



RESEARCH ARTICLE

PREVALENCE OF INTESTINAL PARASITES, MALNUTRITION, ANEMIA AND THEIR RISK FACTORS AMONG ORPHANED CHILDREN IN SANA'A CITY, YEMEN

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Abstract

Background: Intestinal parasites infection, malnutrition, and anemia are endemic among children living in poor and developing low-income countries, particularly Yemen.

Aims: The current study aims to determine the prevalence of intestinal parasites, malnutrition, and anemia and their risk factors among orphaned children in Sana'a city, Yemen.

Methods: A cross-sectional study was conducted in the orphanage between September 2022 and February 2023. One hundred and ninety-five (195) stool and blood samples were collected from orphan children aged 7-15 years. Intestinal parasites were examined using the formal ether concentration technique and hemoglobin was assessed using a Sysmex hematology analyzer.

Result: Out of 195 specimens, 77(39.49%) were positive for parasite infection. The high rate of infections was among subjects aged between 10-12 years (43.9%), at primary schools (42.9%), didn't have a history of parasite infection (48.9%), between 102-118 cms in height (48.6%), 11-30 kg in weight (49.4%), and underweight (40.1%) non-statistical differences ($p>0.05$). The most predominant parasite was *Entamoeba histolytica* (17.4%), followed by *Giardia lamblia* (10.3%), *Hymenolepis nana* (6.2%), *Ascaris lumbricoides* (3.6%), and *Enterobius vermicularis* (3.6%). The prevalence of anemia was 19% and statistically significant with parasitic infection ($p=0.000$) but not significantly to risk factors ($p>0.05$).

Conclusions: There is a high prevalence of intestinal parasites, anemia and malnutrition among the participating children, and this affects their health and life. Therefore, the implementation of control and prevention programs including improvement of health status, regular deworming practices with medication, health education, provision of appropriate food, and iron supplementation is required to reduce the incidence of malnutrition and anemia associated with intestinal parasitic infection.

Keywords: Anemia, Children, Intestinal parasites, Malnutrition, Prevalence, Orphanage Sana'a, Yemen.

INTRODUCTION

Intestinal parasites are the commonest health concern in poor and limited resources countries and cause considerable morbidity and mortality internationally,

particularly in children¹. Parasite infections are endemic in developing nations due to limited economic resources, inadequate sanitation, living in overcrowded conditions, lack-hygienic practices, low latrine availability, lack of safe water and food, low health

awareness, and malnutrition as a consequence of poverty². Internationally, approximately 1.5 billion people are infected by intestinal parasitic infections with a prevalence rate between 30–60% in low-income countries and 2% in developed countries³. The commonest signs and symptoms associated with parasite infection are abdominal pain, nausea and vomiting, diarrhea, and loss of weight. The persistent infections among children can progress to serious complications such as malabsorption, indigestion, Iron-deficiency anemia, vitamin A deficiency, retardation of growth, loss of weight, deprived school performance, and other mental consequences⁴.

Anemia is a serious health problem with highly prevails in poor and low-income countries. Nearly 50% of all types of anemia resulting from a deficiency of Iron and is almost responsible for a million deaths each year worldwide. Iron-deficiency anemia is ranked one of the top ten risk factors in the "top ten" risk factors causal the disease incidence globally. The prevalence rate of anemia was 43% in underdeveloped nations and 9% in industrialized countries. According to the World Health Organization estimation in 2019, it was reported that about 40% of younger children (aged 6–59 months) around the world were suffering from anemia, contrary to 48% in 2000. Also, the prevalence of anemia in the year 2019 among children aged 6–59 months exceeded 70% in 11 countries⁵.

The consequences of anemia in children result in weakened immunity, increased vulnerability to diseases, intellectual disability, delay of physical development, poor eruditeness, and rising social disability and economic development of the country⁶.

Yemen is ranked as one of the poorest low-income nations in the world and more than 79% of the population living below the national poverty line according to the UNDP report in 2019⁷. In addition, poor socioeconomic status, inadequate toilet facilities, poor personal hygiene, inadequate sanitation conditions, nutritional deficiency, and limited access to drinking water may be the commonest factors that contribute to the transmission of communicable diseases among the population, particularly children suffering from malnutrition that develop anemia diseases⁸⁻¹³.

Also, the prevalence rates of anemia were ranging between 31.7-49% among children¹⁴. Therefore, the presented data are not enough. So, the present study is intended to determine the prevalence of intestinal parasites, malnutrition, and anemia and their risk factors among orphaned children in Sana'a city, Yemen.

MATERIALS AND METHODS

Study area and period

A cross-section study carried out an orphanage at Taiz Street which administratively belongs to Sana'a capital of Yemen. The present study was performed between September 2020 and February 2023.

Sample size

A total of hundred and ninety-five (195) stool and blood specimens were collected from orphans'

children. The laboratory analysis was performed in the Department of Medical Laboratory, Queen Arwa University (QAU).

Data collection

A structured questionnaire was subjected to gather the needed data that includes socio-demographic (i.e., age, study level, number of children in the room, meal frequency/day, and history of parasite infection), and clinical signs and symptoms (i.e., fever, cough, muscles pain, diarrhea, and abdominal pain) were obtained.

Inclusion and exclusion criteria

The children who were residents in orphanage aged between 7-15 years, signed the informed consent, delivered specimens, and non-received any anti-parasitic drugs in the days before sampling were included. Conversely, children who refuse to sign the informed consent, sample collection, or had taken anti-parasitic drugs during the collection of data were excluded from this study.

Blood collection and hemoglobin assessment

About 5 mL of venous blood was sampled from each subject under aseptic procedures by vein puncture and transferred into a sterile tube. Hemoglobin concentration was measured by using a fully automated Hematology analyzer Sysmex KX (Sysmex Corporation, South Korea) at the hematology laboratory in the QAU. Anemia was classified according to WHO¹⁵ parameters. The level of hemoglobin was set at <11 g/dL for children (aged <12 years), <12 g/dL for children (12-14 years), and <13 g/dL for male children (15 or 16 years).

Fecal collection and parasite detection

The fecal specimens were collected by using clean, dry, wide-mouthed, labeled, and screw-capped containers that were distributed to each participant after carefully describing the way of collection. The collected specimens were immediately transported to the parasitology lab. at QAU and processed by using the formol-ether concentration method. The parasite detection was screened under a compound microscope with 10× and 40× objectives¹⁶.

Anthropometry measurement.

The anthropometric data including age, height in centimeters (cms) and weight of the participants in kilograms (Kg) enrolled in this study were obtained during the period of blood and stool specimens collection. Anthropometric measurements were converted into body mass index (BMI) using the growth reference according to WHO¹⁷.

Nutritional status

The assessment of nutritional status of study subjects was assessed by counting their BMI. Calculation of BMI is done by dividing an individual weight (kg) by the square of his height (cms). The nutritional status is classified as underweight, normal weight, and overweight¹⁷.

Ethical statement

Ethical clearance was permitted by the Ethics Committee of Queen Arwa University, Yemen, and an agreement was also obtained from the administration of the orphanage through an official letter from the university. Before collecting the sample, the objectives

and importance of this work were elucidated briefly to all orphaned children and administrative staff working in the orphanage building. Further, the study subjects were knowledgeable well that all gathered data will be only used for the study purpose.

Statistical analysis

The results were analyzed by using the SPSS version 22 (IBM Corp., USA). A descriptive analysis of obtained data was performed and the variables were presented in tables with frequencies and percentages. The association between intestinal parasitic infections and anemia and nutrition status was evaluated by using reporting odds ratio (OR) and its corresponding 95% confidence interval (CI). A *p*-value (*p*<0.05) was considered to be statistically significant.

RESULTS

Socio-demographic characteristics

About 195 orphan children participated in the present study aged between 7-15 years with a mean age of 11.8

years. The majority of specimens were sampled from participants aged 12-15 years (57.4%), attending primary schools (64.6%), living in a room with a number of children between 9-12 individuals (52.8%), eating meals ≤ 3 times per day, and had a history of parasite infection as illustrated in Table 1. **Prevalence of intestinal parasites**

Out of 195 orphan children samples, it was found that 77(39.49%) were infected by intestinal parasites while 118(60.51%) individuals were non-infected with intestinal parasites as shown in Figure 1. **Risk factors associated with intestinal parasitic infections**

The highest rate of intestinal parasitic infections in this result was detected among orphaned children aged between 7-11 years old (42.9% %), children who study at primary schools (42.9%), lived in room content between 3-5 individuals (42.3%), eat meals more than 3 times per day (50%), and didn't have a history of parasite infection (48.9%) with non-significant differences (*p*>0.05).

Table 1: Socio-demographic characterizations of study subjected.

Variables	Categories	Examined	Rate (%)
Study level	7-11	83	42.6
	12-15	112	57.4
	Primary	126	64.6
	Preparatory	69	35.4
Number of children in the room	3-5	52	26.7
	6-8	40	20.5
	9-12	103	52.8
Meal frequency/day	≤ 3 times	189	96.9
	> 3 times	6	3.1
History of parasite infection	Yes	150	76.9
	No	45	23.1

Table 2: Prevalence of parasite infection concerning risk factors.

Variables	Categories	Examined No. (%)	Infected No. (%)	Non-infected No. (%)	<i>p</i> -value
Age (in years)	7-11	83(42.6)	34(40.9)	49(59.1)	0.718
	12-15	112(57.4)	43(38.4)	69(61.6)	
Study level	Primary	126 (64.6)	54 (42.9)	72 (57.1)	0.195
	Preparatory	69 (35.4)	23 (33.3)	46 (66.7)	
Number of children in the room	3-5	52 (26.7)	22 (42.3)	30 (57.7)	0.883
	6-8	40 (20.5)	12 (30.0)	28 (70.0)	
	9-12	103 (52.8)	43 (41.7)	60 (58.3)	
Meal frequency/day	≤ 3 times	189 (96.9)	74 (39.2)	115 (60.8)	0.595
	> 3 times	6 (3.1)	3 (50.0)	3 (50.0)	
History of parasite infection	Yes	150 (76.9)	55 (36.7)	95 (63.3)	0.143
	No	45 (23.1)	22 (48.9)	23 (51.1)	
Anemia	Yes	37(19)	24(64.9)	13(35.1)	0.000
	No	185(81)	53(33.6)	105(66.5)	
Anthropometric measurements					
Height (cm)	102-118	37 (19)	18 (48.6)	19 (51.4)	0.187
	119-135	33 (16.9)	13 (39.4)	20 (60.6)	
	136-152	75 (38.5)	29 (38.7)	46 (61.3)	
	153-170	50 (25.6)	17 (34.0)	33 (66.0)	
Weight (kg)	21-30	85 (43.6)	42 (49.4)	43 (50.6)	0.143
	31-40	70 (35.9)	21 (30.0)	49 (70.0)	
	41-50	28 (14.4)	8 (28.6)	20 (71.4)	
	51-60	12 (6.2)	5 (33.3)	7 (72.7)	
Nutrition status	Underweight	142 (72.8)	57 (40.1)	85 (59.9)	0.587
	Normal weight	48 (24.6)	19 (39.6)	29 (60.4)	
	Overweight	5 (2.6)	1 (20.0)	4 (80.0)	

*Significant association (*p*<0.05)

Furthermore, the existing result found that the prevalence rate of anemia was 19% recorded among the participants and there were statistical differences between anemia and intestinal parasitic infection ($p=0.000$).

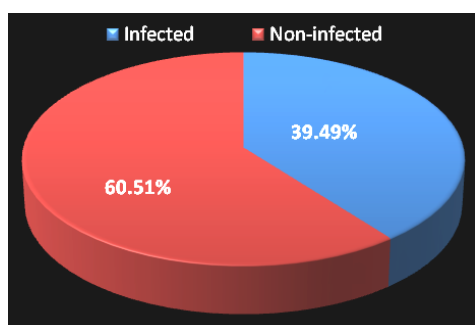


Figure 1: Prevalence rate of intestinal parasites among orphan children.

Additionally, the rate of parasite infections was significantly higher detected among participants between 102-118 cm in height at 48.6%, between 11-30 kg in weight (49.4%), and underweight (40.1%) non-statistical differences ($p>0.05$) as shown in the Table 2. In the present finding, the most predominant parasite was *E. histolytica* (17.4%) among study subjects followed by *G. lamblia* (10.3%), *H. nana* (6.2%), *A. lumbricoides* (3.6%), and *E. vermicularis* (3.6%) (Figure 2). In current result, it was showed that the study subjects who suffered from fever, cough, muscles pain, diarrhea, and abdominal pain had a higher rate of parasite infection with non-statistical differences ($p>0.05$) as summarized in Table 4.

Associations of risk factors with intestinal parasitic infections and anemia

This result revealed that the high risk of anemia was associated with meal frequency a day (OR=1.143; 95% CI=0.186-7.006) followed by study level (OR=0.803; 95% CI=0.447-1.445). Also, anemia prevalence was not statistically associated with all risk factors ($p>0.05$) (Table 5). **Association between intestinal parasitic infections and anemia**

Table 6 displays the association between parasite infections and anemia that infected by *H. nana*, *A. lumbricoides* and *E. histolytica* were associated with an increased risk of anemia with (OR=4.902, 95% CI=3.057-7.860), (OR=4.196, 95% CI=3.057-7.860), and (OR=3.229, 95% CI=1.878-5.552), respectively. Also, it was found that the associations between parasite infections with anemia were significant ($p<0.05$) except *E. vermicularis* ($p>0.05$).

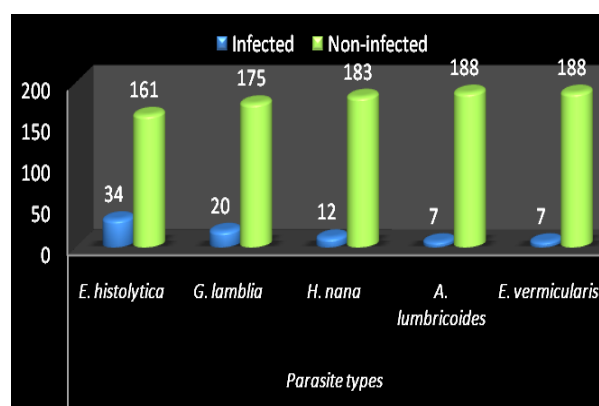


Figure 2: Type of intestinal parasitic infection among orphan children.

Table 3: Distribution of parasite infections concerning sociodemographic characterizations.

Variables	Categories	Parasite types					Total No. (%)
		<i>E. histolytica</i>	<i>G. lamblia</i>	<i>H. nana</i>	<i>A. lumbricoides</i>	<i>E. vermicularis</i>	
Age (in years)	7-11	16(19.3)	9(10.8)	3(3.6)	4(4.8)	3(3.6)	35(43.75)
	12-15	18(16.1)	11(9.8)	9(8)	3(2.7)	4(3.6)	45(56.25)
Study level	Primary	24(42.9)	15(26.8)	9(16.1)	4(7.1)	4(7.1)	56(70)
	Preparatory	10(21.7)	5(20.8)	3(12.5)	3(12.5)	3(12.5)	24(30)
Number of children in the room	3-5	10(23.5)	9(39.1)	1(4.3)	2(8.7)	1(4.3)	23(28.7)
	6-8	4(30.8)	1(7.7)	3(23)	4(30.8)	1(7.7)	13(16.3)
	9-12	20(45.5)	10(22.7)	8(18.2)	1(2.2)	5(11.4)	44(55)
Meal frequency/day	≤3 times	31(40.3)	20(25.9)	12(15.6)	7(9.1)	7(9.1)	77(96.3)
	>3 times	3(100)	0(0)	0(0)	0(0)	0(0)	3(3.7)
History of parasite infection	Yes	24(45.3)	14(26.4)	10(18.85)	6(11.3)	3(5.7)	54(71.3)
	No	10(23.5)	6(26.1)	2(8.7)	1(4.3)	4(17.4)	23(28.7)

DISCUSSION

The overall rate of parasite infection was 39.49% reported among orphan children. Current finding was in disagreement with the reports of an earlier investigation carried out in Yemen that reported the frequency rate of parasites infection was 61.85% in Sana'a¹⁸, 51.26% in Taiz¹⁹, 61.85% in Amran²⁰, 62.7% in Ibb²¹, 73.25% in Hajjah²², and 61.25% in Amran¹¹. The variance in frequency rate may be attributed to variations in geographical locations, study population, sample size, hygienic conditions, socioeconomic status, food consumption behavioral differences, and

diagnostic methods employed by the participants. However, the orphanage center may be contributing to reducing prevalence of the parasitic infections by proved safe foods and water and resident adhering to strong policies in behavior. Regarding the age group, parasite infections were significantly detected among those aged between 7-11 years old (42.9%) compared to the age group of 12-15 years (38.4%) with non-significant differences ($p=0.718$). These results are reliable to findings conducted in Yemen^{19,23-25}.

It could be explained that younger children are more vulnerable to infectious disease sources as a result of their behaviors related to activities outdoors throughout

the day. Poor environmental sanitation and lack of hygienic practices are often revealed as the main factors contributing to the increased prevalence of parasite infection among the study group. However, the children who study at primary schools had a higher rate of parasite infections compared to children who study

at preparatory schools. Correspondingly, another local investigation conducted among children showed that the students who attended primary schools had a higher rate of pathogenic organisms^{21,26}. Educational levels are crucial a significant factor that has been noticed in influencing parasitic infection²⁷.

Table 4: Prevalence of parasite infection concerning signs and symptoms.

Variables	Categories	Examined No. (%)	Infected No. (%)	Non-infected No. (%)	p-value
Fever	Yes	122 (62.6)	51 (41.8)	71 (58.2)	0.395
	No	73 (36.9)	26 (35.6)	47 (64.4)	
Cough	Yes	104 (53.3)	44 (42.3)	60 (57.7)	0.392
	No	91 (46.7)	33 (36.3)	58 (63.7)	
Muscles pain	Yes	107 (54.9)	44 (41.1)	63 (58.9)	0.609
	No	88 (45.1)	33 (37.5)	55 (62.5)	
Diarrhea	Yes	103 (52.8)	46 (44.7)	57 (55.3)	0.119
	No	92 (47.2)	31 (33.7)	61 (66.3)	
Abdominal pain	Yes	137 (70.3)	60 (43.8)	77 (56.2)	0.059
	No	58 (29.7)	17 (29.3)	41 (70.7)	

*Significant association ($P < 0.05$)

In the present result, it was observed that participants who eat meals more than 3 times a day had a higher rate of parasite infections (50%). The report by Hailegebriel²⁸ revealed that the meal frequency (>3 times/day) was associated with parasite infection (OR=1.77; 95% CI: 1.03–3.05). The existing result noticed that a high rate of parasite infections prevailed among participants who didn't have a history of parasite infection (48.9%) with a non-significant difference ($p > 0.05$). Moreover, the prevalence rate of parasites infection was significantly more detected among participants between 102-118 cms in height at

48.6%, between 11-30 kg in weight (49.4%), and underweight (40.1%) non-statistical differences ($p > 0.05$). In this study, the anthropometric result showed that the highest rate of parasite infection was observed between 102-118 cms in height and between 21-30 kg in weight with non-statistical difference ($p > 0.05$). In relation to nutrition status, the underweight participants were found to be had the highest rate of parasite infections (40.1%) and non-statistical differences ($p = 0.587$).

Table 5: Associations of intestinal parasitic infections and anemia with risk factors.

Variables	Categories	Infected No. (%)	p-value	Anemia No n (%)	OR (95% CI)	p-value
Age (in years)	7-11	34(40.9)	0.718	71(85.5)	0.648 (0.346-1.213)	0.168
	12-15	43(38.4)		87(77.7)		
Study level	Primary	54 (42.9)	0.195	104(82.5)	0.803 (0.447-1445)	0.240
	Preparatory	23 (33.3)		54(78.3)		
Number of children in the room	3-5	22 (42.3)	0.883	39(75)	NA	0.226
	6-8	12 (30.0)		33(82.5)		
	9-12	43 (41.7)		86(83.5)		
Meal frequency/day	≤3 times	74 (39.2)	0.595	153(81)	1.143 (0.186-7.006)	0.884
	>3 times	3 (50.0)		5(83.3)		
History of parasite infection	Yes	55 (36.7)	0.143	126(84)	0.554 (0.308-0.996)	0.053
	No	22 (48.9)		32(71.1)		
Height (cm)	102-118	18 (48.6)	0.187	30(81.1)	NA	0.975
	119-135	13 (39.4)		25(75.8)		
	136-152	29 (38.7)		64(85.3)		
	153-170	17 (34.0)		39(78)		
Weight (kg)	21-30	42 (49.4)	0.143	65(76.5)	NA	0.335
	31-40	21 (30.0)		60(85.7)		
	41-50	8 (28.6)		23(82.1)		
	51-60	5 (33.3)		10(83.3)		
Nutrition status	Underweight	57 (40.1)	0.587	113(79.6)	NA	0.475
	Normal weight	19 (39.6)		41(85.4)		
	Overweight	1 (20.0)		4(80)		

*Significant association ($p < 0.05$), OR =odds ratio, CI =confidence interval, NA = not applicable

Table 6: Association between intestinal parasitic infections and anemia among study subjects.

Parasite types	Result	Anemia		OR (95% CI)	p-value
		Yes n (%)	No n (%)		
<i>E. histolytica</i>	Positive	15 (44.1)	19 (22.9)	3.229 (1.878-5.552)	0.000
	Negative	22 (13.7)	139 (86.3)		
<i>G. lamblia</i>	Positive	8 (40)	12 (60)	2.414 (1.284-4.538)	0.011
	Negative	29 (16.6)	146 (83.4)		
<i>H. nana</i>	Positive	9 (75)	3 (25)	4.902 (3.057-7.860)	0.000
	Negative	28 (15.3)	155 (84.7)		
<i>A. lumbricoides</i>	Positive	5 (71.4)	2 (28.6)	4.196 (2.385-7.383)	0.000
	Negative	32 (17)	156 (83)		
<i>E. vermicularis</i>	Positive	0 (0)	7 (100)	1.245 (1.160-1.336)	0.194
	Negative	37 (19.7)	151 (80.3)		

*Significant association ($p < 0.05$), OR=odds ratio, CI=confidence interval

A similar result by Al-Haidari *et al.*,¹⁴ showed that the frequency rate of wasting, stunting, and being underweight among children was 25%, 45.8%, and 27.3%, respectively. Another study by Degarege *et al.*,²⁹ revealed that among the 532 subjects infected with parasites, 15.5% were stunted, 26.8% were underweight, and 35.8% were undernourished. The increased risk of anemia and undernutrition in children infected with intestinal parasitic infection was well documented in some studies^{29,31}. The present finding revealed that the most predominant parasite was *E. histolytica* (17.4%) among study subjects followed by *G. lamblia* (10.3%), *H. nana* (6.2%), *A. lumbricoides* (3.6%), and *E. vermicularis* (3.6%). This result is in agreement with several recently published studies. Recently, *E. histolytica*, *G. lamblia*, *H. nana*, *Taenia* species, and *A. lumbricoides* were reported among participating children in Sana'a¹⁸. Also, in Amran City, the highest rate among children was *E. histolytica* followed by *G. lamblia*, *H. nana*, *S. mansoni*, and *E. vermicularis*²¹. However, Qasem *et al.*,²¹ found that the most intestinal parasites were *E. histolytica*, *G. lamblia*, *A. lumbricoides*, *H. nana*, and *E. vermicularis* reported among children in Ibb City. Furthermore, the majority of infected participants with intestinal parasites in this result were found to be suffered from fever, cough, muscle pain, diarrhea, and abdominal pain ($p > 0.05$). This data is in accord with Al-Haddad and Baswaid³² and Qasem *et al.*,²¹ reported that abdominal pain, diarrhea, fever, cough, myalgia, vomiting, and loss of weight were the most signs and symptoms noticed among those infected by parasites. Conversely, the association between some clinical symptoms and intestinal parasitic infections was documented by Al-Fakih *et al.*,²⁵.

The existing study showed that 19% (37/195) of the participants had anemia and there were statistical differences between anemia and intestinal parasitic infection ($p = 0.000$). This result is lower than recent reports that presented anemia among children was 37.8% in Hodeida³³, and 31.7% in Sana'a¹⁴. The prevalence of anemia in some countries was 12.4% in Eritrea³⁴, 48.8% in Ethiopia³⁵, and 14% in Tanzania³⁶. The prevalence rate of anemia was found to be at two times higher risk among age group of 11-15 years of subjects the aged 11-15 years compared to the younger age group¹⁴. The reason behind the high rate of anemia in Yemen may be accredited to some factors such as economic marginalization, poverty,

household food insecurity, access to social protection, household-level environmental factors, and access to health care³⁷. Also, there were significant associations of intestinal parasitic infections with anemia ($p < 0.05$) except *E. vermicularis* ($p > 0.0$). In this finding, the association between parasitic infections and anemia showed that the risk of anemia was increased among infected participants with *H. nana* (OR=4.902, 95% CI=3.057-7.860), *A. lumbricoides* (OR=4.196, 95% CI=3.057-7.860), and *E. histolytica* (OR=3.229, 95% CI=1.878-5.552). This result is inconsistent with some reports conducted in some countries^{14,33}.

Limitation of the study

The limitation of this work was examined of a single specimen of each subject. In addition, the long distance between the study area and the experimental lab, it was screened for cyst stage only and these are the factors that may be reducing the accuracy and validity of the results.

CONCLUSIONS

In conclusion, the prevalence of intestinal parasitic infection, anemia, and malnutrition is high among orphaned children and is a major concern for their health. Therefore, effective control and prevention strategies such as health education, nutritional education, environmental hygiene practices, pediatric treatment, regular deworming, iron supplementation, and wholesome food provision are important to reduce these problems.

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AUTHOR'S CONTRIBUTIONS

Al-Halani AA: writing original draft, lab work. **Edrees WH:** methodology, investigation. **Alrahabi LM:** data analysis, report drafting. **Thabit JM:** methodology, data curation. **Al-Bahlouli SM:** review, and editing, methodology. **Alwashali FA:**

conceptualization, methodology. **Al-Qhali RM:** editing, data analysis. **Al-Qhali RM:** data curation, conceptualization. **Morshed MM:** editing, investigation. **Al-Hossainy AS:** acquired the data. **Al-Maflihi EA:** editing, investigation. **Al-Sufi NH:** data collection, preparing the first draft. All the authors approved the finished version of the manuscript.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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