA, Pereira AP, Maria de Fátima LA, Souza-Júnior PR, Dias RC, Fonseca JG, et al. Prevalence of intestinal parasites versus knowledge, attitudes, and practices of inhabitants of low-income communities of Campos dos Goytacazes, Rio de Janeiro State, Brazil. Parasitology Research. 2010;107(2):295-307.

18. Curtis V, Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. The Lancet infectious diseases. 2003;3(5):275-81.

19. Vivas A, Gelaye B, Aboset N, Kumie A, Berhane Y, Williams MA. Knowledge, attitudes, and practices (KAP) of hygiene among school children in Angolela, Ethiopia. Journal of preventive medicine and hygiene. 2010;51(2):73.

20. Al-Shammari S, Khoja T, El-Khwasky F, Gad A. Intestinal parasitic diseases in Riyadh, Saudi Arabia: prevalence, sociodemographic and environmental associates. Tropical Medicine & International Health. 2001;6(3):184-9.

21. Cifuentes E, Gomez M, Blumenthal U, Tellez-Rojo MM, Romieu I, Ruiz-Palacios G, et al. Risk factors for Giardia intestinalis infection in agricultural villages practicing wastewater irrigation in Mexico. The American journal of tropical medicine and hygiene. 2000;62(3):388-92.

22. Bello J, Núñez F, González O, Fernández R, Almirall P, Escobedo A. Risk factors for Giardia infection among hospitalized children in Cuba. Annals of Tropical Medicine & Parasitology. 2011;105(1):57-64.