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# Diarrhea In Children (From 1 month to 24 months)

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*Dedicated, in huge gratitude to my beloved, father, mother, wife, sons,  
brothers, sisters and friends for their  
care, understanding and encouragement  
May ALLAH bless them.*

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## **ABSTRACT**

Diarrhea describes bowel movements (stools) that are loose and watery. It is very common and usually not serious. Many people will have diarrhea once or twice each year. Diarrheal disease is the second leading cause of death in children under five years old, and is responsible for killing around 760 000 children every year. In this research, study will be done by collecting data for children whose range ages from 1 month to 24 months. The duration for the study is three months and the place is the AI – Gumhouri Teaching hospital / children department. The study will be collecting data and analyzing the data in order to know numbers of children who has diarrhea and compare the some factors that might cause the diarrhea such as, body weight, breastfeeding and geographical area.

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# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

Diarrheal disease is the second leading cause of death in children under five years old, and is responsible for killing around 760 000 children every year. Diarrhea is a condition that involves the frequent passing of loose or watery stools - it is the opposite of constipation and can have many causes, which may be infectious or non-infectious. Diarrhea comes from the Greek word diarrhoia. Dia means "through" and rheo means "flow". The term "flowing through" was coined by Hippocrates. The spelling of Diarrhea In American English it is spelled "diarrhea", and in British English it is "diarrhoea".[1]

Diarrhea remains as one of the most common causes of morbidity and mortality in almost all people worldwide. Almost every child will experience diarrhea at some point and the potential for dehydration is great. Always be concerned about hypovolemia and electrolyte abnormalities in a child with diarrhea.

People with diarrhea often have fever and/or stomachache (abdominal cramps). Diarrhea might be caused by inflammatory bowel syndrome (IBS), Crohn's disease, an allergy, or an infection. Acute diarrhea, meaning diarrhea that is not long-

term, is a very common cause death in developing nations, especially among young children and babies. It usually appears rapidly and may last from between five to ten days. Chronic diarrhea, meaning long-term diarrhea is the second cause of death among children in developing countries.[2]

### **1.1 Problem Statement**

There are several reasons of doing this research and the most reasons listed below:

- 1.0 Diarrhoeal disease is the second leading cause of death in children under five years old. It is both preventable and treatable.
- 2.0 Each year diarrhoea kills around 760 000 children under five.
- 3.0 A significant proportion of diarrhoeal disease can be prevented through safe drinking-water and adequate sanitation and hygiene.
- 4.0 Globally, there are nearly 1.7 billion cases of diarrhoeal disease every year.
- 5.0 Diarrhoea is a leading cause of malnutrition in children under five years old.

### **1.2 Research Objectives**

The objectives of this research are:

1. Knowing the Diarrhoeal disease and its effects among people especially, children.
2. Collecting data of children (from first month until the 24 months) whom having diarrhoeal disease.
3. Analysis the collecting data using graphs and tables. Also, compare the outcome with other study.

### **1.3 Project Scopes**

This project is conducting for:

1. Gain knowledge of the causes, types, and effects of the Diarrhoeal disease
2. Collecting the data from the patient files in the Jamhor hospital for period of three months.
3. Conduct the analysis and results using Microsoft Excel, graphs and tablets.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

Diarrhea is one of the most common causes of morbidity and mortality in children worldwide. The World Health Organization (WHO) defines a case as the passage of three or more loose or watery stools per day. Nevertheless, absolute limits of normalcy are difficult to define; any deviation from the child's usual pattern should arouse some concern (particularly when the passage of blood or mucus, or dehydration occurs) regardless of the actual number of stools or their water content. [3]

Diarrheal illness is considered as the second cause of child mortality in the worldwide; according one of the studies in diarrhea, they found among children younger than 5 years; it causes 1.5 to 2 million deaths annually. In 1982, on the basis of a review of active surveillance data from studies conducted in the 1950s, 1960s and 1970s, it was estimated that 4.6 million children died annually from diarrhoea. In 1992, a review of studies conducted in the 1980s suggested that diarrhoeal mortality had declined to approximately 3.3 million annually. It was noted that children in the developing world experienced a median of between two and three episodes of diarrhoea every year. Where episodes are frequent, young children may spend more than 15% of their days with diarrhoea. About 80% of deaths due of diarrhoea occur in the

first two years of life. The main cause of morbidity from acute diarrhoea is dehydration, which results from loss of fluid and electrolytes in the diarrhoeal stools. In severe cases this could lead to vascular collapse, shock and eventually death. Other causes of death include malnutrition from loss of nutrients from the stool, effects of infection on metabolism and the withholding or modification of food during diarrhoea which is a common practice.

Diarrhea needs to be distinguished from four other conditions. Although these conditions may accompany diarrhea, they often have different causes and different treatments than diarrhea. These other conditions are:

1. . Incontinence of stool, which is the inability to control (delay) bowel movements until an appropriate time, for example, until one can get to the toilet
2. Rectal urgency, which is a sudden urge to have a bowel movement that is so strong that if a toilet is not immediately available there will be incontinence
3. Incomplete evacuation, which is a sensation that another bowel movement is necessary soon after a bowel movement, yet there is difficulty passing further stool the second time
4. Bowel movements immediately after eating a meal.

Diarrhea can be defined in absolute or relative terms based on either the frequency of bowel movements or the consistency (looseness) of stools.

**Frequency of bowel movements:** Absolute diarrhea is having more bowel movements than normal. Thus, since among healthy individuals the maximum number of daily bowel movements is approximately three, diarrhea can be defined as any number of stools greater than three. "Relative diarrhea" is having more bowel movements than usual. Thus, if an individual who usually has one bowel movement each day begins to

have two bowel movements each day, then relative diarrhea is present-even though there are not more than three bowel movements a day, that is, there is not absolute diarrhea.

**Consistency of stools:** Absolute diarrhea is more difficult to define on the basis of the consistency of stool because the consistency of stool can vary considerably in healthy individuals depending on their diets. Thus, individuals who eat large amounts of vegetables will have looser stools than individuals who eat few vegetables and/or fruits. Stools that are liquid or watery are always abnormal and considered diarrheal. Relative diarrhea is easier to define based on the consistency of stool. Thus, an individual who develops looser stools than usual has relative diarrhea--even though the stools may be within the range of normal with respect to consistency.

## 2.1 Mechanism of diarrhea

The basis of all diarrheas is disturbed intestinal solute transport and water absorption. Water movement across intestinal membranes is passive and is determined by both active and passive fluxes of solutes, particularly sodium, chloride, and glucose. The pathogenesis of most episodes of diarrhea can be explained by secretory, osmotic, or motility abnormalities or a combination.

Secretory diarrhea occurs when the intestinal epithelial cell solute transport system is in an active state of secretion. It is often caused by a secretagogue, such as cholera toxin, binding to a receptor on the surface epithelium of the bowel and thereby stimulating intracellular accumulation of cyclic adenosine monophosphate (cAMP) or cyclic guanosine monophosphate (cGMP). Some intraluminal fatty acids and bile salts cause the colonic mucosa to secrete through this mechanism. Diarrhea not associated with an exogenous secretagogue can also have a secretory component (congenital microvillus inclusion disease). Secretory diarrhea is usually of large volume and persists even with fasting. The stool osmolality is indicated by the electrolytes and the ion gap is 100 mOsm/kg or less. The ion gap is calculated by subtracting the concentration of electrolytes from total osmolality: Ion gap Stool

osmolality stool  $\text{Na} + 2 \times \text{K} = - + ( ) \times [ ]$  Osmotic diarrhea occurs after ingestion of a poorly absorbed solute. The solute may be one that is normally not well absorbed (magnesium, phosphate, lactulose, or sorbitol) or one that is not well absorbed because of a disorder of the small bowel (lactose with lactase deficiency or glucose with rotavirus diarrhea). Mal-absorbed carbohydrate is fermented in the colon, and short-chain fatty acids (SCFAs) are produced. Although SCFAs can be absorbed in the colon and used as an energy source, the net effect is increase in the osmotic solute load. This form of diarrhea is usually of lesser volume than a secretory diarrhea and stops with fasting. The osmolality of the stool will not be explained by the electrolyte content, because another osmotic component is present and the anion gap is  $>100 \text{ mOsm}$ . Motility disorders can be associated with rapid or delayed transit and are not generally associated with large-volume diarrhea. Slow motility can be associated with bacterial overgrowth leading to diarrhea. [4]

**Table 2.1: MECHANISMS OF DIARRHEA**

<b>PRIMARY MECHANISM</b>	<b>DEFECT</b>	<b>STOOL EXAMINATION</b>	<b>EXAMPLES</b>	<b>COMMENT</b>
Secretory	Decreased absorption, increased secretion, electrolyte transport	Watery, normal osmolality with ion gap <100 mOsm/kg	Cholera, toxigenic Escherichia coli; carcinoid, VIP, neuroblastoma, congenital chloride diarrhea, Clostridium difficile, cryptosporidiosis (AIDS)	Persists during fasting; bile salt malabsorption can also increase intestinal water secretion; no stool leukocytes
Osmotic	Maldigestion, transport defects ingestion of unabsorbable substances	Watery, acidic, and reducing substances; increased osmolality with ion gap >100 mOsm/kg	Lactase deficiency, glucose-galactose malabsorption, lactulose, laxative abuse	Stops with fasting; increased breath hydrogen with carbohydrate malabsorption; no stool leukocytes
Increased motility	Decreased transit time	Loose to normal-appearing stool, stimulated by gastrocolic reflex	Irritable bowel syndrome, thyrotoxicosis, postvagotomy dumping syndrome	Infection can also contribute to increased motility
Decreased motility	Defect in neuromuscular unit(s) stasis (bacterial overgrowth)	Loose to normal-appearing stool	Pseudo-obstruction, blind loop	Possible bacterial overgrowth
Decreased surface area (osmotic, motility)	Decreased functional capacity	Watery	Short bowel syndrome, celiac disease, rotavirus enteritis	Might require elemental diet plus parenteral alimentation
Mucosal invasion	Inflammation, decreased colonic reabsorption, increased motility	Blood and increased WBCs in stool	Salmonella, Shigella, infection; amebiasis; Yersinia, Campylobacter infections	Dysentery evident in blood, mucus, and WBCs



## 2.2 Diarrhea Clinical Presentation

### History

Diarrhea implies an increase in stool volume and diminished stool consistency.

- In children younger than 2 years, diarrhea is defined as daily stools with a volume greater than 10 mL/kg.
- In children older than 2 years, diarrhea is defined as daily stools with a weight greater than 200 g. In practice, this typically means loose-to-watery stools passed 3 or more times per day.
- Individual stool patterns widely vary; for example, breastfed children may normally have 5-6 stools per day.

Flatulence associated with foul-smelling stools that float suggests fat malabsorption, which can be observed with infection with *Giardia lamblia*. Knowledge of the characteristics of consistency, color, volume, and frequency can be helpful in determining whether the source is from the small or large bowel. Table 1 outlines these characteristics and demonstrates that an index of suspicion can be easily generated for a specific set of organisms.

**Table 2.2. : Stool Characteristics and Determining Their Source**

<b>Stool Characteristics</b>	<b>Small Bowel</b>	<b>Large Bowel</b>
<b>Appearance</b>	<b>Watery</b>	<b>Muroid and/or bloody</b>
<b>Volume</b>	<b>Large</b>	<b>Small</b>
<b>Frequency</b>	<b>Increased</b>	<b>Highly increased</b>
<b>Blood</b>	<b>Possibly positive but never gross blood</b>	<b>Commonly grossly bloody</b>
<b>pH</b>	<b>Possibly &lt; 5.5</b>	<b>&gt;5.5</b>
<b>Reducing substances</b>	<b>Possibly positive</b>	<b>Negative</b>
<b>WBCs</b>	<b>&lt; 5/high power field</b>	<b>Commonly&gt;10/high power field</b>
<b>Serum WBCs</b>	<b>Normal</b>	<b>Possible ,leukocytosis, bandemia</b>
<b>Organisms</b>	<b>Viral</b> <ul style="list-style-type: none"> <li>• <b>Rotavirus</b></li> <li>• <b>Adenovirus</b></li> <li>• <b>Calicivirus</b></li> <li>• <b>Astrovirus</b></li> <li>• <b>Norovirus</b></li> </ul>	<b>Invasive bacteria</b> <ul style="list-style-type: none"> <li>• <b>EscherichiaColi (enteroinvasive, enterohemorrhagic)</b></li> <li>• <b>Shigella species</b></li> <li>• <b>Salmonella species</b></li> <li>• <b>Campylobacter species</b></li> <li>• <b>Yersinia species</b></li> <li>• <b>Aeromonas species</b></li> <li>• <b>Plesiomonas species</b></li> </ul>
	<b>Enterotoxigenic bacteria</b> <ul style="list-style-type: none"> <li>• <b>E coli</b></li> <li>• <b>Klebsiella</b></li> <li>• <b>Clostridium perfringens</b></li> <li>• <b>Cholera species</b></li> <li>• <b>Vibrio species</b></li> </ul>	<b>Toxic bacteria</b> <ul style="list-style-type: none"> <li>• <b>Clostridium difficile</b></li> </ul>
	<b>Parasites</b> <ul style="list-style-type: none"> <li>• <b>Giardia species</b></li> <li>• <b>Cryptosporidium species</b></li> </ul>	<b>Parasites</b> <ul style="list-style-type: none"> <li>• <b>Entamoeba organisms</b></li> </ul>

Associated systemic symptoms include the following:

- Some enteric infections commonly have systemic symptoms, whereas others less commonly are associated with systemic features.
- Table 2 outlines the frequency of some of these symptoms with particular organisms. It also outlines incubation periods and usual duration of symptoms of common organisms. Certain organisms (eg, *C difficile*, *Giardia*, *Entamoeba* species) may be associated with a protracted course.

**Table 2.3: Organisms and Frequency of Symptoms**

<b>Organism</b>	<b>Incubation</b>	<b>Duration</b>	<b>Vomiting</b>	<b>Fever</b>	<b>Abdominal Pain</b>
<b>Rotavirus</b>	<b>1-7 d</b>	<b>4-8 d</b>	<b>Yes</b>	<b>Low</b>	<b>No</b>
<b>Adenovirus</b>	<b>8-10 d</b>	<b>5-12 d</b>	<b>Delayed</b>	<b>Low</b>	<b>No</b>
<b>Norovirus</b>	<b>1-2 d</b>	<b>2 d</b>	<b>Yes</b>	<b>No</b>	<b>No</b>
<b>Astrovirus</b>	<b>1-2 d</b>	<b>4-8 d</b>	<b>+/-</b>	<b>+/-</b>	<b>No</b>
<b>Calicivirus</b>	<b>1-4 d</b>	<b>4-8 d</b>	<b>Yes</b>	<b>+/-</b>	<b>No</b>
<b>Aeromonas species</b>	<b>None</b>	<b>0-2 wk</b>	<b>+/-</b>	<b>+/-</b>	<b>No</b>
<b>Campylobacter species</b>	<b>2-4 d</b>	<b>5-7 d</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
<b>C difficile</b>	<b>Variable</b>	<b>Variable</b>	<b>No</b>	<b>No</b>	<b>Few</b>
<b>C perfringens</b>	<b>Minimal</b>	<b>1 d</b>	<b>Mild</b>	<b>+/-</b>	<b>Yes</b>
<b>Enterohemorrhagic E coli</b>	<b>1-8 d</b>	<b>3-6 d</b>	<b>No</b>	<b>Low</b>	<b>Yes</b>
<b>Enterotoxigenic E coli</b>	<b>1-3 d</b>	<b>3-5 d</b>	<b>Yes</b>	<b>+/-</b>	<b>Yes</b>
<b>Plesiomonas species</b>	<b>None</b>	<b>0-2 wk</b>	<b>+/-</b>	<b>Yes</b>	<b>+/-</b>
<b>Salmonella species</b>	<b>0-3 d</b>	<b>2-7 d</b>	<b>Yes</b>	<b>High</b>	<b>Yes</b>
<b>Shigella species</b>	<b>0-2 d</b>	<b>2-5 d</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Vibrio species</b>	<b>0-1 d</b>	<b>5-7 d</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>Y enterocolitica</b>	<b>None</b>	<b>1-46 d</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>
<b>Giardia species</b>	<b>2 wk</b>	<b>1+ wk</b>	<b>No</b>	<b>Low</b>	<b>Yes</b>
<b>Cryptosporidium species</b>	<b>5-21 d</b>	<b>Months</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>
<b>Entamoeba species</b>	<b>5-7 d</b>	<b>1-2+ wk</b>	<b>No</b>		<b>No</b>

## Physical

The following may be observed:

- Dehydration
  - Dehydration is the principal cause of morbidity and mortality.
  - Assess every patient with diarrhea for signs, symptoms, and severity.
  - Lethargy, depressed consciousness, sunken anterior fontanel, dry mucous membranes, sunken eyes, lack of tears, poor skin turgor, and delayed capillary refill are obvious and important signs of dehydration. Table 3 below details dehydration severity and symptoms.

**Table2.4: Dehydration Severity, Signs, and Symptoms**

Hydration	0-5% Dehydration (Mild)	5-10% Dehydration (Moderate)	10% or More (Severe)
General	Well	Restless	Lethargic
Eyes	Normal	Sunken	Very sunken
Tears	Present	Absent	Absent
Mouth	Moist	Dry	Very dry
Thirst	Drinks normally	Thirsty	Drinks poorly
Skin	Pinch retracts immediately	Pinch retracts slowly	Pinch stays folded

- 
- Failure to thrive and malnutrition
  - Reduced muscle and fat mass or peripheral edema may be clues to the presence of carbohydrate, fat, and/or protein malabsorption.
  - Giardia organisms can cause intermittent diarrhea and fat malabsorption.
- Abdominal pain
  - Nonspecific nonfocal abdominal pain and cramping are common with some organisms.
  - Pain usually does not increase with palpation.

- With focal abdominal pain worsened by palpation, rebound tenderness, or guarding, be alert for possible complications or for another noninfectious diagnosis.
- Borborygmi: Significant increases in peristaltic activity can cause an audible and/or palpable increase in bowel activity.
- Perianal erythema
  - Frequent stools can cause perianal skin breakdown, particularly in young children.
  - Secondary carbohydrate malabsorption often results in acidic stools.
  - Secondary bile acid malabsorption can result in a severe diaper dermatitis that is often characterized as a "burn." [5]

## 2.4 Causes diarrhea

Acute diarrhea is usually caused by a bacterial, viral, or parasitic infection. Chronic diarrhea is usually related to a functional disorder such as irritable bowel syndrome or an intestinal disease such as Crohn's disease.

The most common causes of diarrhea include the following:

### ❖ **Bacterial agents**

In developing countries, enteric bacteria and parasites are more prevalent than viruses and typically peak during the summer months.

**Diarrheagenic Escherichia coli.** The distribution varies in different countries, but enterohemorrhagic E. coli (EHEC, including E. coli O157:H7) causes disease more commonly in the developed countries.

- Enterotoxigenic E. coli (ETEC) causes traveler's diarrhea.
  - Enteropathogenic E. coli (EPEC) rarely causes disease in adults.
  - Enteroinvasive E. coli (EIEC)\* causes bloody mucoid (dysentery) diarrhea; fever is common.
  - Enterohemorrhagic E. coli (EHEC)\* causes bloody diarrhea, severe hemorrhagic colitis, and the hemolytic uremic syndrome in 6–8% of cases; cattle are the predominant reservoir of infection.
  - **Pediatric details.** Nearly all types cause disease in children in the developing world:
    - Enteroaggregative E. Coli (EAaggEC) causes watery diarrhea in young children and persistent diarrhea in children with human immunodeficiency virus (HIV).
    - Enterotoxigenic E. coli (ETEC) causes diarrhea in infants and children in developing countries.
    - Enteropathogenic E. coli (EPEC) causes disease more commonly in children < 2 years, and persistent diarrhea in children.
- \* EIEC and EHEC are not found (or have a very low prevalence) in some developing countries.

- **Campylobacter:**

- 

Asymptomatic infection is very common in developing countries and is associated with the presence of cattle close to dwellings.

- Infection is associated with watery diarrhea; sometimes dysentery.
- Guillain–Barré syndrome develops in about one in 1000 of people with *Campylobacter colitis*; it is thought to trigger about 20–40% of all cases of Guillain–Barré syndrome. Most people recover, but muscle weakness does not always completely resolve.
- Poultry is an important source of *Campylobacter* infections in developed countries, and increasingly in developing countries, where poultry is proliferating rapidly.
- The presence of an animal in the cooking area is a risk factor in developing countries.

- **Pediatric details.** *Campylobacter* is one of the most frequently isolated bacteria from the feces of infants and children in developing countries, with peak isolation rates in children 2 years of age and younger.

- **Shigella species:**

- Hypoglycemia, associated with very high case fatality rates (CFRs) (43% in one study) occurs more frequently than in other types of diarrheal diseases
- *S. sonnei* is common in developed countries, causes mild illness, and may cause institutional outbreaks.
- *S. flexneri* is endemic in many developing countries and causes dysenteric symptoms and persistent illness; uncommon in developed countries.
- *S. dysenteriae* type 1 (Sd1) — the only serotype that produces Shiga toxin, as does EHEC. It also is the epidemic serotype that has been associated with many outbreaks during which CFRs can be as high as 10% in Asia, Africa,

and Central America. For unexplained reasons, this serotype has not been isolated since the year 2000 in Bangladesh and India.

- **Pediatric details.** An estimated 160 million episodes occur in developing countries, primarily in children. It is more common in toddlers and older children than in infants.
- **Vibrio cholerae:**
  - Many species of *Vibrio* cause diarrhea in developing countries.
  - All serotypes (>2000) are pathogenic for humans.
  - *V. cholerae* serogroups O1 and O139 are the only two serotypes that cause severe cholera, and large outbreaks and epidemics.
  - In the absence of prompt and adequate rehydration, severe dehydration leading to hypovolemic shock and death can occur within 12–18 h after the onset of the first symptom.
  - Stools are watery, colorless, and flecked with mucus; often referred to as “rice-water” stools.
  - Vomiting is common; fever is typically absent.
  - There is a potential for epidemic spread; any infection should be reported promptly to the public health authorities.
- **Pediatric details.** In children, hypoglycemia can lead to convulsions and death
- **Salmonella:**
  - Enteric fever — *Salmonella enterica* serovar Typhi and Paratyphi A, B, or C (typhoid fever); fever lasts for 3 weeks or longer; patients may have normal bowel habits, constipation or diarrhea.
  - Animals are the major reservoir for salmonellae. Humans are the only carriers of typhoidal *Salmonella*.
  - In nontyphoidal salmonellosis (*Salmonella gastroenteritis*), there is an acute onset of nausea, vomiting, and diarrhea that may be watery or dysenteric in a small fraction of cases.
  - The elderly and people with immune-compromised status for any reason (e.g., hepatic and lymphoproliferative disorders, hemolytic anemia), appear to be at the greatest risk.



- **Pediatric details:**

- Infants and children with immune-compromised status for any reason (e.g., severe malnourishment) appear to be at the greatest risk.
- Fever develops in 70% of affected children.
- Bacteremia occurs in 1–5%, mostly in infants.

- ❖ **Viral agents**

In both industrialized and developing countries, viruses are the predominant cause of acute diarrhea, particularly in the winter season.

**Rotavirus:**

- Accounts for one-third of diarrhea hospitalizations and 500,000 deaths worldwide each year.
- Associated with gastroenteritis of above-average severity.

**Pediatric details:**

- Leading cause of severe, dehydrating gastroenteritis among children.
- Nearly all children in both industrialized and developing countries get infected by the time they are 3–5 years of age.
- Neonatal infections are common, but often asymptomatic.
- The incidence of clinical illness peaks in children between 4 and 23 months of age.

**Human caliciviruses (HuCVs):**

- Belong to the family Caliciviridae—the noroviruses and sapoviruses (previously called “Norwalk-like viruses” and “Sapporo-like viruses.”)
- Noroviruses are the most common cause of outbreaks of gastroenteritis, affecting all age groups.

**Pediatric details.** Sapoviruses primarily affect children. This may be the second most common viral agent after rotavirus, accounting for 4–19% of episodes of severe gastroenteritis in young children.

**Adenovirus** infections most commonly cause illnesses of the respiratory system.

**Pediatric details:** depending on the infecting serotype, this virus may cause gastroenteritis especially in children.

### ❖ Parasitic agents

**Cryptosporidium parvum, Giardia intestinalis, Entamoeba histolytica, and Cyclospora cayetanensis:** these are uncommon in the developed world and are usually restricted to travelers.

**Pediatric details.** Most commonly cause acute diarrheal illness in children.

- These agents account for a relatively small proportion of cases of infectious diarrheal illnesses among children in developing countries.
- *G. intestinalis* has a low prevalence (approximately 2–5%) among children in developed countries, but as high as 20–30% in developing regions.
- *Cryptosporidium* and *Cyclospora* are common among children in developing countries; frequently asymptomatic. [6]

#### **Other common causes are listed below:**

- Functional bowel disorders. Diarrhea can be a symptom of irritable bowel syndrome.
- Intestinal diseases. Inflammatory bowel disease, ulcerative colitis, Crohn's disease, and celiac disease often lead to diarrhea.
- Food intolerances and sensitivities. Some people have difficulty digesting certain ingredients, such as lactose, the sugar found in milk and milk products. Some people may have diarrhea if they eat certain types of sugar substitutes in excessive quantities.
- Reaction to medicines. Antibiotics, cancer drugs, and antacids containing magnesium can all cause diarrhea. Some people develop diarrhea after stomach surgery, which may cause food to move through the digestive system more quickly.

## **2.5 Classification of diarrhea**

Classification facilitates the approach to management of childhood diarrhoea. Issues related to the etiology, clinical assessment, treatment, and prevention of different types of diarrhoea are better analyzed when classified. Diarrhoea can be classified based on duration of each diarrhoeal episode, aetiological factor, pathophysiological mechanism and systemic diseases contributing to diarrhea. The distinction, supported by the World Health Organization (WHO), has implications not only for classification and epidemiological studies but also from a practical standpoint because protracted diarrhea often has a different set of causes, poses different problems of management, and has a different prognosis. [7]

### **2.5.1 Classification based on duration**

#### **2.5.1.1 Acute watery diarrhoea**

This term refers to diarrhoea that begins acutely, lasts less than 14 days (most episodes last less than seven days), and involves the passage of frequent loose or watery stools without visible blood. Vomiting may occur and fever may be present. Acute watery diarrhoea causes dehydration; when food intake is reduced it also contributes to malnutrition. When death occurs, it is usually due to acute dehydration. The most important causes of acute watery diarrhoea in young children in developing countries are rotavirus, enterotoxigenic *Escherichia coli*, *Shigella*, *Campylobacter jejuni*, and *Cryptosporidium*. In some areas *Vibrio cholerae* 01, *Salmonella* and enteropathogenic *E. Coli* are also important.

#### **2.5.1.2 Persistent diarrhoea**

This is diarrhoea that begins acutely but is of unusually long duration (at least 14 days). The episode may begin either as watery diarrhoea or as dysentery. Marked weight loss is frequent. Diarrhoeal stool volume may also be great, with a risk of dehydration. There is no single microbial cause for persistent diarrhoea; enteroadherent *E. coli*, *Shigella* and *Cryptosporidium* may play a greater role than other agents. Persistent diarrhoea should not be confused with chronic diarrhoea,

which is recurrent or long lasting diarrhoea due to no infectious causes, such as sensitivity to gluten or inherited metabolic disorders.

### **2.5.1.3 Intractable (protracted) or chronic diarrhoea**

Is a term applied to diarrhoea episodes which are of long duration, (more than 4 weeks), for which no known cause can be found and which does not respond to specific or non-specific form of treatment. Chronic diarrhoea is defined as stool volume of more than 10 grams/kg/day in infants and toddlers, or more than 200 grams/day in older children for more than 14 days. This typically translates to persistent loose or watery stools occurring at least three times a day, where the change in stool consistency is more important than stool frequency. Some authors make a distinction between chronic diarrhoea, which they define as having a gradual onset, from persistent diarrhoea, which they define as having a sudden onset. However, it is frequently difficult to identify the time of onset of the diarrhoea and delineation of the two entities can be problematic. Chronic diarrhoea is a common condition. Diarrhoea lasting more than two to four weeks occurs in up to 3 to 5 percent of the population worldwide. It is generally more frequent in males, with a male-to-female ratio of 1.2 to 2.6:1 in the age range of 6 to 24 months. In the developed world, the prevalence of chronic diarrhoea is substantially lower. In the United States, there is approximately one case of persistent diarrhoea per five person-years in infants and young children. Most of these cases are self-limited, with fewer than 28 percent presenting for medical care. Fewer than 100 per 10,000 children are hospitalized in the United States for diarrhoeal disease, and this figure includes many cases of acute diarrhoea.

## **2.5.2 Classification based on pathophysiology**

### **2.5.2.1 Secretory diarrhea**

Secretory diarrhoea occurs when there is active secretion of water into the gut lumen. This type of diarrhoea is often caused by a secretagogue, such as cholera toxin, binding to a receptor on the surface epithelium of the bowel and thereby stimulating intracellular accumulation of cyclic adenosine monophosphate or cyclic

guanosine monophosphate. Also there are many other infectious and non-infectious causes. Examples of the latter include those mediated by gastrointestinal peptides (such as vasoactive intestinal peptide and gastrin). Certain substances, such as bile acids, fatty acids, and laxatives, also can produce a secretory diarrhoea, as can congenital problems (eg, congenital chloride diarrhea). Diarrhoea not associated with an exogenous secretagogue may also have a secretory component (congenital microvillus inclusion disease). Secretory diarrhoea tends to be watery and of large volume; the osmolality of the stool can be accounted for by the presence of electrolytes. Secretory diarrhoea generally persists even when no feedings are given by mouth.

#### **2.5.2.2 Osmotic diarrhoea**

This occurs after ingestion of a poorly absorbed solute. The solute may be one that is normally not well absorbed such as magnesium, phosphate, lactulose, and sorbitol or one that is not well absorbed because of a disorder of the small bowel (lactose with lactase deficiency or glucose with rotavirus diarrhoea). This results in a higher than normal concentration of the solute in the gut lumen, altering the gradient of water absorption toward fluid retention in the intestinal lumen. Enteric infections that cause damage to intestinal epithelial cells leading to malabsorption may cause diarrhoea with an osmotic component. Rotavirus and shigella are examples. Rotavirus selectively invades mature enterocytes causing a disruption of absorptive capacity. Shigella produces a "shiga" toxin which can cause villous cell destruction leading to malabsorption.

Malabsorbed carbohydrate is fermented in the colon, and short-chain fatty acids (SCFAs) are produced. Although SCFAs can be absorbed in the colon and used as an energy source, the net effect is to increase the osmotic solute load. This form of diarrhoea is usually of lesser volume (quantity) than secretory diarrhoea and stops with fasting. The osmolality of the stool will not be explained by the electrolyte content, because another osmotic component is present. Motility disorders can be associated with rapid or delayed transit and are not generally associated with large-volume diarrhoea. Slowed motility can be associated with bacterial overgrowth as a cause of diarrhoea.

### **2.5.2.3 Inflammatory**

Diarrhoea can be caused by intestinal inflammation. Exudation of mucus, protein, and blood into the gut lumen leads to water and electrolyte loss and subsequent diarrhoea. The most common cause of inflammatory diarrhoea is infection. The initial event in the pathogenesis of acute infection is the ingestion of the offending organism. After ingestion, the organism colonizes the intestinal epithelium and adheres to the enterocyte. One of two pathways are generally followed depending upon the offending organism, either mucosal invasion or production of an enterotoxin.

Intestinal inflammation can also be caused by chronic diseases, such as inflammatory bowel disease and celiac disease. It can also be caused by tuberculosis, colon cancer, and enteritis. Diarrhoea in these disorders is multifactorial but is due in part to the mucosal inflammation, which leads to malabsorption. Malabsorbed substances produce an osmotic load in the gut lumen resulting in diarrhoea. Several bacterial infections of the gastrointestinal tract produce diarrhoea secondary to preformed toxins. Examples include the enterotoxins produced by *Clostridia perfringens* and *Clostridia difficile*, and the shiga-like toxins of *Escherichia coli*, *Staphylococcus aureus*, and *Shigella* species. Viral enterotoxins also have been described. As an example, rotavirus produces a viral enterotoxin, the non-structural glycoprotein (NSP4). NSP4 causes calcium-dependent transepithelial chloride secretion from the crypt cells, with resultant secretory diarrhoea.

### **2.5.2.4 Impaired motility**

Motility disorders are relatively uncommon causes of acute diarrhoea. Changes in gastrointestinal motility can influence absorption. This could be hypermotility or hypomotility. Hypermotility is caused by the rapid movement of food through the intestines. If the food moves too quickly through the gastrointestinal tract, there is not enough time for sufficient nutrients and water to be absorbed. Hypermotility can be observed in people who have had portions of their bowel removed, allowing less total time for absorption of nutrients. Motility related diarrhoea can also be due to a vagotomy or diabetic neuropathy, or a complication of menstruation. Hyperthyroidism can produce hypermotility and

lead to pseudodiarrhoea and occasionally real diarrhoea. This type of diarrhoea can be treated with antimotility agents (such as loperamide). Hypomotility, or the severe impairment of intestinal peristalsis, results in stasis, with subsequent inflammation, bacterial overgrowth, and secondary bile acid deconjugation and malabsorption.

### **2.5.3 Classification based on systemic diseases**

#### **2.5.3.1 Infectious causes**

##### **2.5.3.1.1 Postenteritis syndrome**

Most enteric infections in otherwise healthy children resolve within 14 days and do not develop into a chronic diarrhoeal illness. However, in a minority of patients, an acute gastroenteritis can trigger persistent diarrhoea by causing mucosal damage to the small intestine, termed a "postenteritis syndrome". The mechanisms underlying this syndrome are not fully understood. Contrary to previous hypotheses, sensitization to food antigens and secondary disaccharidase deficiency, including lactase deficiency (causing lactose intolerance), are uncommon. Therefore, international guidelines discourage the use of hypoallergenic or diluted milk formulas during acute gastroenteritis. Recurrent or sequential enteric infections may be responsible for some of these cases. In some cases, treatment with probiotic bacteria may facilitate recovery from postenteritis syndrome.

##### **2.5.3.1.2 Bacterial infection**

In immunocompromised patients, common infectious causes of acute diarrhoea, such as *Campylobacter* or *Salmonella*, can cause persistent diarrhoea. Chronic infections with these pathogens are uncommon in immunocompetent hosts. Bacterial cultures should be part of the initial diagnostic evaluation for all patients if the stool contains blood, or for immunocompromised patients regardless of fecal blood.

In children recently treated with antibiotics, *Clostridium difficile* may cause a colitis characterized by "pseudomembrane" formation. The enzyme immunoassay available in most laboratories detects *C. difficile* toxins A and B with high

specificity but only moderate sensitivity. Polymerase chain reaction (PCR) based diagnostic methods can enhance the detection rate.

Enterotoxigenic strains of *Staphylococcus aureus* typically cause acute gastrointestinal symptoms in children or adults, due to the effects of ingested pre-formed toxin produced in contaminated food. Enterotoxigenic strains of *Staphylococcus aureus* typically cause acute gastrointestinal symptoms in children or adults, due to the effects of ingested pre-formed toxin produced in contaminated food.

#### **2.5.3.1.3 Parasitic infections**

Intestinal parasites sometimes cause diarrhea especially among children in developing countries. However, they are an uncommon cause of chronic diarrhoea in developed countries, except among individuals with an immunodeficiency. Specific antigen assays for *Giardia* and examination from the stool for parasites is imperative for children with known immunodeficiencies or with a history of travel to endemic areas. A step in the evaluation of immunocompetent children if initial testing fails to determine a cause of the chronic diarrhoea. When a specific parasite is identified, treatment with specific medications is generally indicated, although the organism may not always be the cause of the diarrhoea. Empiric therapy for enteric pathogens is generally not advisable, except in cases with special characteristics in developing countries.

#### **2.5.3.1.2 Syndromic persistent diarrhoea**

Occasionally children in developed countries will develop a pattern in which enteric infection triggers a cycle of undernutrition, immune compromise and re-infection, resembling the syndromic persistent diarrhoea that is more commonly seen in developing countries. This pattern is uncommon in developed countries except in children with an underlying immunodeficiency.

#### **2.5.3.2.1 Immune deficiency**



Chronic diarrhoea may present as a complication of a known immune deficiency such as HIV disease. In this case, the evaluation should focus on potential infectious causes of the diarrhoea, particularly parasites and opportunistic infections such as *Cryptosporidium*, *Isospora*, and *Cyclospora*. These children also are at risk for persistent infectious pathogens that typically cause acute diarrheas, such as rotavirus. Chronic diarrhoea also may be a presenting symptom of immune deficiency in a child. When a patient is infected with an unusual pathogen, or has multiple or recurrent infections of the gastrointestinal tract or elsewhere, further evaluation for immune deficiency is required. In rare instances, live vaccines may call attention to the potential diagnosis of immunodeficiency by inducing chronic infection. As an example, vaccine-acquired chronic rotavirus diarrhoea has been observed in infants with severe combined immunodeficiency

## **2.5.4 Abnormal immune response**

### **2.5.4.1 Celiac disease**

Celiac disease (also known as gluten-sensitive enteropathy or nontropical sprue) is an immune-mediated inflammation of the small intestine caused by sensitivity to dietary gluten and related proteins in genetically sensitive individuals. The disorder is common, occurring in 0.5 to 1 percent of the general population in most countries. Celiac disease often presents as chronic diarrhoea, with or without malnutrition, during late infancy or early childhood.

### **2.5.4.2 Inflammatory bowel disease**

#### **Ulcerative colitis and Crohn's disease**

These are idiopathic chronic inflammatory diseases of the bowel. These disorders typically present with gradual onset of chronic diarrhoea, with or without blood, from mid-childhood through adulthood.

#### **Allergic enteropathy**

An abnormal immune response to food proteins can cause a proctitis/colitis or an enteropathy. The former tends to present as bloody diarrhoea and is frequently

triggered by cow's milk protein in infants. The latter presents as non-bloody diarrhea and/or failure to thrive.

### **Eosinophilic gastroenteritis**

This is an incompletely understood disorder that is sometimes but not always associated with an identifiable dietary antigen. Approximately one-half of patients have allergic disease, such as asthma, defined food sensitivities, eczema, or rhinitis; some patients have elevated serum IgE levels; rare patients have IgE antibodies directed against specific foods.

### **Microscopic and collagenous colitis**

Microscopic colitis typically presents with chronic watery non bloody diarrhoea. It typically occurs in middle-aged adults, but occasionally presents in children. The endoscopy is grossly normal, but histopathology reveals abnormal inflammatory findings, characterized by a collagenous colitis or lymphocytic colitis, sometimes with an eosinophilic infiltrate. In some cases, this disorder may represent an overlap with the eosinophilic gastroenteropathies. Collagenous colitis is a related form of colitis that has been reported in a few children. The colon appears grossly normal, but biopsies show a thickened subepithelial collagenous band in the colonic mucosa.

### **Autoimmune enteropathies**

Autoimmune enteropathies are rare disorders that may present as severe diarrhoea during infancy or toddler hood. The diarrhoea may be isolated, or may occur in association with diabetes mellitus as part of the IPEX syndrome (Immune dysregulation, Polyendocrinopathy and Enteropathy, X-linked), which is associated with mutations in the FOXP3 gene. IPEX is characterized by chronic diarrhoea, which usually begins in infancy, dermatitis, autoimmune endocrinopathy (diabetes mellitus, thyroiditis). Autoimmune polyendocrine syndrome 1 (APS-1), also known as autoimmune polyendocrinopathy-candidiasis ectodermal dystrophy (APECED), is one of several autoimmune disorders caused by mutations in

the autoimmune regulator gene (AIRE). Features include hypoparathyroidism and adrenal insufficiency, and about 25 percent of patients develop autoimmune enteritis.

## **2.6 Complication of diarrhea**

Diarrhea may be accompanied by cramping, abdominal pain, nausea, an urgent need to use the bathroom, or loss of bowel control. Some infections that cause diarrhea can also cause a fever and chills or bloody stools. Dehydration Diarrhea can cause dehydration. Loss of electrolytes through dehydration affects the amount of water in the body, muscle activity, and other important functions. Dehydration is particularly dangerous in children, older adults, and people with weakened immune systems. Dehydration must be treated promptly to avoid serious health problems, such as organ damage, shock, or coma 'a sleeplike state in which a person is not conscious. Also, when people are dehydrated, their skin does not flatten back to normal right away after being gently pinched and released. Anyone with signs of dehydration should see a health care provider immediately. Severe dehydration may require hospitalization. Although drinking plenty of water is important in preventing dehydration, water does not contain electrolytes. Adults can prevent dehydration by also drinking liquids those contain electrolytes, such as fruit juices, sports drinks, caffeine-free soft drinks, and broths. Children with diarrhea should be given oral rehydration solutions such as Pedialyte, Naturalyte, Infalyte, and CeraLyte to prevent dehydration. [12]

## 2.7 Work UP

### 2.7 .1 Laboratory Studies

The following may be noted in patients with diarrhea:

- In patients with diarrhea, a stool pH level of 5.5 or less or presence of reducing substances indicates carbohydrate intolerance, which is usually secondary to viral illness and transient in nature.
- Enteroinvasive infections of the large bowel cause leukocytes, predominantly neutrophils, to be shed into stool. Absence of fecal leukocytes does not eliminate the possibility of enteroinvasive organisms. However, presence of fecal leukocytes eliminates consideration of enterotoxigenic E coli, Vibrio species, and viruses.
- Examine any exudates found in stool for leukocytes. Such exudates highly suggest colitis (80% positive predictive value). Colitis can be infectious, allergic, or part of inflammatory bowel disease (Crohn disease, ulcerative colitis).
- Many different culture mediums are used to isolate bacteria. Table 3 lists common bacteria and optimum culture mediums for their growth. A high index of suspicion is needed to choose the appropriate medium.
- With stool not cultured within 2 hours of collection, refrigerate at 4°C or place in a transport medium. Although stool cultures are useful when positive, yield is low.
- Always culture stool for Salmonella, Shigella, and Campylobacter organisms and Y enterocolitica in the presence of clinical signs of colitis or if fecal leukocytes are found.
- Look for C difficile in persons with episodes of diarrhea characterized by colitis and/or blood in the stools. Remember that acute-onset diarrheal episodes associated with C difficile may also occur without a history of antibiotic use.

- Bloody diarrhea with a history of ground beef ingestion must raise suspicion for enterohemorrhagic E coli. If E coli is found in the stool, determine if the type of E coli is O157:H7. This type of E coli is the most common, but not only, cause of HUS.
- History of raw seafood ingestion or foreign travel should prompt additional screening for Vibrio and Plesiomonas species

Table 2.5: Common Bacteria and Optimum Culture Mediums

<b>Organism</b>	<b>Detection Method</b>	<b>Microbiologic Characteristics</b>
<i>Aeromonas</i> species	Blood agar	Oxidase-positive flagellated gram-negative bacillus (GNB)
<i>Campylobacter</i> species	Skirrow agar	Rapidly motile curved gram-negative rod (GNR); <i>Campylobacter jejuni</i> 90% and <i>Campylobacter coli</i> 5% of infections
<i>C. difficile</i>	Cycloserine-cefoxitin-fructose-egg (CCFE) agar; enzyme immunoassay (EIA) for toxin; latex agglutination (LA) for protein	Anaerobic spore-forming gram-positive rod (GPR); toxin-mediated diarrhea; produces pseudomembranous colitis
<i>C. perfringens</i>	None available	Anaerobic spore-forming GPR; toxin-mediated diarrhea
<i>E. coli</i>	MacConkey eosin-methylene blue (EMB) or Sorbitol-MacConkey (SM) agar	Lactose-producing GNR
<i>Plesiomonas</i> species	Blood agar	Oxidase-positive GNR
<i>Salmonella</i> species	Blood, MacConkey EMB, xylose-lysine-deoxycholate (XLD), or Hektoen enteric (HE) agar	Nonlactose non-H <sub>2</sub> S-producing GNR

- 
- Culture mediums used to isolate bacteria include the following:
  - Blood agar - All aerobic bacteria and yeast; detects cytochrome oxidase production
  - MacConkey EMB agar - Inhibits gram-positive organisms; permits lactose fermentation
  - XLD agar; HE agar - Inhibits gram-positive organisms and nonpathogenic GNB; permits lactose fermentation H<sub>2</sub>S production
  - Skirrow agar - Selective for *Campylobacter* species
  - SM agar - Selective for enterohemorrhagic *E coli*
  - CIN agar - Selective for *Y enterocolitica*
  - TCBS agar - Selective for *Vibrio* species
  - CCFE agar - Selective for *C difficile*
- Rotavirus antigen can be identified by enzyme immunoassay and latex agglutination assay of the stool. The false-negative rate is approximately 50%, and false-positive results occur, particularly in the presence of blood in the stools.
- Adenovirus antigens can be detected by enzyme immunoassay. Only serotypes 40 and 41 are able to induce diarrhea.
- Examination of stools for ova and parasites is best for finding parasites. Perform stool examination every 3 days or every other day.
- The leukocyte count is usually not elevated in viral-mediated and toxin-mediated diarrhea. Leukocytosis is often but not constantly observed with enteroinvasive bacteria. *Shigella* organisms cause a marked bandemia with a variable total white blood cell count.
- At times, a protein-losing enteropathy can be found in patients with extensive inflammation in the course of enteroinvasive intestinal infections (eg, *Salmonella* species, enteroinvasive *E coli*). In these circumstances, low serum albumin levels and high fecal alpha<sub>1</sub>-antitrypsin levels can be found. [8]

### **2.7 .2 Other Tests**

Because the pathogenesis of diarrhea can be either osmolar (due to the presence of an excess of unabsorbed substrates in the gut lumen) or secretory (due to active anion

secretion from the enterocytes), the anion gap in the stools is occasionally used to ascertain the nature of the diarrhea. The stool anion gap is calculated according to the formula:  $290 - [(Na+K) \times 2]$ . If the value is more than 100, osmolar diarrhea can be assumed to be present. If the value is less than 100, the diarrhea has a secretory origin.

### **2.7 .3 Procedures**

Intestinal biopsy is not required in evaluating an otherwise healthy child with acute-onset diarrhea, but it may be indicated in the presence of chronic or protracted diarrhea, as well as in cases in which a search for a cause is believed to be mandatory (eg, in patients with acquired immunodeficiency syndrome [AIDS] or patients who are otherwise severely immunocompromised).

## **2.8 Treatment**

### **2.8.1 Supportive therapy**

#### **Oral rehydration solution**

An oral rehydration solution (ORS) is a mixture of water, salts and sugar in specific amounts. These solutions can be absorbed even when your child is vomiting or has serious diarrhea.[9]

Oral rehydration solutions can be used to:

- Keep children well hydrated when their diarrhea is serious.
- Replace lost fluids when children show signs of mild dehydration.

Oral rehydration solutions are available at pharmacies in ready-to-serve preparations. It is best to buy an ORS that has already been mixed.

It's important to give small amounts of the ORS often (for example, 1 teaspoon every 5 minutes), gradually increasing the amount until your child can drink normally.



**For the first 4 hours**

Babies under 6 months of age	30 to 90 mL (1 to 3 oz.) every hour
Children 6 months to 2 years of age	90 to 125 mL (3 to 4 oz.) every hour
Over 2 years of age	125 to 250 mL (4 to 8 oz.) every hour

If your child refuses to take the ORS by the cup or bottle, give the solution using a medicine dropper, small teaspoon or frozen pops.

If your child vomits, you may need to stop giving food and drink, but continue to give the ORS using a spoon.

Give 15 mL (1 tbsp.) every 10 min to 15 min until the vomiting stops. Increase the amounts gradually until your child is able to drink the regular amounts. If your child continues vomiting for longer than 4 to 6 hours, take your child to the hospital.[10]

**After 4 hours until 24 hours: Recovery stage**

Keep giving your child the oral rehydration solution until diarrhea is less frequent.

When vomiting decreases, it's important to start your child breastfeeding as usual, drinking formula or whole milk, or eating regular food in small, frequent feedings.

**After 24 to 48 hours, most children can resume their normal diet.**

Once your child starts eating normally, his bowel movements may increase at first (1 or 2 more each day). It can take as long as 7 to 10 days for his stool to become completely formed again. This is part of the normal healing in a child's bowel system.

### 2.8.1.2 Antidiarrheals

- Loperamide (Imodium)
  - Has been used in older children and adults, but with only limited supporting evidence
  - Contraindicated under age 2 years and not routinely recommended overall in children
- ❖ Dosing
  - Initial: 4 mg PO for single first dose
  - Titrate: 2 mg PO after each loose stool
  - Maximum: 16 mg/day
- Lomotil
  - Do not use at any age due to potential risks.

### 2.8.1.3 Antibiotics

Not indicated in most cases

Trend toward use of antibiotics in adult Diarrhea is not mirrored in children

Age restrictions on many antimicrobial agents used for Diarrhea

Avoid Fluoroquinolones under age 18 years

Avoid Septra under age 2 months

Avoid Tetracycline under age 9 years

Avoid Bismuth Subsalicylate (Pepto Bismol) under age 12 years

### 2.8.1.34 Antimicrobials in adults and children

Cause	First choice Alternative(s)
<b>Cholera</b>	Doxycycline Adults: 300 mg once Children: 2 mg/kg (not recommended) Azithromycin Adults: 1.0 g as a single dose, only once Children: 20 mg/kg as one single dose Cholera Ciprofloxacin* Adults: 500 mg 12-hourly for 3 days, or 2.0 grams as a single dose only once Children: 15 mg/kg every 12 hours for 3 days * The minimum inhibitory concentration (MIC) has increased in many countries—multiple-dose therapy over 3 days
<b>Shigellosis</b>	Ciprofloxacin Adults: 500 mg 2×/day for 3 days, or 2.0 g as a single dose only once Pivmecillinam Adults: 400 mg 3–4 times/day for 5 days Children: 20 mg/kg 4×/day for 5 days Ceftriaxone Adults: 2–4 g as a single daily dose Children: 50–100 mg/kg 1×/day i.m. for 2–5 days
<b>Amebiasis—invasive intestinal</b>	Metronidazole Adults: 750 mg 3×/day for 5 days* Children: 10 mg/kg 3×/day for 5 days* *10 days for severe disease
	Metronidazole Adults: 250 mg 3×/day for 5 days Children: 5 mg/kg 3×/day for 5 days

	<p>Tinidazole</p> <p>Can also be given in a single dose—50 mg/kg orally; maximum dose 2 g</p> <p>Ornidazole</p> <p>Can be used in accordance with the manufacturer's recommendations—single, 2-g dose</p> <p>Secnidazole</p> <p>For adults (not available in USA)</p>
<b>Campylobacter</b>	<p>Azithromycin</p> <p>Adults: 500 mg 1×/day for 3 days</p> <p>Children: single dose of 30 mg/kg early after disease onset</p> <p>Fluoroquinolones such as ciprofloxacin</p> <p>Adults: 500 mg 1×/day for 3 days</p>

### **Preventing spread of infection to others**

Diarrhea infections can very easily be passed on from person to person. Therefore, you and your child need to take measures to try to reduce this chance.

If your baby has diarrhea, be especially careful to wash your hands after changing nappies and before preparing, serving, or eating food. Ideally, use liquid soap in warm running water, but any soap is better than none. Dry your hands properly after washing. For older children [11], whilst they have diarrhea, the following are recommended:

- Regularly clean the toilets used, with disinfectant. Also, clean the flush handle, toilet seat; sink taps, bathroom surfaces and door handles at least daily with hot water and detergent. Disposable cleaning cloths should be used (or a cloth just for toilet use).
- If a potty has to be used, wear gloves when you handle it, dispose of the contents into a toilet, then wash the potty with hot water and detergent and leave it to dry.

- Make sure your child washes their hands after going to the toilet. Ideally, they should use liquid soap in warm running water, but any soap is better than none. Dry properly after washing.
- If clothing or bedding is soiled, first remove any feces into the toilet. Then wash in a separate wash at as high a temperature as possible.
- Don't let your child share towels and flannels.
- Don't let them help to prepare food for others.
- They should stay off school, nursery, etc, until at least 48 hours after the last episode of diarrhea or vomiting. Sometimes this time may be longer with certain infections. Check with your doctor if you are not sure.
- If the cause of diarrhea is known to be (or suspected to be) a germ called *Cryptosporidium* spp., your child should not swim in swimming pools for two weeks after the last episode of diarrhea.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.0 Introduction**

The study of this research will involve two stages for completion. The stages followed are: data collection and study the case with pictures supported. The total number of the cases that conducted was 57 cases, 30 of them are female and 24 are male. The overall methodology of the research is explained and discussed.

#### **3.1 Research Settings**

The study was conducted at Al – Gumhuri Teaching hospital / children department. The hospital has average bed occupancy of 253. Also, the hospital has many different departments such as, surgery department, children department and others. The children department has about 32 beds. The study has taken three months duration, from first June 2014 until the end of August 2014.

#### **3.2 The Study sample and Criteria**

The sample study consisted of children whose range ages from the first month to 24 months only. The study has conducted in children whose have diarrhea disease in general. There are some criteria has been taken in order to complete the study

successfully. The criteria are, age, gender, body weight, geographical area, duration of illness, type of breast and degree of the disease (mild, moderate and severe).

### 3.3 Data Collection

#### 3.3.1 Data collection instrument

Patient's files from the hospital were chosen as data collection instrument. The patient's files were collected from the records of the hospital. The data collection has been gathered daily in order monitoring and organizes the case. The table below shows sample of the data collection that has been taken in the study.

**Table 3.1: Example of the Collecting Data**

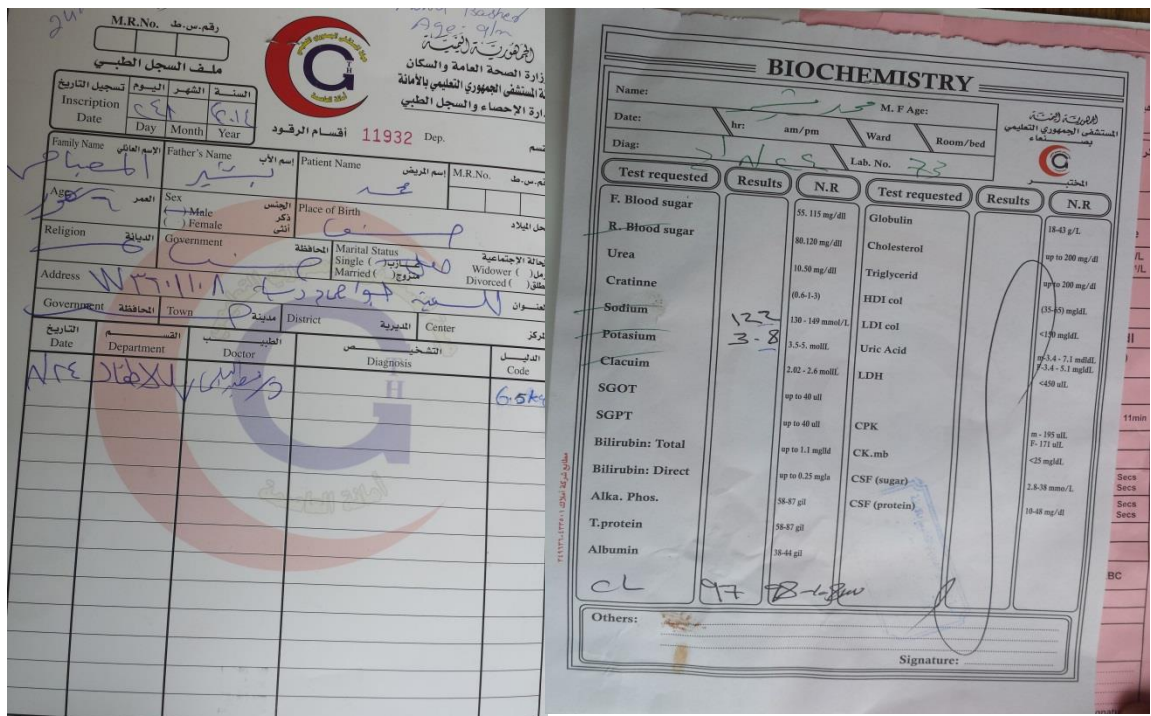
No	Age	Gender	Area	B.W	Breast	Duration of illness
1	7 months	male	Damar	5.9 Kg	normal	6 days
2	18 months	female	Sana'a	6 Kg	normal	10 days
3	3 months	male	Sana'a	4.2Kg	normal	4 days
4	10 months	female	Amran	4.8Kg	normal	17 days
5	8 months	male	Sana'a	7 Kg	normal	3 days
6	2 months	female	Sana'a	2.4Kg	normal	10 days
7	15 months	female	Sana'a	4.4 Kg	normal	12 days
8	6 months	female	Hajeeh	4.9Kg	normal	14 days

### 3.3.2 Data collection procedure

Files will be collected by the researcher from the archive of the hospital. The data was collected over a period of three months. The data collection will be compare with each other in order to find the perfect analyze for the study. Then, the collection data will be inserting in to Microsoft Excel to create a charts. The charts will be analyzed to show the different in the collection data in the next chapter.

### 3.4 patients' condition with files and pictures provided

Another stage in the research will be done which is the study the patients' condition supporting the study with pictures and the files of each patient. For this stage, there are six patients will be study in the research. The files of each patient will be analyzed according to the type of diarrhea and medical history sheet of the patient and physical examination and the description medical. Also, the lab report will be provided. The pictures below show the important files that will provide in the research.





### **3.5 Conclusion**

The researcher used the collection data as the main instrument in the study. There are 57 patients' files collected from the records of the hospital. The sample collected included only children who are their range age from the first month until the 24 months. Another stage of the research is study patient's condition and supports the case with pictures. The condition of the patient is studied according to pictures and files provided. This chapter described the research methodology, including the population, sample, data collection instruments as well as strategies used to ensure the ethical standards, reliability and validity of the study.

## CHAPTER 4

### RESULT & DISCUSSION

#### 4.0 Introduction

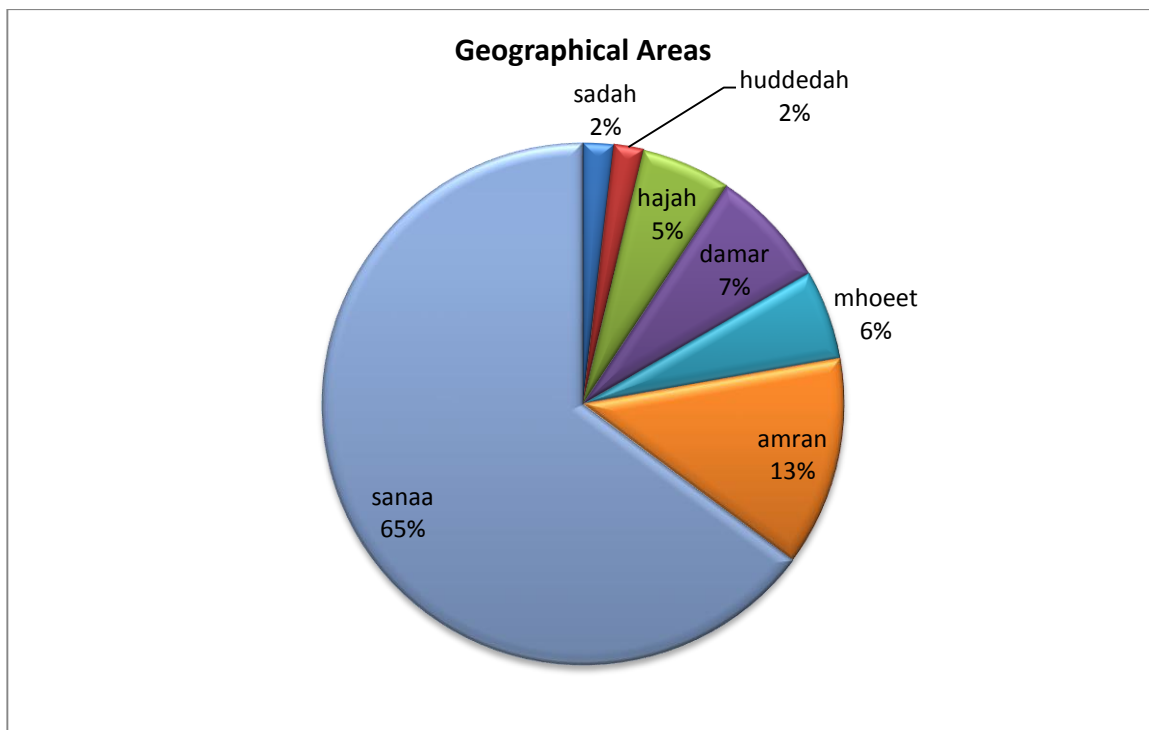
The overall results have been carried out through some steps which have been discussed in the previous chapter. There two kinds of results, the first one are collecting data analysing and the second one is pictures analysing.

#### 4.1 Data collecting analyzing

**Table4.1: Demographic Information about the children**

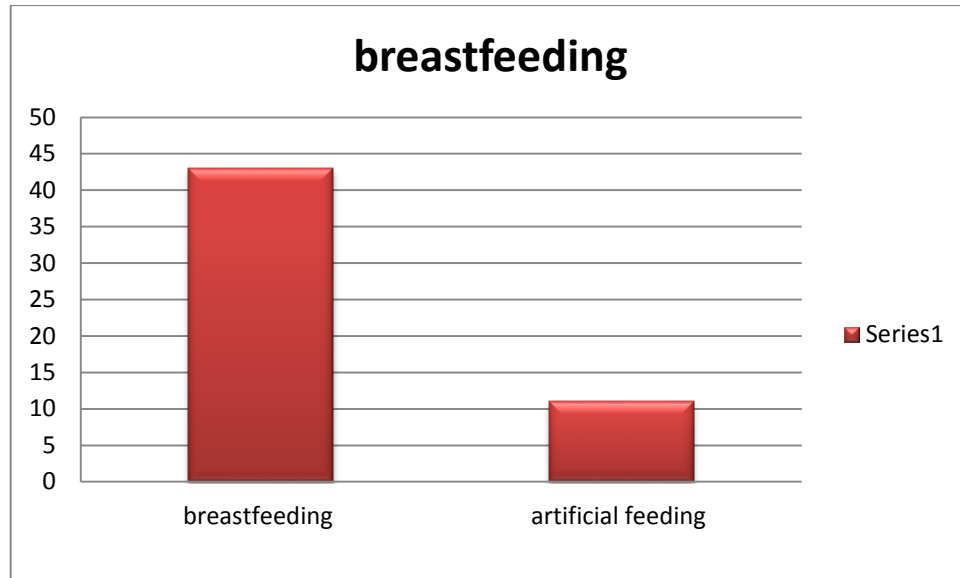
Gender	Male	30
	Female	24
Age	From	to
	1 months	24 months

This above table shows the demographic information of the children who selected in this survey. The result shows that 24 out of 54 children are males and 30 are females. The children' age is between 1 to 24 months.



**Figure 4.1 Geographical Areas of children.**

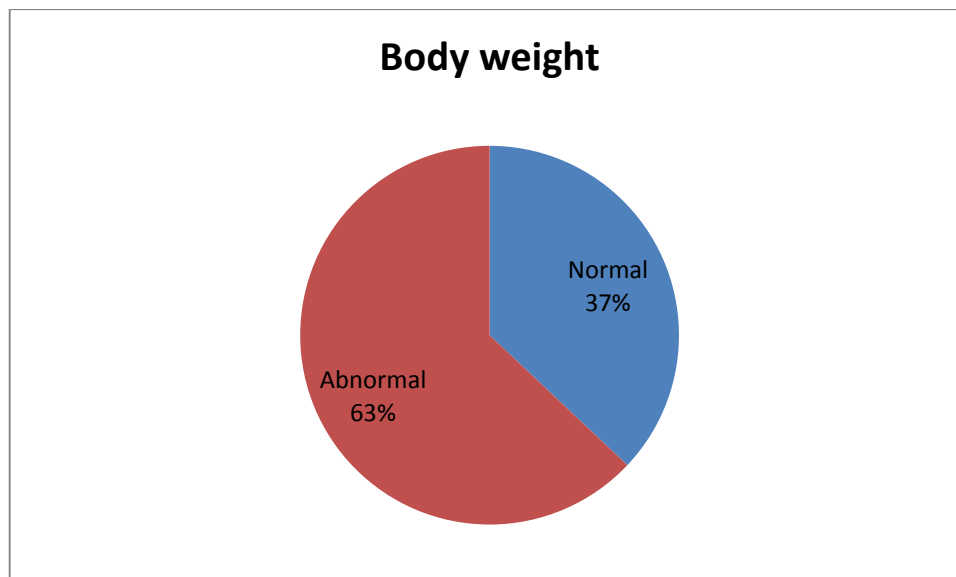
The figure 4.1 represents the geographical area of the children of different cities in Yemen. As can be seen in the figure, the majority of children (65 percent) are from Sana'a the capital of the republic of Yemen. This is mainly because the hospital is located in Sana'a and most of the children are from Sana'a. The second highest percentage (13 percent) of the total of children who are from Amran city, where is located near Sana'a. This is followed by 7 percent of the patients. As can be seen clearly from the chart above, the children are actually from Dammar. The next percentage (6 percent) is from Mhoet city. The rest of the percentage is dividing to three cities. Hajah has 5 percent of them. and Sadah and Huddedah have the smallest percent of children where both of them have only 2 percent because they are so far from Sana'a. Finally, as can be seen in the chart above the majority of the children are from Sana'a and this is due to the location of the hospital as it mentioned above. Another reason, the most of population density of Yemen is located in Sana'a



**Figure 4.2 Types of Breastfeeding of Patients**

This figure determines the number of children who breastfeed normally and the children who are artificial feeding. The artificial feeding could be fresh fluid animal milk or dried powdered milk. It shows that the number of children who breastfeed normally from are 43, while the numbers of those who are feeding from artificial feeding are 11 as shown in the chart above.

In conclusion, the majority of children are breastfeed normally. The rest of children are artificial feeding.



**Figure 4.3: Body Weight of Children**

The figure above shows the percentage of children whose body weight is normal or under body weight. The percentage above was determined by comparing the age of the child with his body weight. Knowing whether the body weight is normal or under body weight, is determined according to Integrated Management of Children Illness (IMCI). As can be seen in the figure, the majority of children (63 percent) are under body weight and the reason for that might be malnutrition in Yemen. While 37 percent of the children are under body weight. Finally, most of the children are under body weight which is considered as a reason for diarrhea in children.

**Table 4.2: Comparison of Body Weight with Duration of illness**

Body weight \ Duration	Normal	Under body weight
One week	14 cases	13 cases
Two weeks	6 cases	21 cases

This above table shows the comparison of body weight with duration of illness for children who selected in this survey. As it can be seen clearly in the table above, 21 cases of all children are under body weight have duration of illness two weeks while children with normal body weight, only 6 cases recorded with two weeks duration. Also, it found that there are 14 cases recorded for one week with normal body weight. More than that, 13 cases are under body weight, the illness last for only one week. In conclusion, as the diarrhea last for long time, the loss of body weight will increase and the patient will have dehydration which considered the most serious complication resulting from diarrhea.

## 4.2 pictures analyzing

### Case 1



**Age:** 6 months

**Sex:** male

**Body weight:** 5.8 kg

**Chief Complaint:** The case above has diarrhea and vomiting since 10 days also, fever since three days ago.

**History of Present illness:** This condition started 10 days ago by diarrhea and vomiting gradually. Progressive course with long duration. Also, watery diarrhea. More than that, average amount vomiting color this is related to feeding associated with fever.

**General examination:**

- Patient looks ill
- Under body weight

- No pallor
- No cyanosis
- Moderate dehydration

### Provisional Diagnosis:

- Gastroenteritis
- Dehydration
- Malnutrition

### Tests required

LAB. REPORT

Patient Name : ██████████  
 Sex : ذكر  
 Ref. Doctor :  
 Print date : 30/08/2014 01:03:48 PM

Age :  
 Date : 30/08/2014  
 Order No. : 5006  
 User Name : د.ياسمين الوراد S No. 366

#### BIOCHEMISTRY

TEST	RESULT	NORMAL RANGE	Titer
Total Protein	6.3		
Albumin	4.2	6.3 - 8.6	
K.F.T		3.6 - 5.1	

#### K.F.T

TEST	RESULT	NORMAL RANGE
S. Urea	10	10 - 50
S. Creatinine	0.2	0.5 - 1.1

#### GENERAL

RBS	91	80 - 170
-----	----	----------

#### Serum Electrolytes

Sodium	149	135 - 153
Potassium	4.0	3.5 - 5.3
Calcium	9.4	8.5 - 10.5

#### HAEMATOLOGY ANALYSIS

##### CBC

Hb	12.0	13 - 18
PCV	38.0	40 - 54
WBC	15.1	4 - 10
NEUTROPHILE	24	40 - 70
LMPHOCYTE	70	20 - 45
MONOCYTE	05	2 - 10
OSINOPHIL	01	1 - 6
Platelets	520	150 - 400

#### SEROLOGY



**Doctor's prescriptions:-**

- N/S 0.9 % 500 cc iv over 1 hour start.
- Cefotaxime 250 mg iv TDS
- L.F milk (milk F75 notval)
- Check body weight daily
- Motilim syrup 1.5 ml TDS before feeding.

**Case 2**

**Age:** 6 months

**Sex:** male

**Body weight:** 6.5kg

**Chief Compliant:** Diarrhea, vomiting and fever since 4 days. Also, convulsion started one day ago.

**History of Present illness:** six months old male patient, condition of patient started 4 days ago. This condition also has watery diarrhea many times per day and vomiting related to feeding

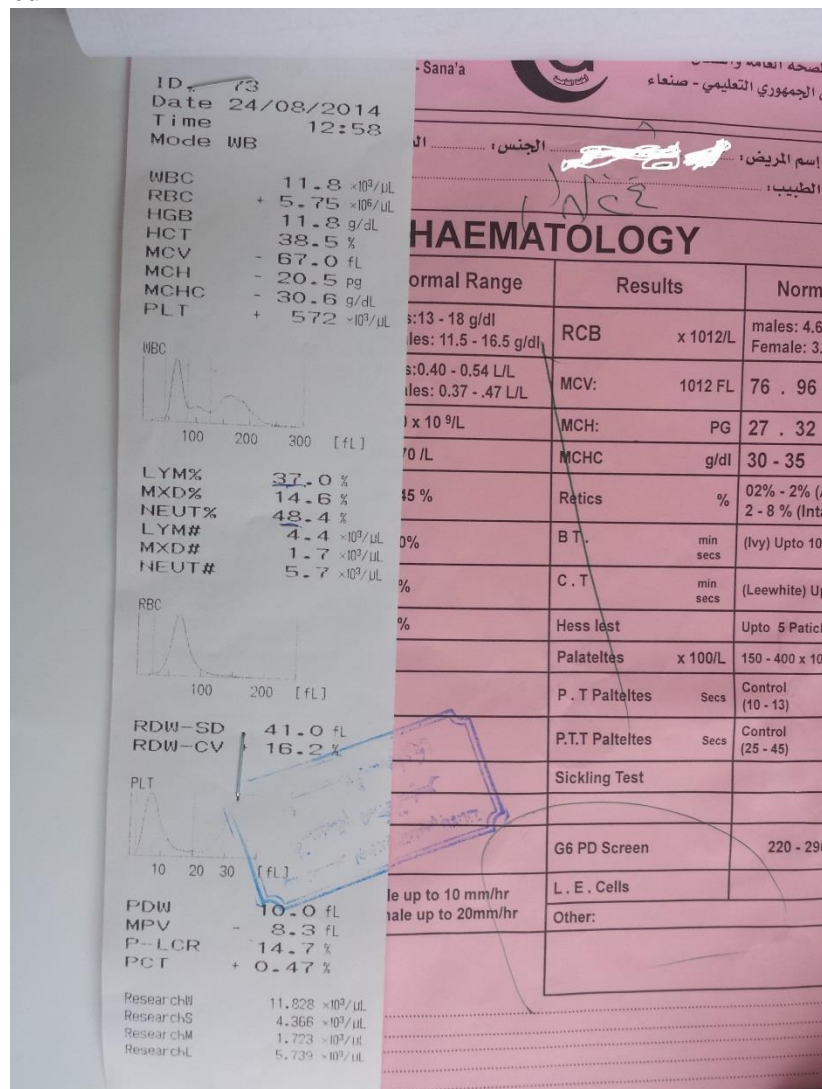
**General examination:**

- Patient look ill
- Drowsy
- Febrile
- Not pallor
- Not jaundice
- No cyanosis

**Provisional Diagnosis:**

- Cute diarrhea

**Tests required**



**Doctor's prescriptions:**

- D/S : 5% 500cc over 8 hours
- D/S (1/5) 300 cc, kcl 3cc twice per day
- Ceftriaxon 250mg B.D
- Flagyl 13cc infusion TID
- Adol syrup 2ml s.o.s

**Case 3**

**Age:** 8 months

**Sex:** male

**Body weight:** 5.3 kg

**Chief Compliant:** Diarrhea, vomiting and fever since 3 days. Also, convulsion started one day ago.

**History of Present illness:** patient condition started since 3 days ago by vomiting related to feeding. Also, diarrhea watery associated high grade fever. General convulsion happened just one time.

**General examination:**

- Patient look ill
- Asthenia
- Febrile
- Not pallor
- No cyanosis

**Provisional Diagnosis:**

- Gastroenteritis

**Tests required**

مختبر العوارى العامة  
تلفون ٢٤٦٩٦٦ - ٣٢٠

**LAB. REPORT**

Patient Name : [REDACTED] Age : ADULT  
 Sex : M Date : 20/08/2014  
 Ref. Doctor : Order No. : 3665  
 Pre-Diag. : [REDACTED] Print date 20/08/2014 06:42:20 PM Doc No. : 597649

**Haematology**

CBC	Result	Normal value
T.WBC	5.2	4 - 11
RBC	4.84	4.5 - 5.5
Hb	12.5	M: 13.0 - 18.0 F: 11.5 - 16.5
PCV	37.9	M: 40 - 54 F: 37 - 47
MCV	78.3	76 - 96
MCH	25.8	27 - 32
MCHC	33.0	30 - 35
Platelets	202	150 - 450
Lymphocyte	38.4	20 - 45
Mixed	19.0	2 - 16
Neutrophil	42.6	40 - 70
RDW -CV	13.2	11 - 16

Signature.....

**Doctor's prescriptions:**

- O2 inhalation
- Ceftraxon iv500mg one time today
- Ampicilline 259mg iv four times per day
- Dtx 50% 200cc, N/S 0.9% 200cc , kcl 3cc over 8 hours
- Diazepam 1mg sos.

**Case 4**

**Age:** 2 months

**Sex:** male

**Body weight:** 2.5 kg

**Chief Compliant:** Diarrhea and vomiting since 5 days.

**History of Present illness:** the age of the patient is 2 months old. Condition started progressive by course diarrhea watery and vomiting. There is not convulsion or blood in the stool. Also, the condition associated with high grade fever.

**General examination:**

- Patient look ill
- Asthenia
- Febrile
- Not pallor
- No cyanosis
- No lower limb edema.

**Provisional Diagnosis:**

- Acute diarrhea
- moderate Dehydration

**Tests required**

Test	Result	Normal values
<b>Biochemistry</b>		
RBS	58	65 - 140 mg/dl
<b>Haematology</b>		
<b>CBC</b>		
Test	Result	Normal values
Hb	14.9	M. 13.0 - 18.0 F. 11.5 - 16.5 g/dl
PCV	44.7	40 - 54 %
T.WBC	13.4	4 - 10 $\times 10^9$ /L
Neutrophil	28	40 - 70 %
Lymphocyte	64	20 - 45 %
Monocyte	01	2 - 10 %
Eosinophil	07	0 - 6 %
Basophil	00	0 - 1 %
Platelets	567	150 - 450 $\times 10^9$ /L
RBC	4.63	4.5 - 5.5
RDW -CV	14.4	11 - 16
MCH	34.2	27 - 32 pg
MCHC	35.6	30 - 35 mg/l
MCV	104.4	76 - 96 femto litres
RBCs		Normocytic , Normochromic.
WBCs		Leucocytosis with Reactive lymphocytes.
Platelets		Adequate in number with normal shape.

Ref. Doctor : د/عبد السلام الحنش  
Print date : 25/08/2014 10:13:40 PM  
Age : INFANT  
Date : 25/08/14  
Order No. : 13468  
Serial No. :

AL-NEEL Specialist  
Signature: [Signature]

**Doctor's prescriptions:**

- N/S 0.9 % 50 cc over 1 hour
- Then, D/S 5 % 200cc + 2cc kcl over 2 hours
- ORS 20 cc after each motion.
- Coffniaxone iv 150 mg twice per day
- L.F milk.

## CHAPTER 5

### CONCLUSIONS

#### 5.0 Conclusions

Diarrhea is loose, watery stools. Having diarrhea means passing loose stools three or more times a day. Acute diarrhea is a common problem that usually lasts 1 or 2 days and goes away on its own. Chronic diarrhea—diarrhea that lasts at least 4 weeks, may be a symptom of a chronic disease. Chronic diarrhea symptoms may be continual or they may come and go.

There are many causes diarrhea, acute diarrhea is usually caused by a bacterial, viral, or parasitic infection. Chronic diarrhea is usually related to a functional disorder such as irritable bowel syndrome or an intestinal disease such as Crohn's disease.

According to the survey, we found that most of the cases are male, where there are 30 male out of 54 cases while the rest are female. The most of the cases are from Sana'a because the hospital is located in Sana'a; another reason is that Sana'a has high density population. About 43 of the children are breastfeeding normally while the others are not. According to the body weight for the selected children, 63 percent are under body weight and 37 percent are normal. As the condition of the patient last for long time, the body weight will decrease gradually and this might cause dehydration.

Finally, all the cases that are selected in the study are acute diarrhea. Few of them have dehydration. All the cases have taken care of them and they become well. There were no deaths recorded from the selected children.



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