Epidemiology of Diarrhoeal Diseases Among Children Under (5 years) at Elfashir Teaching Hospital, (2009)

By:

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A thesis submitted in partial fulfillment for the requirements of the degree of MPEH (Public Health)

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Dedication

To my mother

To my brothers and sisters

To my family, neighbours and friends

To the soul of my father

To every one who helped me to conduct this study.
# Table of contents

<table>
<thead>
<tr>
<th>Title page</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title page</td>
<td></td>
</tr>
<tr>
<td>Dedication</td>
<td></td>
</tr>
<tr>
<td>Table of contents</td>
<td>I</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>II</td>
</tr>
<tr>
<td>List of abbreviations</td>
<td>III</td>
</tr>
<tr>
<td>English Abstract</td>
<td>IV-V</td>
</tr>
<tr>
<td>Arabic Abstract</td>
<td>VI-VII</td>
</tr>
<tr>
<td>List of Figures</td>
<td>VIII</td>
</tr>
<tr>
<td>List of Tables</td>
<td>IX-X</td>
</tr>
<tr>
<td>Chapter one</td>
<td></td>
</tr>
<tr>
<td>Introduction &amp; Literature Review</td>
<td>1-33</td>
</tr>
<tr>
<td>Chapter two</td>
<td></td>
</tr>
<tr>
<td>Methodology</td>
<td>34-35</td>
</tr>
<tr>
<td>Chapter three</td>
<td></td>
</tr>
<tr>
<td>Results</td>
<td>36-49</td>
</tr>
<tr>
<td>Chapter four</td>
<td></td>
</tr>
<tr>
<td>Discussion</td>
<td>50-51</td>
</tr>
<tr>
<td>Conclusion</td>
<td>52</td>
</tr>
<tr>
<td>Recommendations</td>
<td>53</td>
</tr>
<tr>
<td>References</td>
<td>54-57</td>
</tr>
<tr>
<td>Appendices</td>
<td>58-60</td>
</tr>
</tbody>
</table>
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I would also thank staff of ElFashir Teaching Hospital and EPI Department for helping me in data collection.
LIST OF ACRONYMS AND ABBREVIATIONS USED

CDC: Center for Disease Control.

CDD: Control of Diarrhoeal Diseases.

(CDR): Division of Diarroeal and Acute Respiratory Disease

E.coli: Esherichia coli.

EPI: Expanded Programme of Immunization.

FMOH Federal Ministry of Health

IV: Intravenous.

ORS: Oral Rehydration Salts.

ORT: Oral Rehydration Therapy.

(PAHO): Pan American Health Organization.

S.aureus: Staphylococcus aureus.

Spp.: Species.


UN’s: United Nations.

US: United States.

WFP: World Food Programme.

WHO: World Health Organization.
Abstract

Background:-

Diarrhoeal diseases represent a major public health problem in many areas of the world. It is estimated that there are approximately 1.3 thousand million episodes and almost 5 million deaths in children younger than 5 years each year.(Health Journal, 2002).

Objectives:-

To study diarrhoeal diseases among children less than 5 years, the most affected age group and the effect of, environmental and socio-economic factors in its causation.

Study design:-

This is a hospital based descriptive analytical study conducted at Elfashir Teaching Hospital in March, 2009.

Material and methods:-

The population sample for the study was total coverage of all children less than 5 years attending to Elfashir Teaching Hospital in March, 2009. Data was obtained from 307 mothers of children under 5 years attending the hospital during March, 2009.

Data was collected using a questionnaire and an interview and analyzed by computer program (SPSS).
Results:

48.5% of children had diarrhoea. The most vulnerable group was children aged one and two years (53.1%), (27.7%) respectively (PV=0.00857).

The two most significant factors associated with diarrhoea were low income (56.4%), and unavailability of latrines in the houses (39.9%), (PV= 0.011)

Recommendations:

* To increase awareness of mothers and families about the causes of diarrhoea.

* To encourage environmental health committees to establish latrines.

* To conduct early treatment of cases.
المقدمة:
تمثل أمراض الأسهالات أهم مشاكل الصحة العامة في معظم أنحاء العالم، يقدر بالقرب 1.3 الف
وهي حالة منها 5 مليون وفيات عند الأطفال أقل من خمسة سنوات كل سنة.

الأهداف:
الهدف من الدراسة معرفة نسبة الأسهالات وسط الأطفال أقل من خمسة سنوات وعلاقتها بالفئة
العمرية والعوامل البيئية والاجتماعية والاقتصادية.

نوعية الدراسة:
دراسة وصفية تحليلية أجريت بمستشفى الفاشر التعليمي خلال شهر مارس 2009م.

منهجية البحث:
تمت تغطية كاملا للعينة موضوع الدراسة خلال مارس 2009م.
تم جمع البيانات من 307 من أمهات الأطفال أقل من خمسة سنوات اللاتي أحضرن أطفالهن
للمستشفى خلال شهر مارس 2009.
تم جمع البيانات بواسطة الاستبيان والمقابلات وتمت تحليلها بواسطة برنامج الحاسب.

النتائج:
1- 48.5٪ من الأطفال أقل من خمسة سنوات مصابون بالأسهال.
2- الأطفال الذين تتراوح أعوامهم بين سنة وستينيون أكثر تعرضا للإصابة (53٪)، (27.7) على
التوالي مع وجود علاقة قوية بينها والإسهال (PV=0.00857).
3- أوضحت الدراسة أن أكثر عاملان ذا علاقة قوية بالإسهال هما الفئات محدودي الدخل،
(PV=0.011) وعدم وجود المراهض بالمنازل (39.9) (PV=0.056).
التوصيات:

* رفع مستوى الوعي للامهات والأسر عن مسببات الأسهالات.

* تكوين لجان صحاج البيئة وتشجيعها لانشاء مراحيض مبكرة.

* التشخيص المبكر للحالات وعلاجها.
List of figures

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Figure title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>The children with diarrhoea with dehydration at Elfashir Teaching Hospital, March, 2009.</td>
<td>48</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Knowledge of the causes of diarrhoea among mothers of children under 5 years at Elfashir Teaching Hospital, March, 2009.</td>
<td>49</td>
</tr>
</tbody>
</table>
# List of Tables

<table>
<thead>
<tr>
<th>Table No.</th>
<th>Table title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Composition of ORS</td>
<td>17</td>
</tr>
<tr>
<td>Table 2</td>
<td>Oral Rehydration Formula</td>
<td>23</td>
</tr>
<tr>
<td>Table 3</td>
<td>Plan B: Treat Some Dehydration with ORS</td>
<td>26</td>
</tr>
<tr>
<td>Table 4</td>
<td>Plan C: Treat severe dehydration quickly</td>
<td>27</td>
</tr>
<tr>
<td>Table 5</td>
<td>Key components in prevention of diarrhoeal diseases</td>
<td>29</td>
</tr>
</tbody>
</table>

## Results

<p>| Table 1   | The proportion of diarrhoeal diseases among the study group at Elfashir Teaching Hospital, March, 2009. | 38   |
| Table 2   | Age group in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching hospital, March, 2009. | 39   |
| Table 3   | Gender group in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009. | 40   |
| Table 4   | Family size in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, | 41   |</p>
<table>
<thead>
<tr>
<th>Table 5</th>
<th>Educational level of mothers of respondents in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 6</td>
<td>Family income per month in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009.</td>
</tr>
<tr>
<td>Table 7</td>
<td>Duration of breastfeeding in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009.</td>
</tr>
<tr>
<td>Table 8</td>
<td>Type of weaning in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009.</td>
</tr>
<tr>
<td>Table 9</td>
<td>Availability of latrines in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009.</td>
</tr>
<tr>
<td>Table 10</td>
<td>Additional diet in relation to diarrhoeal diseases among the children &lt; 5 years at Elfashir Teaching Hospital, March, 2009.</td>
</tr>
</tbody>
</table>
Chapter One
Introduction & Literature Review
1-1- Introduction

Diarrhoea is one of the main causes of morbidity and mortality in children younger than 5 years in developing countries, where the average number of episodes of diarrhoea per child per year is 3.2 (American journal, 2007).

Acute diarrhoeal diseases continue to represent one of the two most frequent causes (together with acute respiratory infections) of morbidity and mortality among children below 5 years, with considerable incidence among other age-groups as well. It was estimated that, in 1995, 190 million cases of acute diarrhoea occurred in the Eastern Mediterranean Region, including 20 million moderate or severe cases that resulted in approximately 350 000 deaths. These cases and deaths are estimated to include about one million cases and 40 000 deaths due to endemic and epidemic shigellosis, (WHO, 2006).

Diarrhoeal diseases represent a major public health problem in many areas of the world. It is estimated that there are approximately 1.3 thousand million episodes and almost 5 million deaths in children younger than 5 years each year. (Health Journal, 2002). Active programmes for control of diarrhoeal diseases (CDD) exist in all countries of the Region. Accelerated implementation of CDD activities to achieve the mid- and end-of-decade CDD goals continued in 1995. Several countries, Egypt, Iraq, Morocco, Pakistan, Sudan and Yemen, with WHO collaboration, prepared new plans or revised their plans of action for the control of diarrhoeal diseases and cholera. Some of these plans established new national policies for control
measures and case-management of cholera, shigellosis and persistent diarrhoea, (WHO, 2006). On the 2nd of August 2007 – A campaign led by the United Nations Children’s Fund (UNICEF) to prevent major outbreaks of acute watery diarrhoea in Sudan during the rainy season that year is paying dividends, with the number of cases of the sometimes fatal condition in the north of the country almost 90 per cent below last year’s figures. Less than 800 cases of acute watery diarrhoea have been reported in two states in northern Sudan since April, despite the presence of heavy floods across the nation in recent weeks. This compares to last year’s devastating outbreak, when 6,000 cases of diarrhoea were reported in nine Sudanese states during the equivalent period and at least 900 people died, (UN NEWES CENTR, 2007).

An estimated 2 million children die each year from diarrhoeal diseases; almost all of them are living in developing countries and are aged 5 years. Infants younger than 1 year account for more than half of these deaths, and can be 2-3 times higher among infants who are not exclusively breastfed, (WHO, 2006).

Acute diarrhoea is rivaled in importance only by respiratory infection, as a cause of morbidity world-wide scale. The total diarrhoea morbidity for a given child may be as higher as one third of its first two years of life, (K. Park, 2005).

Findings of a survey just completed by World Health Organization and Sudan's Ministry of Health in North Darfur and West Darfur, diarrhea is linked to 75 percent of deaths among children under the age of five, (UNICEF's report, 2004).
1-2- Justification:-

Diarrhea is the main cause of morbidity and mortality among the children under 5 years in Sudan. The survey conducted in the three Darfur states during August and September (2008) by UN's World Food Programme (WFP), found that more than 40 percent of children having diarrhoea and 18 percent acute respiratory infection (WFP report, 2008). These are the major cause of death for children in developing countries, (WFP report, 2008). In addition to this there is no study done on this topic in North Darfur State to measure the magnitude of the problem, and more research about it is needed.

1-3- Objectives

General objective:

-To measure the proportion of diarrhoeal diseases among children under five years attending Elfashir Teaching Hospital during March, 2009.

Specific objectives:

1-To measure the proportion of diarrhoeal diseases among children under (5 years).

2-To identify the most affected age group and gender.

3- To assess the environmental-socio –economic factors in relation to diarrhoeal diseases among infected children under 5 years.
1-4- Literature Review

1-4-1-Definition of diarrhea:

Diarrhoea is defined as three or more abnormally loose or fluid stools over a period of 24 hours. (WHO, CDS, 2005).

Diarrhea Disease is a common symptom, patient with Diarrhea Disease defecates more frequently than in normal time, and stool is loose and there is more water, the quantity of defecation is more than 200g, or the quantity of defecation is lower than 200g but the defecation is more than 3 time associated with mucus, bloody pus or undigested food. Generally Diarrhea associated with the symptom including defecation urgency, anus malaise and incontinence. (China CDC, 2004).

Acute diarrhea is defined as symptom of at least 3 loose stools or one watery or one mucous-bloody stool within 24 hours, either with accompany symptom as vomiting or dehydration. (Department of Disease Control, December 30, 2005).

Acute gastroenteritis was defined as >3 looser-than normal stools within a 24-hour period or an episode of forceful vomiting and any loose stool. (Alicia Sanchez-Fauquier, 2008).

1-4-2-Types of diarrhea:-

Classified by clinical characteristics into 6 categories as;
1. Simple diarrhea. Treatment is oral rehydration solution (ORS) which compose of glucose and necessary salts and no need to take antibiotics. (Department of Disease Control, December30, 2005).

2. Dysentery: Small amount of stool but stain either with blood and/ or mucous. The symptoms are either colicky pain or pain from abdominal muscle spam. It is caused by Shigella spp. or Nontoxigenic Invasive E.coli strain or other infectious germs. The germs invade large bowel mucous membrane causing inflammation. Mucous cells are killed by the germs toxin and become necrosis, therefore mucous-bloody stool occur.

3. Persistent diarrhea. The symptoms are continuous and last longer than 14 days, probably caused by gardiasis.

4. Severe diarrhea, which exhibits cholera-like signs and symptoms, has frequent watery stool.

5. Viral gastroenteritis. Main symptom is vomiting but mostly only diarrhea with out main symptom.

6. Hemorrhagic colitis. This is the watery stool with prominent bloody stain without fever. (Department of Disease Control, December30, 2005).

1-4-3-The classification according to disease course:-

I-Acute diarrhea: the course is less than two weeks.

Acute diarrhea can be classified to following categories:

A) Infectious diarrhea.

a) Viral diarrhea: Gastroenteritis caused by rotavirus, enteric adenoviruses, Norwalk group viruses and Astrovirus, etc.
b) Bacillary diarrhea: includes bacillary dysentery, Salmonella gastroenteritis, enteropathogenic Escherichia coli enteritis, enterohemorrhagic Escherichia coli enteritis, enterotoxigenic E.Coli enteritis, enteroinvasive E.Coli enteritis, Cholera, staphylococcus aureus food-poisoning, Bacillus proteus food-poisoning, Yersinia food-poisoning, campylobacter enteritis and vibrio parahaemolyticus food-poisoning, etc.

c) Fungi diarrhea: enteritis caused by Candida albicans, Aspergillus and Blastocystishominis, etc.

d) Protozoa diarrhea: infected by amebic dysentery, cryptosporidiosis and Giardia lamblia, etc.

e) Vermes diarrhea: infected by schistosomiasis, trichinosis and strongyloides stercoralis, etc. (China CDC, 2005).

B) Acute poisoning: some poisoning caused by biotoxin and chemical toxin.

C) Intestinal diseases: Acute hemorrhagic enteritis necroticans, acute episode of chronic non specific ulcerative colitis, Crohn's disease and partial intestinal obstruction, etc.

D) Generalized diseases: uremia, hyperthyroidism, acute systemic infection such as typhus, paratyphoid fever, hematosepsis and leptospirosis, etc.

E) Drug diarrhea: the common drug which cause diarrhea are as followed: catharsis agents, cholinergic drugs or cholinesterase inhibitors, digitoras, diuretics, anticancer chemotherapy drugs, antibiotics, gastric secretogogues, adrenergic never block drugs and biguanides drugs, etc. (China CDC, 2005).
II- Persisting diarrhea: the course is more than 2 weeks but less than 2 months.

III- Chronic diarrhea: the course is more than 2 months. (China CDC, 2005).

1-4-4-Agent factors:-

While there are many causes of diarrhea, it is most often due to enteritis (inflammation of the small intestine) of infectious or noninfectious etiology. In the U.S, most cases of infectious diarrhea are of viral and bacterial origin. Most infectious diarrheas are acquired by fecal-oral transmission via contaminated food or water. Improperly cooked meats may also be the source of infection. In the U.S, common diarrhea-producing pathogens are Shigella, Salmonella, Campylobacter, Staphylococcus, Bacillus cereus, Norwalk viruses and rotaviruses. Toxigenic Escherichia coli and S. aureus cause diarrhea through an enterotoxin, while Shigella, Salmonella, Campylobacter and invasive E. coli directly invade the mucosal epithelial cells. Toxin-producing pathogens usually cause a watery, large-volume diarrhea. Nausea, vomiting, cramps and fever may also occur. Invasive organisms may invade the large intestine and produce frequent small-volume stools that may contain mucus or blood. (Jane. S. Horne, 1995).

Bacteria such as Salmonella (commonly S. Enteritidis or S. Typhimurium) and Escherichia coli can cause diarrhoea, but the most severe outbreaks are caused by Shigella dysenteriae type 1 and Vibrio cholerae. Other pathogens that cause diarrhoea include protozoa (such as Giardia lamblia, E. histolytica, C. parvum) and viruses (such as rotavirus and Norwalk virus). Diarrhoea may occur as one of the symptoms of other infections (e.g. measles). (WHO, CDS, 2005).
Studies have shown that poor nutritional status can double the risk of contracting diarrhea when exposed to an infectious agent. In addition, the duration of the acute episode can be up to three times as long in malnourished children. In addition, reduced immunity and deficiencies of nutrients such as vitamin A and zinc, which are common in malnourished individuals, can increase the health risks from diarrhea. Diarrhea also causes decreased appetite and food intake, decreased absorption of nutrients from the food that is ingested and increased catabolism of body proteins. The resulting undernutrition stunts future mental and physical development. (Semba, 2000).

**i- Bacillary dysentery (shigellosis):**

- Bacillary dysentery is an acute bacterial disease involving the large and small intestine.

- It is caused by bacteria of the genus Shigella, of which *S. dysenteriae* type 1 causes the most severe disease and the largest outbreaks (other species include *S. flexneri*, *S. sonnei* and *S. boydii*).

- It is the most important cause of acute bloody diarrhoea. (WHO/ 2005.27).

**ii - Cholera:**

- Cholera is an acute bacterial enteric disease caused by the Gram-negative bacillus *Vibrio cholerae*.

- *Vibrio cholerae* produces a powerful enterotoxin that causes profuse watery diarrhoea by a secretory mechanism.
• Infection results from ingestion of organisms in food and water or directly from person to person by the faecal–oral route. (WHO/ 2005.27).

**iii - Rotavirus:**

Rotavirus infection is the leading cause of severe acute diarrhoea among young children worldwide. An estimated 527000 children aged <5 years die from rotavirus diarrhoea every year, with >85% of these deaths occurring in low income countries in Africa and Asia. (WHO, 2008).

Rotavirus has been recognized as an important cause of acute diarrhea in infants and young children. It has been estimated that over 500,000 deaths occur annually due to rotavirus diarrhea. The WHO is therefore, actively encouraging development of vaccines to decrease the rotavirus associated mortality and morbidity. Several vaccines have thus passed through the stage of human clinical trials. (S.K.Yachha, 1994).

**iv- Measles:**

Measles has been a major cause of child deaths in refugee camps and in internally displaced populations, and further contributes to child mortality by exacerbating malnutrition and vitamin A deficiency. Many deaths attributed to diarrhea and pneumonia may also be associated with measles. Measles case-fatality rates in children in complex emergencies have been as high as 20-30%. During a famine in Ethiopia, measles alone or in combination with wasting accounted for 22% of 159 deaths among children younger than 5 years of age, and 17% of 72 deaths among children aged 5 to 14 years. Progress in global control has made outbreaks of measles less likely in some regions. Nevertheless, the interruption of measles virus transmission requires a high level of population immunity and measles outbreaks continue to occur
in refugee and internally displaced populations with low levels of immunity or in which high vaccination coverage is not maintained. (Johns Hopkins, 2003)

1-4-5-Host factors:-

Both period and point prevalence rates of diarrhoea decreased significantly with increased age apart from the first 6 months of age. These rates were highest in the age group of 6 months to less than 12 months and were lowest among children aged 48 months to less than 60 months. Both rates were significantly higher among higher birth order children compared with lower birth order children. However, the sex of the child had no significant effect on both prevalence rates of diarrhoea and among children under 24 months of age, breastfeeding had no significant affect either. (WHO, Volume11 No4 May, 2005).

According to findings of recent study no relation has been observed between sex and children's age in diarrheal episode, indeed after restrict analysis separately in two sexes it was defined that the chance of diarrhea infection in boys is decreased by increasing in age, which demonstrate the correlation of age and sex effects. The relation between sex - age and acute diarrhea reports in various studies, some shows female sex is more liable to the risk of diarrhea episode and some other contradicts to this. In many studies increasing in age mentioned as conservational factor and some studies contradicted this. Age, compared to sex in general, has more significant effect on acute diarrheal episode. (Vafaee, Khabazkhoob, 2008).
1-4-6-Reservoir of infection:-

For some enteric pathogens man is the principal reservoir and thus most transmission originates from human factors, examples are enterotoxigenic E. coli, shigella spp., V.cholerae, giardia lamblia and E.histolytica. For other enteric pathogens animals are important reservoirs and transmission originates from both human and animal faeces, examples are campylobacter jejuni, Salmonella spp. and Y.enterocolitica for viral agent of diarrhoea, the role of animal reservoir in human disease remain uncertain. (K. Park, 2005).

1-4-7-Environmental factors:-

Environmental factors contribute to 23% of all deaths worldwide and 36% of all deaths among children 0-14 years old. An estimated 24% of all deaths in children under 15 are due to environmentally-related diarrhoea, malaria and respiratory infections; these same three killers also represent the largest share of the childhood environmental disease burden. (WHO, 2002).

People in developing countries suffer most from infectious forms of diarrhea. Most infections pass through a fecal-oral route. This results from environmental causes such as poor sanitation, decreased access to clean water, and a poor understanding of transmission and treatment of disease. These are conditions that arise most frequently in the developing world, though they affect both rural and urban populations. Improvements in these areas result in a dramatic reduction of cases of infectious diarrhea, as shown in studies in numerous developing nations, such as India, Gambia, and elsewhere, where poor socioeconomic status affects a large percentage of the population. Traveler's diarrhea is the result of exposure to such infectious
agents when visiting countries where sanitation is inadequate. (Semba, 2000).

A lack of maternal education often leads to the common practice of withholding food during acute episodes of diarrhea out of fear that eating will exacerbate the symptoms. Because of the nutritional losses from diarrhea, children actually need up to a 30 percent increase in calories and a 100 percent increase in protein intake during the acute and recovery stages of diarrhea. (Semba, 2000). Studies show that the risk of exposure to the causes of diarrhea is strongly related to both environmental characteristics and the socioeconomic characteristics of mothers. Indeed, infant mortality itself continues to be used as an indicator of standard of living and environmental conditions. This is especially true for children below the age of 2 years (Betty Wakou, 2005).

1-4-8-Mode of transmission:-

Common sources of infection in emergency situations:-

Outbreak investigations in emergency situations have identified the following risk factors for infection:

a- polluted water sources (e.g. by faecally contaminated surface water entering an incompletely sealed well), or contamination during storage or transport (e.g. by contact with hands soiled by faeces);

b- Shared water containers and cooking pots;

c- Lack of soap;

d- Contaminated food items (e.g. dried fish, shellfish). (WHO, CDS, 2005).
Nosocomial infections, or infections acquired within the hospital, are a major source of illness. About 6 percent of all patients acquire a nosocomial infection, and 4 percent of those die either as a direct result of the infection or with the infection as a major contributing factor. Since the majority of nosocomial infections are the result of bacteria normally found in the digestive tract, it seems reasonable to investigate whether diarrhea might be a contributing factor to nosocomial infection. The cases of 78 patients (33 with diarrhea and 45 without) were reviewed to determine if diarrhea, along with other factors, might contribute to the development of infection. The results found that the presence of diarrhea contributes to the colonization of the urinary meatus and the subsequent development of a urinary tract infection. (Farr, Barry M., 2008).

1-4-9-Diagnosis:-

Specific points to enquire about in the history include:

a- Duration of diarrhea.
b- Presence of blood in the stool.
c- Local knowledge or reports of cholera endemic.
d- Presence of fever, cough, or other important problems (e.g. Convulsions, measles).
e- Usual feeding practices.
f- Type and amounts of fluids (including breast milk) and food taken during illness.
g- Drugs or other remedies taken.
h- Immunization history (Brake (c) BMJ books, 2oo2).
**Diagnosis principle:**

The cause of diarrhea is complex; other factors such as chemical drug besides pathogen such as bacteria, virus, and parasite also can lead to infectious diarrhea. So, diagnosis of infectious diarrhea should base on date of epidemiology, clinical situation and routine examination of stool. Final diagnosis must based on the relate pathogen detected from stool or specific nucleic acid or specific antibody detected from blood serum. (China CDC, 2005).

The diagnosis of diarrhoeal diseases is usually based on clinical signs and symptoms. However, in outbreak situations stool samples must be collected from 10–20 cases to confirm the cause and to identify antimicrobial sensitivity. Once the outbreak has been confirmed, it is not necessary to obtain laboratory confirmation for every patient as this depletes laboratory supplies. (WHO, 2005).

IMPORTANT. Do not wait for laboratory results before starting treatment/control activities. (WHO, CDS, 2005).

**1-4-10-Management of acute diarrhoea:-**

The new formula Oral Rehydration Salts (ORS), released by the World Health Organization (WHO) today, will save millions of lives and reduce the severity of illness of those suffering from acute diarrhea. ORS is a sodium and glucose solution that is widely used to treat children with acute diarrhea, a serious killer of children under five worldwide. The new formula ORS will reduce the severity of diarrhea and vomiting, the number of hospitalizations, the need for costly intravenous (IV) fluid treatment and the length of illness. (WHO, 2009).
i- Promotion of breast-feeding:

Breast-feeding is recognized in the Region as one of the most cost-efficient diarrhoea preventive interventions and its promotion was continued in the countries. In an effort to maximize its benefit, the training modules of the new WHO/UNICEF breast-feeding counselling course were translated into Arabic and plans were made in several countries to conduct courses with WHO assistance during 1996-97 (WHO CDC, 1997).

Breastfeeding continues to make an important nutrition a longer duration of breastfeeding has been linked to reduced risk of childhood chronic illnesses and obesity, and to improved cognitive outcomes. Although the causal relationships underlying these associations remain controversial. Most of these studies have not specifically examined the effect of breastfeeding. Complementary feeding is defined as the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. The target age range for complementary feeding is generally taken to be 6 to 24 months of age, even though breastfeeding may continue beyond two years. (WHO/UNICEF, 2003).

Attention to hygienic practices during food preparation and feeding is critical for prevention of gastrointestinal illness. The peak incidence of diarrheal disease is during the second half year of infancy, as the intake of complementary foods increases. Microbial contamination of foods is a major cause of childhood diarrhea, and can be prevented by the practices described above. Because they are difficult to keep clean, feeding bottles are a particularly important route of transmission of pathogens. In peri-urban
Peru, 35% of bottle nipples tested positive for E. coli, an indicator of fecal contamination, and 31% of teas served in baby bottles were contaminated with E. coli compared with only 2% of teas served in cups. (WHO/UNICEF, 2003).

ii- AMOUNT OF COMPLEMENTARY FOOD NEEDED

Guideline: Start at six months of age with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding. The energy needs from complementary foods for infants with “average” breast milk intake in developing countries are approximately 200 kcal per day at 6-8 months of age, 300 kcal per day at 9-11 months of age, and 550 kcal per day at 12-23 months of age. In industrialized countries these estimates differ somewhat (130, 310 and 580 kcal/d at 6-8, 9-11 and 12-23 months, respectively) because of differences in average breast milk intake. (WHO/UNICEF, 2003).

iii - Children with severe dehydration:

Children with severe dehydration should quickly be given intravenous fluids (Ringer’s lactate, Hartman’s solution, or, if not available, normal saline). If the child can drink, he or she should also be given oral rehydration salts (ORS) solution while the drip is being set up. If the child cannot drink, give ORS solution as soon as he or she can drink without difficulty. (WHO, CDS, 2005).

When the child is improving and can drink, stop the IV and give ORS solution. The signs of improvement include urination, improved consciousness, and more normal breathing and pulse rates (unless the child has an infection or heart failure or is over hydrated). Watch the child for
several hours before discharge to be sure he or she can retain fluids. (WHO, CDS, 2005).

iv- How to prepare ORS:-

i- Wash your hands.

ii- Measure 1 litter of clean drinking water using the measurement container.

iii- Pour all the powder from one packet into the water and mix well until powder is completely dissolved. Fresh ORS solution should be mixed each day in a clean container. The container should keep covered. Any solution remaining from the day before should thrown away. (Gupta, 2003).

The detailed composition of ORS (WHO formulation) is: Table (1):

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>20.0 g</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>3.5 g</td>
</tr>
<tr>
<td>Trisodium citrate dihydrate</td>
<td>2.9 g</td>
</tr>
<tr>
<td>Potassium chloride</td>
<td>1.5 g</td>
</tr>
</tbody>
</table>

Source (Gupta, 2003).

v- Reduced Osmolarity ORS in Acute Diarrhea:

The current standard WHO ORS has a sodium concentration of 90 mEq/L (glucose 110 mmol/L, osmolarity 311 mOsm/L), which corresponds to the stool electrolyte composition in toxin-mediated diarrhea. However it has
worked well even in Young children with non-cholera diarrhea when used according to the recommended guidelines with ready access to plain water during oral rehydration. (Shinjini and Rakesh, 2007).

1-4-11-Treatment:

1. At initial phrase with diarrhea, give the patient large amount of water or liquid diet which could be prepared in the house. Prevention of dehydration and salt is by adding 2 pinches of salt in rice water, soup, fruit juice, porridge, or rice congee and follow by ORS every time of loose stool with appropriate proportion. The dehydration status is assessed according to Department of Disease Control guideline. (Department of Disease control, December 30, 2005).

2. For breast feeding children, continue with breast feeding. For children who drink bottle milk, continue the feeding and alternate with ORS. (Department of Disease control, December 30, 2005).

3. Do not stop feeding while diarrhea is going on; give easily digestible meal such as porridge, rice congee with vegetable, fish, slow cooked meat. (Department of Disease control, December 30, 2005).

4. The aforementioned treatments will improve the patient condition but if it still has large amount and frequent watery stool, frequent vomiting, severe thirsty, sunken eyeball, unable to eat or drink, fever, or mucous bloody stool, refer the patient to the health service center, health station or the hospital nearby. (Department of Disease control, December 30, 2005).

5. No need to give antidiarrheal drug because most diarrheal diseases are self limiting. Diarrhea is the body defense mechanism to get rid of wastes, toxins
and germs out of the body. Antidiarrheal drug do not prevent loss of water and salts from the intestines but interfere with the effectiveness of antibiotics used in the case of intestinal infection. (Department of Disease control, December 30, 2005).

6. Use of antiseptic or antibiotics should be prescribed by the physician and use only in the dysentery case that has mucous or bloody stool. In case of severe diarrhea or other complications, unnecessary antibiotics use will cause drug allergy or resistance (Department of Disease control, December 30, 2005).

I. Treatment scheme A: adapt to the patient without desiccation, can be used at home. Three principles of home treatment: (China CDC, 2005).

i- Patients should take orally enough liquid to prevent desiccation. The prevention and redress of desiccation are very important in the treatment of diarrhea disease because diarrhea lead to mass loss of water and electrolure. So, patients should take orally enough liquid to prevent desiccation at the beginning of diarrhea. (China CDC, 2005).

ii. Patients should supplement enough food to prevent dystrophy. (China CDC, 2005).

iii. If patient doesn’t recovery or the time and amount of diarrhea increase, can’t diet normally, frequent vomit, has fever or thirstiness or bloody stool, he must be send to see doctor in time. (China CDC, 2005).

II. Treatment scheme B: adapt to the patient with mild desiccation, use ORS to correct dehydration in time.
i- Use ORS at first four hours (supplement fluid according to physician order of doctor in time).

ii. Observe closely patient’s condition to find symptom in time. If edema occurs, patient should stop taking ORS, and take it after edema eliminate according to treatment scheme A.

iii. Re-evaluate patient’s desiccation condition after four hours, then select reasonable treatment scheme (A, B or C) to treat. (China CDC, 2005).

III. Treatment scheme C adapt to the patient with severe desiccation. (China CDC, 2005).

i. Patient with severe desiccation needs venoclysis.

ii. Supplement kalium and calcium.

iii. Patient should take ORS once he can drink, Re-evaluate patient’s condition after 6-7 hours, and select reasonable schem A, B or C to treat. In a word, the slowly, thick at first and then thin, supplement kalium when patient can urinate. (China CDC, 2005).

IV. Drug treatment:

WHO suggest 90% of patient with diarrhea needn’t antibacterial drug treatment because viral infectious diarrhea and part bacterial diarrhea tend to spontaneous cure. Domestic experts suggest 70% of diarrhea needn’t and shouldn’t use antibiotic to treat, antibiotic adapts to the patient infected by invasive bacteria (30% or so). (China CDC, 2005).
i- Guidelines for the Management of Acute Diarrhea

Infants and Toddlers:

Refer infants and toddlers with acute diarrhea for medical evaluation if any of the following are present:

1- Young age (e.g., aged <6 months) or weight <18 lbs
2- Premature birth, history of chronic medical conditions or concurrent illness. (Duggan C, Santosham, September 2008).
3- Fever ≥38 °C (100.4 °F) for infants aged <3 months or ≥39 °C (102.2 °F) for children aged 3–36 months (Duggan C, Santosham, September 2008).
4- Visible blood in stool (Duggan C, Santosham, September 2008).
5- High output diarrhea, including frequent and substantial volumes of stool (Duggan C, Santosham, September 2008).
6- Persistent vomiting (Duggan C, Santosham, September 2008).
7- Caregiver’s report of signs consistent with dehydration (e.g., sunken eyes or decreased tears, dry mucous membranes, or decreased urine output) (Duggan C, Santosham, September 2008).
8- Change in mental status (e.g., irritability, apathy, or lethargy). (Duggan C, Santosham, September 2008).
9- Suboptimal response to oral rehydration therapy already administered or inability of the caregiver to administer oral rehydration therapy (Duggan C, Santosham, September 2008).
**Older Children and Adults:**

Refer children > 3 years old and adults with acute diarrhea for medical evaluation if any of the following are present:

1- Elderly age.
2- History of chronic medical conditions or concurrent illness.
3- Fever $\geq 39 \, ^\circ C$ (102.2 °F) (Duggan C, Santosham, September 2008).
4- Visible blood in stool (Duggan C, Santosham, September 2008).
5- High output of diarrhea, including frequent and substantial volumes of stool (Duggan C, Santosham, September 2008).
6- Persistent vomiting (Duggan C, Santosham, September 2008).
7- Signs consistent with dehydration (e.g., sunken eyes or decreased tears, dry mucous membranes, orthostatic hypotension or decreased urine output) (Duggan C, Santosham, September 2008).
8- Change in mental status (e.g., irritability, apathy, or lethargy) (Duggan C, Santosham, September 2008).
9- Suboptimal response to oral rehydration therapy already administered or inability to administer oral rehydration therapy. (Duggan C, Santosham, September 2008)

**ii- Recommendations of the IAP National Task Force for use of zinc in diarrhea:**

Based on studies in India and other developing countries there is sufficient evidence to recommend zinc in the treatment of acute diarrhea as adjunct to oral rehydration. However, ORS remains the mainstay of therapy during acute diarrhea and zinc has an additional modest benefit in the reduction of stool volume and duration of diarrhea as an adjunct to ORS. Under all
circumstances, oral rehydration therapy must remain the main stay of treatment. Treatment of acute diarrhea with zinc may have benefits on morbidity and mortality from other childhood infections and these should be further investigated. A uniform dose of 20 mg of elemental zinc should be given during the period of diarrhea and for 7 days after cessation diarrhea to children older than 3 months. Recommendations for below 3 months must await further research. (Shinjini and Rakesh, 2007).

Adult individuals with acute diarrhea who are otherwise healthy are not likely to develop dehydration. Lost fluids and electrolytes can be replaced with virtually any beverage plus a source of sodium chloride (salted crackers, etc.). Patients can rest the bowel by avoiding high-fiber foods, fats, milk and other dairy products, caffeine and alcohol. A bland diet emphasizing such foods as bananas, clear soups, juice, gelatin and boiled vegetables may be helpful. The diet can gradually be returned to normal as tolerated and as stools become formed. For less than severe diarrhea, an oral glucose-electrolyte solution may be given if nausea and vomiting are not severe. Intravenous fluid therapy is necessary for the treatment of severe dehydration or diarrhea that is accompanied by severe vomiting. The degree of dehydration present determines the treatment of a child with diarrhea. Children with diarrhea who are not dehydrated should continue to be fed age-appropriate diets. Oral rehydration therapy (ORT) is the preferred treatment of fluid and electrolyte losses caused by diarrhea in children with mild to moderate dehydration. Several glucose-electrolyte or rice-based physiologic solutions (Pedialyte, Infalyte, etc.) are commercially available for children who require ORT. Parents should be discouraged from using nonphysiologic solutions (cola, apple juice, chicken broth and sports
beverages) to treat their children with diarrhea. These solutions are hypertonic and have low electrolyte concentrations. While commercially available pre-mixed solutions are recommended for ORT, several recipes exist for homemade oral replacement solutions. One example is noted in TABLE (2): (Jane S. Horne, 1995)

<table>
<thead>
<tr>
<th>Oral Rehydration Formula Recipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ tea spoon salt</td>
</tr>
<tr>
<td>1 tea spoon baking soda</td>
</tr>
<tr>
<td>8 tea spoons sugar</td>
</tr>
<tr>
<td>8 ounces orange juice</td>
</tr>
<tr>
<td>Dilute to 1 liter with water</td>
</tr>
</tbody>
</table>

Fluids may be given at rates of 50 mL/kg/24 h to 200 mL/kg/24 h depending on the patient’s hydration status.

**Teach mothers to care for their children at home:**

Before the child goes home, give mothers clear instructions about continued care. Make these points clear:

· Make sure the child has plenty of liquids. If the child is breast-feeding, increase breast-feeding. (WHO, CDS, 2005.27).

· Make sure the child does not get too hot or cold.

· Give the child plenty of nutritious food. (WHO, CDS, 2005.27).

· Give medicine correctly. (WHO, CDS, 2005.27).
· Bring the child back if he or she becomes sicker, has difficulty breathing, is breathing fast, or is not able to drink (WHO, CDS, 2005.27)

· Teach the mother how to monitor the child's health and prevent future problems. (WHO, CDS, 2005.27).

· Tell the mother that the child should have a regular health check up at the local clinic until he or she is school age.

(WHO, CDS, 2005.27).

· Show the mother a growth chart. Tell her how to check the child's weight and height to be sure that he or she is growing properly. (WHO, CDS, 2005.27).

· Explain to the mother that the child needs enough to eat to grow properly. Teach her about foods that the child needs. These include: meat, fish, eggs, beans and lentils potato, rice, plantain, taro, cassava fruits and vegetables, milk, some high calorie foods such as oil and sugar.

· Explain the importance of cleanliness, particularly hand washing (WHO, CDS, 2005.27).

Everyone in the family should wash their hands every morning, before every meal, after going to the toilet, and before helping other family members with eating, dressing, etc. (WHO, CDS, 2005.27)

· Stress the importance of clean foods and clean water. Tell the mother that water from a spring well, pond or river should be boiled. Food should be cooked thoroughly and eaten soon after it is cooked. (WHO, CDS, 2005.27).
· Explain the importance of breast-feeding the baby. Tell her that breast-feeding is much better for the baby than bottle-feeding.

· Explain the importance of having all children immunized against infectious diseases. (WHO, CDS, 2005.27)

Show the mother how to take care of the child who becomes sick. For example, tell her to give one glass of rehydration fluid every time the child passes a watery or bloody stool. Explain that any fluid, if given early enough, will help to prevent dehydration. (WHO, CDS, 2005.27)

Tell her that some time-tested home remedies work well such as herbal teas for coughs and colds and coconut water or rice water for diarrhoea. Help her to use these in her care. However, the mother should not rely on home remedies for serious illnesses. She should bring the child to the clinic without delay. Tell the mother to watch for these danger signs: (WHO, CDS, 2005).

¨ the child is unable to drink or breast-feed

¨ the child becomes sicker

¨ the child develops a fever

¨ the child develops fast breathing or has difficulty breathing. (WHO, CDS, 2005).

¨ the child has blood in the stool

¨ the child is lethargic or has convulsions. · Ask the mother if she has any worries about her own health. Help her get care if she has a health problem.
Give her information about how to care for her own health. (WHO, CDS, 2005).

**Use these basic steps to teach the mother:**

· Give information

· Show an example

· Let her practice

· Check her understanding. (WHO, CDS, 2005).

**iii- Guidelines for the Management of Acute Diarrhea in Sudan**

**i- Plan A: treat diarrhoea at home:**

Counsel the mother on the 3 Rules of Home Treatment: Give extra fluid, Continue feeding, when to Return.

1- Give extra fluid (as much as the child will take). Tell the mother: Breastfeed frequently and for longer at each feed. If the child is exclusively breastfed, give ORS or clean water in addition to breast milk. (WHO, FMOH/Sudan, 2007).

*If the child is not exclusively breastfed, give one or more of the following: ORS solution, food-based fluids (such as soup, rice, water, and yoghurt drink), or clean water. (WHO, FMOH/Sudan, 2007).

*Teach the mother how to mix and give ORS; give the mother 2 packets of ORS to use at home.

*Show the mother how much fluid to give in addition to the usual fluid intake: (WHO, FMOH/Sudan, 2007).
Up to 2 years                  50 to 100 ml after each loose stool
2 years or more               100 to 200 ml after each loose stool

-Continue giving extra fluid until the diarrhoea stops.
-Give zinc (WHO, FMOH/Sudan, 2007).

2- Continue feeding   

3- When to return      } see counsel the mother chart

ii- Plan B: Treat Some Dehydration with ORS

Give in clink recommended amount of ORS over 4-hour period (WHO, FMOH/Sudan, 2007).

*Determine amount of ORS to give during first 4 hours. Table (3):

<table>
<thead>
<tr>
<th>Age</th>
<th>Up to 4 month</th>
<th>4 month up to 12month</th>
<th>12 month up to 2 years</th>
<th>2 years up to 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>&lt; 6 Kg</td>
<td>6-&lt; 10 Kg</td>
<td>10- &lt; 12Kg</td>
<td>12- 19 Kg</td>
</tr>
<tr>
<td>In ml</td>
<td>200- 400</td>
<td>400- 700</td>
<td>700- 900</td>
<td>900- 1400</td>
</tr>
</tbody>
</table>

(WHO, FMOH/Sudan, 2007).

*Reassess the child and classify the child for dehydration.

*Select appropriate plan to continue treatment.

*Begin feeding the child in clinic. (WHO, FMOH/Sudan, 2007).

iii- Plan C: Treat severe dehydration quickly
*Start IV fluid immediately. If the child can drink, give ORS by mouth while the drip set up. Give 100 ml/Kg Ringer's lactate solution (or, if not available, normal saline), divided as follow: Table (4):

<table>
<thead>
<tr>
<th>Age</th>
<th>First give 30 ml/Kg in:</th>
<th>Then give 70 ml/Kg in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants (under 12 months)</td>
<td>1 hour</td>
<td>5 hour</td>
</tr>
<tr>
<td>Children (12 month up to 5 years)</td>
<td>30 minutes</td>
<td>21/2 hours</td>
</tr>
</tbody>
</table>

(WHO, FMOH/Sudan, 2007).

1-4-12-Prevention of diarrhea:-

1. Wash hands with soap every times before cooking or eating or preparing milk for children and before leaving the toilet.

2. Drink clean or boiled water

3. Eat clean and just cooked meal; avoid half cooked food especially prepared from meat or food that has house fly, flying around.

4. Avoid eating left over food because diarrheal symptoms easily occur. Put the cooked food in tight container and keep in the refrigerator. Heat the food to boiling temperature before consuming.

5. Fresh vegetables and fruits should be cleaned with tap water or chlorinated water (half tea spoon of chlorine powder in 20 litres of water).
6. Disposal of garbage and refuses properly. Wet garbage should put in plastic bag, tight firmly and discard into the trash can, then dispose of by bury or burn to get rid of fly breeding place.

7. Deficate in the toilet or place that the feces can not contaminate water reservoir.

8. For food handler and food server, hands should be washed frequently before touching food. Keep the utensils and cooking equipment clean. Disposal of waste and garbage daily. If diarrheal symptoms occur, take a sick leave until stool is free of infectious germs (Department of Disease control, December 30, 2005).

Recent data on diarrhoeal mortality attributable to persistent diarrhoea and dysentery suggest that once ORT use is high, further reduction of diarrhoeal mortality will depend upon additional interventions such as improved case management, hygiene education, encouragement of breast-feeding, improved sanitation, and general socioeconomic development, all of which are more difficult to implement. Thus, in areas where diarrhoeal mortality is very high and ORT access is low, such as sub-Saharan Africa, a large fraction of deaths may be preventable through improved ORT access and education, while areas such as Brazil may already be at the point where further reduction will require other interventions in addition to the maintenance of ORT promotion. (Murray & Lopez, 1996).

Table (5): Key components in the prevention of diarrhoeal diseases
<table>
<thead>
<tr>
<th>Practices or activities</th>
<th>Interventions to move theory to practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe drinking-water</td>
<td>Provision of an adequate supply, collection, transport and storage system, Provision of information on the importance of clean water with appropriate use of water container lids and household storage</td>
</tr>
<tr>
<td>Safe disposal of human excreta</td>
<td>Provision of adequate facilities for the disposal of human waste, Provision of information on the importance of human waste disposal, also covering the use and maintenance of the facilities</td>
</tr>
<tr>
<td>Food safety</td>
<td>Provision of adequate storage facilities for food (both uncooked and cooked), cooking utensils, adequate quantity of water, and fuel to allow for cooking and reheating, Provision of information on the importance of food safety</td>
</tr>
<tr>
<td>Hand-washing with soap</td>
<td>Provision of soap, allowing for bathing and laundry Provision of information on the diseases spread through lack of or poor hand-washing, and demonstration of good hand-washing</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>Provision of information on: the protective qualities of breastfeeding and the importance of breastfeeding sick children, Practical support to enable mothers to breastfeed sick children</td>
</tr>
</tbody>
</table>

(WHO, CDS, 2005)
Highly effective category contained seven interventions:

1- Promotion of breast feeding.
2- Improvement of weaning practices.
3- Rotavirus immunization.
4- Cholera immunization (in special circumstances).
5- Measles immunization.
6- Improvement of water supply and sanitation.
7- Promotion of personal domestic hygiene. (Chien Hung Chang, 2005).

The Centers for Disease Control and Prevention (CDC) and the Pan American Health Organization (PAHO) have developed an inexpensive, rapidly implementable alternative for water quality improvement. This intervention consists of three elements:

(1) point-of-use treatment of contaminated source water with disinfectant produced locally using appropriate technology;

(2) Safe storage of treated water;


1-4-13- Control of diarrhea diseases:

WHO's Division of Diarrhoeal and Acute Respiratory Disease Control (CDR), among its many activities, supports research into ways of preventing and treating diarrhoeal diseases. The research is coordinated by CDR's Programme for Diarrhoeal Disease Control (CDD). Over the years this research has evaluated a number of new or improved approaches to the control of diarrhoeal diseases. Research findings have been the basis for
CDD guidelines for the case management of diarrhoea. As new research results have come to light, CDD has adjusted its case management guidelines accordingly. The following examples related to the nutritional management of patients with diarrhoea show how research has been used to improve CDD's guidelines. (WHO, 2001).

Between 1980 and 1987 research into diarrhoeal diseases produced a number of findings on child nutrition. These confirmed the assumptions underlying the 1980 recommendations, allowing further precision in the advice, and clarified areas of previous uncertainty. The findings showed that:

* Complementary foods offered to children with diarrhoea usually have low energy or nutrient density, so it is important to increase their energy and nutrient density to achieve adequate intake during and after diarrhoea. (WHO, 2001).

* The body continues to absorb animal fats and vegetable oil during diarrhoea.

* Promoting improved feeding during an episode of diarrhoea and during convalescence after-wards reduces the negative effects of the episode on a child's nutritional status and does not make the symptoms worse. (WHO, 2001).

* Promoting food safety is important to prevent diarrhoea.

* Continued breastfeeding reduces the severity of the episode of diarrhoea, accelerates recovery and helps prevent further episodes.
* Give fresh fruit juices or bananas to provide potassium.

* Cook and mash or grind food well so it will be easier to digest.

* After the diarrhoea stops, give one extra meal each day for a week, or until the child has regained normal weight. (WHO, 2001).

* Give breast milk or milk feeds prepared with twice the usual amount of water. (WHO, 2001).

In view of these findings, CDD again revised the diarrhoea management chart in 1990. This revision incorporated the following recommendations:

* Give the child plenty of food to prevent malnutrition.

* Continue to breastfeed frequently.

* If the child is not breastfed, give the usual milk. If the child is less than 6 months old and not yet taking solid foods, dilute milk or formula with an equal amount of water for 2 days. (WHO, 2001).

* If the child is 6 months or older, or already taking solid foods, also give cereal or another starchy food mixed, if possible, with pulses, vegetables, and meat or fish. Add 1 or 2 teaspoonfuls of vegetable oil to each serving. (WHO, 2001).

* Encourage the child to eat; offer food at least 6 times a day.

* Give the same foods after diarrhoea stops, and give an extra meal each day for 2 weeks. (WHO, 2001).
1-4-14-Previous studies:-

Results from Mortality Surveys in Darfur, Sudan (January 2004 – January 2008). The report show a high burden of disease for children 6-59 months during the two-weeks prior to the survey: more than half of the children had an episode of fever (55.7 percent), half of them had an episode of diarrhea (49.3 percent had watery and bloody diarrhea) and over one third had an episode of acute respiratory infection (36.4 percent). (Emily Mates, March 2009).

Study conducted at Omdurman- Dar Elsalam, found 52.7% of children fewer than 5 years were infected with diarrhea, and 57.5 of families have no special diet for their infected children. The study illustrated no relation between duration of breast feeding and diarrhea (56.3% of infected children their breastfeeding 20-27 month. There was strong relationship between diarrhea and family income. The study found strong relationship between educational level of mothers and diarrhea among children less than 5 years. (Sanhory, 2005).

In other study conducted at Elsalama area –Khartoum State 2007. The study revealed high percentage of diarrhea among children less than 5 years (47.8%). The study showed high percentage of diarrhea among families with low income (45.7%). The study also showed high prevalence among age group 4 and 5 years. (23.4%, 26.6% respectively). (Ahmed, 2007).
Chapter Two
Methodology
2- Methodology

2-1-Study design:-

This hospital based analytical descriptive study was conducted to study the epidemiology of diarrheal diseases among children under 5 years attending Elfashir Teaching Hospital-North Darfur State in March, 2009.

2-2-Study area:-

Elfashir Teaching Hospital was established in 1916. It is located in North Darfur State in the middle of Elfashir Town; the main departments were Emergency and Accidents Department, Surgery, Internal Medicine, Pediatric, Tuberculosis, ENT, Pharmacology, Dental and X-ray Department.

Wards:

It consist of the following wards: Surgery with, 59 beds capacity, Internal Medicine with 57 beds, High Class with 18 beds, Pediatric with 48 beds, Children Nutrition with 40 beds, Tuberculosis with 18 beds, ENT with 15 beds, Intensive Care with 7 beds, Emergency with 42 bed.

Man power:

There were 12 physician specialists, 24 general physicians , 20 registrar physician, 7 sisters, 126 nurses, 47 student nurses, 3 general medical assistants, 9 medical dentistry assistants, 3 medical assistants for physical treatment , 10 laboratory technicians, 12 pharmacy medical assistants, 13 operational preparatory staff, 10 anaesthetization specialists, 2 radiology assistants, 4 radiology technicians and 20 sociologists, 2 sanitary overseers,
one assistant sanitary overseers, 11 sanitary sweepers, 3 sanitary workers, 9 personnel, 12 counters, 22 statistical employees, 9 clerks and 74 workers.

**Sanitation:-**

There was one tractor belonging to the hospital for waste collection and disposal. The source of water supply was from the main network piped water.

**2-3-Study population:-**

The study population included all the children less than 5 years attending Elfashir Teaching Hospital at out patient clinic during March, 2009.

**2-4- Sample size:-**

Total coverage of all the children under 5 years attending the hospital during March, 2009.

**2-5- Data collection:-**

The data was collected in one month (March, 2009) by the following methods:-

1- Questionnaire directed to mothers or fathers or other members of the family who brought the child to the hospital to collect information needed for the study group covering, age, gender, socio-economic status and environmental factors.

2- Interview with hospital administration to know the background of the study area.
2-6- Data analysis:-

The data was analyzed using (SPSS) program and Chi-square test to determine the P-value to compare between different variables and diarrhea.
3- Results

The data was obtained from 307 mothers of children under 5 years attending Elfashir Teaching Hospital in March, 2009. The study revealed high proportion of diarrhea among the study group (48.5%) as shows in table (1).

The finding shows most infected children were from age group one and two years, (53.1%) and 27.7% respectively as in table (2). This findings is statistically significant (X2= 11.68, PV= 0.00857).

Table 3 shows that male children were more infected than female (59% male and 41% female). This finding is statistically not significant (X2= 0.54, PV= 0.46).

Table 4 shows that 11.1% of families have a family size of (1-3) person, 44% of family size (4-6) person, 32.9% (7-9) person and 11.7% having family size more than 10. This findings statistically not significant (X2= 0.53, PV= 0.913) when compared with diarrhea.

Tables 5 shows the educational levels of the mothers were contrasted to their children less than 5 years attending at out patient clinic, who were found with diarrhea. The replies to the questionnaire indicated that 41.4% of the mothers attended primary schools, 32.2% were illiterate, 21.8% attended secondary school and 3.3% were university level. The results illustrated the inconsistent decline of diarrhea cases with increase in the level of education of mothers. The differences is statistically not significant (x2=3.40, PV=0.493).
The family income per month as a factor related to low standard of hygiene was questioned. The findings showed that most of the families (56.4%) were with low income per month being less than 200 SG, 30.9% earn (200-400) SG, 10.7% (400-600) SG and 2% more than (600) SG per month (table 6). This factors is statistically significant (X2=11.05, PV=0.0114).

The promotion of breast feeding as a factor related to prevention of diarrheal diseases is shown in table (7). The finding showed that 82.7% of the children were breastfed for (18-24) months.

Table 8 shows the type of weaning as a factor related to diarrhea disease. The results showed that 51.1% of mothers weaned their children suddenly and 48.9% gradually.

The availability of latrines in the houses as environmental factors related to diarrheal diseases is shown in table (9). 66.1% of houses were provided with latrines and 33.9% have no latrines. This finding is statistically significant (X2=6.45, PV=0.011).

The addional diet as a factor related to the growth of the child and prevention of diseases is illustrated in table (10). The finding revealed that 78.8% of mothers apply their children under 5years addional diet besides the breast feeding and 21.2% do not.

Figure 1 shows that most of infected children with diarrhea have no dehydration (79.2%).

Rising awareness about the causes of diarrhea diseases among the children under 5years as factors to avoid the causes of infection is shown in Fig (2).
The finding showed that 66.1% of mothers were not aware of the causes of diarrhea.
Chapter Three

Results
**Table (1):** The proportion of diarrhoea disease among the study group at Elfashir Teaching Hospital in March, 2009.

(n=307)

<table>
<thead>
<tr>
<th>Diarrhea</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>149</td>
<td>48.5</td>
</tr>
<tr>
<td>No</td>
<td>158</td>
<td>51.5</td>
</tr>
<tr>
<td>Total</td>
<td>307</td>
<td>100</td>
</tr>
</tbody>
</table>
Table (2): Age group in relation to diarrhoea disease among the children <5years at Elfashir Teaching Hospital in March, 2009.

(n=307)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>One year</td>
<td>90</td>
<td>55.2</td>
<td>73</td>
</tr>
<tr>
<td>2years</td>
<td>41</td>
<td>48.2</td>
<td>44</td>
</tr>
<tr>
<td>3years</td>
<td>11</td>
<td>26.2</td>
<td>31</td>
</tr>
<tr>
<td>4years</td>
<td>7</td>
<td>41.2</td>
<td>10</td>
</tr>
<tr>
<td>5years</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

X= 11.68  \quad PV=0.00857  \quad \text{Significant}
Table (3): Gender distribution in relation to diarrhoea disease among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

(n= 307)

<table>
<thead>
<tr>
<th>Diarrhea</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Male</td>
<td>91</td>
<td>50.3</td>
<td>90</td>
</tr>
<tr>
<td>Female</td>
<td>58</td>
<td>46</td>
<td>68</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

X = 0.54  
PV = 0.46

Not significant
Table (4): Family size in relation to the diarrhoea disease among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

(n= 307)

<table>
<thead>
<tr>
<th>Family Size</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>1-3</td>
<td>15</td>
<td>44.1</td>
<td>19</td>
</tr>
<tr>
<td>4-6</td>
<td>66</td>
<td>48.5</td>
<td>70</td>
</tr>
<tr>
<td>7-9</td>
<td>49</td>
<td>48.5</td>
<td>52</td>
</tr>
<tr>
<td>&gt;10</td>
<td>19</td>
<td>52.8</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

X = 0.53

PV = 0.913

Not significant
**Table (5):** Educational level of mothers of respondents in relation to diarrhea disease among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

(n= 307)

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>54</td>
<td>45</td>
<td>99</td>
</tr>
<tr>
<td>Khalwa</td>
<td>50</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Primary</td>
<td>59</td>
<td>68</td>
<td>127</td>
</tr>
<tr>
<td>Secondary</td>
<td>28</td>
<td>39</td>
<td>67</td>
</tr>
<tr>
<td>University</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>158</td>
<td>307</td>
</tr>
</tbody>
</table>

X = 3.40 \quad \quad PV = 0.493

Not significant
Table (6): Family income per month in relation to diarrhoea disease among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

(n= 307)

<table>
<thead>
<tr>
<th>Diarrhea Income</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>&lt; 200</td>
<td>94</td>
<td>54.3</td>
<td>79</td>
</tr>
<tr>
<td>201-400</td>
<td>35</td>
<td>36.8</td>
<td>60</td>
</tr>
<tr>
<td>401-600</td>
<td>19</td>
<td>57.6</td>
<td>14</td>
</tr>
<tr>
<td>&gt; 600</td>
<td>1</td>
<td>16.7</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

X = 11.05
PV = 0.0114
Significant
Table (7): Duration of breastfeeding in relation to diarrhoea disease among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

(n= 307)

<table>
<thead>
<tr>
<th>Diarrhea duration</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>&lt; 12 month</td>
<td>9</td>
<td>75</td>
<td>3</td>
</tr>
<tr>
<td>12-17 month</td>
<td>18</td>
<td>43.9</td>
<td>23</td>
</tr>
<tr>
<td>18-24 month</td>
<td>122</td>
<td>48</td>
<td>132</td>
</tr>
<tr>
<td>&gt; 24 month</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

X = 3.74 

PV = 0.154

Not significant
Table (8): Type of weaning in relation to the diarrhoea disease among the children <5 years at Elfashir Teaching Hospital in March, 2009.

(n= 307)

<table>
<thead>
<tr>
<th>Diarrhea weaning</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Gradually</td>
<td>70</td>
<td>46.7</td>
<td>80</td>
</tr>
<tr>
<td>Suddenly</td>
<td>79</td>
<td>50.3</td>
<td>78</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

X = 0.41  
PV = 0.522

Not significant
**Table (9):** Availability of latrine in relation to the diarrhoea disease among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

\( n = 307 \)

<table>
<thead>
<tr>
<th>Latrine</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Available</td>
<td>88</td>
<td>43.3</td>
<td>115</td>
</tr>
<tr>
<td>Not available</td>
<td>61</td>
<td>58.7</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

\( X = 6.45 \) \quad PV = 0.011 \quad \text{Significant}
**Table (10):** Addional diet in relation to diarrhoea among the children < 5 years at Elfashir Teaching Hospital in March, 2009.

\[ (n= 307) \]

<table>
<thead>
<tr>
<th>Adding</th>
<th>Infected</th>
<th>Non-infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>117</td>
<td>48.3</td>
<td>125</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>49.2</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>48.5</td>
<td>158</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 0.02 \quad \text{PV} = 0.899 \]

Not significant
Figure (1): The Children with Diarrhea with dehydration at Elfashir Teaching March 2009.

N=149
**Figure (2):** knowledge of the causes of diarrhoea among mothers of children <5 years

n=307
Chapter Four

Discussion, Conclusion, Recommendations, References and Appendices
4-1- Discussion

The study population was a total coverage of all children less than 5 years attending Elfashir Teaching Hospital in March, 2009.

The present study showed higher percentage of diarrhea among the children under 5 years at Elfashir Teaching Hospital. The percentage was 48.5% when compared to previous studies done in Sudan, (Sanhory, 2005) and (Ahmed, 2007), and results from morbidity surveys in Darfur, Sudan (January 2004-January 2008). They reported a higher burden of disease for children 6-59 months. Half of them had an episode of diarrhea (49.3 per cent), (Emily Mates, March 2009). From studies conducted indifferent parts of Sudan, the prevalence of diarrhea among the children under 5 years was found high eg. 52.7% in study at Dar elsalam –Omdurman (Sanhory, 2005), and 47.8% in study at Elsalama area – Khartoum (Ahmed, 2007).

The finding similarity may be due to socio-economic condition and health status.

In the present study, most of the infected children were aged one and two years (53.1% and 27.7) respectively. This finding is in agreement with (WHO, volume 11 No.4, May 2005), in which the prevalence rate of diarrhea degreases significantly with increased age.

The present study revealed that male children were more infected than females, (59% for male). The finding disagrees with Vafaee, Khabazkhoob,
(2008). The relation between sex-age and acute diarrhea was reported in various studies. Some show females are more liable to risk of diarrhea episodes and some other contradicts this. (Vafae, Khabazkhoob, 2008).

The educational level of mothers as a factor related to raise awareness about the causes of disease, have not been shown to have a relation. This finding disagrees with the previous studies (Sanhory, 2005).

The family income per month as a factor related to low standard of hygiene was been shown to have a strong relationship with diarrhea. This finding agrees with the previous studies (Sanhory, 2005, and Ahmed, 2007).

The availability of latrines in the houses as factors related to sanitary conditions showed that 32.9% of families has no latrines, (most infections pass through a fecal oral route). These findings agree with (Semba, 2000).

The study showed strong relationship between availability of latrines in the houses and diarrhea (58.7%) of diarrhea in families with no latrines (X= 6.45, PV = 0.011). This finding is in agreement with (WHO, 2002), (An estimated 24% of all deaths in children under 15 years are due to environmentally-related diarrhea, malaria and respiratory infections).

Rising awareness about the causes of diarrhea diseases among the children under 5 years as factors to avoid the causes of infection. The finding showed that 66.1% of mothers were not aware of the causes of diarrhea. This findings disagreement with (Semba, 2000). (A lack of maternal education often leads to the common practice of withholding food during acute episodes of diarrhea out of fear that eating will exacerbate the symptoms).
4-2- Conclusion

The data was obtained from 307 mothers of children under 5 years attending at Elfashir Teaching Hospital in March, 2009.

The data was collected by questionnaire and interview with hospital administration and analyzed using computer (SPSS) programme and chi-square test.

The proportion of diarrhoea was 48.5%.

The study showed male children were more infected than females (59%).

Most of the infected children were aged one and two years (53.1% and 27.7) respectively.

The educational level of mothers showed that 41.4% attended primary school and 32.2% were illiterate.

The findings show most families have low income (56.4%).

The study revealed that 33.9% of families have no latrines.
4-3- Recommendations

The following recommendation is suggested:-

3- To increase awareness of mothers and families about the causes of diarrhea.
4- To encourage environmental health committees to establish latrines.
5- To conduct early diagnosis of cases and treatment.
4-4- References

1- Ahmed M. El, (2007): Prevalence of Diarrhoeal Diseases among the Children under 5 years at Elsalama area, University of Khartoum, Faculty of Public and Environmental Health, Qualifying year research.

2- Alicia Sanchez-Fauquier, (October 2008), Vol. 12, No. 10, Human Rotavirus G9 and G3 as Major Cause of Diarrhea in Hospitalized Children, Spain.


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7- Department of Disease Control, (December 30, 2005): Health advice for Public: Acute diarrhea, New Dalhi.


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20- S. K. Yachha (January 1994), Volume 31, Epidemiology, Subgroups and Serotypes of Rotavirus Diarrhoea in North Indian Communities, New Dalhi.


22- The American Journal of Tropical Medicine and Hygiene, (March 2007).No. 22.


بسم الله الرحمن الرحيم

جامعة الخرطوم
كلية الصحة العامة وصحة البيئة
قسم الوبائيات

4-5- استبيان عن وفاة مرض الأسلاف الحادة وسط الأطفال دون الخامسة بمستشفى الفاشر التعليمي 2009م

القسم الأول: العوامل الاجتماعية والاقتصادية:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1-</td>
<td>اسم الطفل:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-</td>
<td>العمر</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-</td>
<td>الجنس:</td>
<td>ذكر ( )</td>
<td>أنثى ( )</td>
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</tr>
<tr>
<td>4-</td>
<td>السكن</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5-</td>
<td>عدد أفراد الأسرة:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>عائلة ( )</td>
<td>أ- 3 أفراد</td>
<td>ب- 4-6 ( )</td>
<td>ج- 7-9 ( )</td>
</tr>
<tr>
<td></td>
<td>أكثر من 10 ( )</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6-</td>
<td>المستوى التعليمي للأم:</td>
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<tr>
<td></td>
<td>أمي ( )</td>
<td>ب- خلوة ( )</td>
<td>ج- ابتدائي ( )</td>
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<td>د- ثانوي ( )</td>
<td>د- جامعي ( )</td>
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<td>7-</td>
<td>مهنة رب الأسرة:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>عامل ( )</td>
<td>ب- موظف ( )</td>
<td>ج- تاجر ( )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>د- مزارع ( )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

78
8- الدخل الشهري للأسرة:

أ- أقل من 200ج ( )
ب- 200-400ج ( )
ج- 400-600ج ( )
د- أكثر من 600ج ( )

القسم الثاني: الممارسات والسلوك

9- مدة رضاعة الطفل:

أ- أقل من 12شهر ( )
ب- 12-17شهر ( )
ج- 18-24شهر ( )
د- أكثر من 24شهر ( )

10- كيف تطمئنين طفلك؟

أ- تدريجي ( )
ب- فجائي ( )

11- هل تعطى الطفل أغذية إضافية؟

أ- نعم ( )
ب- لا ( )

12- في حالة الأجاية (بنعم) ما هي الأغذية التي تعطى للأطفال؟

13- في حالة اصابة الطفل بالإسهال ماذا تفعل؟

أ- الذهاب إلى الطبيب ( )
ب- استخدام العلاج البلدى ( )
ج- أخرى............

14- هل يناسب الإسهال هناك اصابة بأمراض أخرى للطفل؟ أ- نعم ( )

15- إذا كانت الأجاية (بنعم) ما هي هذه الأمراض؟

أ- السل ( )
ب- الحصبة ( )
ج- السعال الديكي ( )
د- التايفويد ( )
ه- شلل الأطفال ( )
و- سوء التغذية ( )

79
ز- الرقاق ( )
- أخرى حدود..................

16- عدد الأيام التي استمر فيها الأسهال؟
أ- 1-3 أيام ( )
ب- 4-7 أيام ( )
ج- أكثر من 7 أيام ( )

17- شكل الأسهال؟
أ- مائي ( )
ب- مخلوط بالدم ( )
ج- عادي ( )

18- هل يعانى الطفل من جفاف؟ نعم أ- ( )
ب- لا ( )
ج- أخرى

19- هل تم اعطاء الطفل محلول الأرواء (ORS) أو أ- ( )
ب- لا ( )
ج- أخرى

20- هل صرف للطفل (ORS) أثناء الزيارة؟ أ- نعم ( )
ب- لا ( )
ج- أخرى

21- ما هي مسببات الأسهال؟
أ- تلوث الطعام ( )
ب- تلوث المياه ( )
ج- أخرى..................

القسم الثالث: العوامل البيئية والاصحاح

22- هل يوجد لديكم مرحاض بالمنزل؟ أ- نعم ( )
ب- لا ( )
ج- أخرى

23- في حالة الإجابة بنعم ما هي نوع المرحاض؟ أ- حفرة ب- مهوا محسن
ج- سايفون

24- في حالة عدم وجود مرحاض بالمنزل أين تقضوا حاجتكم؟
أ- في العراء ( )
ب- مرحاض عام بالحى ( )
ج- منزل الجيران ( )