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Knowledge, attitude and practice of mothers on prevention and control of intestinal parasitic infection in a rural area of Bangladesh: a cross-sectional study

Emdadul Hasan Mukul[1], Safayet Jamil[2,3*], Harshini Suresh[4], Mahdi Hasan[5], Habib Mohammad Ali[6], ABM Alauddin Chowdhury[2], Quazi Istiaque Bari[7], Asma Akhter[8], Tawhed Islam[9], Rakibur Rahman[10], Nazmul Islam[11], Ashikur Rahman Rony[12]

[1] Department of Pharmacy, Khwaja Yunus Ali University, Sirajganj, Bangladesh.
[2] Department of Public Health, Daffodil International University, Dhaka, Bangladesh. [3]Center of Health and Disease Research, Bangladesh.
[4] Singhealth Dukenus Global Health Institute, Singapore.
[5] Department of Statistics, Dhaka College, Dhaka, Bangladesh.
[6] Department of Media Studies and Journalism, University of Liberal Arts Bangladesh, Dhaka, Bangladesh.
[7] Department of Pharmacy, State University of Bangladesh, Dhaka, Bangladesh.
[8] Department of Public Health, Daffodil International University, Dhaka, Bangladesh.
[9] Department of Pharmacy, Islamic University, Khustia, Bangladesh.
[10] Department of Pharmacy, International Islamic University, Chittagong, Bangladesh.
[11] Department of Pharmacy, Pabna University of Science and Technology, Pabna, Bangladesh.
[12] Department of Statistics, Govt Titumir College, Bangladesh.

Correspondence: safayetkyau333@gmail.com

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Evidence in Context

• Investigated mothers' knowledge, attitudes, and practices on preventing intestinal parasitic infections. • Mothers showed good knowledge and attitudes but inadequate preventive practices. • Practices were significantly influenced by mothers' education, occupation, and family size. • Highlighted the importance of targeted public health programs on deworming and hygiene. • Suggested boosting community education to reduce infection rates effectively.

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Abstract

Background: Intestinal parasite infections (IPI) pose a substantial public health issue in numerous developing nations, such as Bangladesh. To prevent this, proper knowledge, attitude and good practice are essential. This research was conducted to determine the amount of knowledge, attitude, and practice that mothers possess, as well as the factors that are connected with their practice variables.

Methods: This study followed cross-sectional methods with a close-ended questionnaire. Convenience sampling technique was utilized for data collection. 648 respondents participated in this study. R software was used for data analysis including frequency analysis, chi-square test and logistic regression analysis.

Results: The mother's knowledge and attitude level were good. But the practice level was not satisfactory. Mother's education level, occupation and number of children were significantly associated with practice variables in this study.

Conclusion: It is recommended that public health programs be implemented to address the prevention and control of intestinal parasite infections. These efforts should specifically target mothers and school teachers, emphasizing the importance of deworming medications and promoting basic hand hygiene practices.

Keywords: *intestinal parasitic infection, rural mother, anthelmintic, parasiticides, deworming, Bangladesh*

Introduction

Intestinal parasitic infestations (IPIs) are a significant public health concern in many developing countries, including Bangladesh. IPIs are caused by a variety of parasites, including protozoa, helminths, and intestinal worms, and they can lead to a range of health problems, such as malnutrition, anaemia, and diarrhoea [1]. In rural areas of Bangladesh, IPIs are particularly prevalent due to a lack of access to clean water, sanitation, and proper hygiene practices [2].

Mothers play a crucial role in the prevention and control of IPIs in their households. Their knowledge, attitude, and practice (KAP) regarding IPIs can greatly impact the health of their families [3]. Therefore, understanding the KAP of mothers in rural areas of Bangladesh regarding IPIs is essential for developing effective interventions to reduce the burden of IPIs in these communities [4].

The significance of this study lies in the fact that it will provide a comprehensive understanding of the KAP of mothers in the prevention and control of IPIs in rural areas of Bangladesh [4]. The findings of this study will not only help to identify gaps in knowledge and practice but also guide the development of interventions to improve the KAP of mothers and ultimately reduce the burden of IPIs in these communities [3]. Furthermore, the study will provide insight into the potential barriers and facilitators to the effective implementation of IPI prevention and control programs in rural areas of Bangladesh [5].

The results of this study will be particularly relevant for public health practitioners, policymakers, and researchers working in the field of IPI control in developing countries [1]. The study will provide a baseline for future research on the KAP of mothers in the prevention and control of IPIs in rural areas of Bangladesh and will contribute to the development of effective interventions to reduce the burden of IPIs in these communities [2].

This study's objective was to give a complete understanding of the knowledge, attitudes, and practices (KAP) of mothers in rural parts of Bangladesh regarding the prevention and control of intraperitoneal infections (IPIs). The findings of this study will be helpful in informing the creation of interventions to enhance the knowledge, attitudes, and practices (KAP) of mothers within these communities, which will ultimately lead to a reduction in the burden of IPIs. This study will provide insight into the potential barriers and facilitators to the effective implementation of IPI prevention and control programs in rural areas of Bangladesh.

The objective of this study is to assess the KAP of mothers on the prevention and control of IPIs in rural areas of Bangladesh. The research investigated whether or not there are any possible connections between KAP and other aspects, such as socioeconomic position, educational level, and access to medical care opportunities. The findings of this study will provide important information on the current state of knowledge, attitudes, and practices (KAP) among mothers in rural areas of Bangladesh about IPIs.

Methods

Study area and design

The design of this study was a cross-sectional study [15], and the methodology used was quantitative [6]. It was carried out on mothers of several rural areas including Sirajganj, Pabna, Kushtia, Dhaka, Chattogram, Madaripur districts. This study was conducted from 30 May 2022 to 12 February 2023. The inclusion criteria were: a) mothers who had children between 1 month and 12 years old, b) mothers who lived in rural areas for at least 1 year.

Sampling and data collection

Convenience sampling technique was followed during data collection [7]. A total of 678 respondents participated in the survey. However, due to incomplete responses, we excluded 30 respondents. After that, a total of 648 participant’s data was used for analysis. Data collection was performed by following a face-to-face approach [8]. Before data collection, eight surveyors were recruited for the survey. They presented the research goal and collected responses from consenting participants. All guidelines and procedures followed the World Medical Declaration of Helsinki [9].

Questionnaire settings

A structured four-sectioned questionnaire was used. Demographic status-related questions were in the first section. The second, third and fourth sections included knowledge, attitude and practice related questions. All questions were adopted from previously published studies [3, 10, 11, 12]. The questionnaire was in English language. To maintain the content validity, the questionnaire was approved by two experts.

Data analysis

Data analysis was performed using R software. Frequency analysis, chi-square analysis and binary logistic regression analysis were conducted. Frequency analysis was done to get the percentage of each variable. Chi-square analysis and binary logistic regression analysis were done to find out the associated factors between demographic variables and practice related variables. At the 95% confidence interval (CI), the *p*-value <0.05 was considered statistically significant.

Results

Demographic characteristics:

The table 1 shows the Socio-Demographic profile of the participants. A total of 648 participants were included in the study. Among them, 38.7% of the mothers had completed their primary education, 30.6% had completed their secondary education and 10.5% were illiterate. It was observed that 85.2% of the mothers were housewives and 91.8% of them had 1-3 children and 0.8% had more than 7 children.

Table 1: Demographic status of variables (Total sample, N=648)

Variables	Categories	Frequency	Percentage (%)
Mother's Education	Unable to write & read	68	10.5
	Read & write	36	5.6
	Primary	251	38.7
	Secondary	198	30.6
	Above Secondary	95	14.7
Mother's Occupation	Housewife	552	85.2
	Govt. employee	23	3.5
	Private employee	32	4.9
	Merchant	9	1.4
	Other	32	4.9
No. of Child	1-3	595	91.8
	4-6	48	7.4
	7-9	5	0.8

Knowledge level of mothers on prevention and control of intestinal parasitic infection:

Table S1 depicts the Knowledge level of mothers on prevention and control of intestinal parasitic infection. Mothers listed abdominal pain (75.6%), abdominal cramps (58.3%), diarrhea (58.6%), vomiting (62.5%), loss of appetite (40.3%), and itching of anal area (57.4%) as signs and symptoms of intestinal parasitic infections.

Regarding the complications of intestinal parasitic infection, anemia was mentioned by 29.5% of the mothers, malnutrition by 78.5%, growth retardation by 35% of the mothers, and 53.5% mentioned diarrhea as a complication of parasitic infestations.

Regarding the mode of transmission, nearly 78.7% mentioned contaminated food, 58.9% mentioned because of eating raw food, 54.3% mentioned the reason as drinking contaminated water, and 70.4% described lack of hygiene as a mode of transmission.

Of the 648 mothers, 83.3% mentioned washing hands before eating as a method of prevention of intestinal infections, 63.4% mentioned that taking deworming drugs as a method of prevention,77.5% mentioned that use of clean toilet and 78.5% mentioned that cleaning hands before food and after defecation as the prevention methods for controlling the intestinal parasitic infections.

Attitude level of mothers on prevention and control of intestinal parasitic infection:

Table S2 shows the attitude of mothers on intestinal parasitic infections. 66.4% of the mother agreed that lack of hygiene causes intestinal parasite infections. 70.2% of the mothers agreed that this infection can be prevented and treated and 65.7% of the mothers agreed that health education can reduce the prevalence of this infection. 41.2% agreed that this infection can progress to cause growth retardation and 63.7% agreed that using soap for washing hands can be preventive for intestinal parasite and 63.7% agreed that consumption of cooked foods can prevent worm infestation. 66.8% agreed that foods prepared from outside of the home are unhygienic.

Practice level of mothers on prevention and control of intestinal parasitic infection:

Table S3 shows the practice level of mothers on intestinal parasitic infections. 73.9% of the mothers have never done stool examination for their children, 55.7% of them had mentioned that their child has been diagnosed for intestinal parasitic infections and 8.5% were not sure about the same. 81.6% of the mothers wash their child's hand after defecation and 84.7% and 82.4% wash their child's hand before meal and after meal respectively. 70.7% of the mothers cut their children's nails regularly, only 50.3% of the mothers give antihelminthic drugs to their children routinely and 63.9% of them clean their child thoroughly after defecation.

Chi-square analysis of demographic variables and practice level:

According to Table 2, 3 and 4 the association of demographic variables including mothers' educational status, occupation and number of children were assessed with the practice level of mothers on prevention and control of intestinal parasitic infections, the variables which were found to have significant association with mothers education status were children diagnosed with intestinal parasitic infection (p value<0.001), mothers who wash their child's hand after defecation (p value<0.001), before meal and after meal (p value<0.001), mothers who cut the child's nails regularly (p value<0.001) and mothers who use chemically treated or tap water (p value<0.001). Also there was a statistically significant association of mother education status with the mothers who give antihelmintic drugs to their children (p value<0.001), who wash fruits and raw vegetables thoroughly before eating (p value<0.001) and mothers who clean their child thoroughly after defecation (p value<0.001).

Mothers occupational status were found to have significant association with mothers who wash their child's hand after defecation (p value=0.001) and after meal (p value<0.006), mothers who use chemically treated or tap water (p value<0.012). Also there was a statistically significant association of mother occupational status with the mothers who clean their child thoroughly after defecation (p value<0.001).

While assessing the association of a number of children in the family with the practice level of mothers on prevention and control of intestinal parasitic infections, the variables which were found to have significant association with the number of children status were, mothers who wash their child's hand after defecation (p value<0.001), before meal and after meal (p value<0.001), mothers who cut the child's nails regularly (p value<0.001) and mothers who use chemically treated or tap water for washing (p value<0.007).

Table 2: Chi-square test for evaluating the correlation between practice-level of mother's and mother's education (N=648)

IPI Practice related variable	Dependent variable

Level		Mothers education status						
		Unable to write & read	Read & write	Primary	Secondary	Above Secondary	Total	P-value
		N(%)=68 (10.5)	N(%)=36 (5.6)	N(%)=251 (38.7)	N(%)=198 (30.6)	N(%)=95 (14.7)	N(%)=648	
Have your child ever been diagnosed for intestinal parasitic infection?	Yes	26 (38.2)	17 (47.2)	155 (61.8)	112 (56.6)	51 (53.7)	**<0.001**	361 (55.7)
	No	37 (54.4)	15 (41.7)	65 (25.9)	76 (38.4)	39 (41.1)		232 (35.8)
	Not sure	5 (7.4)	4 (11.1)	31 (12.4)	10 (5.1)	5 (5.3)		55 (8.5)
Do you wash your child's hand after defecation?	Yes	42 (61.8)	29 (80.6)	208 (82.9)	171 (86.4)	79 (83.2)	529 (81.6)	**<0.001**
	No	11 (16.2)	4 (11.1)	12 (4.8)	22 (11.1)	11 (11.6)	60 (9.3)	
	Not sure	15 (22.1)	3 (8.3)	31 (12.4)	5 (2.5)	5 (5.3)	59 (9.1)	
Do you wash your child's hand before meal?	Yes	42 (61.8)	28 (77.8)	205 (81.7)	187 (94.4)	87 (91.6)	549 (84.7)	**<0.001**
	No	8 (11.8)	1 (2.8)	12 (4.8)	10 (5.1)	5 (5.3)	36 (5.6)	
	Not sure	18 (26.5)	7 (19.4)	34 (13.5)	1 (0.5)	3 (3.2)	63 (9.7)	
Do you wash your child's hand after meal?	Yes	40 (58.8)	31 (86.1)	204 (81.3)	174 (87.9)	85 (89.5)	534 (82.4)	**<0.001**
	No	6 (8.8)	2 (5.6)	10 (4.0)	19 (9.6)	6 (6.3)	43 (6.6)	
	Not sure	22 (32.4)	3 (8.3)	37 (14.7)	5 (2.5)	4 (4.2)	71 (11.0)	
Do you shorten your child's nails regularly?	Yes	33 (48.5)	21 (58.3)	149 (59.4)	175 (88.4)	80 (84.2)	458 (70.7)	**<0.001**
	No	21 (30.9)	3 (8.3)	24 (9.6)	11 (5.6)	9 (9.5)	68 (10.5)	
	Not sure	14 (20.6)	12 (33.3)	78 (31.1)	12 (6.1)	6 (6.3)	122 (18.8)	
Do you use chemically treated/tap water?	Yes	10 (14.7)	10 (27.8)	84 (33.5)	46 (23.2)	53 (55.8)	203 (31.3)	**<0.001**
	No	48 (70.6)	24 (66.7)	105 (41.8)	141 (71.2)	39 (41.1)	357 (55.1)	
	Not sure	10 (14.7)	2 (5.6)	62 (24.7)	11 (5.6)	3 (3.2)	88 (13.6)	
Do you give anthelmintic drug routinely?	Yes	17 (25.0)	10 (27.8)	131 (52.2)	113 (57.1)	55 (57.9)	326 (50.3)	**<0.001**
	No	43 (63.2)	16 (44.4)	69 (27.5)	69 (34.8)	31 (32.6)	228 (35.2)	
	Not sure	8 (11.8)	10 (27.8)	51 (20.3)	16 (8.1)	9 (9.5)	94 (14.5)	

Do you wash fruits & raw vegetables thoroughly before eating?	Yes	41 (60.3)	26 (72.2)	172 (68.5)	176 (88.9)	87 (91.6)	502 (77.5)	**<0.001**
	No	11 (16.2)	4 (11.1)	17 (6.8)	17 (8.6)	6 (6.3)	55 (8.5)	
	Not sure	16 (23.5)	6 (16.7)	62 (24.7)	5 (2.5)	2 (2.1)	91 (14.0)	
Do you wash meal before cooking?	Yes	53 (77.9)	32 (88.9)	225 (89.6)	188 (94.9)	92 (96.8)	590 (91.0)	**<0.001**
	No	7 (10.3)	1 (2.8)	4 (1.6)	4 (2.0)	1 (1.1)	17 (2.6)	
	Not sure	8 (11.8)	3 (8.3)	22 (8.8)	6 (3.0)	2 (2.1)	41 (6.3)	
Do you clean your child thoroughly after defecation?	Yes	31 (45.6)	23 (63.9)	142 (56.6)	136 (68.7)	82 (86.3)	414 (63.9)	**<0.001**
	No	14 (20.6)	5 (13.9)	25 (10.0)	32 (16.2)	5 (5.3)	81 (12.5)	
	Not sure	23 (33.8)	8 (22.2)	84 (33.5)	30 (15.2)	8 (8.4)	153 (23.6)	

Table 3: Chi-square test for evaluating the correlation between practice-level of mother's and mother's occupation (N=648)

IPI Practice related variable	**Level**	**Dependent variable**						
		Mothers occupational status						
		Housewife	**Govt. employee**	**Private employee**	**Merchant**	**Other**	**Total**	**P-value**
		N(%)=552 (85.2)	N(%)=23 (3.5)	N(%)=32 (4.9)	N(%)=9 (1.4)	N(%)=32 (4.9)	N(%)=648	
Have your child ever been diagnosed for intestinal parasitic infection?	Yes	303 (54.9)	18 (78.3)	22 (68.8)	6 (66.7)	12 (37.5)	361 (55.7)	0.096
	No	201 (36.4)	5 (21.7)	7 (21.9)	3 (33.3)	16 (50.0)	232 (35.8)	
	Not sure	48 (8.7)	0 (0.0)	3 (9.4)	0 (0.0)	4 (12.5)	55 (8.5)	
Do you wash your child's hand after defecation?	Yes	450 (81.5)	21 (91.3)	30 (93.8)	7 (77.8)	21 (65.6)	529 (81.6)	**0.001**
	No	56 (10.1)	2 (8.7)	0 (0.0)	1 (11.1)	1 (3.1)	60 (9.3)	
	Not sure	46 (8.3)	0 (0.0)	2 (6.2)	1 (11.1)	10 (31.2)	59 (9.1)	
Do you wash your child's hand before meal?	Yes	461 (83.5)	23 (100.0)	29 (90.6)	9 (100.0)	27 (84.4)	549 (84.7)	0.240
	No	35 (6.3)	0 (0.0)	1 (3.1)	0 (0.0)	0 (0.0)	36 (5.6)	
	Not sure	56 (10.1)	0 (0.0)	2 (6.2)	0 (0.0)	5 (15.6)	63 (9.7)	
Do you wash your child's hand after meal?	Yes	457 (82.8)	21 (91.3)	27 (84.4)	7 (77.8)	22 (68.8)	534 (82.4)	**0.006**
	No	38 (6.9)	1 (4.3)	4 (12.5)	0 (0.0)	0 (0.0)	43 (6.6)	
	Not sure	57 (10.3)	1 (4.3)	1 (3.1)	2 (22.2)	10 (31.2)	71 (11.0)	
Do you shorten your child's nails regularly?	Yes	386 (69.9)	21 (91.3)	26 (81.2)	7 (77.8)	18 (56.2)	458 (70.7)	0.133
	No	60 (10.9)	2 (8.7)	2 (6.2)	0 (0.0)	4 (12.5)	68 (10.5)	
	Not sure	106 (19.2)	0 (0.0)	4 (12.5)	2 (22.2)	10 (31.2)	122 (18.8)	

Do you use chemically treated/tap water?	Yes	158 (28.6)	12 (52.2)	15 (46.9)	6 (66.7)	12 (37.5)	203 (31.3)	**0.012**
	No	314 (56.9)	10 (43.5)	16 (50.0)	3 (33.3)	14 (43.8)	357 (55.1)	
	Not sure	80 (14.5)	1 (4.3)	1 (3.1)	0 (0.0)	6 (18.8)	88 (13.6)	
Do you give anthelmintic drug routinely?	Yes	283 (51.3)	12 (52.2)	17 (53.1)	4 (44.4)	10 (31.2)	326 (50.3)	0.288
	No	186 (33.7)	10 (43.5)	11 (34.4)	3 (33.3)	18 (56.2)	228 (35.2)	
	Not sure	83 (15.0)	1 (4.3)	4 (12.5)	2 (22.2)	4 (12.5)	94 (14.5)	
Do you wash fruits & raw vegetables thoroughly before eating?	Yes	425 (77.0)	21 (91.3)	26 (81.2)	6 (66.7)	24 (75.0)	502 (77.5)	0.368
	No	48 (8.7)	1 (4.3)	4 (12.5)	0 (0.0)	2 (6.2)	55 (8.5)	
	Not sure	79 (14.3)	1 (4.3)	2 (6.2)	3 (33.3)	6 (18.8)	91 (14.0)	
Do you wash meal before cooking?	Yes	504 (91.3)	22 (95.7)	30 (93.8)	9 (100.0)	25 (78.1)	590 (91.0)	0.256
	No	14 (2.5)	1 (4.3)	0 (0.0)	0 (0.0)	2 (6.2)	17 (2.6)	
	Not sure	34 (6.2)	0 (0.0)	2 (6.2)	0 (0.0)	5 (15.6)	41 (6.3)	
Do you clean your child thoroughly after defecation?	Yes	332 (60.1)	21 (91.3)	29 (90.6)	7 (77.8)	25 (78.1)	414 (63.9)	**0.001**
	No	77 (13.9)	1 (4.3)	2 (6.2)	0 (0.0)	1 (3.1)	81 (12.5)	
	Not sure	143 (25.9)	1 (4.3)	1 (3.1)	2 (22.2)	6 (18.8)	153 (23.6)	

Table 4: Chi-square test for evaluating the correlation between practice-level of mother's and no. of children of mothers (N=648)

IPI Practice related variable	**Level**	**Dependent variable**				
		No. of children				
		1-3	**4-6**	**7-9**	**Total**	**P-value**
		N(%)=595 (91.8)	N(%)=48 (7.4)	N(%)=5 (0.8)	N(%)=648	
Have your child ever been diagnosed for intestinal parasitic infection?	Yes	334 (56.1)	24 (50.0)	3 (60.0)	361 (55.7)	0.201
	No	208 (35.0)	23 (47.9)	1 (20.0)	232 (35.8)	
	Not sure	53 (8.9)	1 (2.1)	1 (20.0)	55 (8.5)	
Do you wash your child's hand after defecation?	Yes	494 (83.0)	31 (64.6)	4 (80.0)	529 (81.6)	**<0.001**
	No	55 (9.2)	4 (8.3)	1 (20.0)	60 (9.3)	
	Not sure	46 (7.7)	13 (27.1)	0 (0.0)	59 (9.1)	
Do you wash your child's hand before meal?	Yes	512 (86.1)	33 (68.8)	4 (80.0)	549 (84.7)	**<0.001**
	No	33 (5.5)	2 (4.2)	1 (20.0)	36 (5.6)	
	Not sure	50 (8.4)	13 (27.1)	0 (0.0)	63 (9.7)	
Do you wash your child's hand after meal?	Yes	498 (83.7)	32 (66.7)	4 (80.0)	534 (82.4)	**0.001**
	No	40 (6.7)	2 (4.2)	1 (20.0)	43 (6.6)	
	Not sure	57 (9.6)	14 (29.2)	0 (0.0)	71 (11.0)	

Do you shorten your child's nails regularly?	Yes	428 (71.9)	26 (54.2)	4 (80.0)	458 (70.7)	0.077
	No	60 (10.1)	7 (14.6)	1 (20.0)	68 (10.5)	
	Not sure	107 (18.0)	15 (31.2)	0 (0.0)	122 (18.8)	
Do you use chemically treated/tap water?	Yes	179 (30.1)	19 (39.6)	5 (100.0)	203 (31.3)	**0.007**
	No	336 (56.5)	21 (43.8)	0 (0.0)	357 (55.1)	
	Not sure	80 (13.4)	8 (16.7)	0 (0.0)	88 (13.6)	
Do you give anthelmintic drug routinely?	Yes	305 (51.3)	17 (35.4)	4 (80.0)	326 (50.3)	0.171
	No	205 (34.5)	22 (45.8)	1 (20.0)	228 (35.2)	
	Not sure	85 (14.3)	9 (18.8)	0 (0.0)	94 (14.5)	
Do you wash fruits & raw vegetables thoroughly before eating?	Yes	461 (77.5)	36 (75.0)	5 (100.0)	502 (77.5)	0.626
	No	52 (8.7)	3 (6.2)	0 (0.0)	55 (8.5)	
	Not sure	82 (13.8)	9 (18.8)	0 (0.0)	91 (14.0)	
Do you wash meal before cooking?	Yes	545 (91.6)	40 (83.3)	5 (100.0)	590 (91.0)	0.359
	No	15 (2.5)	2 (4.2)	0 (0.0)	17 (2.6)	
	Not sure	35 (5.9)	6 (12.5)	0 (0.0)	41 (6.3)	
Do you clean your child thoroughly after defecation?	Yes	380 (63.9)	29 (60.4)	5 (100.0)	414 (63.9)	0.297
	No	77 (12.9)	4 (8.3)	0 (0.0)	81 (12.5)	
	Not sure	138 (23.2)	15 (31.2)	0 (0.0)	153 (23.6)	

Logistic regression analysis of demographic variables and practice level:

Table 5 shows the logistic regression analysis of practice level of mothers with their educational status. Univariate logistic regression analysis was done to estimate the strength of association and to study the direction of association of various factors with the mother's educational status among the study participants. Out of the 10 influencing factors, odds ratio was statistically significant ($p < 0.05$) for all following practices related to Intestinal Parasitic infection. With respect to the practices, whether the child has ever been diagnosed for intestinal parasitic infection, Yes was taken as reference. When the child was not diagnosed with infection, log odds of Higher educational status of the mother was 0.41 times [95% CI: 0.24-0.69] high than the mother with lower educational status. The next practice whether the child wash his/her hands after defecation, yes was taken as reference. When the child doesn't wash the hands after defecation, log odds of Higher educational status of the mother was 0.38 times [95% CI: 0.19-0.83] high than the mother with lower educational status and mothers who were not sure of the child's hand washing practice, log odds of Higher educational status of the mother was 0.25 times [95% CI: 0.13-0.5] high than the mother with lower educational status. Regarding the practice of washing child's hand before meal, yes was taken as reference. When the child doesn't wash the hands before meal, log odds of Higher educational status of the mother was 0.29 times [95% CI: 0.13-0.72] higher than the mother with lower educational status and mothers who were not sure of the child's hand washing practice before meal, log odds of higher educational status of the mother was 0.21 times [95% CI: 0.11-0.4] high than the mother with lower educational status. The practice of child washing hands after meal, yes was taken as reference. When the mothers were not sure of the child's hand washing practice after meal, log odds of higher educational status of the mother was 0.18 times [95% CI: 0.13-0.5] less than the mother with lower educational status. With respect the practice of shortening the nails if the child, yes was taken as a reference. When the mothers doesn't shorten the nails of the child, log odds of higher educational status of the mother was 0.17 times [95% CI: 0.19-0.83] less than the mother with lower educational status. The practice of using chemically treated or tap water for

Washing hands, yes was taken as a reference. When the mother doesn't use chemically treated or tap water for washing the hands, log odds of Higher educational status of the mother was 0.33 times [95% CI: 0.16-0.65] high than the mother with lower educational status. The practice of giving antihelminthic drugs routinely, yes was taken as reference. When the mother doesn't give antihelminthic drugs to the child, log odds of Higher educational status of the mother was 0.24 times [95% CI: 0.13-0.42] high than the mother with lower educational status. Other factors, like washing the fruits and vegetables before eating, washing the meal before cooking and cleaning the child after defecation also showed statistically significant association with the mother's education status.

Besides on the multivariate analysis, the practice of washing child's hand before meal [0.4 (95%CI: 0.16-1.04)] and after meal [0.39 (95% CI: 0.16-1.02)] and shortening the child's nails regularly [0.45 (95% CI: 0.2-1.03)].

Table 5: Univariate and multivariate logistic regression analysis for finding the significant factor with mother's educational status (N=648)

IPI practice related variable	Level	Univariate	Multivariate
		OR (95% CI), p-value	OR (95% CI), p-value
Have your child ever been diagnosed for intestinal parasitic infection?	Yes	-	-
	No	0.41 (0.24-0.69, p=0.001)	0.62 (0.33-1.16, p=0.134)
	Not sure	0.78 (0.31-2.38, p=0.620)	1.36 (0.43-5.15, p=0.624)
Do you wash your child's hand after defecation?	Yes	-	-
	No	0.38 (0.19-0.83, p=0.010)	0.69 (0.28-1.81, p=0.433)
	Not sure	0.25 (0.13-0.50, p<0.001)	0.67 (0.26-1.84, p=0.426)
Do you wash your child's hand before meal?	Yes	-	-
	No	0.29 (0.13-0.72, p=0.004)	0.40 (0.11-1.54, p=0.171)
	Not sure	0.21 (0.11-0.40, p<0.001)	0.40 (0.16-1.04, p=0.054)
Do you wash your child's hand after meal?	Yes	-	-
	No	0.50 (0.21-1.38, p=0.139)	1.96 (0.54-8.68, p=0.341)
	Not sure	0.18 (0.10-0.33, p<0.001)	0.39 (0.16-1.02, p=0.049)
Do you shorten your child's nails regularly?	Yes	-	-
	No	0.17 (0.09-0.33, p<0.001)	0.45 (0.20-1.03, p=0.053)
	Not sure	0.60 (0.32-1.19, p=0.128)	1.42 (0.58-3.67, p=0.458)
Do you use chemically treated/tap water?	Yes	-	-
	No	0.33 (0.16-0.65, p=0.002)	0.57 (0.25-1.24, p=0.170)
	Not sure	0.40 (0.16-1.02, p=0.052)	0.69 (0.23-2.07, p=0.498)
Do you give anthelmintic drug routinely?	Yes	-	-
	No	0.24 (0.13-0.42, p<0.001)	0.55 (0.26-1.14, p=0.109)
	Not sure	0.59 (0.25-1.49, p=0.239)	0.86 (0.32-2.50, p=0.775)
Do you wash fruits & raw vegetables thoroughly before eating?	Yes	-	-

No	0.36 (0.18-0.77, p=0.006)	0.75 (0.29-2.10, p=0.560)	
Not sure	0.42 (0.23-0.80, p=0.006)	0.73 (0.31-1.80, p=0.483)	
Do you wash meal before cooking?	Yes	-	-
	No	0.14 (0.05-0.40, p<0.001)	0.29 (0.09-1.09, p=0.055)
	Not sure	0.41 (0.19-0.99, p=0.032)	1.05 (0.35-3.44, p=0.934)
Do you clean your child thoroughly after defecation?	Yes	-	-
	No	0.39 (0.20-0.79, p=0.006)	0.49 (0.22-1.11, p=0.077)
	Not sure	0.46 (0.26-0.82, p=0.008)	0.67 (0.33-1.38, p=0.267)

Table 6 shows the logistic regression analysis of practice level of mothers with their occupational status. Out of the 10 influencing factors, odds ratio was statistically significant ($p < 0.05$) for all following practices related to Intestinal Parasitic infection. The practice of using chemically treated or tap water for washing hands, yes was taken as reference. When the mother doesn't use chemically treated or tap water for washing the hands, log odds of mother who were unemployed were 0.48 times [95% CI: 0.3-0.76] high than the mother who were employed and the mother's who were not sure of this practice, log odds of mother who were unemployed were 0.35 times [95% CI: 0.15-0.74] high than the mother who were employed. The practice of whether the mother clean the child after defecation, yes was taken as reference. When the mother doesn't wash the child after defecation, log odds of mother who were unemployed were 0.21 times [95% CI: 0.06-0.52] high than the mother who were employed and the mother's who were not sure of this practice, log odds of mother who were unemployed were 0.28 times [95% CI: 0.13-0.54] high than the mother who were employed.

While performing multivariate analysis, the practice of using chemically treated/tap water, yes was taken as reference. When the mother doesn't use chemically treated or tap water for washing the hands, log odds of mother who were unemployed were 0.55 times [95% CI: 0.32-0.95] high than the mother who were employed and the mother's who were not sure of this practice, log odds of mother who were unemployed were 0.39 times [95% CI: 0.15-0.89] high than the mother who were employed. The practice of giving antihelminthic drugs to children, yes was taken as reference. When the mother doesn't give antihelminthic medications to the child, log odds of mother who were unemployed were 2.09 times [95% CI: 1.17-3.77] high than the mother who were employed. The practice of whether the mother clean the child after defecation, yes was taken as reference. When the mother doesn't wash the child after defecation, log odds of mother who were unemployed were 0.26 times [95% CI: 0.07-0.69] high than the mother who were employed and the mother's who were not sure of this practice, log odds of mother who were unemployed were 0.25 times [95% CI: 0.11-0.51] high than the mother who were employed.

Table 6: Logistic regression analysis for finding the significant factor with mother's occupation (N=648)

IPI practice related variable	Level	Univariate	Multivariate
		OR (95% CI) , p-value	OR (95% CI), p- value
Have your child ever been diagnosed for intestinal parasitic infection?	Yes	-	-
	No	0.81 (0.50-1.28, p=0.369)	0.65 (0.37-1.10, p=0.113)
	Not sure	0.76 (0.30-1.67, p=0.526)	0.63 (0.23-1.53, p=0.335)
Do you wash your child's hand after defecation?	Yes	-	-
	No	0.41 (0.12-1.03, p=0.091)	0.69 (0.19-1.97, p=0.522)
	Not sure	1.61 (0.80-3.04, p=0.158)	2.15 (0.93-4.80, p=0.065)

Do you wash your child's hand before meal?	Yes	-	-
	No	0.15 (0.01-0.71, p=0.063)	0.13 (0.01-0.87, p=0.075)
	Not sure	0.65 (0.26-1.39, p=0.310)	0.34 (0.11-0.87, p=0.033)
Do you wash your child's hand after meal?	Yes	-	-
	No	0.78 (0.26-1.88, p=0.615)	1.53 (0.43-4.68, p=0.482)
	Not sure	1.46 (0.75-2.68, p=0.243)	1.68 (0.75-3.68, p=0.198)
Do you shorten your child's nails regularly?	Yes	-	-
	No	0.71 (0.30-1.48, p=0.399)	1.04 (0.40-2.51, p=0.925)
	Not sure	0.81 (0.44-1.42, p=0.477)	1.07 (0.48-2.29, p=0.867)
Do you use chemically treated/tap water?	Yes	-	-
	No	0.48 (0.30-0.76, p=0.002)	0.55 (0.32-0.95, p=0.031)
	Not sure	0.35 (0.15-0.74, p=0.010)	0.39 (0.15-0.89, p=0.034)
Do you give anthelmintic drug routinely?	Yes	-	-
	No	1.49 (0.93-2.37, p=0.094)	2.09 (1.17-3.77, p=0.013)
	Not sure	0.87 (0.41-1.71, p=0.704)	1.07 (0.47-2.29, p=0.874)
Do you wash fruits & raw vegetables thoroughly before eating?	Yes	-	-
	No	0.80 (0.32-1.74, p=0.608)	0.93 (0.32-2.35, p=0.880)
	Not sure	0.84 (0.42-1.56, p=0.597)	1.14 (0.50-2.53, p=0.748)
Do you wash meal before cooking?	Yes	-	-
	No	1.26 (0.29-3.95, p=0.725)	1.76 (0.32-7.07, p=0.462)
	Not sure	1.21 (0.48-2.66, p=0.663)	1.25 (0.44-3.26, p=0.656)
Do you clean your child thoroughly after defecation?	Yes	-	-
	No	0.21 (0.06-0.52, p=0.003)	0.26 (0.07-0.69, p=0.016)
	Not sure	0.28 (0.13-0.54, p<0.001)	0.25 (0.11-0.51, p<0.001)

Table 7 shows the logistic regression analysis of practice level of mothers with number of children. Out of the 10 influencing factors, odds ratio was statistically significant ($p < 0.05$) for all following practices related to Intestinal Parasitic infection. The practice of whether the child wash his/her hands after defecation, yes was taken as reference. When the mothers were not sure of the child's hand washing practice, log odds of having less number of children was 3.99 times [95% CI: 0.13-0.5] less than the mothers having children of higher order. Regarding the practice of washing child's hand before meal, yes was taken as reference. When the mothers were not sure of the child's hand washing practice before meal, log odds of having less number of children was 3.6 times [95% CI: 1.74-7.07] less than the mothers having children of higher order. The practice of child washing hands after meal, yes was taken as reference. When the mothers were not sure of the child's hand washing practice after meal, log odds of having less number of children was 3.4 times [95% CI: 1.68-6.56] less than the mothers having children of higher order.. With respect the practice of shortening the nails if the child, yes was taken as reference. When the mothers were not sure of the practice of shortening the nails of the child, log odds of having less number of children was 2 times [95% CI: 1.01-3.8] less than the mothers having children of higher order. The practice of using chemically treated or tap water for washing hands, yes was taken as

Reference. When the mother doesn't use chemically treated or tap water for washing the hands, log odds of having less number of children was 0.47 times [95% CI: 0.25-0.86] less than the mothers having children of higher order.

On multivariate analysis, the practice of whether the child wash his/her hands after defecation, yes was taken as reference. When the mothers were not sure of the child's hand washing practice, log odds of having less number of children was 2.63 times [95% CI: 1.07-6.18] less than the mothers having children of higher order. The practice of using chemically treated or tap water for washing hands, yes was taken as reference. When the mother doesn't use chemically treated or tap water for washing the hands, log odds of having less number of children was 0.34 times [95% CI: 0.16-0.7] less than the mothers having children of higher order.

Table 7: Logistic regression analysis for finding the significant factor with no of child of mothers (N=648)

IPI practice related variable	Level	Univariate	Multivariate
		OR (95% CI), p-value	OR (95% CI), p-value
Have your child ever been diagnosed for intestinal parasitic infection?	Yes	-	-
	No	1.43 (0.80-2.54, p=0.226)	1.38 (0.70-2.73, p=0.351)
	Not sure	0.47 (0.07-1.62, p=0.308)	0.27 (0.04-1.09, p=0.109)
Do you wash your child's hand after defecation?	Yes	-	-
	No	1.28 (0.43-3.14, p=0.617)	1.23 (0.35-3.64, p=0.723)
	Not sure	3.99 (1.92-7.92, p<0.001)	2.63 (1.07-6.18, p=0.030)
Do you wash your child's hand before meal?	Yes	-	-
	No	1.26 (0.29-3.73, p=0.714)	1.43 (0.22-7.02, p=0.678)
	Not sure	3.60 (1.74-7.07, p<0.001)	2.26 (0.88-5.59, p=0.084)
Do you wash your child's hand after meal?	Yes	-	-
	No	1.04 (0.24-3.04, p=0.953)	0.96 (0.16-4.20, p=0.965)
	Not sure	3.40 (1.68-6.56, p<0.001)	1.57 (0.60-3.81, p=0.336)
Do you shorten your child's nails regularly?	Yes	-	-
	No	1.90 (0.78-4.16, p=0.127)	1.59 (0.54-4.28, p=0.376)
	Not sure	2.00 (1.01-3.80, p=0.038)	1.42 (0.59-3.34, p=0.421)
Do you use chemically treated/tap water?	Yes	-	-
	No	0.47 (0.25-0.86, p=0.015)	0.34 (0.16-0.70, p=0.004)
	Not sure	0.75 (0.30-1.67, p=0.495)	0.62 (0.22-1.58, p=0.337)
Do you give anthelmintic drug routinely?	Yes	-	-
	No	1.63 (0.88-3.04, p=0.121)	1.40 (0.63-3.08, p=0.408)
	Not sure	1.54 (0.65-3.39, p=0.302)	1.41 (0.54-3.45, p=0.459)
Do you wash fruits & raw vegetables thoroughly before eating?	Yes	-	-
	No	0.65 (0.15-1.87, p=0.482)	0.49 (0.09-1.85, p=0.343)
	Not sure	1.23 (0.54-2.53, p=0.587)	0.56 (0.20-1.40, p=0.231)

	Yes	-	-
Do you wash meal before cooking?	No	1.61 (0.25-5.97, p=0.533)	1.80 (0.23-8.74, p=0.509)
	Not sure	2.08 (0.75-4.88, p=0.119)	1.03 (0.30-3.01, p=0.958)
	Yes	-	-
Do you clean your child thoroughly after defecation?	No	0.58 (0.17-1.51, p=0.317)	0.76 (0.20-2.20, p=0.639)
	Not sure	1.21 (0.63-2.26, p=0.550)	1.11 (0.50-2.34, p=0.795)

Discussion

In many developing countries, intestinal parasitic infections pose a serious threat to public health. Through this study, the researchers intended to acquire an understanding of the knowledge, attitudes, and practices of women living in rural areas of Bangladesh concerning IPI.

Here, the knowledge level of the mothers regarding the IPI in all aspects was in the range of 70-75%. Another study conducted by Sujan et al [13] in Bangladesh stated that 81.5% of the parents had inadequate knowledge of Helminthic infections and a study conducted by Narkkul et al [14] in Thailand stated that 70.4% of the respondents had a poor knowledge level. A similar study conducted by Kassaw et al [3] in Ethiopia stated that 45.2% of the mothers had good knowledge of preventing and controlling intestinal parasitic infection. The knowledge level of the mothers in this study is comparatively good compared to other studies, this may be due to the increased awareness of intestinal parasitic infections in the country.

The attitude level of the mothers slightly deviated from the knowledge level in this study. In comparison to this study, a similar study by Kassaw et al [3] in Ethiopia revealed that 55.3% of the mothers had a positive attitude and 44.7% had a negative attitude [10]. Narkkul et al stated that in their study 69.57% had a good attitude and 30.43% had a poor attitude towards soil-transmitted helminthiasis [14]. Regarding the practice level related to intestinal parasitic infections in this study shows that the majority of the mothers (73.9%) have never done stool examination and only 50.3% had given anthelminthic medications to the children.

Regarding the hand washing practices the mothers' practice level was good compared to other studies. A similar study in Bangladesh by Sujan et al stated that only 54.6% of the mothers consulted the physician in case of helminthiasis and only 60.5% of the mothers gave anthelminthic medications to their children and 64.8% of them did not wash their children's hands after defecation or before meal [13]. Kassaw et al stated that in their study 51.1% of the mothers had a good practice towards IPI and control [3]. To ameliorate the attitude and practice among mothers towards intestinal parasitic infection prevention and control, Behavioral change communication (BCC) programs should be conducted to a greater extent on good hygienic practices [10].

Furthermore, Public Health campaigns focusing on intestinal parasitic infection prevention and control activities like deworming medications and proper hand washing practices should be conducted for mothers and school teachers. For children to readily grasp these preventative measures and put some of them into practice, schools must teach students about health and cleanliness. Like India, National Deworming Day should be conducted twice a year in Bangladesh which can help in successfully eliminating these diseases. To eliminate Helminthic infections in Bangladesh by the target date of 2025, multi-sectoral coordination is mandatory. To effectively control intestinal parasitic infections, all of these strategies must be put into action simultaneously. To do so, it is necessary to get the support of the local governments, health professionals, schoolteachers, and the general public.

Conclusion

This study revealed the knowledge, attitude and practice level of mothers who were living in rural area of Bangladesh. Some factors were significantly associated with practice related variables. There has some bias regarding this study. As this study was conducted in some rural area of Bangladesh, nationwide survey may be conducted for getting exact scenario about intestinal

Parasitic infection prevention status. Sampling criteria may create bias in this study. So large sample should be used in next study.

Supporting information

Table S1: Knowledge of mother's on intestinal parasitic infection (N=648)

Table S2: Attitude of mother's on intestinal parasitic infection (N=648)

Table S3: practice level of mother's on intestinal parasitic infection (N=648)

Ethical Considerations

The study was approved by the Ethical Review Committee of Khwaja Yunus Ali University, Sirajganj 6751, Bangladesh. The reference number is KYAU/DEAN/SBS/2023/002.

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All authors contributed equally and attest they meet the ICMJE criteria for authorship and gave final approval for submission.

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Declaration of competing interest

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