

Assessing Risk Factors and Causative Organisms of Acute Diarrhea in Children Under 5 Years in AL-Hindiya, Karbala, Iraq

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Abstract

Background: Acute diarrhea is a leading source of illness and death all over the world, especially in developing countries and the most affected are children below 5 years age. **Objectives:** To throw a light on the risk factors, presentations, and causative organisms of acute diarrhea, to find a way to protect our children. **Materials and Methods:** This prospective cross-sectional study was conducted on 250 children under 5 years of age; they attended AL-Hindiya general Hospital, in the period between November 2018 and end of June 2019. Full history was taken from each patient focused on risk factors, presentation, and possible complications; then, patients were subjected to clinical examination, stool analysis, and stool culture, and some of them were sent for abdominal ultrasound. **Results:** The most vulnerable age group for acute diarrhea was 2–12 months. Male to female ratio is 1.17. Crowded family and poor income were the most frequently risk factors to develop acute diarrhea. Bottle feeding was used in 111 patients (44.4%); improper sewage and trash disposal, poor hand washing practice, incomplete vaccination, prior use of antibiotics, and underweight all are considerable risk factors. The peak for acute diarrhea occurs during summer (63.6%). Those patients most commonly presented as watery bowel motion less than or equal to five times per day, well-hydrated, vomiting, fever, associated with upper respiratory tract infection. There is no growth of organism in stool sample of 126 patients (50.4%), while *Entamoeba histolytica* isolated from 34 samples (13.6%). **Conclusion:** Children under 5 years in A-Hindiya city still at considerable risk of acute diarrhea. The risk is more in rural, young, low educated, unemployed, and poor parents with crowded families. It is vital to encourage breastfeeding, immunization, improve personal hygiene, water supply, and sanitation to reduce the risks of acute diarrhea. The most frequent isolated organism from stool samples is *E. histolytica* followed by Rota virus.

Keywords: Acute diarrhea, causative organisms, children, risk factors

INTRODUCTION

Diarrhea is a leading source of illness and death all over the world causing 1.3 million death, especially in developing countries, and the most affected age group (0.54 million) are children below 5 years age,^[1] especially in Africa and South Asia.^[2] Diarrhea defined as the passage of three or more watery or loose bowel motions per day.^[3] Diarrhea can be classified clinically as acute diarrhea when it lasts for few days which could be either watery or bloody, or classified as persistent diarrhea when it stays for 2 weeks or more. Severe form of diarrhea can lead to body fluid and electrolyte loss which can result in serious complication or even death, especially in malnourished ill child.^[4]

Previously many studies in cities of Iraq indicate that improper breast feeding, water supply, poor sanitation, hygiene and socioeconomic status, low income, crowdedness,

and low mother education are important risk factors for occurrences of diarrhea;^[5-11] however, we are still facing a lot of cases of acute diarrhea and its complication in every day practice.

The purposes of this study to determine the possible risk factors, presentation, and causative organisms causing continuation of acute diarrhea as a big health problem in children <5 years of age in AL-Hindiya, Karbala, Iraq.

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MATERIALS AND METHODS

Study design and patients

This cross-sectional study was directed among children under 5 years age complaining from acute diarrhea between November 2018 and end of June 2019. In AL-Hindiya city, Karbala, Iraq. This city include many small rural and central urban areas and contain only one public hospital where the study conducted with permission from ethics committee in AL-Hindiya general hospital with verbal agreement hopping to throw light on the risk factor, presentation and causative organisms of acute diarrhea to find the possible ways to protect our children. All parents learnt about the facets of the study and were asked to signed an informed written consent before beginning the interview.

The study involve 250 child under 5 years age attending AL-Hindiya general hospital, Karbala, Iraq, with acute diarrhea in a period involved the times at which most cases of diarrhea could have happened. *Elimination conditions* involve children above 5 years, refusal to participate in the study, fail to give stool sample or incomplete data collection. Information were collected from mothers or in the absence of the mother taken from care giver using an interviewer-administered inquiry form and observation lists.

The questionnaire was modified from former studies done on a similar subject,^[5-8] and according to World Health Organization questionnaires connected to diarrhea. The checklist involve questions about socioeconomic status including age, sex, residence of child and age, level of education, employment of the mother, fathers education, family income, and family size. Then, estimation of potential environmental risk factors like type of feeding, water supply, sewage and trash disposal, proper hand washing, vaccination, prior use of antibiotics and season of presentation. Then, check for clinical presentations like Frequency of bowel motion, type of bowel motion, hydration state, fever, vomiting, upper respiratory tract infection, abdominal colic, rectal prolapse, and convulsion.

Patients underwent full clinical examination regarding hydration and nutritional states, Then stool sample collected from patients for general stool examination and stool culture (sub typing of *Escherichia coli* strains unfortunately not available) and identification of human rota virus (HRV) by Rota kits, produced by (Bio-Kit, Barcelona-Spain). Some of complicated cases also send for abdominal ultrasound examination which detects the presence of intestinal mucosal thickening.

Statistical analysis

The checklist was tested for completion and coding done. The data was analyzed statistically by using computerized SPSS system version 21.0 software (SPSS, IBM Company, Chicago, USA). Chi-square test was used to measure the relative importance of various variables, frequency tables used to express different data. $P < 0.05$ was considered as statistically significant.

Ethical consideration

The study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. It was carried out with patients verbal and analytical approval before sample was taken. The study protocol and the subject information and consent form were reviewed and approved by a local ethics committee.

RESULTS

Socioeconomic and demographical data

The baseline characteristics of 250 children with acute diarrhea reveal the followings: mean age of presentation is between 2–12 months, 119 patients – 47.6%. Males were more affected (54%) than females. Male to female ratio was 1.17. Most patients were from rural areas – 156 patients – 62.4%, mothers age <30 years in 192 patients – 76.8%, illiterate or primary educated mother in 133 patients – 53.2%, homemaker mothers in 154 patients – 61.6%, illiterate or primary educated father in 136 patients – 54.4%, family size more than five persons in 207 patients – 82.8%, and family income not enough in 223 patients – 89.2%. With statistically significant difference, $P < 0.05$ for all variables except for sex and education of parents [Table 1].

Table 1: Socioeconomic and demographical data of children with acute diarrhea

Variable	Frequency (%)	P
Age (months)		
Birth-2	38 (15.2)	<0.05
>2–12	119 (47.6)	
>12–60	93 (37.2)	
Sex		
Male	135 (54)	>0.05
Female	118 (46)	
Residence		
Rural	156 (62.4)	<0.05
Urban	94 (37.6)	
Age of mother (years)		
16–30	192 (76.8)	<0.05
>30	58 (23.2)	
Education of mother		
Illiterate or primary	133 (53.2)	>0.05
Secondary and above	117 (46.8)	
Job of mother		
Hose wife	154 (61.6)	<0.05
Others	96 (38.4)	
Education of father		
Illiterate or primary	136 (54.4)	>0.05
Secondary and above	114 (45.6)	
Family size (person)		
<5	43 (17.2)	<0.05
≥5	207 (82.8)	
Family income		
Enough	27 (10.8)	<0.05
Not enough	223 (89.2)	

Environmental risk factors

The significant risk factors associated with acute diarrhea include bottlefeeding noticed in 111 patients – 44.4%, while those exclusively breast fed is only 14 patients – 5.6%, purified water supply 181 patients – 72.4%, improper sewage disposal 194 patients – 77.6%, improper trash disposal 152 patients – 60.8%, improper hand washing 214 patients – 85.6%, incomplete vaccination according to age 187 patients – 74.8%, prior use of antibiotics 173 patients – 69.2%, underweight 161 patients – 64.4%, and during summer season 159 patients – 63.6%. With statistically significant difference, $P < 0.05$ for all variables [Table 2].

Clinical presentations and complications

The most frequent presentations of acute diarrhea include bowel motion equal or <5 times/day 133 patients – 53.2%, watery diarrhea in 219 patients – 87.6%, dehydration in 82 patients – 32.8%, fever in 183 patients – 73.2%, vomiting in 193 patients – 77.2%, upper respiratory tract infection in 169 patients – 67.6%, and abdominal colic in 120 patients – 48%. With statistically significant difference, $P < 0.05$ for all variables except for number of bowel motion and abdominal colic. While the complications was rare which include convulsion in

3 patients 1.2%, intestinal mucosal thickening in two patients 0.8%, and rectal prolapse in 1 patient 0.4% [Table 3].

Causative organisms

Pathogen isolated from stool of children with acute diarrhea include *Entamoeba histolytica* in 34 samples – 13.6%, HRV in 27 samples – 10.8%, mixed infection (two or more enteropathogens) in 19 samples – 7.6%, *E. coli* in 16 samples – 6.4%, *Enterobacter* in 11 samples – 4.4%, *Salmonella* in 10 samples – 4%, *Shigella* in 7 samples – 2.8%, while there is no growth in 126 samples – 50.4% [Table 4].

DISCUSSION

Results of this study revealed that the mean age of presentation of acute diarrhea was from 2 to 12 months then decline after this age. This may be explained by many factors like declining level of transferred maternal immunity, introduction of weaning food (which may be a source of infection) together with the introduction of foreign materials to the mouth of infants (as they begin to crawl and pick up objects in their hands). This finding was compatible with several studies worldwide^[5-8,12] The drop in rate of acute diarrhea in later age may be related to maturation of immune system due to repeated pathogens exposure. However, statistically not significant but male being more affected than female which may be related to boys more likely to play outdoor and eating nonhomemade foods; this finding is agreed by studies done in Baghdad 2014^[5] and Ethiopia 2016.^[12] Increase chance of getting diarrhea in rural areas as detected in our study may be related to type of water supply and poor sanitation facilities in the rural areas, similar findings described by study done in Uganda 2011,^[13] Ethiopia 2013.^[14] The effect of younger maternal age <30 years, illiterate or primarily educated parents, house wife mothers in addition to crowded family (6 or more persons) and low family income all these bad socioeconomic circumstances play a role in increasing chance of getting acute diarrhea as they associated with poor nutritional knowledge and increase financial challenges. All these socioeconomic factors also describe in other studies.^[5,12,14]

The importance of breast feeding as clean natural non contaminated readily available enriched with immunization factors in decreasing acute diarrhea proved in our study and in study done in Ethiopia 2013,^[14] Kolkata 2019.^[15] There is more cases of acute diarrhea even when patients used purified water indicates the need for more attention to the quality of water supply and may be explained by children may got the infection during bathing by tap water or using tap water for cooking or vegetable washing. The significance of improper trash and sewage disposal in transmitting diarrheal pathogens described in this study may be justifies by these sites consider a good location for insects reproduction which carry pathogens from trash or sewage to water and food, this result also described by study done in Lebanon 2019^[16] and another study in Saudi Arabia 2017.^[17]

The importance of proper hand washing, completion of vaccination according to schedule, wisdom use of antibiotics

Table 2: Environmental risk factors for children with acute diarrhea

Risk factors	Frequency (%)	P
Type of feeding		
Breast feeding	14 (5.6)	<0.05
Bottle feeding	111 (44.4)	
Mixed feeding	93 (37.2)	
Usual diet	32 (12.8)	
Water supply		
Purified	181 (72.4)	<0.05
Other sources	69 (27.6)	
Sewage disposal		
Proper	56 (22.4)	<0.05
Improper	194 (77.6)	
Trash disposal		
Proper	98 (39.2)	<0.05
Improper	152 (60.8)	
Proper hand washing		
Yes	36 (14.4)	<0.05
No	214 (85.6)	
Complete vaccination according to age		
Yes	63 (25.2)	<0.05
No	187 (74.8)	
Prior use of antibiotics		
Yes	173 (69.2)	<0.05
No	77 (30.8)	
Nutritional state (weight for age)		
Under weight	161 (64.4)	<0.05
Normal	89 (35.6)	
Season of presentation		
Winter	91 (36.4)	<0.05
Summer	159 (63.6)	

Table 3: Clinical presentations and complications of children with acute diarrhea

Clinical presentation and complications	Frequency (%)	P
Frequency of bowel motion (times/day)		
≤5	133 (53.2)	>0.05
>5	117 (46.8)	
Type of bowel motion		
Watery	219 (87.6)	<0.05
Bloody	31 (12.4)	
hydration state		
Well hydrated	168 (67.2)	<0.05
Dehydrated	82 (32.8)	
Fever		
Yes	183 (73.2)	<0.05
No	67 (26.8)	
Vomiting		
Yes	193 (77.2)	<0.05
No	57 (22.8)	
Upper respiratory tract infection		
Yes	169 (67.6)	<0.05
No	81 (32.4)	
Abdominal colic		
Yes	120 (48)	>0.05
No	130 (52)	
Rectal prolapse		
Yes	1 (0.4)	<0.05
No	249 (99.6)	
Convulsion		
Yes	3 (1.2)	<0.05
No	247 (98.8)	
Intestinal mucosal thickening		
Yes	2 (0.8)	<0.05
No	248 (99.2)	

Table 4: Pathogen isolated from children with acute diarrhea

Pathogen isolated	Frequency (%)
<i>Entamoeba histolytica</i>	34 (13.6)
Human Rotavirus	27 (10.8)
Mixed infection	19 (7.6)
<i>Escherichia coli</i>	16 (6.4)
<i>Enterobacter</i>	11 (4.4)
<i>Salmonella</i>	10 (4)
<i>Shigella</i>	7 (2.8)
No growth	126 (50.4)

and good nutritional status in decreasing acute diarrhea described in this study also agreed by other studies conducted elsewhere.^[12-14,16,17] However, most bacterial cases discovered during hot months, there is high incidence of Rota virus detection during cold months, and these seasonal variations are supported by other studies.^[16,17]

In this study, the most frequent presentations of acute diarrhea include; watery diarrhea five times or less per day, well

hydrated, fever, vomiting, association with upper respiratory tract infection, and no abdominal colic. While complications such as convulsion, intestinal mucosal thickening, and rectal prolapse rarely occur.

This findings supported by study done in Lebanon 2019^[16] and Nigeria 2019.^[18]

No growth of microorganism in culture media was observed in around half of cases of acute diarrhea may be related to many viruses such as adenovirus, astrovirus, or norovirus which unfortunately cannot detect it in our laboratory and lack of advanced bacterial diagnostic techniques.

Results of this study also found that the next frequent isolated organism was *E. histolytica*. This finding supported by studies in nearby regions such as Lebanon 2019^[16] and Saudi Arabia 2017.^[17] The second most common isolated organism is HRV in spite of using vaccination which help to reduce its incidence but it still considerable causative agents may be due to incomplete vaccination coverage of target age group, this finding supported by studies done in Thi Qar province, Iraq,^[9] Babylon, Iraq 2013,^[19] and Sulaimani, Iraq 2015.^[20]

Limitations of the study

Unfortunately the prevalence of acute diarrhea can't calculated in this study because the current city population size unknown and many cases of acute diarrhea treated outside the hospital in primary health centers or private clinics, and some patients excluded from the study when they refuse to participate in the study or when there is incomplete data collection or when they fail to give stool sample. Another limitation is the deficiency in advance diagnostic tests and the need for study all over a whole year to detect the exact seasonal variations involving all primary health centers.

CONCLUSION

Children under 5 years especially between 2-12 months of age in AL-Hindiya city still at considerable risk of acute diarrhea, the risk is more in rural, young, low educated, unemployed, poor parents with crowded families. It is vital to encourage breast feeding, immunization, ensure good nutritional status, improve personal hygiene, water supply, trash and sewage disposal, to reduce the risks of acute diarrhea. There is clear increase in cases of acute diarrhea during hot weather, commonly presented with few watery bowel motions, well hydrated with vomiting, fever, associated with upper respiratory tract infection, while complications are rare. The most common isolated organism is *E. histolytica* followed by Rota virus.

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Conflicts of interest

There are no conflicts of interest.

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