

**RISK FACTORS FOR SYMPTOMATIC GIARDIA LAMBLIA AND  
ENTAMEBA HISTOLYTICA INFECTION AMONG CHILDREN  
UNDER 5 YEARS OF AGE IN AL-SABEEN HOSPITAL,  
SANA'A, YEMEN, A CASE-CONTROL STUDY**

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**ABSTRACT**

Protozoal infestation remains a major health issue by causing recurrent or chronic diarrhea among young children which are reflected in the general nutritional and health status children. This problem magnifies in situations of poor water supplies such as in Yemen. The aim of the study was to determine common risk factors associated with the infection of *G. lamblia* and *E. histolytica* among children under 5 years of age. Unmatched case-control study was conducted to estimate the risk factors associated with acute diarrhea caused by *E. histolytica* and *G. lamblia* among children under 5 years of age who had their stools examined at Al- Sabeen Hospital laboratory. 66.6 % of children's mothers in the cases group used to wash the bottle only by water compared to 17.6 % of those in the control group. Mothers of children in the cases group were less likely to wash their breasts before feeding babies, 15.8 %, compared to mothers in the control group, 60 %, and were less likely to wash their hands before feeding their babies, 35 % compared to 85 % in the control group. We can conclude that inappropriate bottle washing was an important risk factor for the acquisition of intestinal infections. Significant protective factors were found in mothers who washed their nipples before breast-feeding, washed their hands after changing the baby's diaper and in mothers who washed their hands before feeding the child.

**KEYWORDS:** Giardiasis, Entameba, Infection, Yemen & Children

**INTRODUCTION**

Diarrheal diseases continue to be a substantial health problem worldwide, especially in developing countries. Globally, there are 1.7 a billion cases of diarrhea each year. It kills 525000 children under 5 years of age each year. Most of these attacks are preventable through hygienic measures (1). In Yemen, as a poor developing country, *E. histolytica* and *G. lamblia* infection are highly prevalent among children composing significant morbidity due to diarrhea (2, 3, and 4). What makes the picture worse is the prevalence of severe acute malnutrition in Yemen, which is high. Diarrhea worsens malnutrition and malnutrition predisposes children to more infectious diarrhea leading to a vicious circle. (5).

*E. histolytica* is asymptomatic in most of the case, only 20% are presented with diarrhea, abdominal cramps or bloody stools. It rarely causes a liver abscess. Diagnosis of *E. histolytica* can be difficult because under a microscope, other parasites could appear similar. Moreover, it could not be found in every stool sample so repeated examinations may be

needed (6) *Giardia lamblia*, also called *Giardia duodenalis*, is a worldwide protozoan infection that is also asymptomatic in most cases. When symptoms occur, it presents as chronic diarrhea offensive and greasy in character associated with abdominal distension and discomfort as well as loss of weight (7). Risk factors associated with protozoal infection in children vary. It includes the absence of a source of clean water, low socioeconomic status, the presence of an infected person in the family (8) as well as male gender (2) and caregiver hand hygiene and child own hands hygiene (9).

## OBJECTIVES OF THE STUDY

This is a case-control study aimed at assessing some behavioral and demographic factors associated with parasitic infestation with E.H and G.L among Yemeni children.

## METHODOLOGY

This study was an unmatched case-control study, performed in Al-Sabeen hospital for maternity and children, a major referral hospital in Sanaa that receives patients from different regions of northern parts of Yemen. The target population was children under five years old having symptomatic infection with *Entamebahistoltytica* and/ or *Giardia lamblia* diagnosed by stool examination in the laboratories of Al-Sabeen hospital during the period of the study. The sample size was calculated using Epi info™ software. A confidence level of 95%, power 80%, ratio of control to cases 1:1 and percent of control exposed 10% a total of 40 cases was needed, 20 control and 20 cases. Cases were collected randomly from the outpatient and inpatient departments of the hospital. Controls were children under five years of age visiting the surgical department of the hospital with no clinical manifestation and with negative stool analysis for *E.histolytica* and *G.lamblia* performed in the same laboratory in the same period of the study.

Data collection tool was a pretested structured questionnaire used to collect demographic data and risk factors it included a group of questions regarding sex, age, educational level of the mother and other risk factors. Direct interview with the mother/caregiver. Data were collected then entered and analyzed using SPSS program version 21.0. Descriptive statistics, frequencies, odds ratios and Chi-square tests at 5% significant levels were generated using the software. After enrollment in the study and explanation of the purpose of the study, parents of both control and cases were interviewed using the pre-tested questionnaire. Approval was obtained from the Ethical Committee, University of Science and Technology. Verbal informed consent was taken from the parents/care giver before the interview. Confidentiality was assured and maintained. Children names were replaced by numbers for cases and controls data was accessed by participating researchers only.

## RESULTS AND DISCUSSIONS

This study was performed to assess some risk factors for contracting symptomatic infections with *E. histolytica* and *G.lamblia* among children less than five years old in Sana'a City. Forty children under 5 years of age were enrolled in the study between March and June 2014, 20 cases and 20 controls. All cases had stool analysis positive for GL and or/ EH. Table (1) shows an age of the cases and controls. Relatively less cases, 11 (55 %), were at younger age group compared to control group, 14 (70 %), although this difference was not significant, (OR 0.524 CI 0.143- 1.923), P-value 0.327. Table (1) also shows that cases were more likely to be males 12 (60 %) compared to the control group, 9 (45 %), although this was not significant. (OR: 1.833 CI.522- 6.434), p value 0.342. A similar studies revealed that sex and age were not significant factors affecting intestinal parasitic infections among young children (Isaac Anim-Baidoo et al.2016 and Séverine Erismann et al. 2016). On the contrast, (Marit G. Tellevik, 2015), reported that intestinal infection was significantly higher

**Table 1: Distribution of the Enrolled Children according to their Age and Sex  
 (n = 20 control, 20 cases)**

Item		Frequency and Percent		Total	OR
		Case	Control		
Age in months	1 month - 12 months	11 (55.0%)	14 (70.0%)	25 (62.5%)	0.524
	13 months - 60 months	9 (45.0%)	6 (30.0%)	15 (37.5%)	
<b>Total</b>		<b>20 (100 %)</b>	<b>20 (100%)</b>	<b>40 (100 %)</b>	
Item					
sex	male	12 (60.0%)	9 (45.0%)	21 (52.5%)	1.833
	female	8 (40.0%)	11 (55.0%)	19 (47.5%)	
<b>Total</b>		<b>20 (100%)</b>	<b>20 (100%)</b>	<b>40 (100%)</b>	

Table (2) shows that more cases came from urban areas, 15 (75%), compared to controls, 13 (65%). This difference was not significant (OR 1.615, CI : 0.412 - 6.338),  $p = 0.490$ . This coincides with another large study in Cuba where residence did not appear to be a risk factor (Luis Puebla et al, 2017).

**Table 2: Distribution of the Enrolled Children According to their Residence**

Item		Frequency and Percent		Total	OR
		Case	Control		
Residence	city	15 (75.0%)	13 (65.0%)	28 (70.0%)	1.615
	village	5 (25.0%)	7 (35.0%)	12 (30.0%)	
<b>Total</b>		<b>20 (100.0%)</b>	<b>20 (100.0%)</b>	<b>40 (100.0%)</b>	

In this study, type of feeding during the first 6 months of life (exclusive breastfeeding vs artificial and /or complementary) as well as the duration of breastfeeding were not significant factors affecting the acquisition of the infection.  $P = 0.347$ . In contrast, (Ekhlal et al., 2013) revealed breastfeeding a protective factor for acquisition of infection. This may be due to that 37.5 % of the enrolled children in this study were older than 1 year, when the protecting effect of breastfeeding diminishes, (Carol Gilchrist, 2016). Moreover, Only 8 (20%) of the enrolled children received exclusive breastfeeding. (Table 3).

**Table 3: Type of Breastfeeding During the First 6 Months of the Enrolled Children**

Item		Frequency and Percent		Total	OR
		Case	Control		
Type of feeding in the first 6 months of child's life	Exclusive breastfeeding	5 (25.0%)	3 (15.0%)	8 (20.0%)	1.889
	Complementary/ artificial	15 (75.0%)	17 (85.0%)	32 (80.0%)	
<b>Total</b>		<b>20 (100%)</b>	<b>20 (100%)</b>	<b>40 (100%)</b>	
In case of breastfeeding, how long did it last.	less than 6 months	14 (70%)	13 (65%)	27 (70.3%)	1.200
	more than 6 months	6 (30%)	7(35%)	13 (29.7%)	
<b>Total</b>		<b>20 (100%)</b>	<b>20 (100%)</b>	<b>40 (100%)</b>	

Regarding cleaning the bottles in case of artificial milk feeding, 10(66.6 %), mothers in the cases group used to clean bottles only by water compared to 3 (17.6%) of the control group who used to clean bottles by water plus boiling the bottle, this difference was significant, ( $p = 0.062$ ). (Table 4). Using un-sanitized or sanitized water to prepare the milk in case of bottle-feeding was not a significant factor affecting the infection in this study,  $p = 0.877$ . (Table 4). Séverine Erismann et al. (2016), in their cross-sectional survey in Burkina Faso, also concluded no significant effects of

household drinking water source on conducting intestinal protozoa. However, (Luis Quihui-Cota et al., 2017) in their cross-sectional study on 173 children concluded that untreated water was a significant risk factor for developing the symptomatic infection with Giardiasis. Moreover, (Naelah Alyousefi, et al.2011), in their research in Yemen, found drinking untreated water was a significant risk factor for conducting parasitic infections among children.

**Table 4: Behaviors related to Bottle Cleaning Among the Enrolled Children with Bottle-Feeding**

Item		Case	Control	Total	OR
Method of bottle washing (in case of bottle-feeding)	By water only	10 (66.6%)	3(17.6%)	13 (40.6%)	*3.938 CI ( 0.911- 17.014)
	By water and the boiling the bottle	5 (33.3%)	14 (82.4%)	19 (59.4%)	
<b>Total</b>		<b>15(100 %)</b>	<b>17(100 %)</b>	<b>32 (100 %)</b>	
what type of water do you use to prepare the bottle	Sanitized water	9 (60 %)	7 (41.2%)	16 (50%)	0.900 CI (0.238-3.406)
	Un-sanitized water	6 (40 %)	10 (58.8%)	16 (50%)	
<b>Total</b>		<b>15 (100%)</b>	<b>17 (100 %)</b>	<b>32 (100 %)</b>	

\* Significant at  $p < 0.05$

Mothers of children in the cases group were less likely to wash their breasts before feeding babies, 3 (15.8 %), compared to mothers in the control group, 12 (60 %). This was a significant difference,  $P=0.005$ . Table 5. Although personal hygiene in general, was a significant risk factor for conducting parasitic infection, (SéverineErismann et al. (2016) and Naelah Alyousefi, et al.2011), there were no similar studies discussing the specific practice of breast washing before feeding.

**Table 5: Washing Breasts Before Feeding Among Enrolled Children**

Item		Case	Control	Total	OR
Do the mother wash her breast before feeding	yes	3 (15.8 %)	12 (60 %)	15 (38.5 %)	* 0.125 ( CI 0.027-0.573)
	no	17 (84.2 %)	8 (40.0%)	25 (61.5 %)	
<b>Total</b>		<b>20 (100%)</b>	<b>20 (100.0%)</b>	<b>40 (100.0%)</b>	

\*Significant at  $p < 0.05$

Mothers of children of the cases group were also less likely to wash their hands after they change diapers for their babies, 11 (55 %), compared to the mothers in the control group, (17 (85 %). This was a significant difference,  $P= 0.038$ , Table 6. Intestinal parasitism was significantly associated with weak hand washing practices in several studies (SarmilaTandukar et al., 2013, Mahmud Abdulkader et al, 2015 and Seow Huey Choy, et al.,)

**Table 6: Washing Hands After Diaper Change Among Enrolled Children**

Item		Case	Control	Total	OR
Do the mother wash her hands after changing diapers	yes	11 (55 %)	17 (85 %)	28 (70%)	0.216 ( CI)
	No	9 (45 %)	3 (15%)	12 (30 %)	
<b>Total</b>		<b>20 (100%)</b>	<b>20 (100.0%)</b>	<b>40 (100.0%)</b>	

\*Significant at  $p < 0.05$  ( $p = 0.038$ )

Mothers in the cases group were less likely to wash their hands before feeding their babies, 7 (35 %), compared to the mothers in the control group, 17 (85 %). This difference was significant,  $P =0.028$ , Table 7. This was also concluded in other studies where hand washing practice was infrequent among mothers even when a source of clean water was provided (William E. Oswald, 2014). ZemichaelGizaw et al., (2018) in their study in Ethiopia concluded that hand washing before eating-related activities was an important risk factor for conducting intestinal parasitic infection because these infections

are transmitted by fecal-oral root. On the other side, (Lauren Steinbaum, et al., 2017) concluded that although dirty hand plays a major role in the transmission of parasites, cooking and (boiling) could decrease this risk.

**Table 7: Washing Hands Before Feeding Among Mothers of Enrolled Children**

Item				Total	OR
		Case	Control		
Do the mother wash her hands before feeding the baby	yes	7 (35 %)	17 (85 %)	24(60%)	*0.174 (CI 0.035-0.851)
	no	13(65%)	3 (15 %)	16 (40 %)	
<b>Total</b>		<b>20 (100%)</b>	<b>20 (100.0%)</b>	<b>40(100.0%)</b>	

\*Significant at  $p < 0.05$

## CONCLUSIONS

This case-control study concluded that inappropriate bottle washing procedures was an important risk factor for developing symptomatic infections with *G. lamblia* and *E. histolytica*. Significant protective factors were found in mothers who washed their nipples before breastfeeding, washed their hands after changing the baby's diaper and in mothers who washed their hands before feeding the child.

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