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Epidemiological study of bloody diarrhoea among children in Baghdad, Iraq

ORIGINAL

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Abstract

Introduction: Diarrhoea is a preventable and treatable disease; however it is still a major public health problem particularly in the developing world. Bloody diarrhoea in young children is usually a sign of invasive enteric infection that carries risk of serious morbidity and death. In Iraq, diarrhoea is the second common cause of mortalities among children.

Objective: To determine the prevalence and associated factors of bloody diarrhoea among children less than 10 years old, in Baghdad.

Material and methods: A hospital based prospective cross-sectional study was conducted in two Paediatric hospitals: AL- Manseur Paediatric Teaching Hospital and The Central Paediatric Teaching Hospital. A total of 1500 children (<10 years) with diarrhoea were included. Mothers were interviewed to obtain the necessary information. A Clinical examination and stool laboratory tests were performed for all children.

Results: The prevalence of bloody diarrhoea was 28%. Bloody diarrhoea was significantly higher among children aged 7-9 years, those living in rural areas and on exclusive bottle feeding, with illiterate mother, and where river water is a household source. Gender of child and working mother were not significant. *Entamoeba Histolytica* was a main causative agent especially amongst children in age group 1-3years. *Salmonella* and *Shigella* were common in the age group 4-6 years old.

Conclusion: The prevalence of bloody diarrhoea was high. *Entamoeba Histolytica* was the main causative agent. Poor sanitary condition and low socio-economic status may contribute to bloody diarrhoea among children in Iraq.

Keywords: Childhood bloody diarrhea, risk factors, causative pathogens, environmental sanitation, breast feeding.

Introduction

Diarrhoea is a preventable and treatable disease; however it is still a major public health problem particularly in developing world [1]. It ranks as the third leading cause of both mortality and morbidity among infectious diseases, placing it above tuberculosis and malaria [1]. Young children (less than 10 years old) are especially vulnerable, bearing 68% of the total burden of diarrhoeal disease [1]. World Health Organization (WHO) reported that globally nearly nine million children under five years of age die each year [2]. Boschi et al (2008) reported that the estimated global death of children aged less than 5 years from diarrhoea was 1.87 million, approximately 19% of total child deaths [3]. Interestingly, several studies reported that diarrhoea kills about 1.5 million young children every year, mainly in low and middle income countries [2-5]. In Iraq, diarrhoea is the second commonest cause of mortalities among children [6]. About 10% of diarrheal episodes in children under 5 years of age has visible blood in the stool [7]. Bloody diarrhoea is defined as diarrhoea with visible or microscopic blood in the stool [8-10]. Bloody diarrhoea in young children is usually a sign of invasive enteric infection that carries a substantial risk of serious morbidity and mortality especially in the developing countries, where it occurs most frequently, while non-infectious causes account for a very small proportion of episodes (less than 3%) of bloody diarrhoea [8, 10-12]. Compared to watery diarrhoea, bloody diarrhoea generally lasts longer, is associated with intestinal damage and nutritional deterioration and may result in sepsis, dehydration, fever and abdominal cramps [9, 10]. Therefore it is more likely to adversely affect a child's growth, and have a higher fatality rate [5, 9]. Interestingly bloody diarrhoea accounts for about 15% of diarrhoea-associated deaths in this age group worldwide [5, 9, 10].

Clinically diagnosis of bloody diarrhoea is based on the presence of visible blood in the diarrheal stool, with numerous pus cells. These features suggest bacterial infections that invade the intestinal mucosa. However in some episodes of shigellosis, initially the stool is watery, and become bloody one to two days later [13]. The majority of bloody diarrhoea occurs due to pathogenic infectious which could be bacterial infection like *Shigella* species especially *S. flexneri* and *S. dysenteriae* type, non-Typhoid *Salmonella*, *Campylobacter jejuni, Escherichia coli, Yesinia enterocolitica* or Protozoal infection like *Entamoeba histolytica* [14-16]. Interestingly Bercu et al (2007) reported that *Entamoeba histolytica* affects more than 50 million people worldwide, with more than 100,000 deaths annually [14]. Several important risk factors contribute to the prevalence of bloody diarrhoea like an unhygienic environment, poor environmental sanitation, and improper disposal of human excreta. Use of unsafe water for domestic purposes, poor personal hygiene, inappropriate storage of food and artificial feeding are known to be risk factors [8, 9].

According to WHO, in Iraq, the sanitary condition and general hygiene all over Iraq had been deteriorating during the last decade, particularly following the last war [2]. However, only a few studies have described the epidemiology of bloody diarrheal among this age group. Therefore, this study was conducted to measure the burden and determinants of the problem by identifying the prevalence, factors associated, and identifying the most common pathogenic agent causing bloody diarrhoea.

Population and methods

A cross–sectional study was conducted in Baghdad, Iraq. The Ethical and Review Committee in the Ministry of Heath-Iraq reviewed and approved the protocol. Informed consent was obtained from all mothers. The total number of pediatric hospitals in Baghdad is four. Two were selected because these two represent all Baghdad. Two Pediatric hospitals were chosen, one (AL- Manseur Paediatric Teaching Hospital) located at the AL-Rasafa side, while the other (The Central Paediatric Teaching Hospital) located at AL-Karkh side. A simple random sampling of 1500 children age less than 10 years old and having diarrhoea was collected. After applying the exclusion criteria, the patients were relisted and simple random sampling applied. Sample size was calculated using Epi was info. Children having black stools or streaks of blood on the surface of their formed stool, or had received antibiotics or any other treatment during their illness, children accompanied by person other than their mother were excluded from this study. Mother's child was exclusively interviewed by the researcher using questionnaire which included socio-demographic information (age, sex, residency, mother's education and occupation), type of feeding (breast milk, bottle or mixed) for those at age 6 months or less. In addition information about water and food sanitation (source of household water, eating outside home and food storage methods) was obtained. Following the clinical examination (carried-out by the paediatrician), fresh stool sample was obtained from each participant using a sterile container. The investigation was done in the labs on each hospital. The laboratory analysis was done by one othe authours and lab scientists. Naked-eye examination of the stool was done by the researcher for consistency and presence of blood or mucus in the stool. Within 30 minutes the samples were sent to the laboratory of the same hospital. A Stool sample was divided into two portions, one portion used for direct general stool examination while the other cultured for the detection of causative pathogenic agents of bloody diarrhoea. About 2 grams of stool was emulsified separately with drops of saline and iodine on a glass slide respectively and covered with glass. The saline preparation is examined to detect blood cells (RBCs); pus cells with ingested RBCs & the motility of trophozoite phase of *E. histolytica*. The iodine preparation was examined for detection of cysts of *E. histolytica* & cysts of other protozoa. Data was analyzed using SPSS 16.0. Chi square test was used to test the statistical significance between cases and different risk factors. P-value of <0.05 was considered statistically significant.

Results

Visible blood in the stool was seen in 420/1500 (28%). Male to female ratio of bloody diarrhoea was 1.42: 1. Although the prevalence of bloody diarrhoea was higher among male children (29.5%) than female, there was no significant difference, (p= 0.05) **(Table1)**. Children of age group 7-9 years old showed higher prevalence (66.6%) of bloody diarrhoea compared to other groups, (p=0.001). Children living in rural areas demonstrated significantly higher rates (41.9%) of bloody diarrhoea, compared to (27.1%) of those living in urban areas

Table 1: Socio-demographic characteristics of children with bloody diarrhoea in Baghdad (N=1500).

	Characteristics	Bloody diarrhoea No (%)	Non-bloody diarrhoea No (%)	Total	X^2	P value
Sex						
	Male	247 (29.5)	590 (70.5)	837	1.97	0.15
	Female	173 (26.1)	490 (73.9)	663		
Age						
	<1year	120 (23.2)	398 (76.8)	518	20.95	0.001
	1-3 year	270 (30.6)	612 (69.4)	882		
	4-6 year	20 (23.5)	65 (76.5)	85		
	7-9 year	10 (66.6)	5 (33.4)	15		
Residency						
	Urban	381 (27.1)	1026 (72.9)	1407	8.8	0.01
	Rural	39 (41.9)	54 (58.1)	93		
Maternal education						
	Illiterate	84 (31.5)	183 (68.5)	267	10.26	0.016
	Primary	141 (28.7)	350 (71.3)	491		
	Secondary	176 (28.2)	447 (71.8)	623		
	University & more	19 (16.8)	100 (83.2)	119		
Maternal occupation						
	Worker	50 (33.3)	100 (66.7)	150	2.1	0.1
	House wife	370 (27.6)	980 (72.4)	1350		
Household						
	Public water	356 (26.2)	1005 (73.9)	1361	24.7	0.0001
	Tank water	45 (45.9)	53 (54.1)	98		
	River water	19 (46.3)	22 (53.7)	41		
Food in refrigerator						
	Yes	329 (26.7)	904 (73.3)	1233	5.6	0.01
	No	91 (34.1)	176 (65.9)	267		
Possible contaminated food *						
	Not eating outside home	3 (37.5)	5 (62.5)	8	Fisher exact test	0.01
	Eating outside home	19 (86.4)	3 (13.6)	22		
Type of feeding**						
	Exclusively breast feed	5 (16.7)	25 (83.3)	30	12.47	0.002
	Exclusively bottle	95 (36.5)	165 (63.5)	260		
	Mixed	25 (20.8)	95 (79.2)	120		

* Only patients aging ≥ 5 years.

** Only patients aging < 6 months, Pearson Chi square

P=0.01. This study revealed that childhood bloody diarrhoea was inversely related to the level of maternal education. We found that children of illiterate mothers demonstrated significantly higher rate (31.5%) of bloody diarrhoea compared to (16.8%) children of highly educated mothers (university or more), (p=0.01). No significant association was detected between prevalence (33.3%) of childhood bloody diarrhoea and mother's work outside the home (P=0.05). In families using river water and tank water, the children showed significantly higher rate (46.3% and 45.9% respectively) of bloody diarrhoea compared to those using tap water (26.15%) as a household source of water (p=0.0001). Not using refrigerator for food storage was significantly associated with a high prevalence (34.1%) of childhood bloody diarrhoea (p=0.01). Bloody diarrhoea was significantly higher (86.4%) among children (age ≥ 5 years old) who used to consume food outside home (p=0.01). Significantly higher (36.5%) bloody diarrhoea was detected among children who were on exclusive bottle feeding (p < 0.002) **(Table1)**.

Regarding the causative agent of bloody diarrhoea, majority of the cases 351/420 (83.58%) was infected by *Entamoeba histolytica*, while 27 (6.42%) cases were due to bacterial pathogens (Non-Typhoid *Salmonella* and *Shigella*). *Salmonella* was detected in 4.28% and *Shigella* in 2.14% stool samples of our subjects. On the other hand, 42 (10%) stool samples showed negative culture. The causative pathogenic organism of bloody diarrhoea was significantly associated to child's age (P=0.0001). Entamoeba histolyticca detected in all age groups, with highest prevalence (97.5%) among children at age 1-3 years old, followed by (93.4% and 70%) children <1 and 7-9 years old; respectively. While the lowest rate (42.1%) of Entamoeba histolyticca detected among children at age 4-7 years old. On the contrary, bacterial infection (*Salmonella* and *Shigella*) were detected among those in the age group 4-7 years old (42.1%, 15.8%; respectively). The lowest 3 (1.25%) prevalence of *Salmonella* as well as *Shigella* was found among children aging 1-3 years **(Table2)**.

Table 2: Pathogenic causative organism of childhood bloody diarrhoea distributed according to child's age.

Age group (year)	*E. histolytica*	*Salmonella*	*Shigella*	Total
	No. (%)	No. (%)	No. (%)	No
< 1	99 (93.4)	5 (4.7)	2 (1.9)	106
1 – 3	237 (97.5)	3 (1.25)	3 (1.25)	243
4 – 6	8 (42.1)	8 (42.1)	3 (15.8)	19
7 – 9	7 (70)	2 (20)	1 (10)	10
Total	351 (92.9)	18 (4.7)	9 (2.4)	378
P=0.0001, X^2=91.5				

Discussion

Although we found the prevalence of bloody diarrhoea among children in Baghdad was (28%) within that range (20-30%) reported by Mota et al [17]. It seems as two times much higher than that (10%) detected by other study done in Iraq [7]. This variation may be related to the difference in age of study groups or due to the deterioration of the environmental sanitary condition, general hygiene, and medical care services all over Iraq particularly following the war of 2003. Townes and his colleagues 1997 reported that children at age 1-2 years old are significantly more prone to bloody diarrhoea [21]. Our study contradicts his finding we found that the prevalence of bloody diarrhoea is increasing with increased age of the child and highest prevalence was among children aged 7-9 years.

This may be due to increased mobility and activities as well as exposure to unhygienic conditions as child grows up. Geographic location, place of residence in particular, has been shown to be another form of disparity. Although, our study was carried-out at an urban area, bloody diarrhoea was significantly higher among children living in rural area which is in agreement with Henry [22] and disagreement with Al-Rubaii [23]. In rural areas beside the cohabitation with domestics animals that may carry pathogenic agents, lack of safe water, sanitary disposal system, deficiency in medical care services may contribute as a risk for childhood bloody diarrhoea. In supporting several studies [22, 24, 25], we found an inverse association between maternal educational level and prevalence of childhood bloody diarrhoea. Such illiterate mothers possibly lack appropriate knowledge and attitude about, food and/or personal hygiene, handling a child with diarrhoea, and, seeking medical consultation and improper utilization of primary health care services such as vaccination programmes [24, 26]. In addition illiterate mothers are more common among families of low socio-economic status and residing rural areas.

Brooks et al (2003) found that drinking water from Lake Victoria was independently and significantly associated with increased risk of bloody diarrhoea [27]. His finding was confirmed in our study by founding that higher prevalence of the bloody diarrhoea was significantly among those children coming from families using river and/or tank water as household water for domestic purposes. This river water usually is contaminated with human and animal waste as it is used for bathing, washing clothes, and watering livestock [28]. Interestingly, we found that bloody diarrhoea was also high (26.15%) even among those families who's household water source is a tap water. This could be due to the fact that even chlorination of water cannot kill the amoebic cysts, as reported by several authors [19, 22] and existence of leakage between the main sewage pipes and the public water pipes could not be excluded.

Contradicting Brooks et al (2003) who found no association between bloody diarrheal and vended foods and beverages (27) and confirming several researchers (12, 25, 28,29), we gave evidence that consumption of possibly contaminated food, whether as result of bad storage or vended foods contributed as a risk factor for bloody diarrhoea in children. Best explanations that, vended foods could be, bad stored, raw or uncooked food which be contaminated easily with the entero-pathogens. Moreover, vended vegetables may be irrigated by water contaminated by human or animal faecal materials.

Nakawesi et al (2010) reported that breast feeding has consistently been shown to confer protection against non-viral gastrointestinal pathogens [30]. Our study, showed that significantly the lowest rate of bloody diarrhoea was among the exclusively breast feed children, our results matching with the several studies [23, 29-31]. This finding mostly related to the fact that breast milk is, sterilized in all times, fresh, free of pathogenic bacteria and transfer macrophages and immune-globulins.

Bloody diarrhoea are usually caused by many enteric pathogens such as bacteria or protozoa [14, 32]. It is reported that *Entamoeba histolytica* affects more than 50 million people worldwide, with over 100,000 deaths annually [14]. Interestingly *Entamoeba histolytica* was found as the main pathogenic organism of bloody diarrhoea in our study, followed by bacterial pathogens which is comparable to other studies [18, 23]. On the contrary several researchers reported *Shigella* as the most common recovered pathogen from bloody diarrhoea cases [9, 17, 27].

Conclusion and recommendation

Childhood bloody diarrhoea is high prevalent in Baghdad-Iraq, particularly at age 7-9 years old. *Entamoeba histolytica* is the commonest causative agent. Lack of access to sufficient clean water, consumption of contaminated food, low maternal education and artificial feeding as well as living in rural area, all increase the risk of bloody diarrhoea among children. Therefore, through maximizing; sanitation, accessibility to safe food and water supplies, improving personal hygiene practices as well as promoting of breast-feeding are the essential measures for the reduction of bloody diarrheal morbidity and mortality rates in children.

Competing Interest

The authors declare that they have no competing interests.

Authors' contribution

WA study design and writing the manuscript. AB study design, obtained ethical approval from Ministry of Health, Iraq, data collection and writing the manuscript, RA statistical data analysis and writing the manuscript. NS agreed to be accountable in all aspects of the work, data interpretation, critical revision of the manuscript, final approval and final editing. All authors read and approved the final manuscript.

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