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BLOODY DIARRHEA IN CHILDREN UNDER FIVE YEARS

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1.0 ABSTRACT

This research paper was done by the author as an independent study about acute diarrhea in children under 5 years of age. The epidemiology was according to the presentation of children with diarrhea among the total number of patent. Aim of study to evaluate the most common causes and risk factors of bloody diarrhea in Iraq. Cross sectional study conducted in Central Child Teaching Hospital of Baghdad, for 100 patients with acute bloody diarrhea under 5 years of age from total 1660 cases of gastroenteritis during period of 6 months from 1st, March, 2018 to 31st, December, 2018.

KEYWORD: Bloody diarrhea.

2.0 INTRODUCTION

2.1 Definition

2.1.1 Acute bloody diarrhea: Is defined as the abrupt onset of abnormally high fluid content in the stool (more than the normal value of approximately 10 ml/kg/d) with presence of blood.[1] This situation usually implies an increased frequency of bowel movements, which can range from 4-5 to more than 20 times per day. The augmented water content in the stools is due to an imbalance in the physiology of the small and large intestinal processes involved in the absorption of ions, organic substrates, and water.[2,3]

2.1.2 Dysentery: The term dysentery was used by Hippocrates B.C. to indicate a condition characterized by bloody diarrhea accompanied by tenesmus.[2,3] It has the same meaning of bloody diarrhea. Although clinical texts often use this term to describe the syndrome of bloody diarrhea with fever, abdominal cramps, rectal pain and mucoid stool, these features do

not always accompany bloody diarrhea, and this does not define its etiology or determine appropriate treatment.[3]

In 1859 the pathogenecity of *Entamoeba Histolytica* has been verified, and later in 1891 a clear distinction was made between bacillary and amoebic dysentery. Then the bacillus was first described by Shiga in Japan 1898.[1]

About 80% of deaths due to diarrhea occur in the first two years of life. The main cause of death from acute diarrhea is dehydration. Other important causes of death are dysentery, malnutrition and serious infection such as sepsis.[2] Bloody diarrhea in young children is usually a sign of invasive enteric infection that carries a substantial risk of serious morbidity and death. Non-infectious causes account for a very small proportion of episodes of bloody diarrhea.[3] About 10% of diarrheal episodes in children under 5 years of age have visible blood in the stool and these account for about 15% of diarrhea-associated deaths in this age group world-wide.[4] Compared with the water diarrhea, bloody diarrhea generally lasts longer, is associated with more complications, is more likely to adversely affect a child growth and has a higher case fatality rate.[5], [6], [7]

There is also a synergism between bloody and persistent diarrhea accompanied by malnutrition; therefore, the control of bloody diarrhea will prevent most of death attributed to malnutrition and persistent diarrhea.[2,8]

2.2 Causative agents of bloody diarrhea

The most causes of bloody diarrhea result from intestinal infection and nearly all of these are caused by invasive enteric bacteria.[10] Entameba Histolytica the only important non-bacterial pathogen usually account for 3% of episodes globally.[11]

2.2.1 Bacterial causes[12,13]

1. Shigella species: Shigella flexneri, Shigella dysenteriae, Shigella sonni and Shigella boydii. Although all four species may cause a wide spectrum of diseases, generally Shigella dysenteriae is associated with the severe one.[12]
2. Entero invasive E. coli: it behaves like Shigella in its capacity to invade gut epithelium and produce dysentery like illnesses.[13]
3. Entero hemorrhagic E. coli serotype O157:H7, O26:H11
4. Non typhoidal Salmonella: like Salmonella typhimurium and Salmonella enteridis.

5. Campylobacter jejuni.
6. Yersinia enterocolitica.
7. Clostridium deficile.

2.2.2 Non-bacterial causes[12,13]

Parasitic – Entamoeba Histolytica.

2.3 Epidemiology

Diarrheal disease is one of the leading causes of morbidity and mortality in children world-wide, causing one billion episodes of illnesses and 1.8 million deaths annually.[1]

1- Shigella: world-wide distribution, more in developing countries, occurs most often during warm months, sexes are affected equally. Infection can occur at any age, but it is most common in 2nd and 3rd years of life and it is rare in the 1st six months.[13] Most endemic Shigellosis occurs in children between 6th months and 3rd year of age.[3] Contaminated food and water are important vector, many infections of the gastrointestinal tract are spread by fecally contaminated water because the transit time through the stomach is faster for drinks than for foods.[13,15]

2- Other invasive bacteria: enteroinvasive E. Coli, enterohemorhagic E. Coli, Campylobacter jejuni and non-typhoidal Salmonella. World-wide distribution, more in developing countries, occurs most often during warm months, sexes are affected equally. The incidence is higher in children less than five years. In Salmonellosis the highest isolation rate is for infants.[12,13,14] Direct contact to domestic animals or they're under cooked and unpasteurised products is an important mechanism of transmission in non-typhoidal Salmonella, Campylobacter jejuni and enterohemarhagic E. Coli.[12,13,14,15,16]

3- Entamoeba histolytica: prevalence of infection with E.histolytica and Entameoba dispar varies greatly on region and socioeconomic status, and these prevalence studies have not distinguished between E.histolytica and E.dispar. It estimated that 50 millions cases of symptomatic amebiasis with 40000-110000 death annually. Prospective studies have demonstrated that 4-10% of individuals infected with E.histolytica develop ameobic colitis and 1% of individuals develop disseminated disease, such as ameobic liver abscesses.[1] The major mechanisms of transmission for diarrheal pathogens are person to person through the fecal-oral route or by ingestion of contaminated food or water and anal sex.[1] Enteropathogens that are infectious in a small inoculum *(Shigella, E. coli* O157:H7 and *E. histolytica)* may be transmitted by person-to-person contact.[17] Factors that

increase susceptibility to infection with enteropathogens include young age, immune deficiency, measles, malnutrition, travel to an endemic area, lack of breast-feeding, exposure to unsanitary conditions, ingestion of contaminated food or water, level of maternal education, and attendance at a childcare center.[11]

2.2 Pathogenesis

All microorganism that caused bloody diarrhea shared by its capacity to invade bowel mucosa or production of lytic enzymes that causes inflammation and tissue damage.[18] This cause numerous polymorph nuclear leucocytes and red blood cells to appear in stool.

1- shigella possessing invasive plasmid, endotoxine production by all species, shiga toxin production by shigella dysenteriae type1, enterotoxine production by Shigella flexineri type-11.[12,13,14]
2- Enterinvasive E.coli behaves like shigella by possessing enteroinvaive plasmid.[13,14]
3- Enterohemorrigic E.coli produces one or more shiga toxine resembling that produced by shigella desenteriea type 1, also it possesses heat stable endotoxin and adhesion factor.[13,14,18]
4- Non-typhoidal salmonella:Toxigenic production and invasion.
5- Campelobcter jejuni:cytotoxine production and invasion.[12]
6- Entameoba histolytica:trophozite are responsible for tissue invasion and enzyme production that allow for penetration through epithelial layer.[16]

2.3 Clinical features[19]

1- fever.
2- loss of appetite.
3- Nausea.
4- Vomiting.
5- Mucus and blood in the stool.
6- Dehydration.
7- Abdominal pain.
8- Weight loss.

Table 2.1: Method of Assessing Degree of Dehydration.[1,15]

Signs and symptoms	Mild dehydration <5%	Moderate dehydration (5 – 10) %	Severe dehydration >10%
tachycardia	absent	present	Present
palpable pulse	present	present (weak)	decreased
blood pressure	normal	orthostatic hypotension	hypotension
capillary refilling time	1.5 second or less	1.5 – 3.0 second	>3.0 second
Mental status	Well, alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
skin turgor	slightly decreased	decreased	decreased (retract slowly >2.0 second)
fontanel	normal	slightly depressed	sunken
mucous membrane	moist	dry	very dry
tears	present	Present or absent	absent
respiration	normal	deep, may be rapid	deep and rapid
urine output	normal	oliguria	anuria or severe oliguria
thirst	Drinks normally; might refuse liquid	Thirsty; eager to drink	Drinks poorly; unable to drink

The symptoms of bloody diarrhea are sometimes equal between different pathogens causing it, but there is some variations on these symptoms between different pathogen. Table below show these variations.[1,21,22,23]

Table 2.2 Organisms and Frequency of Symptoms.

Organism	Incubation	Duration of illness	Vomiting	Fever	Abdominal Pain
Campylobacter species	2-4 days	5-7 days	No	Yes	Yes
C difficile	Variable	Variable	No	Yes	Yes
Enterohemorrhagic *E coli*	1-8 days	3-6 days	No	+/-	Yes
Enteroenvasive *E coli*	1-3 days	3-5 days	Yes	Yes	Yes
Non typhoidal Salmonella	0-3 days	2-7 days	Yes	Yes	Yes
Shigella species	0-2 days	2-5 days	No	High	Yes
Yersinia enterocolitica	24-48 hours	1-46 days	Yes	Yes	Yes
Entamoeba species	5-7 days	1-2 weeks	No	Yes	Yes

2.4 Complications

There is a list of complications for bloody diarrhea differ according to the causative agents, table below explain that.[24,9]

Table 2.3 Common Complications.

Organism	Complications
Campylobacter species	Bacteremia, meningitis, cholecystitis, urinary tract infection, pancreatitis, Reiter syndrome (RS)
C difficile	Chronic diarrhea
Enterinvasive E.coli	Hemorrhagic colitis
Enterohemorrhagic *E coli* O157:H7	HUS
Non typhoidal Salmonella	bacteremia, meningitis, osteomyelitis, myocarditis, RS
Shigella species	Seizures, HUS, perforation, RS
Yersinia enterocolitica	Appendicitis, perforation, intussusception, peritonitis, toxic megacolon, cholangitis, bacteremia, RS
Entamoeba species	Colonic perforation, liver abscess

* HUS (hemolytic uraemic syndrome).[25]

2.6 Diagnosis

It is not possible precisely to determine the etiology of bloody diarrhea in children based only on clinical features because they are seldom distinctive enough to allow confident diagnosis. Although in shigellosis the clinical feature suggests the diagnosis.[14]

2.6.1 Microscopic examination of stool: It is done to detect red blood cells, polymorph nuclear cells and trophozoite or cyst of *Entamoeba Histolytica*. Numerous PMNs on the stool microscopy indicate an inflammation. Stool specimens should be examined for mucus, blood, and leukocytes, the presence of which indicates colitis. Fecal leukocytes are produced in response to bacteria that diffusely invade the colonic mucosa. A positive fecal leukocyte examination indicates the presence of an invasive or cytotoxin-producing organism such as *Shigella, Salmonella, C. jejuni,* invasive *E. coli, C. difficile, Y. enterocolitica, V. parahaemolyticus,* and possibly *Aeromonas* or *P. shigelloides.* Not all patients with colitis have positive results on fecal leukocyte examination. Patients infected with Shiga toxin–producing *E. coli* and *E. histolytica* generally have minimal fecal leukocytes.[1]

2.6.2 Stool cultures: Should be obtained as early during disease as possible from patients in whom the diagnosis of hemolytic-uremic syndrome (HUS) is suspected, in patients with bloody diarrhea, if stools contain fecal leukocytes, during outbreaks of diarrhea, and in persons who have diarrhea and are immune suppressed.[19] Because certain bacterial agents, including *Y. enterocolitica, C. difficile, E. coli* O157: H7, and *Campylobacter*, require

modified laboratory procedures for identification, laboratory personnel should be notified when one of these organisms is the suspected etiologic agent. Serotype and toxin assays are available for further characterization of *E. coli*. Detection of *C.difficile* toxins is valuable in the diagnosis of antimicrobial-associated colitis.[19]

2.6.3 Proctosigmoidoscopy: May be helpful in establishing a diagnosis in patients in whom symptoms of colitis are severe or the cause of an inflammatory enteritis syndrome remains obscure after initial laboratory evaluation.[23]

2.6.4 Examination of the peripheral blood: Demonstration of leucocytosis and left shifting, which is usually associated with shigella, Enteroivasive and Enterohaemorragic E.coli infections, it considered as one of the presumptive data that support the diagnosis of bacillary dysentery.[1]

2.7 Treatment

Because most infectious diarrhea is self-limiting, medical care is primarily supportive and aimed to treat dehydration, maintaining hydration, or both. Oral rehydration therapy (ORT) is the mainstay of treatment in all children with diarrhea; never neglect ORT, even in the absence of overt dehydration because maintaining hydration is necessary. Neonates and young infants are at high risk of secondary complications and require close monitoring. Consider intravenous rehydration only in the unlikely event that ORT is unsuccessful.[25] ORT is the cornerstone of treatment, especially for small-bowel infections that produce a large volume of watery stool output.[23,26] The ideal solution has a low osmolarity (210-250) and a sodium content of 50-60 mmol/L.[27,28,29]

2.7.1 Antimicrobial therapy: Is indicated for some types of bloody diarrhea, since most is self-limiting and does not require therapy. Table below shows standard treatment.[1,24]

Table 2.4: Therapies for bacterial bloody Diarrhea.

Microorganism	Antibiotic therapy
Campylobacter species	Erythromycin shortens illness duration and shedding.
C difficile	Discontinue potential causative antibiotics. If antibiotics cannot be stopped or this does not result in resolution, use oral metronidazole or vancomycin. Vancomycin is reserved for the child who is seriously ill.
Entamoeba histolytica	Metronidazole followed by iodoquinol or paromomycin Asymptomatic carriers in nonendemic areas: Iodoquinol or

	paromomycin
E coli Microorganism	Trimethoprim-sulfamethoxazole (TMP-SMX) if moderate or severe; antibiotic treatment may increase likelihood of HUS. Parenteral second-generation or third-generation cephalosporin for systemic complications Antibiotic therapy
Salmonella species	Treatment prolongs carrier state, is associated with relapse, and is not indicated for nontyphoid-uncomplicated diarrhea. Treat infants younger than 3 months and high-risk patients (eg, immunocompromised, sickle cell disease). TMP-SMX is first-line medication; however, resistance occurs. Use ceftriaxone and cefotaxime for invasive disease.
Shigella species	Treatment shortens illness duration and shedding but does not prevent complications. TMP-SMX is first-line medication; however, resistance occurs. Cefixime, ceftriaxone, and cefotaxime are recommended for invasive disease.
Yersinia species	TMP-SMX, cefixime, ceftriaxone, and cefotaxime are used. Treatment does not shorten disease duration; reserve for complicated cases.

2.7.2 Diet: Continued enteral feeding in diarrhea aids in recovery from the episode and a continued age appropriate diet after rehydration is the norm[30] although intestinal fresh border surface and luminal enzymes can be affected in children with a prolonged diarrhea. There is evidence that satisfactory carbohydrates, protein and fat absorption can take place on a variety of diet. Once the rehydration is complete food should be introduced while oral rehydration can be continued to replace ongoing loses from emesis or stools.[1,30,31] Breast feeding, or non-diluted regular formula should be resumed as soon as possible. Food with complex carbohydrates (rice, wheat, potato, bread and cereal), lean meat, yogurt, fruits and vegetables are also tolerated. Fatty food or food high in simple sugar should be avoided.[27,32]

2.7.3 Additional therapy: Zinc supplementation, there is a strong association that giving zinc will lead to reduce in severity and mortality. They recommend giving zinc for 10-14 days during and after diarrhea (10 mg/day for infant <6 months of age and 20 mg / day for those >6 months).[1]

2.8 Prevention

Preventive strategies may be of relevance in both developing and developed countries because of huge number of cases have been encountered.[1]:

1- Promotion of exclusive breast feeding which will lead to promotion of passive immunity and reduction in intake of contaminated food and water

2- Improved complementary feeding practices There is strong inverse association between appropriate, safe complementary feeding and mortality in children age 6-11 month; malnutrition is independent risk for the frequency and severity of diarrheal diseases. Complementary food should be introduced at 6 months of age while breast feeding should continue for up to 1 year (longer period for developing countries).[1]
3- Vaccine immunization, Vaccine would have an effect on reducing acute bloody diarrheal diseases mortality in developing countries, like vaccine against shigella and Enterotoxogenic E. Coli.[18]
4- Improved water sanitation and promotion of personal and domestic hygiene In addition to routine hand washing with plain soap in home can reduce the incidence of bloody diarrhea, in world.[1]
5- Improved case management of diarrhea: Improved management represents a key factor in reducing the burden of prolonged episodes and persistent bloody diarrhea.[1]

The WHO/UNICEF recommendation to use low osmolality ORS and zinc supplementation for the management of acute bloody diarrhea coupled with selective and appropriate use of antibiotic, have potential to reduce the number of acute bloody diarrheal deaths among children.[1,2,33]

2.9 Aims of the Study

House ownership	scores	Crowding index	scores	Educational level of mother	scores	Occupation of mother	scores
Rented	0	> 4	0	illiterate	0	jobless	0
owned	5	3-4	1	primary	1	unskilled	1
		<3	2	secondary	2	skilled	2
				College and university	3		

1- To find out the important factors which predispose children to have bloody diarrhea.
2- To throw a light on the main obstacles that we face in the diagnosis of bloody diarrhea.
3- To identify the most causative agents of bloody diarrhea in infants and children.

3.0 PATIENTS & METHODS

3.1 Patients

One hundred children with bloody diarrhea (three or more loose bowel motion / day with visible blood in stool) from total 1660 of gastroenteritis where studied in Central Child Teaching Hospital of Baghdad from (1st of March to the 31st of August 20018), all of them were less than five years of age. Those with surgical condition were excluded from the study.

Information was taken from their parents including;

- Age, sex and residence.
- Complaint: diarrhea (frequency, presence of blood and mucous), vomiting, fever, tenesmus (pain during defecation).
- Type of feeding; breast, bottle, mixed, diet.
- Type of water supply; tape water, river and well.
- Boiling of the drinking water.
- Having domestic animals (dogs, sheep, chicken or cows) in the house
- Level of education of mother
- Degree of socio economic status: high, middle and low socioeconomic status.

Divisions of socioeconomic status were done according to modified score mainly from Al-Mashhdani 1988; soori 2001; Kim 2003; Sarlio 2004 as in table below:

Table 3.1 calculation of socioeconomic status

All the patients were examined thoroughly looking mainly for the degree of dehydration. Their temperature was measured from the axilla (with adding 0.5 C°), regarded feverish if the temperature was 38.3 C^{o}. Their weights were measured and plotted on growth chart. Full systemic examination was done to all patients.

3.2 Methods

Two fresh stool samples were collected from these patients and sent to laboratory for general stool examination and stool culture, and those with no finding in the first general stool examination, 2^{nd} and 3^{rd} general stool examination will be done to them to find the microorganism.

3.2.1 General stool examination: Two direct smears were prepared by mixing a small amount of freshly passed fecal materials (2g within 30 minutes of defecation), one with saline and other with iodine. The saline preparation was used primarily to detect RBCs, pus cells and motile trophozoites and the iodine preparation was used to detect cysts of Entamoeba histolytica.

3.2.2 Stool culture: Fresh stool is cultured on MacConcky agar, Shigella-Salmonella agar (SS) agar and tetrathionate broth, incubated aerobically for 18-24 hour at 37 C°.

Growth from tetrathionate broth was sub-cultured on SS agar for additional 24 hour at 37 C° in order to enhance the growth of bacteria and yield better results.

For further confirmation of etiological pathogen specific antisera for Shigella, Salmonella using slide agglutination test was also done. Strain of E. coli was not determined whether it is pathogenic or not.

Cultures and tests for other causative microorganisms are unfortunately not available in our laboratory.

3.3 Statistical analysis

The data were analyzed statistically by using computerized SPSS system version (10) to determine:

1- Chi-square ($א^2$) test which was carried out to determine the relative importance of various variables.
2- P-value less than 0.05 was considered as a statistically significant, and value less than 0.01 was considered to be highly significant.[34]

4.0 RESULTS

Percentage of patients of bloody diarrhea (100) in relation to total patients of gastroenteritis (1660) was 16.6%. Results of stool culture and stool examination of 100 patients identified as follows:

Table 4.1 Isolation rate of enteropathogenes in children with bloody diarrhea.

Enteropathogenes Isolated	Number and Percentage of cases
E. histolytica	50 (50%)
E. Coli	20 (20%)
Shigella	7 (7%)
Salmonella	2 (2%)
No isolate	21 (21%)

P value < 0.05.

There is significant difference between types of microorganisms which refer that the higher percentage with E. histolytica 50 (50%). Their stool culture was showed growth of normal flora. Second microorganism was E. Coli 20 (20%), Third microorganism was Shigella 7 (7%). Fourth microorganism was Salmonella 2 (2%), & 21 (21%) of cultures showed no isolates, also their stool examination shows no microorganism too.

Table 4.2 Age Distribution of the patients according to etiological agents.

Age (months)	Etiological agent			NO. of cases
	Bacterial	Amoebic	Unknown	
1-12	5(19.2%)	15 (57%)	6(23%)	26
13-24	11(33.3%)	20(60.6%)	2(6%)	33
25-36	6(42.8%)	5(35.7%)	3(21.4%)	14
37-48	5(33.3%)	5(33.3%)	5(33.3%)	15
4 9-60	2(16.6%)	5(41.6%)	5(41.6%)	12
Total	29	50	21	100

There is no relationship between types of microorganisms in bloody diarrhea and different age group. P value > 0.05.

More than 50% of the patients with bloody diarrhea was found in those who were below 2 years. P value < 0.05.

Table 4.3 Sex Distribution of the patients according to the etiological agents.

Sex	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Male	16(28.5%)	33(58.9%)	7(12.5%)	56
Female	13(29.5%)	17(38.6%)	14(31.8%)	44
Total	29	50	21	100

P value < 0.05.

There is no significant difference between type of microorganisms and gender of the patients p> 0.05. There is significant difference between total number of cases and gender of the patients p> 0.05. Male more affected 56 (56%) than female 44 (44%).

Table 4.4 Distribution of the patients and their etiology of according to the residence of the patients.

Residence	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Urban	9(22.5%)	20(50%)	11(27.5%)	40
Rural	20(33.3%)	30(50%)	10(16.6%)	60
Total	29	50	21	100

P value < 0.0.

There is a significant difference between total number of patients and residence of patients. Patient come from rural area were more 60 (60%) than those from urban area 40 (40%).

Table 4.5 Distribution of the patients and their etiology according to the type of feeding.

Type of feeding	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Breast	12(42.8%)	10(35.7%)	6(21.4%)	28
Bottle	7(20.5%)	20(58.8%)	7(20.5%)	34
Diet	5(35.7%)	5(35.7%)	4(28.5%)	14
Mixed	5(20.8%)	15(62.5%)	4(16.6%)	24
Total	29	50	21	100

There is no relationship between type of microorganism and different types of feeding. P value > 0.05.

There is relationship between number of cases of bloody diarrhea and different types of feeding showed more patients occur with bottle feeding P value < 0.05.

Table 4.6 Distribution of the patients and their etiology according to the types of water supply.

Water supply	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Tape water	28(29.7%)	46(48.9%)	20(21.2%)	94
*Other sources	1(16.6%)	4(66.6%)	1(16.6%)	6
Total	29	50	21	100

River, irrigation canals, wells…etc.

There is a highly relationship between total number of patients and different types of water supply. P value < 0.01. There is also a relationship between different etiological factors and type of water supply. Tap water associated with more amoebic diarrhea than bacterial, P value < 0.05.

Table 4.7 Distribution of the patients and their etiology according to the habit boiling water.

Boiling of water	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Yes	8(57.1%)	5(35.7%)	1(7.1%)	14
No	21(24.4%)	45(52.3%)	20(23.2%)	86
Total	29	50	21	100

P value < (0.01).

There is a highly relationship between total number of patients and habit of boiling water, showed more patients of bloody diarrhea were using un boiled water. There is no relationship between different types of microorganism and habit of boiling of water. P value > 0.05.

Table 4.8 Distribution of the patients and their etiology according to the presence of animals in the houses of the patients.

Presence of animals	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Yes	19(28.35%)	30(44.7%)	18(26.8%)	67
No	10(30.3%)	20(60.6%)	3(9%)	33
Total	29	50	21	100

There is no significant relationship between types of microorganisms and presence of animals. P value > 0.05.

However, we see significant difference between total number of bloody diarrhea and presence of domestic animals (chicken, cows, sheep and dogs) 67 (67%). P value < 0.05. thus, more patients of bloody diarrhea come from families have domestic animals.

Table 4.9 Distribution of the patients and their etiology according to the weight of the patient.

Weight for age	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
< 5th centile	16(28%)	30(52.6%)	11(19.2%)	57
> 5th centile	13(30.2%)	20(46.5%)	10(23.2%)	43
Total	29	50	21	100

There is no significant relationship between types of microorganisms and the weight of patients. P value > 0.05.

There is a significant relationship between total patients of bloody diarrhea and weight of the patient, < 5^{th} centile more prone to get bloody diarrhea 57 (57%) than those above the 5^{th} centile 43 (43%). P value < 0.05

Table 4.10 Distribution of the patients and their etiology according to the degree of dehydration.

Dehydration	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Mild	9(26.4%)	15(44.1%)	10(29.4%)	34
Moderate	15(36.5%)	20(48.7%)	6(14.6%)	41
Severe	5(20%)	15(60%)	5(20%)	25
Total	29	50	21	100

There is no significant relationship between types of microorganisms and the degree of dehydration. P value > 0.05. There is a highly significant difference between total patients of

bloody diarrhea and degree of dehydration. More patients were moderately dehydrated 34 (34%) and the least percentage were severely dehydrated 25 (25%). P value < 0.01

Table 4.11 Distribution of the patients and their etiology according to the clinical manifestation.

Clinical presentation	Etiological agent			Total no. of patients	P-value
	Bacterial	Ameobic	Unknown		
Fever	25 86%	30 60%	18 86%	73 73%	P<0.05
Vomiting	20 69%	15 30%	17 81%	52 52%	P<0.05
Tenesmus	14 65%	32 64%	20 95%	71 71%	P<0.05
Abdominal pain	26 90%	30 60%	21 100%	77 77%	P<0.05

There is a significant difference according to the number of patients presented with fever between bacterial 25 (86%) than amoebic bloody diarrhea 30 (60%), p-value <0.05. There is a significant difference according to the number of patients presented with vomiting between bacterial 20 (69%) than amoebic bloody diarrhea 15 (30%), p-value <0.05. There is a significant difference according to the number of patients presented with abdominal pain between bacterial 26 (90%) than amoebic bloody diarrhea 30 (60%), p-value <0.05.

There is no significant difference between the number of patients presented with tenesmus between bacterial & amoebic but there is significant difference to those patients of bloody diarrhea in which no isolate in their culture (p-value <0.05).

Table 4.12 Distribution of the patients and their etiology according to the level of the socioeconomic status.

socio economic status	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Low	15 (27.2%)	30 (54.5%)	10 (18.1%)	55
Middle	10(32.2%)	15(48.3%)	6(19.3%)	31
High	4(28.5%)	5(35.7%)	5(35.7%)	14
Total	29	50	21	100

There is no significant relationship between types of microorganisms and the level of socio economic status. P value > 0.05.

But there is highly significant difference between total number of cases of bloody diarrhea and level of socio economic status. More patients were coming from low socioeconomic status (55%). P value < 0.0.

Table 4.13 Distribution of the patients and their etiology according to the level of the education of the mothers of the patients.

Level of education	Etiological agent			No. of patients
	Bacterial	Amoebic	Unknown	
Illiterate	6(26%)	10 (43.4%)	7(30.4%)	23
Read and write	3(25%)	5(41.6%)	4(33.3%)	12
Primary school	12(32.4%)	20(54%)	5(13.5%)	37
Preparatory school	6(27.2%)	12(54.5%)	4(18.1%)	22
College or institute	2(33.3%)	3(50%)	1(16.6%)	6
Total	29	50	21	100

There is no significant relationship between types of microorganisms and the level of the education of the mother of the patient. P value > 0.05. But there is significant difference between total number of patients of bloody diarrhea and level of education of the mothers. (P value < 0.05).

5.0 DISCUSSION

The study revealed that the total number of cases of bloody diarrhea was 100 cases from 1660 cases of gastroenteritis were gathered and studied from (1st, of March to the 31st of August), so the percentage was 16.6%. Entameoba Histolytica was the most common isolated pathogen as it was detected in stool sample of half the patient in contrast shigella species which are known by many as the most common causative organisms of bloody diarrhea, was detected only in 7% of patients, this finding was similar to that observed in studies conducted in our country.[9,17], The opposite finding was reported in many studies in different countries which showed that shigella species were the most common agent associated with bloody diarrhea[4,10,19,36], the reason for this difference could be explained by the fact that invasive amebiasis is an important public health problem and occur globally in endemic area, this is aided by some study[2] and may be due to irrational use of antibiotics in our country. On the other hand, probably Amebiasis is routinely over diagnosed and laboratory reports may be of a little value, a study done by Walsh support that.[16] E. Coli was second microorganism (20%) which is different from other studies (4%)[1] and Salmonella (2%) which is similar to the Nelson text book of pediatrics[1] and there is no comment by other research to that.

It was not possible to identify the causative agent in 21 cases (21%). This could be due to infection with other organisms not routinely investigated in the stool samples or due to the lack of sensitivity of some laboratory procedures that use in our hospital or not present at all and lack of skillful lab personnel that work on them, this was similar to studies conducted in our country.[9,17] But this was not compatible with studies done outside because of highly sophisticated investigation found there.[1,19]

The age of the most children was below 2 year, a similar study showed same result by Henery.[7] Susceptibility of this age group to bloody diarrhea may be explained by many factors such as declining level of maternal immunity, introduction of solid food which may be contaminated by enteropathogen, together with introduction of foreign material to the mouth of these children as they have learned to crawl up and pick subjects in their hands by this age, which increases the risk of exposure to fecal pathogens, similar studies support that.[38,43] Also most of the admitted cases were in this age group, because of high worry of the families toward their children at this age group.[2] Although amoebiasis is seen more in older ages, it could affect neonate, especially those who are bottle fed as in our study we found 40-days old baby with amoebic dysentery. Edward found fulminant amoebic colitis in a 10- days neonate.[17]

Male sex was affected more than female with ratio of (1.3:1). This is in agreement with other studies[5,10], this can be explained by that more samples collected in this study were male, and in our society families are more care about their male kids than female, while others studies showed the opposite, which means that the reverse occurred (female affected more than male).[38] The significant difference in sex distribution was in those with the amoebic dysentery, male to female ratio (1.9 – 1), this was also supported by other studies.[16,17]

A study done in Ethiopia claimed that male gender has a significant association with diarrheal morbidity.[42] A high percentage were bottle fed34 (34%) while breast fed is less 28(28%) and this strengthen the protective value of breast milk against diarrhea, especially bloody diarrhea, similar results were found in other studies.[1,2,4,16,40]

The majority of the patients included in the study had tap water supply 94 (94%) while other sources is just 6 (6%), this occurred due to usage of tap water is highly predominant and there is a little persons who use other sources and we do not know the total number of them, which will lead to few number of children included in this study.

However, even chlorination of water cannot kill amoebic cyst or some other enteropathogenes this was aided by some studies[1,10], or it may be due to contamination of water system by ground water was responsible for outbreak of amoebic dysentery.[23,42] Majority of the patients 86 (86%) were consuming un boiled water, which increase the risk of the infection because boiling of water decreases the risk of water-borne enteropathogene transmission by destruct them like ameobic cyst, similar studies support that.[1,2,23,38]

Domestic animals were found in the house of 67 (67%) of the patients with significant association between occurrence of bloody diarrhea and harboring domestic animals in the house, this can be explained by that many pathogen can live in product of these animal like salmonella in dairy product or cambylobacter species in poultry or other because these stuff act as culture for these pathogens and help for distribution of pathogens to society also these families harboring domestic animal are from rural area in which many risk factor play a role like poverty and low educational level and bad hygiene, many studies showed that direct contact with domestic animals or the consumption of there under cooked products are risk factors for transmission of pathogens (especially the bacterial), other studies support that.[1,17]

The weight of 57 (57%) of the cases was below the 5th centile for age which indicate poor nutritional status[1], and this made them more susceptible to have bacterial and amoebic bloody diarrhea. This is consistent with studies found that patient with invasive amoebiasis had lower body weight than those affected with other diarrheal diseases.[3,7]

High number of cases were come from rural area 60 (60%), while just 40 (40%) from urban area. And this occurred due to collection of risk factors in this area as poor nutritional history, low socioeconomic status and the safety of water supply was low in this area due to poor observation because they are remote from the center of the governorate, also the educational level of mothers in general is very low. Also, this strengthen by many studies.[1,2]

Moderate dehydration was more evident in those with bloody diarrhea and severe dehydration was the less percentage (25%), this can be explained by the pattern of bowel motion in bloody diarrhea due to that most of the causative agents of bloody diarrhea infect the large intestine which will lead to small volume and less frequent bowel motion per day, beside the great worry of their families when they see blood that made them bring their children early to the hospital, this explanation aided by many studies.[1,2]

According to the educational level of the mother we see high percentage in those who got primary school and those who were illiterate (37%, 23%) respectively, because mother educational background influence maternal knowledge and practice in health and hygiene and this reflect on occurrence of bloody diarrhea in children[1], also the variation between levels of education of mothers can be explained according to the sample size which included more mothers from primary school levels in this research. Also, this explanation coincides with the explanation of variation of degree of socio economic status and incidence of bloody diarrhea more with low socioeconomic status (55%) and a less with moderate socioeconomic status (31%) and least with high socioeconomic status, just (14%). Low socioeconomic status leads to irregular primary health attendance and to malnutrition and these factors make family away from health worker instructions and make children vulnerable to occurrence of bloody diarrhea many studies show similar results.[37,38]

Fever was reported in 73% of cases, another study found that 92% of patients with dysentery had fever. It was significantly more frequent and higher with bacterial bloody diarrhea (86%) than amebic bloody diarrhea (60%) and this can be explained due invasion of these pathogen to the wall of intestine and systemic effect of them. This similar to other studies.[7,36] Tensemus was present in 71% of cases. It occurs in both bacterial and amebic bloody diarrhea with no significant difference. Bin Saeed also noticed tensemus in 69% of cases.[25]

Vomiting was more common in patients with bacterial bloody diarrhea (69%) than amebic (30%). This in agreement with other studies.[17,24] Abdominal pain was present in 77% of cases and was more significant in bacterial (90%) than amebic 60%, this can be explained due systemic effect of these pathogen that cause bloody diarrhea many studies found similar results.[23,40]

6.0 CONCLUSIONS

1. Entamoeba Histolytica one of the most frequent offending pathogen in patient with bloody diarrhea in our society.
2. Children below 2 years are the main affected group and male sex affected more than female.
3. Bottle feeding preference, poor nutritional status, low socioeconomic status, non-boiling of drinking water and presence of domestic animals in the houses make children more prone to have bloody diarrhea.

4. Low educational level of the mothers makes their children more prone to have bloody diarrhea.
5. Tap water sometimes may carries pathogen that cause bloody diarrhea.
6. Rural areas still have the high number of cases of bloody diarrhea than urban areas.
7. Fever, vomiting and abdominal pain are the most prominent feature of acute bloody diarrhea of bacterial etiology.

8.0 RECOMMENDATIONS

1. Encouragement of breast feeding and show the unlimited value of breast milk to the people through mass media like (TV).
2. Adequate and proper water treatment system to decrease the rate of contamination of drinking water supplies in the community.
3. Boiling of water decreases the risk of transmission of enteropathogen.
4. Improving the standard of sanitation and proper disposal of the sewage system and improving the standard of personal hygiene, mother educational level, health education about cleanliness, hand washing, proper cooking and pasteurization of milk.
5. Well-trained and expert examiners are needed in the laboratories to discover the trophozoite and lessen the Entamoeba Histolytica over diagnosis and further larger studies and well equipped laboratories are needed to identify the other causative agents of bloody diarrhea as Campylobacter jejuni, Yersinia Entercolitica and others.

REFERENCES

1. Pickering, L.K. and Snyder, J. D.: Gastroenteritis. In: Behrman, R. E.; Kligman, R. M. and Jenson, H. B., (eds). Nelson text book of pediatrics, 18th ed. Pheladelphia, W. B. Saunders Company, 2007, chap. Page 1369.
2. World Health Organization. Reading on diarrhea. Student manual. WHO/Geneva, 1992.
3. Victora, C. G., Huttly, S. R. A., Fuchs, S. C., *et al.*: International differences in clinical patterns of diarrheal deaths: a comparison of children from Brazil, Senegal, Bangladesh and India. J. diarrheal Dis. Resources, 1993; 11: 25-29.
4. Black, R. E., Brown, K. H., Becker, S., *et al.:* Longitudinal studies of infectious disease and physical growth of children in rural Bengladesh. Am J Epidemiology, 2000; 115: 315-324.
5. Ronsmans, C., Bennish, M. L. and Wierzba, T.: Diagnosis and management of dysentery by community health workers. Lancet, 1988; 2: 552-55.

6. Briend, A., Hasan, K. Z., Aziz, K. M. *et al.*: Are diarrhea control programs likely to reduce childhood malnutrition? Observation from rural Bangladesh. Lancet, 1989; 2: 319.
7. Henry, F. S.: The epidemiological importance of dysentery in community. Rev. Infectious diseases, 2002; 4: 3000-44.
8. Veinh, H., Wain, J., Chinh, M. T., *et al.*: Treatment of bacillary dysentery in Vitnamese children trop. Med. Hyy., 2000; 94: 324-326.
9. Mohammad, H. F.: Campylobacter jejuni gastroenteritis in children in Basrah. A thesis submitted to the Iraqi commission for medical specialization in partial fulfillment of the requirements for the degree of fellowship of Iraqi commission for medical specialization in pediatrics, 2001.
10. huilan, S., zhen, LG., MATHAN, N.m.,*etal.*: Etiology of acute diarrheoa among children in developing countries:amulticenter study in five countries. Bull world health organization, 1991; 69: 549-55.
11. American Academy of Pediatrics,: Subcommittee on Acute Gastroenteritis: Practice parameter: The management of acute gastroenteritis in young children. *Pediatrics,* 1996; 97: 424–35.
12. Barwick RS, Levy DA, Craun GF, *et al*: Surveillance for waterborne disease outbreaks—United States, 1997–1998. *MMWR Morbid Mortal Wkly Rep.,* 2000; 49: 1–35.
13. Center for disease control and prevention:- preliminary food net data on the incidence of infection with pathogens transmitted commonly through food:- 10 states, united states, 2005. MMWR, 2006; 55: 392-395.
14. AAP. 1997 Red Book.: Report of the Committee on Infectious Disease. 24th ed. Elk Grove Village, IL: AAP, 1997.
15. DeWitt TG.: Acute diarrhea in children. Pediatr Rev., 1989; 11: 6-13 [Published erratum in Pediatr Rev., 1989; 11: 124].
16. WALSH, j, A,: problems in recognition and diagnosis of amebiasis.REV.INF, DIS, 1986; 8: 228.
17. Edward, S, almuck, J. and alani, W.: Epidemiology of bloody diarrhea. Iraq. j. COM. MED, 2000; 13.
18. Besser-RE; Griffin-PM: Slutsker-L.: Escherichia Coli O157:H7 gastroenteritis and the hemolytic uremic syndrome: an emerging infectious disease. Annu – Rev – Med., 1999; 50: 355 – 67.
19. Vanessa Costa Soares, MD; Acute diarrhea in Infants part 1; published by Medstudents' Homepage, 2008.

20. Mackenzie A, Barnes G, Shann F.: Clinical signs of dehydration in children. Lancet, 1989; 2(8663): 605-7.
21. Sullivan PB.: Nutritional management of acute diarrhea. *Nutrition,* Oct 1998; 14(10): 758-62.
22. Liebelt EL.: Clinical and laboratory evaluation and management of children with vomiting, diarrhea, and dehydration. *Curr Opin Pediatr*., Oct 1998; 10(5): 461-9.
23. Stefano Guandalini, MD, Director, University of Chicago.: diarrhea, article published in Apr 25, 2008. www.eMedicine.com
24. Guandalini S.: Treatment of acute diarrhea in the new millennium. *J Pediatr Gastroenterol Nutr*., May 2000; 30(5): 486-9.
25. Bin Saeed A.A.A.; El Bushra, H.E.: Does treatment of bloody diarrhea due to Shigella dysenteriae type 1 with ampicilline precipitate hemolytic uremic syndrome? Gastroenterology J., 1995 Oct – Dec; 1(4): 31-33.
26. Bellemare S, Hartling L, Wiebe N, *et al.*: Oral rehydration versus intravenous therapy for treating dehydration due to gastroenteritis in children: a meta-analysis of randomised controlled trials. *BMC Med*., Apr 15 2004; 2: 11.
27. Duggan C, Nurko S.: "Feeding the gut": the scientific basis for continued enteral nutrition during acute diarrhea. *J Pediatr,* Dec 1997; 131(6): 801-8.
28. Gavin N, Merrick N, Davidson B. :Efficacy of glucose-based oral rehydration therapy. Pediatrics, 1996; 98: 45-51.
29. Brown KH, Peerson JM, Fontaine O: Use of nonhuman milks in the dietary management of young children with acute diarrhea: A meta-analysis of clinical trials. *Pediatrics,* 1994; 93: 17–27.
30. Sandhu BK, Isolauri E, Walker-Smith JA, *et al.*: A multicentre study on behalf of the European Society of Paediatric Gastroenterology and Nutrition Working Group on Acute Diarrhoea. Early feeding in childhood gastroenteritis. *J Pediatr Gastroenterol Nutr*., May 1997; 24(5): 522-7.
31. Guandalini S, Dincer AP.: Nutritional management in diarrhoeal disease. *Baillieres Clin Gastroenterol,* Dec 1998; 12(4): 697-717.
32. Walker-Smith JA, Sandhu BK, Isolauri E, *et al.*: Guidelines prepared by the ESPGAN Working Group on Acute Diarrhoea. Recommendations for feeding in childhood gastroenteritis. European Society of Pediatric Gastroenterology and Nutrition. *J Pediatr Gastroenterol Nutr*., May 1997; 24(5): 619-20.

33. American Academy of Pediatrics Committee on Nutrition.: Use of oral fluid therapy and posttreatment feeding following enteritis in children in a developed country. Pediatrics, 1985; 75: 358-61.
34. WAYNE W. DANIEL,: Biostatic foundation for analysis in the health sciences, 7th edition, 1999.
35. DeFancisco A, Khan SA, Chakraborty J.: Interrater agreement in the assessment of dehydration in infants [Letter]. J Trop Pediatr, 1997; 43: 119-21.
36. KHalil_khan; SR. MAZHAR_; *Et al.*: occurence and susceptibility to antibiotic of shigella species in stoolof hospitalized children with bloody diarrhea in pakistan. AM-J-TROPMED-hyg, 1998; 58(6).
37. Reid SR, Bonadio WA.: Outpatient rapid intravenous rehydration to correct dehydration and resolve vomiting in children with acute gastroenteritis. Ann Emerg Med, 1996; 28: 318-23.
38. Townes. J. M., Quick, R., Gonzales, O. Y.: *et al.*: etiology of bloody diarrhea in Bolivian children implication for empiric therapy. J. infectious disease, 1997; 175: 1527 – 230.
39. Virginia Keane : Assessment of growth in Nelson text book of pediatrics 18th edition page 70.
40. Midzi, S-M; Tshimanga,-M; Siziya,-S; *et al.*: an out break of desentery in arural district of Zimbabwe: the role of personal hygiene at public gatherings. Cent –Afr-J-MED, 2000 Jun: 150-30
41. Mahdi.L.K.: Infantile diarrhea and type of feeding. A thesis submitted to the College of Medicine and the committee of post graduate studies of the University of Nehrine in partial fulfillment of the requirement for the degree of Ph.D in Microbiology, 1998.
42. Teklemariam,-S; Getaneh-T; Bekele,-F.: Environmental determinant of diarrheal morbidity in under –five years children, Keffasheka zone, West Ethiopia_MED_J2000 Jan; 38(1): 27-34.
43. *Mehta DI, Lebenthal E.: New developments in acute diarrhea. Current Problems in Pediatrics, 1994; 24: 95-107.*