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Risk Factors Associated with Diarrhea among Hospitalized Children in Gaza Governorates: Case Control Study

Ghadeer Abdo Bakry

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Risk Factors Associated with Diarrhea among Hospitalized Children in Gaza Governorates: Case Control Study

Prepared By:

Ghadeer Abdo Bakry

Bachelor in Science of Nursing – Palestine College of Nursing - Palestine

Supervisor: Dr. Yousef Ibrahim Al Jeesh, PhD

Islamic University - Gaza

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Prepared by: Ghadeer Abdo Bakry

Registration No.: 21012319

Supervisor: Dr. Yousef Ibrahim Al Jeesh

Master thesis submitted and accepted. Date. / /

The names of signatures of the examining committee members are as follows:

1. Dr. Yousef Al Jeesh	Head of committee	.....
2. Dr. Yehia Abed	Internal examiner	.....
3. Dr. Nabeel Albarqouni	External examiner	.....

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Dedication

To….

My patient husband who awarded me all of his time to finish this thesis

My precious father, mother, brothers and sisters

My dear son, Rawad

Ghadeer Abdo Bakry

Declaration

I certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed

Ghadeer Abdo Bakry

Date: / /

Acknowledgment

First of all, praise to Allah, the lord of the world, and peace and blessings of Allah be upon the noblest of all Prophets and messengers, our prophet Mohammed, all thanks for Allah who granted me the help and capability to complete this thesis.

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I hope this study could be helpful for the practice and for anyone concerned.

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Abstract

Globally, Diarrhea is the leading cause of burden of disease in children worldwide, it is one of the leading causes of childhood morbidity and mortality in developing countries. This study aimed to know the main risk factors which are associated with diarrhea among hospitalized children in Gaza governorates. The design of this study is case-control, the study sample consisted of 140 children (70 cases and 70 controls). Seventy cases were taken as a stratified cluster sample from Naser Medical Complex and Alnasser Pediatric Hospital, 70 controls were taken from Khanyounis primary health care center and Sheikh Radwan primary health care center. The researcher used an interview questionnaire, face, content validity were done. Different statistical procedures were used for data analysis including cross tabulation, percentages, mean, Chi square test and multiple regression.

By bivariate analysis using Chi-square test was used, the results revealed that there was a significant association between diarrhea and household environmental factors such as (residence, family income per month, source of drinking water, type of toilet facility, p value < 0.05). On the other hand; the results showed that there was no significant association between diarrhea and (main source of water, fuel used for cocking, child's feces disposal method, household animals, number of children less than 5 years at home and number of rooms in the home, p value > 0.05).

Among socio-demographic factors; bivariate analysis using Chi-square test showed that there was a significant association between diarrhea and father age, p value < 0.05 and there was no significant association between diarrhea and (child gender, age of the child, orphaned and vulnerable status, type of family, mother's education level, father's education level, mother age and mother work, p value > 0.05). Also there was a significant association between (Exclusive breast feeding, complementary feeding, number of meals per day and the age of weaning) and diarrhea as p value < 0.05 and there was no significant association between diarrhea and (Immediate breast feeding and replacement feeding) as p value > 0.05.

Bivariate analysis using person's chi-square revealed that there was a significant association between diarrhea and (weight for age z score and height for age z score) as p value < 0.01 and there was no significant association between diarrhea and (head circumference and body mass index) as p value > 0.05.

Multivariate analysis of risk factors of diarrhea in children aged less than 5 years using multiple logistic regression by binary logistic regression, results showed that there was a significant association between diarrhea and (family income, residence, complementary feeding and age of weaning) as p value < 0.05. The results showed that the children who are living in villages have decreased the odds of having diarrhea by 53.2% than children who are living in cities and the children who have families with income of (1800 – 2300 NIS) have decreased odds of having diarrhea by 80.8% than children who have families with income less than 1800 NIS. Also children who didn't take complementary feeding have decreased odds of having diarrhea by 59.0% and children with increase in one month of weaning age, will have a decrease 1.058 times the odds to have diarrhea

The study concluded that the residence, family income, complementary feeding and age of weaning are risk factors for diarrhea among children less than 5 years in Gaza Strip. The results of the study imply the need for paying the attention for whom who have low income families and for whom who weren't naturally breast fed.

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List of Abbreviations

BLS	Bureau Labor of Statistics
BMI	Body Mass Index
DHS	Demographic and Health Survey
EGH	European Gaza Hospital
GS	Gaza Strip
MOH	Ministry of Health
NCDDP	National Clinical Dataset Development Programme
NIS	New Israeli Shekel
NGOs	Non Governmental Organization
OVC	Orphaned and Vulnerable Children
PPCBS	Palestinian Central Bureau of Statistics
PHC	Primary Health Care
RCTs	Randomized Clinical Trials
UK	United Kingdom
UNICEF	United Nations Children's Fund
UNRWA	United Nations Relief and Works Agency
WB	West Bank
WHO	World Health Organization

Chapter one

1.1 Introduction

Diarrhea is the second leading cause of death in children under five years old, and is responsible for killing 1.5 million children every year, most people who die from diarrhea actually die from severe dehydration and fluid loss. Children who are malnourished or have impaired immunity are most at risk of life-threatening diarrhea, it is usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person-to-person as a result of poor hygiene (WHO, 2008). Diarrheal disease is treatable with a solution of clean water, sugar and salt, and with zinc tablets. In developing countries, children under three years old experience on average three episodes of diarrhea every year. Each episode deprives the child of the nutrition necessary for growth. As a result, diarrhea is a major cause of malnutrition, and malnourished children are more likely to fall ill from diarrhea (WHO, 2008).

Under nutrition among children is usually determined by assessing the anthropometric status of the child relative to a reference standard. In assessing a child's nutritional status, three types of under nutrition can be distinguished: wasting or insufficient weight for height indicating acute under nutrition; stunting or insufficient height for age indicating chronic under nutrition; and underweight or insufficient weight for age which could be a result of either or both. Wasting, stunting, and underweight for a child are typically determined by using a Z-score which is obtained by dividing the difference between the observed value and the median reference value with the standard deviation of a reference population (WHO, 2006). There exists a significant association between malnutrition and diarrhea (Lima, A. and et al, 2000).

1.2 Research problem

Globally, diarrhea occurs world-wide and causes 4% of all deaths and 5% of health loss to disability; it is most commonly caused by gastrointestinal infections, worldwide, 19% of all deaths in children under five years old are attributed to diarrheal diseases, a total of 1.87 million deaths in 2004 (Pinto and et al, 2008). In United States (US) 1.4 per person per year have episodes of acute diarrhea (World Gastroenterology Organization, 2008). In developing countries, diarrhea is considered the major killer among the poor people. In 1998, diarrhea was estimated to have killed 2.2 million people, most of whom were under 5 years of age (WHO, 2000). In Egypt, with its population of about 60 million in1995, 10% are children less than 5 years are suffering from an average 3 bouts of acute diarrhea annually (National Clinical Dataset Development Programme {NCDDP}, 1996). Clearly, many factors have been found in other studies to play a role in diarrheal disease in children under five, these factors need to be explored thoroughly in Gaza hospitals which have been shown to have an increase in diarrhea cases. There are approximately four billion cases of diarrhea worldwide each year; it is an important area of significantly reduced by appropriate interventions and treatment. Diarrhea is usually self-limiting (Iyun and Oke, 2000), but can lead to severe dehydration or death, especially in children (WHO, 2009). This problem is common on Gaza strip as the prevalence of diarrhea based on findings of the health survey of the West Bank (WB) and Gaza Strip (GS) reveal that 14% of under the age of five children were reported to have had the episode in the last two weeks preceding the survey, the percentage of dehydration among children suffering from diarrhea is 6% in Gaza Strip. Moreover, this percentage increases most of all among infants aged less than 6 months (23%), compared with other children (PCBS, 2005), There was an obvious increase in the incidence of diarrhea in children less than 3 years during the fourth quarters of the year 2011. In 2011

incidence was 20% (Quarterly Epidemiological Report-Gaza, 2011), this is a dangerous indicator, and no one take this problem into consideration to be solved.

1.3 Justification of the study:

Diarrhea is the leading cause of burden of disease in children worldwide; it is one of the serious childhood diseases with fatal consequences in some cases due to exposure of the child to dehydration and malnutrition. According to the Palestinian Central Bureau of Statistics (PCBS) in 2006, there are about 30 thousands of children under five years suffering from chronic malnutrition and expected to more deterioration due to the shortage of food staff and pollution of water sources that will increase the prevalence of diarrhea, it is expected to find newly infant deaths due to diarrhea and dehydration due to shortage of medications, moreover, diarrhea is expected to exceed 15% among under five children despite it was excluded from main causes of deaths (PCBS, 2006). Based on what the researcher have seen; there are many children under five years old attending governmental hospitals due to diarrhea, those children need many research to know the risk factors leading to the disease, there is currently limited information on the risk factors of diarrhea among children in Gaza, to the best of the researcher's knowledge; this study is the first to be conducted in Gaza. In this study further analysis with the aim of exploring factors associated with diarrhea will be done among children aged less than five years, the results will be useful in making recommendations to public health policy makers and for comparisons with studies conducted elsewhere in the world to strengthen the available information in this field.

1.4 General aim of the study:

The general aim of this study is to know the main risk factors which are associated with diarrhea among hospitalized children in Gaza governorates.

1.4.1 Specific objectives:

1. To identify the main risk factors which are associated with diarrhea among hospitalized children in Gaza governorates.
2. To identify the association between socio-demographic factors and diarrhea among case and control group.
3. To explore the association between diarrhea and household environment among case and control group.
4. To identify the association between diarrhea and other factors such as (nutritional status and feeding practices among children under five years).
5. To suggest recommendations for mothers, care givers and policy makers to prevent diarrhea among children.

1.5 Questions of the study:

1. What are the main risk factors which are associated with diarrhea among children in Gaza governorates?
2. Are there significant associations between Child's socio-demographic factors such as (age of child, gender, status e.g. orphan and vulnerable status, parent's age, parents educational level, type of family) and diarrhea among children in Gaza governorates?
3. Is there significant association between family income, type of fuel used for cocking and diarrhea among children in Gaza governorates?
4. Is there a significant association between method of disposal of child's feces, type of toilet facility, household animals and diarrhea among children in Gaza governorates?
5. Is there a significant association between residence, source of drinking water, number of children under five in the home and diarrhea among children in Gaza governorates?
6. Is there a significant association between diarrhea and weight for age z score?

7. Is there a significant association between diarrhea and height for age z score?
8. Is there a significant association between diarrhea and feeding practices?
9. Are there significant associations between child's health status such as previous hospitalization and diarrhea among children in Gaza governorates?

1.6 Context of the study

1.6.1 Demography and population

1.6.1.1 Gaza Strip

The Palestinian territories consist of two geographically separated areas West Bank (WB) and Gaza Strip. Gaza strip is a narrow zone of land bounded of the south by Egypt, on the west by the Mediterranean Sea, and on the east and north by the occupied territories in 1948 (PCBS, 2010). Gaza Strip is very crowded place with 46 kilometers long and 5 –12 kilo-meters wide and with a total area of 365 sq km. Gaza strip is administratively divided into five governorates: North, Gaza, Mid-zone, Khan-Younes and Rafah. It consists of four cities, fourteen villages and eight refugees' camps. Gaza Strip has a population of 1.561.906 people. Male/Female ratio in general population is 103.100, population density is 4279 inhabitants per sq km. Gaza Strip has an extremely high population growth rate of over 3.3%, and as a result some 44.2% of the population is under the age of 15 (PCBS, 2010).

In WB, the number of population approximately 2.654.725 millions; 1.27 million males and 1.24 million females. with population density 422 square kilometers spread over 11 provinces. The province of Jerusalem were the highest population density where the estimated population density of about 1.117 people per square kilometer while Jericho governorate was the least density about 77 people per square kilometer (MOH, 2011).

1.6.1.2 Socioeconomic status

The Palestinian economy refers to the economy of the Palestinian territory; including GS, WB and East Jerusalem. Current political events have severely damaged the Palestinian economy due to halting the international aid.

MOH (2004) reported that, Gaza Strip is considered one of the lowest incomes in the Middle East area. The majority of the income comes from salary of the employees and security persons, while the agriculture products share by reasonable portion in the economy. The economy nowadays mainly depends on international donors that are suspended. International aids were funding some projects and paid the salaries. The economic situation is usually especially after Al-Aqsa Intifada because of frequent closure and restriction of trade. The deteriorating economic situation, limited income and lack of work opportunities lead to low standard of living and inadequate health facilities which lead to chronic malnutrition among children, about 15 child per 100 one are suffering from stunting, in addition to the water in GS, its contaminated water and its consumption average for one person reached 91 liter daily in comparison with 242 liter for one israelian person (MOH, 2010). Despite poverty, the Palestinians are eager to learn, adult literacy ratio among those aged 15 years and more is 91%, which is considered among the high percentage literacy rates of Arab countries (MOH, 2004). In 2007, the unemployment rate among males in Gaza Strip was higher than the unemployment rate among females, while in the West Bank it was higher for females than males. Over one half (57%) of household were living under poverty line which is 3.18 $ per person daily. The rate of participation in the labor force in the West bank decreased from 45.2% in 1997 to 41.1% in 2007 and decreased in the Gaza strip from 40.0% in 1997 to 36.6% in 2007 (Palestinian Central Bureau of Statistics, 2007).

According to the Palestinian Central Bureau of Statistics, (2010), the percentage of unemployed people in Palestine in the first half of 2010 about 22%, where the percentage in GS was 33.9%, while in the WB was 16.5%.The unemployment rate reached the highest in Palestine compared to surrounding countries such as Jordan and Israel, where the percentage was in Jordan, about 12.9% in 2009 and 7.2% in Israel in the 1st quarter of 2010 (PCBS, 2010).

1.6.2 Palestinian Health Care System:

The Palestinian Health Care System (PHCS) is consists of four major providers: Ministry of Health (MOH), United Nation Relief and Work Agency (UNRWA), Non-Governmental Organizations (NGOs) and for profit private sector (WHO, 2008).The main provider MOH is operating 25 hospitals and 453 PHC facilities, 394 in WB and 59 in GS(MOH, 2010). Another main component UNRWA is operating 51 PHC facilities (MOH, 2010).

1.6.2.1 PHC center:

Primary health care (PHC) is a major component of Palestinian health care system. PHC provides preventive, promotional, curative and rehabilitative health care to all Palestinian people especially for children and other vulnerable groups through MOH, UNRWA, non-governmental and private centers. PHC centers try to offer accessible and affordable health services for all Palestinians regardless of geographical locations. According to MOH policy, PHC centers classified from level I to level IV according to health services they provide which include:

- Child's health including the care of child at birth, and immunization;

- Women's health including prenatal care, high risk pregnancy, family planning and reproductive health;
- Nutrition and micronutrient deficiencies, including breast feeding;
- Communicable and non-communicable disease control including control of diarrhea diseases, acute respiratory infections, brucellosis and others;
- School health;
- Health promotion and education;
- Environmental health
- Curative care for children and adults with provision of essential drugs in the PHC centers including medical emergency and chronic diseases;
- Oral preventive and curative health care; and
- Diagnostic services including laboratory and x- ray.

At the end of 2011, the total number of PHC centers in the GS were 54 centers guided by MOH, 20 centers guided by UNRWA and many other centers guided by (non-governmental organizations) NGOs (PCBS, 2010).

1.6.2.2 Ministry of Health

In Gaza Strip, the secondary healthcare is provided by the governmental, non-governmental and private hospitals. The MOH is responsible for a significant portion of the secondary healthcare of general and specialized hospital beds. According to Palestinian health information center in GS (PHIC-G), there was a total of 29 hospitals at the end of 2010 (13 guided by MOH, 13 by NGOs and 3 by Military cervices) (Annual Epidemiological Report Gaza Strip, 2011).

1.6.2.2.1 Naser Medical complex

Nasser Medical Complex (NMC), contain two hospitals: Nasser (medical and surgery) and Mubarak hospital (obstetrics and women, and children), it has two pediatric departments, the clinical capacity is a total of 258 beds. The complex is situated in the western area of Khanyounis, which was built in 1958 on an area of 50000 m2, and serves the area of Khanyounis, with a population of 270,979 inhabitants (MOH, 2009).

1.6.2.2.2 Alnasser Hospital

Nasser pediatric hospital offers pediatric services, and clinical capacity with 151 beds, located in Nasr district in Gaza city which was built in 1962 on an area 4400 m2, And serves the area coverage of the province of Gaza from Wadi Gaza, south, until the neighborhood of Sheikh Radwan north, and with a population of 496,411 inhabitants (MOH, 2009).

1.6.2.2.3 Other hospitals:

Al Shifa is a medical complex includes three hospitals: the surgery hospital, medical, obstetrics & gyna hospital, the clinical capacity is a total of 500 beds. It is located in the central west of Gaza City, it was built in 1946 on an area of 42000 m2, and serves the area of coverage of the Gaza province with a population of 496,411 people in particular, and the Gaza Strip in general (MOH, 2009). European Gaza Hospital (EGH) located in the southern Gaza Strip, located in the south-eastern town of Khanyounis area, which was built in 1987 on an area of 65,000 m2, provide medical, surgical, and pediatric services (medical and surgical pediatric department and SCBU). The total clinical capacity is about 207 beds. The hospital serves the east area of Khanyounis and the northern area of Rafah. Dr. Abdel Aziz Rantisi Pediatric hospital provides specialized medical services for children, and the clinical ability of the current operating stage is about 49 bed, located in Nasr district, start working in

2008. Aqsa Martyrs Hospital provides medical, surgical, pediatric, and women and obstetrics services, the clinical capacity is about 103bed, located in the middle governorate of Deir Al-Balah, it has been built in 2001 on an area of 4000 m2, serves the segment of the population living in the central Gaza governorate with a population of 205,535. Al Emaraty Crescent hospital is a specialized hospital of gynecology and obstetrics services, the clinical capacity of about 40 beds, located in the Tel Sultan-Rafah, built in the year 2000 on an area of 4000 m2, and serves the segment of the population living in Rafah governorate with a population of 173,372. Mohamed Al-Durra hospital for Children, has the capacity of 72 bed, located in Gaza and it was established on the year 2000 on an area of 1600 m2.

Kamal Adwan Hospital is an agencies hospital provides surgical, pediatrics and medical services, with a clinical capacity 73 beds which was built in 2002 on an area of 5000 m^2, and serves the segment of the population living in the northern Gaza Strip with a population of 270,246 people. **BeitHanoun hospital** provides surgical, pediatric and medical services, the clinical capacity is the total of 36 beds, located in the center of the town of BeitHanoun, built in 2006 on an area of 2500 m^2, has two operating rooms (MOH, 2009). Psychiatric Hospital is a hospital specializes in providing psychiatric services located in Gaza. **Abu Yousef Al Najjar Martyr Hospital** is a hospital that provides medical, surgical, and pediatric services, with clinical capacity of 40 beds, located in the district of Rafah, it has been built in 2000 on an area of 4000 m2, and serves the segment of the population living in the Rafah governorate with a population of 173,372 people (MOH, 2009).

1.6.2.2.4 Laboratories

The laboratory services in Gaza Strip (GS) are offered to the Palestinian people mainly through MOH and UNRWA at three levels: Central, Intermediate, and Peripheral. According to PHIC-G, there were a total of 51 laboratories at the end of 2010 guided by MOH (11

hospital laboratories, 38 PHC laboratories, 1 central laboratory and 1 public health laboratory), in addition to 20 PHC laboratories were guided by UNRWA. Many other laboratories are guided by non-governmental organizations (NGOs).

1.7 Operational definition of variables

1.7.1 Diarrhea

Defined as the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual. It is usually a symptom of gastrointestinal infection, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person to person as a result of poor hygiene. Severe diarrhea leads to fluid loss, and may be life-threatening, particularly in young children and people who are malnourished or have impaired immunity (WHO, 2012).

1.7.2 Risk Factors

A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury, but is not necessarily causal factor. Some examples of the more important risk factors are underweight, gender, high blood pressure, tobacco and alcohol consumption, and unsafe water, sanitation and hygiene (WHO, 2012)**.**

1.7.3 Hospitalized child

A child who has the age of five and under and being admitted to Naser Medical Complex and/or Alnasser Hospital due to diarrhea.

Chapter two

Conceptual framework and literature review

2.1 Conceptual framework

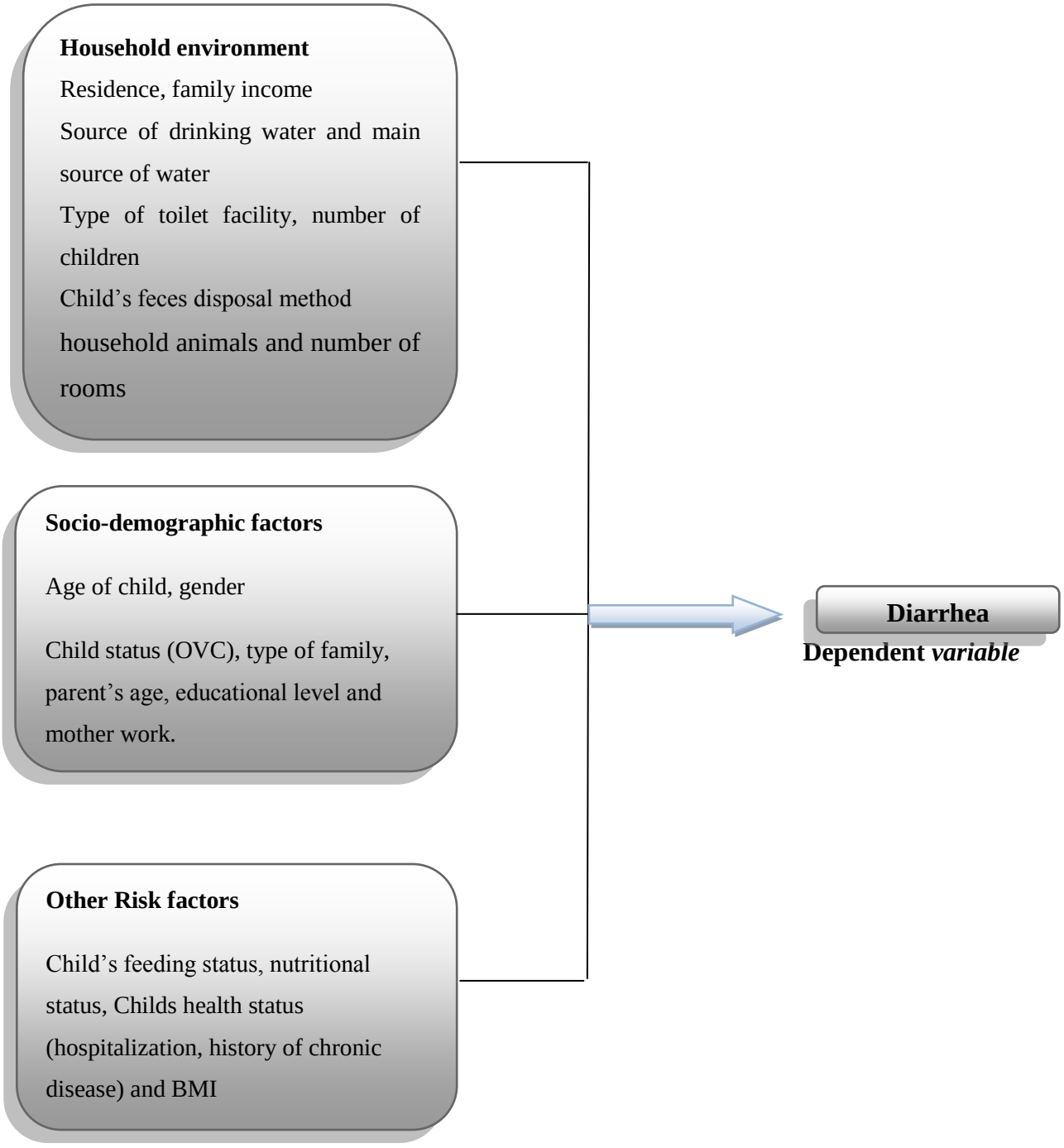

Figure (2.1): Conceptual framework

The preceding conceptual framework consists of three dimensions as shown, each dimension represent multi variables to measure the associated factors as elucidated below:

2.1.1 Household factors as:

2.1.1.1 Residence referred to the location of household: city, village and camp.

2.1.1.2 Family income (less than 1800 NIS, {1800-2300} NIS, more than 2300 NIS and no income or no employment).

2.1.1.3 Materials used for household construction such as, access to drinking water and water for general usage, and nature of sanitation facilities.

2.1.1.4 Treatment of drinking water: treated or not, shortage of clean water for drinking, cooking and cleaning.

2.1.1.5 Number of children under five referred to all children in the household who were aged less than five years old.

2.1.1.6 Type of toilet facility; classified into improved or unimproved sanitation facility: Improved facilities included flush/pour toilets connected to a sewage system, tanks or pit latrines; and pit latrines with slabs. Unimproved facilities included use of flush or pour flush to rivers or canals, pit latrines without slabs or no facilities (using bush or field).

2.1.1.7 Method of disposal of child's feces referred to what was done to dispose of stool the last time a child passed it; classified as safe or unsafe. Safe method such as: using toilet, putting feces into a flush toilet connecting to a piped to sewage system. Unsafe method such as putting the feces in garbage or leaving it in the open area.

2.1.1.8 Type of fuel used for cocking classified as clean or unclean. Clean fuel such as electricity liquid gas. Unclean include charcoal, kerosene and wood.

2.1.2 Child's socio-demographic factors:

2.1.2.1 Child status: orphan, vulnerable and neither orphan nor vulnerable (OVC). The child is considered orphan if one or both of his/her parents are dead, vulnerable child whose one parents is sick for at least 3 months in the past 12 months (chronically ill) (Smart, 2003).

2.1.2.2 Father and mother educational level; classified as: primary, secondary and university.

2.1.2.4 Types of family:

2.1.2.4.1 A nuclear family often called the traditional family. It is consists of a mother, father, and their biological or adoptive descendants. It can be a fostering environment in which to hoist children as long as there is love, time spent with children, emotional support, low stress, and a constant economic upbringing.

2.1.2.4.2 Extended family can be found all over the world in different communities and countries. It is consist of two or more adults from unlike generations of a family, who share a household. It consists of more than parents and children; it may be a family that includes parents, children, cousins, aunts, uncles, grandparents, foster children. At times children are raised by their grandparents when their biological parents have died or no longer can take care of them.

2.1.3 Risk factors of diarrhea

2.1.3.1 Child feeding practices; classified as: exclusive breast feeding, complementary feeding and replacement feeding.

2.1.3.1.1 Exclusive breast feeding; referred to the children who receive only breast milk or breast milk and vitamins, mineral supplements and medicines.

2.1.3.1.2 Complementary feeding; referred to the children who receive breast milk and solid or semi solid food.

2.1.3.1.3 Replacement feeding (weaned); referred to children who aren't receiving breast milk.

2.1.3.2 Nutritional status; classified as weight for age, height for age and weight for height

2.1.3.2.1 Weight for age z-score is a nutritional status indicator of weight and age of a child expressed in standard deviation from the median of the national center for health statistics- Centre for Disease and Control (NCHS-CDC) reference population, classified as less than 2 standard deviation (SD) and considered as underweight, and 2 or more SD (CDC, 2011).

2.1.3.2.2 Height for age z-score is a nutritional status indicator of height and age of a child expressed in standard deviation from the median of the (NCHS-CDC) reference population, classified as less than 2 standard deviation (SD) and considered as stunted, and 2 or more SD (CDC, 2011).

2.1.3.2.3 Body mass index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems (CDC, 2011). It is categorized according to WHO standards as follow:

- 18.5 and Less than considered as Underweight
- (18.5 - 24.9) considered as Normal
- (25 - 29.9) considered as Pre-obese
- (30 - 34.9) Obese class I
- (35 - 39.9) Obese class II
- 40 and more Obese class III

2.1.3.3 Child health status e.g., previous hospitalization.

2.2 literature review

2.2.1 Epidemiological background

Diarrheal disease accounts for approximately 1.3 million deaths annually in children under five years of age, it is the second most common cause of death in young children after pneumonia, with about 2 billion cases of diarrheal diseases globally every year, there is an urgent need for safe and affordable anti-diarrheal drugs to be used in conjunction with oral rehydration therapy (ORT) (One World Health, 2012).

In the year 2000, diarrheal diseases claimed an estimated 1.4 to 2.5 million lives; they are among the leading causes of death in children in developing countries (World Gastroenterology Organisation, 2008). Both the incidence and the risk of mortality from diarrheal diseases are greatest among children younger than 1 year of age, and thereafter rates decline incrementally. Other direct consequences of diarrhea in children include malnutrition, diminished growth, and impaired cognitive development in resource-limited countries (World Gastroenterology Organisation, 2008). In industrialized countries, relatively few patients die from diarrhea, but it continues to be an important cause of morbidity and incurs substantial health-care costs (table 2.1).

Diarrheal diseases are one of the leading causes of childhood morbidity and mortality in developing countries. An estimated 1,000 million episodes occur each year in children under 5 years of age. Diarrhea causes an estimated 5 million deaths in children under 5 years of age per year, about 80% of these deaths occur in children in the first 2 years of life, approximately one third of deaths among children under five are caused by diarrhea (Snyder and Merson, 1982). Diarrhea is considered the third leading cause of infant deaths (Philippine Health Statistics, 1986). Less than half of all children with persistent diarrhea have a recognized enteric pathogen in their feces. Enteropathogens that are isolated with greater

frequency from episodes of persistent diarrhea include enteroadherent E. coli, enter pathogenic E. coli and cryptosporidium, the mechanisms by which these agents cause persistent diarrhea is probably related to their capacity to adhere to or invade the bowel mucosa (WHO, 1989).

Table 2.1: Epidemiology of acute diarrhea: developed versus developing countries

Per year	Estimated episodes of acute diarrhea	Hospitalizations	Deaths
United States	375 million — 1.4 episodes per person per year	900 000 total	6000 total
	> 1.5 million child outpatient visits	200 000 children	300 children
Worldwide	1.5 billion episodes		1.5–2 million children < 5 y
Pine College	In developing countries, children < 3 y have 3 episodes per year		

Source: World Gastroenterology Organisation (2008)

During the past three decades, factors such as the widespread distribution and use of oral rehydration solutions (ORS), improved rates of breastfeeding, improved nutrition, better sanitation and hygiene, and increased coverage of measles immunization have contributed to a consistent decline in the mortality rate in developing countries (CDC, 2003). The morbidity from diarrhea has remained relatively constant during the past two decades, with each child under 5 years of age experiencing an average of three annual episodes. ORS and nutritional improvements probably have a greater impact on mortality rates than the incidence of diarrhea (Fig.1). Interventions such as breastfeeding and improved sanitation are expected to affect mortality and morbidity simultaneously (Cincinnati Children's Hospital Medical Center, 2006).

2.2.2 Definition of diarrhea

Acute diarrhea is defined as an abnormally frequent discharge of semisolid or fluid fecal matter from the bowel, lasting less than 14 days (World Gastroenterology, 2012).

Is a three or more loose or watery stools per day or a definite decrease in consistency and increase in frequency based upon an individual baseline (Wanke, 2006).

The passage of three or more loose or liquid stools per day, or more frequently than its normal for the individual, it is usually a symptom of gastrointestinal infection, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person to person as a result of poor hygiene (WHO, 2008).

The U.S. National Institutes of Health (NIH) defines diarrhea as loose, watery stools occurring more than three times a day. The term acute diarrhea is used to describe an episode lasting less than three weeks. Persistent diarrhea is an episode that lasts more than fourteen days, and chronic diarrhea is the term for recurring episodes of diarrhea. Dysentery is diarrhea that contains blood. The severity of diarrhea ranges from asymptomatic to severe dehydration resulting in death.

Diarrhea reflects increased water content of the stool, whether due to impaired water absorption and/or active water secretion by the bowel. In severe infectious diarrhea, the number of stools may reach 20 or more per day, with defecation occurring every 20 or 30 minutes. In this situation, the total daily volume of stool may exceed two liters, with resultant volume depletion and hypokalemia. Most patients with acute diarrhea have three to seven movements per day with total stool volume less than one liter per day. When diarrhea lasts

for 14 days it can be considered persistent; the term chronic generally refers to diarrhea that lasts for at least one month (DuPont, 1997).

2.2.3 Pathophysiology of Diarrhea

There are numerous causes of diarrhea, but in almost all cases, this disorder is a manifestation of one of the four basic mechanisms described below. It is also common for more than one of the four mechanisms to be involved in the pathogenesis of a given case.

2.2.3.1Osmotic Diarrhea

Absorption of water in the intestines is dependent on adequate absorption of solutes. If excessive amounts of solutes are retained in the intestinal lumen, water will not be absorbed and diarrhea will result. Osmotic diarrhea typically results from one of two situations:

- *Ingestion of a poorly absorbed substrate:* The offending molecule is usually a carbohydrate or divalent ion. Common examples include mannitol or sorbitol, epson salt ($MgSO_4$) and some antacids ($MgOH_2$).
- *Malabsorption:* Inability to absorb certain carbohydrates is the most common deficit in this category of diarrhea, but it can result virtually any type of malabsorption. A common example of malabsorption, afflicting many adults humans and pets is lactose intolerance resulting from a deficiency in the brush border enzyme lactase. In such cases, a moderate quantity of lactose is consumed (usually as milk), but the intestinal epithelium is deficient in lactase, and lactose cannot be effectively hydrolyzed into glucose and galactose for absorption. The osmotically-active lactose is retained in the intestinal lumen, where it "holds" water. To add insult to injury, the unabsorbed lactose passes into the large intestine where it is fermented by colonic bacteria, resulting in production of excessive gas. A distinguishing feature of osmotic diarrhea is that it stops after the patient is fasted or stops consuming the poorly absorbed solute (Bowen, 2006).

2.2.3.2 Secretory diarrhea

Large volumes of water are normally secreted into the small intestinal lumen, but a large majority of this water is efficiently absorbed before reaching the large intestine. Diarrhea occurs when secretion of water into the intestinal lumen exceeds absorption. The responsible organism, *Vibrio cholerae*, produces cholera toxin, which strongly activates adenylyl cyclase, causing a prolonged increase in intracellular concentration of cyclic adenosine monophosphate (AMP) within crypt enterocytes. This change results in prolonged opening of the chloride channels that are instrumental in secretion of water from the crypts, allowing uncontrolled secretion of water. Additionally, cholera toxin affects the enteric nervous system, resulting in an independent stimulus of secretion. Exposure to toxins from several other types of bacteria (e.g. E. coli heat-labile toxin) induce the same series of steps and massive secretory diarrhea that is often lethal unless the person or animal is aggressively treated to maintain hydration. In most cases, secretory diarrheas will not resolve during a 2-3 day fast (Bowen, 2006).

2.2.3.3 Inflammatory and Infectious Diarrhea

The epithelium of the digestive tube is protected from insult by a number of mechanisms constituting the gastrointestinal barrier, but like many barriers, it can be breached. Disruption of the epithelium of the intestine due to microbial or viral pathogens is a very common cause of diarrhea in all species. Destruction of the epithelium results not only in exudation of serum and blood into the lumen but often is associated with widespread destruction of absorptive epithelium. In such cases, absorption of water occurs very inefficiently and diarrhea results. Examples of pathogens frequently associated with infectious diarrhea include:

- Bacteria: *Salmonella, E. coli, Campylobacter*
- Viruses: rotaviruses, coronaviruses, parvoviruses (canine and feline), norovirus

- Protozoa: coccidia species, *Cryptosporium*, *Giardia*

The immune response to inflammatory conditions in the bowel contributes substantively to development of diarrhea. Activation of white blood cells leads them to secrete inflammatory mediators and cytokines which can stimulate secretion, in effect imposing a secretory component on top of an inflammatory diarrhea. Reactive oxygen species from leukocytes can damage or kill intestinal epithelial cells, which are replaced with immature cells that typically are deficient in the brush border enzymes and transporters necessary for absorption of nutrients and water. In this way, components of an osmotic (malabsorption) diarrhea are added to the problem (Bowen, 2006).

2.2.3.4 Diarrhea associated with deranged motility

In order for nutrients and water to be efficiently absorbed, the intestinal contents must be adequately exposed to the mucosal epithelium and retained long enough to allow absorption. Disorders in motility than accelerate transit time could decrease absorption, resulting in diarrhea even if the absorptive process was proceeding properly. Alterations in intestinal motility (usually increased propulsion) are observed in many types of diarrhea. What is not usually clear, and very difficult to demonstrate, is whether primary alterations in motility are actually the cause of diarrhea or simply an effect (Bowen, 2006).

2.2.4 Clinical manifestations and diagnosis

Despite clinical clues, determining the causative agent of diarrhea in an individual patient on the basis of clinical grounds alone is usually difficult (Wingate and *et al*, 2001).

Acute diarrhea: presence of three or more loose, watery stools within 24 hours.

Dysentery: bloody diarrhea, visible blood and presence of mucus.

Persistent diarrhea: episodes of diarrhea lasting more than 14 days.

2.2.5 Episodes of diarrhea can be classified into three categories

Fever: common and associated with invasive pathogens.

Bloody stools: invasive and cytotoxin releasing pathogens, suspect infection in the absence of fecal leukocytes and not with viral agents and enterotoxins releasing bacteria.

Vomiting: frequently in viral diarrhea and illness caused by ingestion of bacterial toxins (e.g., S. aureus) (World Gastroenterology Organisation, 2008).

2.2.6 Diarrhea in Gaza Strip

During the first quarter 2012, the diarrheal disease situation was improved comparing with the previous quarter. A total of 20110 cases of diarrhea were notified during this period, representing almost the same reported number (20333 cases) during the same quarter 2011. The usual seasonal variation was seen during this quarter and the numbers of notifications were more among age group less the three years (Quarterly Epidemiological Report-Gaza, 2012).Water access was from the first predictors of diarrhea among attendance for diarrhea in primary health care centers in Gaza strip(OR: 0.046; 95% CI: 0.005-0.454; P=0.0083), poultry or rabbits at home, and presence of cooker at home. A bacterial cause was found in 5.5% (7) and Giardia duodenal is in 20% (Abouteir and *et al*., 2011).

2.2.6.1 Diarrhea in children less than 3 years

There is mild decrease in incidence during the first quarter 2012. During this quarter a total of 11.116 cases were reported which constitute an incidence of 0.67%. During the same quarter 2011, a total of 12.100 cases were reported with an incidence of 0.76%. The majority of cases were reported in Khanyounis governorate, which follow the same distribution as during the year of 2011 (Quarterly Epidemiological Report-Gaza, 2012). Various common enteropathogens (viral, bacterial and parasites) associated with diarrhea were investigated by

conventional and molecular techniques, polymerase chain reaction (PCR) in 150 children less than 5 years of age admitted to the Central Pediatric Hospital, Gaza Strip, Palestine, the occurrence of enteropathogens identified was as follows: rotavirus 42/150 (28%), Entamoeba histolytica/dispar 23/150 (15%), Shigella spp. 9/150 (6%), Campylobacter coli/jejuni and Escherichia coli O157:H7 7/150 (5%) each, Salmonella spp. 3/150 (2%), Giardia intestinalis 1/150 (1%), and Strongyloidesstercoralis 1/150 (1%) of the samples (Abu-Elamreen and *et al*., 2008).

2.2.6.2 Diarrhea in children more than 3 years

During the first quarter 2012, a total of 7.419 cases were reported with an incidence of 0.45%. During the same quarter 2011, a total of 6.964 cases were reported with an incidence of 0.44%. This almost showed the same incidence. The majority of cases were reported in the North governorate. The number of reported cases in Mid-Zone governorate is decreasing since February (Quarterly Epidemiological Report-Gaza, 2012).

2.2.6.3 Bloody diarrhea in Gaza Strip

During the first quarter 2012, a total of 1.575 cases were reported with an incidence of 0.1%. During the same quarter 2011, a total of 1.269 cases were reported with an incidence of 0.08%. Since the beginning of this quarter, a decrease of reported cases were noticed especially in January. The high incidence which was reported during the fourth quarter 2011, returned to the usual incidence. Since the fourth quarter 2011, the highest reported incidence was in Mid-Zone governorate. During February, the incidence decreased but during march there was slightly increase in the incidence (Quarterly Epidemiological Report-Gaza, 2012).

2.2.7 Treatment of diarrhea

2.2.7.1 Rehydration

Oral rehydration therapy (ORT) is the administration of fluid by mouth to prevent or correct dehydration that is a consequence of diarrhea. ORT is the standard for efficacious and cost-effective management of acute gastroenteritis, also in developed countries. Oral rehydration solution (ORS) is the fluid specifically developed for ORT. A more effective, lower-osmolarity ORS (with reduced concentrations of sodium and glucose, associated with less vomiting, less stool output, and a reduced need for intravenous infusions in comparison with standard ORS) has been developed for global use. The hypotonic WHO-ORS is also recommended for use in treating adults and children with cholera. ORT consists of:

• Rehydration — water and electrolytes are administered to replace losses.

• Maintenance fluid therapy (along with appropriate nutrition) (WHO 2005).

In children who are in hemodynamic shock or with abdominal ileus, ORT may be contraindicated. For children who are unable to tolerate ORS via the oral route (with persistent vomiting), nasogastric feeding can be used to administer ORS. Global ORS coverage rates are still less than 50%, and efforts must be made to improve coverage (WHO 2005).Oral rehydration should be taken by patient in small, frequent volumes (spoonfuls or small sips for toddlers; small volumes in bottles for infants, paced to mimic sipping); For rapid realimentation, an age-appropriate, unrestricted diet is recommended as soon as dehydration is corrected. For breastfed infants, nursing should be continued. Additional ORS or other rehydration solutions should be administered for ongoing diarrheal losses (CDC, 2008).

2.2.7.2 Supplemental zinc therapy, multivitamins, and minerals

This is for all children with diarrhea: 20 mg zinc for 14 days. Zinc deficiency is widespread among children in developing countries. Micronutrient supplementation — supplementation treatment with zinc (20 mg per day until the diarrhea ceases) reduces the duration and severity of diarrheal episodes in children in developing countries. Supplementation with zinc sulfate (2 mg per day for 10–14 days) reduces the incidence of diarrhea for 2–3 months. It helps reduce mortality rates among children with persistent diarrheal illness. Administration of zinc sulfate supplements to children suffering from persistent diarrhea is recommended by the WHO. All children with persistent diarrhea should receive supplementary multivitamins and minerals each day for 2 weeks. Locally available commercial preparations are often suitable; tablets that can be crushed and given with food are least costly. These should provide as broad a range of vitamins and minerals as possible, including at least two recommended daily allowances (RDAs) of folate, vitamin A, zinc, magnesium, and copper (WHO 2005).

2.2.7.3 Diet

The practice of withholding food for > 4 hours is inappropriate. Food should be started 4 hours after starting ORT or intravenous fluid. The notes below apply to adults and children unless age is specified. Give the following:

• An age-appropriate diet — regardless of the fluid used for ORT/maintenance

• Infants require more frequent breast feedings or bottle feedings — special formulas or dilutions unnecessary

• Older children should be given appropriately more fluids

• Frequent, small meals throughout the day (six meals/day)

• Energy and micronutrient-rich foods (grains, meats, fruits, and vegetables)

• Increasing energy intake as tolerated following the diarrheal episode

Avoid the following:

• Canned fruit juices — these are hyperosmolar and can aggravate diarrhea (WHO 2005).

2.2.7.4 Antimicrobials

Antimicrobial therapy is not usually indicated in children. Antimicrobials are reliably helpful only for children with bloody diarrhea (most likely shigellosis), suspected cholera with severe dehydration, and serious non intestinal infections (e.g., pneumonia). Antiprotozoal drugs can be very effective for diarrhea in children, especially for Giardia, Entamoeba histolytica, and now Cryptosporidium, with nitazoxanide (WHO 2005).

2.2.8 Prevention of diarrhea

Water, sanitation, and hygiene including; safe water, sanitation such as houseflies can transfer bacterial pathogens and hygiene such as hand washing (WHO 2005).

2.2.8.1 Safe food

• Cooking eliminates most pathogens from foods

• Exclusive breastfeeding for infants

• Weaning foods are vehicles of enteric infection

Micronutrient supplementation: the effectiveness of this depends on the child's overall immunologic and nutritional state; further research is needed (WHO, 2005).

2.2.8.2 Vaccines

- **Rotavirus vaccine:** is an oral (swallowed) vaccine, not a shot, it will not prevent diarrhea or vomiting caused by other germs, but it is very good at preventing diarrhea

and vomiting caused by rotavirus. Most babies who get the vaccine will not get rotavirus diarrhea at all, and almost all of them will be protected from severe rotavirus diarrhea. Rotavirus vaccine has been used since 2006 in the United States. By 2010 it had reduced the number of babies and young children needing emergency department care or hospitalization for rotavirus disease by about 85%.The doses are recommended at these ages: first dose at 2 months of age, second dose at 4 months of age and the third one at 6 months of age (if needed). The first dose may be given as early as 6 weeks of age, and should be given by age 14 weeks 6 days. The last dose should be given by 8 months of age. This vaccine may be given at the same time as other childhood vaccines (CDC, 2010).

- **Salmonella typhi**: two typhoid vaccines currently are approved for clinical use. No available vaccine is currently suitable for distribution to children in developing countries.
- **Shigella organisms**: three vaccines have been shown to be immunogenic and protective in field trials. Parenteral vaccines may be useful for travelers and the military, but are impractical for use in developing countries. More promising is a single-dose live-attenuated vaccine currently under development in several laboratories (WHO 2005).

2.2.9 Diarrhea in developing countries

Diarrhea is a major cause of death in much of the world, particularly in developing nations, where the effect is greatest among the young. The World Health Organization attributes 3.5 million deaths a year to diarrhea, with 80 percent of these deaths occurring in children under the age of five, and most occurring in children between six months and three years of age. Children are the most susceptible because a smaller amount of fluid, 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 and *et al*, 2000).

2.2.10 Previous studies

A matched case-control study was conducted in the Maternal and Child Health Clinic in Ifakara, Tanzania in year 2000 during the rainy season in order to elucidate the risk factors for and etiology of diarrheal diseases in children less than 5 years of age. Cases (103) and controls (206) were matched for sex and age group. Precoded questionnaires with demographic details, clinical history, and physical signs were completed. Stools samples were collected for bacterial, parasitological, and viral studies. A high number of siblings (odds ratio [OR], 0.86; P = 0.027), the number of siblings surviving (OR, 0.82; P = 0.007), the birth order (OR, 0.85; P = 0.018) and the distance from the house to the water source (OR, 0.33; P = 0.011) were associated with the risk of diarrhea. There were high rates of enteropathogen isolates in stool samples from children without diarrhea (52.23%). Shigella species were the only enteropathogen statistically related with diarrhea (OR, 2.90; P < 0.029). Enterotoxigenic, enteropathogenic, and enteroaggregative strains of Escherichia coli were not related with diarrhea, and neither were Giardia lamblia or Salmonella species (J. Gascon and *et al*, 2000).

A case-control study in children less than five years of age was undertaken in Bahrain between February 1984 to March 1986 to study the aetiology of diarrhoea with special reference to rotavirus. During this period fecal samples were collected from 698 hospitalized and non-hospitalized diarrhea cases and 532 from non-diarrhea controls. Rotavirus was the enteropathogen most commonly detected (20.8%) and represented 68.7% of the total positives from the cases. Percentage rotavirus infection detected in the hospitalized patients was significantly higher than in non-hospitalized cases. Rotavirus was most frequently detected in the age group 6-11 months (26.6%). Rotavirus was not detected at all above 24 months of age. A higher percentage of rotavirus infection was noticed in males up to 11 months. Children of mothers with university education showed a higher level of rotavirus infection (39.3%) in comparison to children of mothers with school level education (20.4%) or no education (19.6%). Rotavirus was detected more often in patients from higher income homes (25.6%) compared to a lower income group (18.2%). No significant difference in rotavirus positivity was noticed between the children of working and non-working mothers. Rotavirus detection in relation to different feeding habits showed no difference. Rotavirus could be detected throughout the year from diarrhea cases in Bahrain and showed no seasonal trend. It did not show any correlation with mean monthly temperature and mean monthly relative humidity (Dutta and *et al*., 1990).

2.2.11 A prospective case-control study was performed involving 3646 case patients (both children and adults) who presented with diarrhea to the Dhaka hospital of the International Centre for Diarrheal Disease Research, Bangladesh, and 2575 control subjects with asymptomatic infection. Parasitic infection was detected by use of a stool parasite antigen test, and the parasite load and the species and/or genotypes were determined by use of polymerase chain reaction (PCR).

The results showed that Cryptosporidium species and E. histolytica were more prevalent in patients with acute diarrhea than in healthy control subjects, for all ages (2.1% vs. 1.4%; P=.039) and, specifically, for those 0–12 months of age (2.2% vs. 0.4%; P=.009). G. lamblia assemblage A was also more prevalent in case patients with diarrhea than in healthy control subjects (20% vs. 5%; P<.001). For case patients with diarrhea, the parasite load in feces, as measured by quantitative real-time PCR cycle threshold, was not higher that for control subjects with asymptomatic infection. Case patients with diarrhea and cryptosporidiosis were less likely to have abdominal pain, compared with control subjects (15% vs. 37%; P<.001); case patients with amebiasis more likely to have visible blood in stool, compared with control subjects (8% vs. 1.6%; P<.001); and case patients with giardiasis more likely to be dehydrated, compared with control subjects (81% vs. 71%; P=.001). The author concluded that E. histolytica, C. hominis, C. parvum, and G. lamblia assemblage A infections are important causes of diarrheal illness in Bangladesh (William and *et al*. 2009).

2.2.11 Household factors associated with diarrhea in children

A pooled analysis of DHS data from 12 Latin American countries showed that household economic status is an important determinant of diarrhea morbidity in children (Hatt& Waters, 2005) In a case control study in Bangladesh, income in the uppermost quartile of the study population was independently associated with 41% reduced risk of severe diarrhea compared to the lowest quartile (Mahalanabis, Faruque, Islam, &Hoque, 1996). Lack of access to safe drinking water is associated with an increased risk of diarrheal disease in children (Marino, 2007). In a cohort study of about 1300 children in Guinea Bissau, drinking water from unprotected public supply was independently associated with increased incidence of diarrhea (Molbak, *et al.* 1997) Poor hygienic practices like indiscriminate disposal of child feces have shown to increase diarrhea in children (Ghosh et al. 1997; Tumwine, *et al*. 2002). Same

results have also been demonstrated in a study in 3 East African countries (Tumwine, *et al*. 2002), which also showed an association between household head's education and diarrhea in children.

A study in Egypt showed higher risk of diarrhea among rural children than in their urban counterparts (El-Gilany&Hammad, 2005). Similar results were found in Philippines (Costello, Lieno, & Jensen, 1996) where researchers found higher prevalence of diarrhea in rural than in urban children.

2.2.12 Maternal/caretaker's factors associated with diarrhea in children

Maternal and caretaker's socio-demographic factors have been shown to be associated with the risk of diarrhea children. A cross sectional study in Saudi Arabia demonstrated increased prevalence of diarrhea among children with young mothers, those who were not under the care of their mothers and in those whose mothers were working away from home (Ahmed, *et al.* 2002). Higher diarrhea incidence has also been demonstrated in children with younger mothers in a cohort study in Brazil (Melo, *et al.* 2008). A study in Guinea Bissau showed that lack maternal education was associated with diarrhea in children (Molbak, *et al.* 1997). Mothers education was also associated with diarrhea in Latin America (Hatt & Waters, 2005) and Philippines (Costello, *et al*. 1996).

2.2.13 Child factors associated with diarrhea in children

A number of child factors are associated with an increased risk of diarrhea. These include age, immunization status, birth weight and gender. In Saudi Arabia, a higher prevalence of diarrhea was identified in children aged over 6 months and in those who had no vaccination or follow-up cards (Ahmed, *et al.* 2002). Missed immunizations has been associated with diarrhea in children (Melo, *et al*. 2008). Longitudinal studies in Brazil have found higher

incidences of diarrhea among children under 1 year of age (Giugliano, Bernardi, Vasconcelos, Costa, &Giugliano, 1986; Melo, *et al*. 2008). Low birth weight has been identified as a risk factor for community acquired alveolar pneumonia in Israel (Coles, *et al*. 2005). A study in Papua new Guinea identified a strong association between low birth weight and diarrhea in children under 5 years (Bukenya, Barnes, &Nwokolo, 1991). Another study in Pakistan however failed to show the relationship between low birth weight and diarrhea incidence among infants (Cheung, Jalil, Yip, &Karlberg, 2001). Male children have been shown to suffer more diarrheal episodes than their female counterparts (Melo, *et al*. 2008; Molbak, *et al*. 1997).

2.2.14 Feeding practices in children

The WHO classifies child feeding practices into three categories: Exclusive breast feeding; supplementary feeding and replacement feeding. Exclusive breastfeeding refers to breastfeeding while giving no other food or liquid, not even water, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines. Complementary feeding refers to the process of giving an infant food in addition to breast milk or infant formula, when either becomes insufficient to satisfy the infant's nutritional requirements while replacement feeding refers to the process of feeding a child who is not receiving any breast milk with a diet that provides all the nutrients the child needs until the child is fully fed on family foods (WHO, 2003).

Inappropriate feeding practices and their consequences are major obstacles to sustainable socioeconomic development and poverty reduction. Breast milk is the ideal food for healthy growth and development of infants and young children. The WHO and UNICEF recommend exclusive breastfeeding of infants for the first 6 months of life. This is important in achieving optimal growth, development and health. From 6 months, infants should receive nutritionally

adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond. Exclusive breastfeeding from birth is possible except for a few medical conditions (WHO/UNICEF, 2003). It is worth noting that the duration of exclusive breastfeeding recommendation by WHO and UNICEF was born out of an expert consultation which recommended exclusive breast feeding for six months, emphasizing that this recommendation applies to populations while recognizing that some mothers will be unable to, or choose not to, follow it (WHO, 2002).

Infants are particularly vulnerable during the transition period when complementary feeding begins. To ensure that their nutritional needs are met thus requires that complementary foods have the following properties (WHO/UNICEF, 2003):

a) **Timeliness**: Foods should be introduced when the need for energy and nutrients exceeds what can be provided through exclusive and frequent breastfeeding
b) **Adequacy**: Foods should provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs
c) **Safety**: Foods should be hygienically stored and prepared, and fed with clean hands using clean utensils and not bottles and teats
d) **Properly fed**: Foods should be given consistent with a child's signals of appetite and satiety.

Despite this recommendation and the efforts put into promoting breastfeeding, only about 38% of infants in the developing world are exclusively breastfed during the first six months of life (UNICEF, 2007). Complementary feeding frequently begins too early, and foods are often nutritionally inadequate and unsafe (WHO/UNICEF, 2003). This underscores the importance of continued efforts to promote the first six months exclusive breastfeeding and appropriate complementary feeding especially in developing countries where most mothers

cannot afford to provide nutritionally adequate complementary and replacement feeds under hygienic conditions.

In a longitudinal study in the UK among 11,490 infants on the patterns of exclusive breastfeeding, exclusive breastfeeding declined steadily from 54.8% in the first month to 31% in the third, and fell to 9.6% in the fourth month mainly due to the introduction of solids to the infants. In the first 2 months, complementary feeding was used in combination, and declined from 22% in the first month to 16.8% in the second due to a switch to exclusive commercial infant formula feeding. Replacement feeding increased steadily from 21.9% in the first month to 67.1% by the seventh. This obscured the change from exclusive commercial infant formula feeding only to commercial infant formula feeding plus solids/semi-solids, a change which started in the third month and was complete by the fifth (Pontin, Emmett, Steer, Emond, & ALSPAC Study Team, 2007). In another longitudinal study in the UK involving 18,125 singletons born over a 12-month period spanning 2000-01, breastfeeding was initiated for 71% of babies, and by 1, 4 and 6 months of age the proportions being exclusively breast-fed were 34%, 3% and 0.3%, respectively (Kelly & Watt, 2005).

2.2.15 Factors affecting child feeding practices

Several factors could play a role in influencing child feeding practices. Results from the Millennium Cohort Study in the UK showed that initiation and exclusive feeding rates were higher among mothers aged 30 or over, who were non-smokers, living in higher income households, who lived with a partner and who were first-time mothers. Women with routine jobs with the least favorable working conditions were more than four times less likely to initiate breastfeeding compared with women in higher managerial and professional

occupations and were less likely to exclusively breast-feed their infants at 1 month (Kelly & Watt, 2005).

In a longitudinal study of 3600 children in Australia , researchers found that infants born before 40 weeks had a greater risk of being artificially fed than infants born at or after 40 weeks (Donath& Amir, 2008).

The risk of mother to child transmission of HIV is an important factor that has an influence on child feeding practice. Studies show that exclusively breastfed infants are at lower risk of HIV transmission than mixed fed infants leading to the recommendation by the WHO of the need for adequate replacement feeding for infants born to HIV-positive mothers who choose not to breastfeed. In resource poor settings, six months exclusive breastfeeding followed by replacement feeding is recommended (WHO/UNICEF, 2003).

In a cross sectional study among 130 mothers in Singhburi Province in Thailand, mothers who had higher incomes tended to use artificial feeding more, while those who worked at home tended to exclusively breast feed (Zainal, Isaranurug, Nanthamongkolchai, &Voramongkol, 2004). In another cross sectional study in Ratchaburi Province in Thailand, maternal self efficacy and lactation problems were found to be independent variables associated with exclusive breastfeeding with low self efficacy and having lactation problems being related to low levels of exclusive breastfeeding (Aung, 2007). A study in Bangkok Thailand has found a significant association between exclusive breastfeeding pattern and the duration mothers are allowed for work absence and their intended time to breastfeed (Laisiriruangrai, *et al.* 2008).

2.2.16 Feeding practices and diarrhea in children

The relationship between feeding practices and nutritional status of children is well documented in a plethora of studies. Most studies have demonstrated the multiple benefits of breastfeeding generally and particularly exclusive breastfeeding in reducing morbidity in children. These studies have provided the basis upon which the WHO and UNICEF developed recommendations for infant and young children feeding practices (WHO/UNICEF, 2003).

In a longitudinal study of the feeding practices and morbidity from infectious diseases of 153 Peruvian newborns from an underprivileged, peri-urban community, the incidence and prevalence rates of diarrhea in infants younger than 6 months of age were less among those who were exclusively breast-fed compared with those who received other liquids or artificial milks in addition to breast milk. The diarrheal prevalence rates doubled with the addition of these other fluids Infants for whom breastfeeding was discontinued during the first 6 months had 27.6% diarrheal prevalence. During the second 6 months of life, discontinuation of breast-feeding was also associated with an increased risk of diarrheal incidence and prevalence.

There are two possible reasons for reduced infection rates among exclusively breastfed infants. One is due to the role of breast milk in immunity and the other explanation is related to the reduced exposure to contaminated replacement or complementary feeds. In conditions with substandard hygienic levels, children are often exposed to contaminated food and water through weaning resulting into increased risk of diarrhea (Molbak, *et al.* 1997). A recent prospective study of 84 children younger than 4 months in Brazil has demonstrated that early weaning among children is associated with suffering a diarrheal episode (Melo, *et al.* 2008). In a cross sectional study among 138 weanlings in North East Thailand,

consumption of un-boiled water by weanlings, not covering perishable foods and washing feeding utensils of weanlings without dishwashing detergent were significantly related to reported weanling diarrhea (Cao, *et al.* 2000).

In a 12 month cohort study among 1677 infants who were born in slum areas of Dhaka in Bangladesh, infants who were either partially or not breastfed had a higher risk of post neonatal death than infants who were breastfed exclusively for the first 4 months of life.

A longitudinal study of 9,942 children in Philippines demonstrated a great effect of not breastfeeding on diarrhea mortality. In the first 6 months of life, failing to initiate breastfeeding or ceasing to breastfeed resulted in an 8- to 10-fold increase in the rate of diarrheal mortality. However, after age 6 months, the protective effects of breastfeeding dropped dramatically (Yoon, Robert E. Black, Moulton, & Becker, 1996). These studies highlight the important role of appropriate breastfeeding practices in child survival through reduction of morbidity and mortality.

2.2.17 Factors associated with under nutrition in children

Under nutrition among children is associated with multiple risk factors as demonstrated in many studies. In a case control study of 6,881 severely malnourished under 5 children hospitalized with diarrhea in Bangladesh, it was found that severely underweight children were more likely to be older than 11 months, non breastfed, have illiterate mothers, lack a sanitary toilet at home, have history of measles preceding 6 months and had dehydrating diarrhea (Chisti, *et al.* 2007).

A cross sectional study of 2-11 years old children in Vietnam revealed that children of rural households, poor households, and ethnic minority backgrounds were significantly more

likely to be malnourished than urban residents, children of non poor households, and the majority Kinh population (Thang&Popkin, 2003).

Child stunting has been found to be significantly related to educational level of primary care givers and the size of the household in a cross sectional study of 131 children aged 30-80 months in Guatemala (Sereebutraa, Solomonsc, Aliyub and Jolly, 2006). In this study, children with illiterate primary caregivers were 5 times more likely to be stunted compared with those whose primary caregivers were literate. Children living in households with 4 or more children were three times more likely to be stunted than children living in less crowded households. A cross sectional study of 132 children aged 6-23 months in Kenya (Kariuki, *et al*. 2002) showed that having children at an early age was a risk factor for stunting in children.

In South Africa, a cross sectional survey of 868 children aged 3 to 59 months revealed that migrant father, mother's education, literate mother, housing materials, the presence of a toilet, whether the last child was breast-fed, duration of breast-feeding and birth weight were significantly related to underweight for age (Chopra, 2003).

In a hospital based case control study among children aged 6-24 months from low income families in Brazil, increased risks of infant malnutrition were significantly associated with households that had no toilet facilities or refrigerator, high parity for the mother, no breastfeeding of the infant, inadequate vaccination coverage and previous hospitalization for diarrhea and pneumonia (Lima, Motta, Santos, & Pontes da Silva, 2004).

2.2.18 The global magnitude of diarrhea among children

According to a fairly recent study on estimation of child mortality in developing countries, approximately 1.87 million children aged less than 5 years die annually from diarrhea,

representing 19% of total child deaths globally. WHO African and South-East Asia Regions combined contain 78% (1.46 million) of all diarrhea deaths occurring among children in the developing world; 73% of these deaths are concentrated in just 15 developing countries (Boschi-Pinto, Velebit, & Shibuya, 2008). It is important to note that this study utilized mainly epidemiological studies to estimate the causes of death owing to the fact that in countries that account for 98% of under-5 deaths worldwide, there is very limited or virtually no functioning vital registration system in place to support attribution of causes of deaths.

Morbidity due to diarrhea and pneumonia are significant causes of mortality in children. Pneumonia (excluding neonatal pneumonia or sepsis) and diarrhea are the second and third respective causes of death in children younger than 5 years with pneumonia accounting for 19% and diarrhea for 18% of the 10.6 million annual deaths (Bryce, *et al.* 2005). Under nutrition has been identified as an under-lying cause of more than one half of all deaths in children younger than 5 years (Bryce, *et al.* 2005).

2.2.19 Diarrhea in developed countries

Diarrhea is a rare occurrence for most people who live in developed countries where sanitation is widely available, access to safe water is high and personal and domestic hygiene is relatively good (WHO, 2012). The overall burden of acute infectious diarrhea in the United States and other developed countries has not been well-studied in contrast to this entity in the developing world. Most series have focused on specific groups of patients or specific pathogens, morbidity and mortality due to acute diarrhea is significant even in the United States where diarrhea is more often than not a "nuisance disease" in the normally healthy individual (Wanke, 2012).

Chapter Three

Methodology

3.1 Introduction

The aim of this study is to know the risk factors which are associated with diarrhea among hospitalized children in Gaza Strip. This chapter addresses issues related to methodologies used to answer the research questions, the chapter commences with study design, study population, study setting, period of the study, sample size, and sampling.

3.2 Study design

The design of this study is case-control, it is suitable design to identify risk factors of disease, it's suitable in term of time, people, money, resources and it is relatively practical and manageable, also it was chosen because it is less expensive and enables the researcher to meet the study objectives in a short time.

3.3 Study Setting

This study was carried out at Gaza Strip mainly at Naser Medical Complex, Alnasser Pediatric Hospital, Khanyounis primary health care center and Sheikh Radwan primary health care center.

3.4 Study population

The target population consisted of two groups, the first group were cases (hospitalized children aged less than five years who are staying in pediatric ward at Naser Medical complex and Alnasser Pediatric Hospital during June and July 2012 and having diarrhea), the second group were controls who don’t have diarrhea, subjects are not randomized to the

exposed or unexposed groups, rather the subjects are observed in order to determine both their exposure and their outcome status and the exposure status is thus not determined by the researcher.

3.5 Sample size and sampling process

The sample of this study was a stratified cluster sample from all those who attended during a period of time, the Gaza Strip was divided into two areas; south and north, Naser Medical Complex represented the south area and Alnasser Pediatric Hospital represented the north area. Sample was calculated by using Epi-info software V. 3.0.43, based on literature review and consultation with experts in the field of study, the most risk factor of diarrhea is malnutrition, 30% among ill group and 10% among healthy group based on Epi-info calculation, the sample size is 70 cases and 70 controls at (α= 0.05, power= 0.8), matching was done for age and gender.

3.6 Selection criteria

3.6.1 Inclusion criteria for cases

- Age less than 5 years (males and females).
- Admitted to the pediatric ward at Naser Medical Complex and Alnasser Pediatric Hospital during June and July 2012.
- Diagnosed as diarrhea or gastroenteritis confirmed by physician.

3.6.2 Inclusion criteria for control

- Age less than 5 years (males and females).
- Not complaining of diarrhea or other medical and/or chronic disease.

3.6.3 Exclusion criteria

- Age more than 5 years old.
- Children with history of chronic diseases (celiac disease).

3.7 Instrument of the study

A structured interview questionnaire (annex 9) was distributed to 70 children who are admitted to the above mentioned hospitals and have disease (cases) during June and July 2012 and 70 (controls) matched for age and gender to control them as confounding variables, the researcher herself filled up the questionnaire.

3.7.1 Questionnaire design

- The questionnaire was designed in English language and was revised by those who are experienced and expert in pediatrics and diarrhea. Questionnaire was developed in categorical scale and closed- ended questions.
- The first part represented child socio-demographic factors.
- The second part represented Child health and nutritional status.
- The third part represented household characteristics
- The fourth part represented child's feeding practices.

3.8 Validity and Reliability

3.8.1 Face and content validity

The questionnaire was submitted to expert's panel with experience and knowledge of the topic to make suggestions and judgment about the adequacy of the instrument (annex 10), the researcher used construct validity as well.

3.9 Pilot study

Pilot study was conducted on 30 subjects before the start of actual data collection, 15 cases and 15 controls, in order to provide feedback about the questionnaire and ensure validity and reliability of questionnaire, there was no modification and it was included in the sample.

3.10 Statistical management

To achieve the goal of the study, the researcher used the statistical package for the Social Science (SPSS 17) for analyzing the data.

3.11 Statistical methods which used as follow:

1. Descriptive statistics such as frequencies and percentages.
2. Bivariate analysis was used using person's chi-square to show if there are statistical significant associations between factors and diarrhea such as socio-demographic factors and other factors.
3. Multivariate analysis was used using binary logistic regression to determine which independent variables affect the probability of an outcome of diarrhea and results was presented with beta coefficients, adjusted odds ratio with 95% CI and repetitive p- value.

3.12 Administrative and Ethical Consideration

The researcher was committed to all ethical considerations required to conduct a research, ethical approval was obtained from the school of public health (Al-Quds University) and Helsinki committee to carry out the study (annex 6), an approval letter was obtained from ministry of health in Gaza strip to visit the hospitals (annex 7) and from primary health care (annex 8). Informed consent was obtained from the mother of child to fill up the questionnaire.

3.13 Period of the study

The study was conducted during the period from June 2012 to November 2012.

3.14 Limitations of the Study

- Frequent electricity cut off, Limited time; few numbers of cases, old references, financial costs and transportation were considered as limitations of this study.

Chapter Four

Results and Discussion

4.1 Introduction

This chapter illustrates the results of statistical analysis of the data, including descriptive analysis that presents the socio -demographic characteristics of the study sample and answers to the study questions. The researcher used simple statistics including frequencies, means and percentages, also advanced statistical procedures were used such as Chi square, simple and multiple regression.

4.2 Demographic characteristics

The study population consisted of 140 children, 70 (50%) were cases and 70 (50%) were controls. Seventy children (50%) (35 cases and 35 controls) were from Gaza and seventy (50%) (35 cases and 35 controls) were from Khanyounis. Thirty seven (50.0%) from males were cases, 37 (50.0%) from males were controls, 33 (50.0%) from females were cases and33 (50.0%) from females were controls. Their age ranged between (1 month to 4.6 years), mean age was 1.38 and standard deviation was 1.39. Twenty six (50.0%) from age group between (1.1 – 2 years) were case, and 26 (50.0%) from this group were controls, 34 (50.0%) from age group between (1 month – 1 year) were cases and34 (50.0%) were controls. Ten (50.0%) from age group between (2.2 – 4.6 years) were cases and 10 (50.0%) were controls.

There were 31 (37.8%) from who are living in cities were cases and 51 (62.2%) were controls. Twenty three (56.1%) from who are living in villages were cases and 18 (43.9%) were controls. Also there are 16 (94.1%) from who are living in camps were cases and 1 (5.9%) were controls (Table 4.1).

4.2.1 Distribution of study population according to the type of subject, age group, gender, governorate and area of residence

Table 4.1: Distribution of Study Population According to the Type of Subject, Age Group, Gender, Governorate and Area of Residence

Variable		Cases N (%)	Control N (%)	Total N (%)
Type of subject		70 (50.0)	70 (50.0)	140 (100.0)
Gender	Male	37 (50.0)	37 (50.0)	74 (52.9)
	Female	33 (50.0)	33 (50.0)	66 (47.1)
	Total	70 (100.0)	70 (100.0)	140 (100.0)
Age group	(1) month – (1)year	34 (50.0)	34 (50.0)	68 (48.6)
	(1.1 – 2) years	26 (50.0)	26 (50.0)	52 (37.1)
	(2.1 – 4.6) years	10 (50.0)	10 (50.0)	20 (14.3)
	Total	70 (100.0)	70 (100.0)	140 (100.0)
Governorate	Khanyounis	35 (50.0)	35 (50.0)	70 (50.0)
	Gaza	35 (50.0)	35 (50.0)	70 (50.0)
	Total	70 (100.0)	70 (100.0)	140 (100.0)
Residence	City	31 (37.8)	51 (62.2)	82 (58.6)
	Village	23 (56.1)	18 (43.9)	41 (29.3)
	Camp	16 (94.1)	1 (5.9)	17 (12.1)
	Total	70 (100.0)	70 (100.0)	140 (100.0)

4.2.2 Distribution of study population according to family income, family type and OVC status

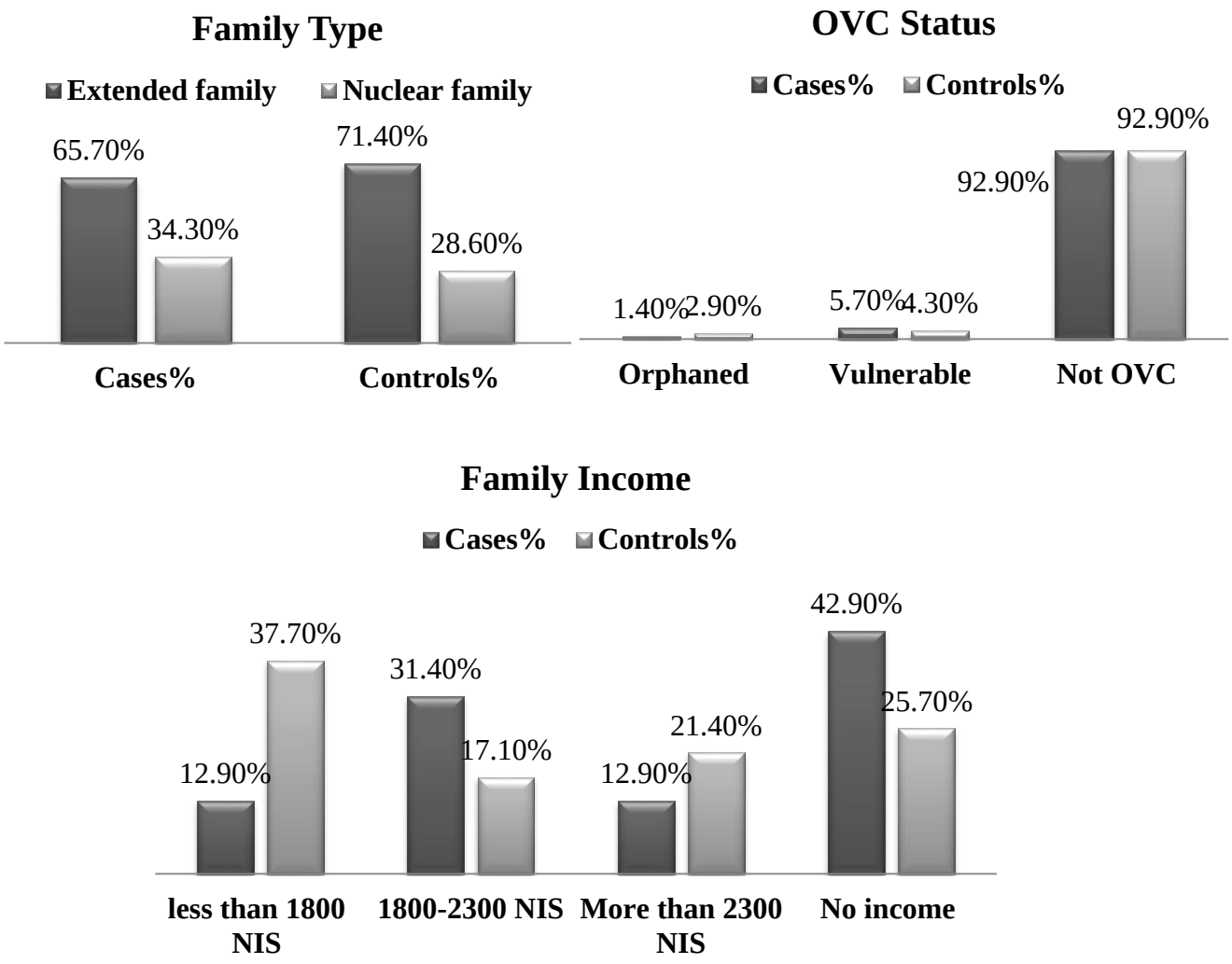

Figure 4.1: Distribution of Study Population According to Family Income, Family Type and OVC Status

Figure (4.1) show that the majority (71.4%) of controls and (65.7%) of cases were from extended families, (28.6%) of controls and (34.3%) of cases were from nuclear families.

The majority (92.9%) of cases and (92.9%) of controls were neither orphaned nor vulnerable, (5.7%) of cases and (4.3%) of controls were vulnerable, (1.4%) of cases and (2.9%) of controls were orphaned. Also the table shows that (42.9%) of cases and (25.7%) of controls

have no income, (12.9%) of cases and (21.4%) of controls have income more than 2300 NIS per month.

4.2.3 Distribution of study population according to the main source of water before illness, source of drinking water

Table 4.2: Distribution of Study Population according to the Main Source of Water before Illness, Source of Drinking Water and Fuel Used

Variable		Cases N (%)	Control N (%)
Main source of water before illness	Municipal water	48 (68.6)	42 (60.0)
	Buying water tanks	14 (20.0)	12 (17.1)
	UN agency	1 (1.4)	3 (4.3)
	Household well (rainfall collection well)	7 (10.0)	13 (18.6)
	Total	70 (100.0)	70 (100.0)
Source of drinking water	Filter	16 (22.9)	25 (35.7)
	Bottle (Mineral water)	47 (67.1)	40 (57.1)
	The same as the source of water	7 (10.0)	5 (7.1)
	Total	70 (100.0)	70 (100.0)

Table (4.2) shows that the majority 48 (68.6%) of cases and 42 (60.0%) of controls are using the municipal water as a source of running water, 14 (20.0%) of cases and 12 (17.1) of controls are buying water tanks. The table also shows that there are 47 (67.1%) of cases and 40 (57.1%) are drinking mineral water, (22.9%) of cases and (35.7%) of controls are using filter as the source of drinking water and (10.0) of cases and (7.1%) of control are drinking from the same source of water they used.

4.2.4 Distribution of study population according to the toilet facility

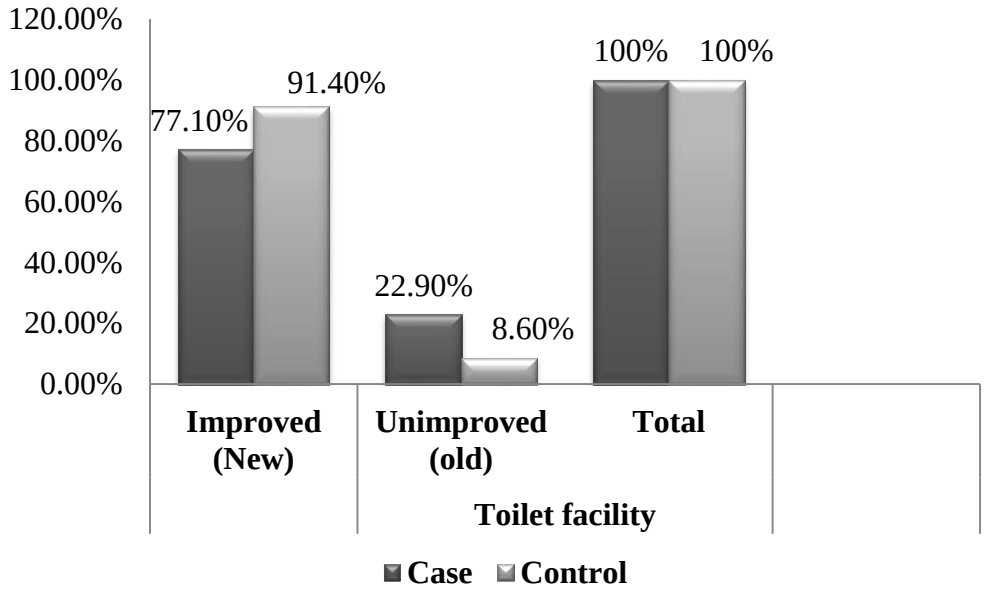

Figure (4.2): Distribution of Study Population according to the Toilet Facility

Figure (4.2) shows that (77.1%) of cases and (91.4%) of controls have improved toilet facility and (22.9%) of cases and (8.6 %) of controls have unimproved toilet facility.

4.2.5 Distribution of Study Population according to Feces Disposal

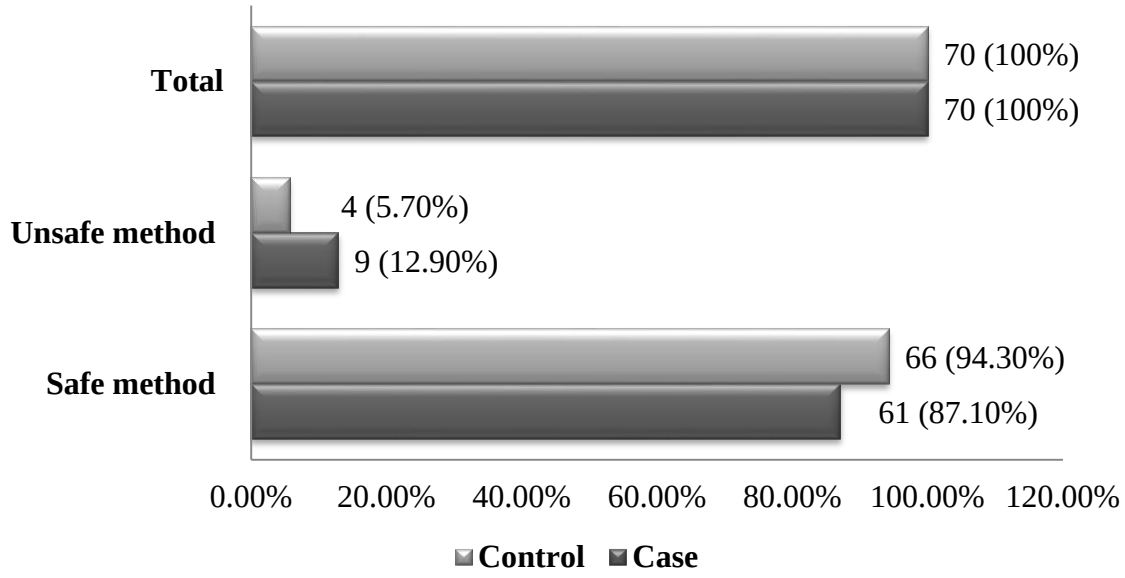

Figure (4.3): Distribution of Study Population according to Feces Disposal

Figure (4.3) shows that (94.3%) of cases and (87.1%) of controls have safe method for feces disposal and (12.9%) of cases and (5.7%) of controls have unsafe method.

4.2.6 Distribution of Study Population according to the Fuel they used

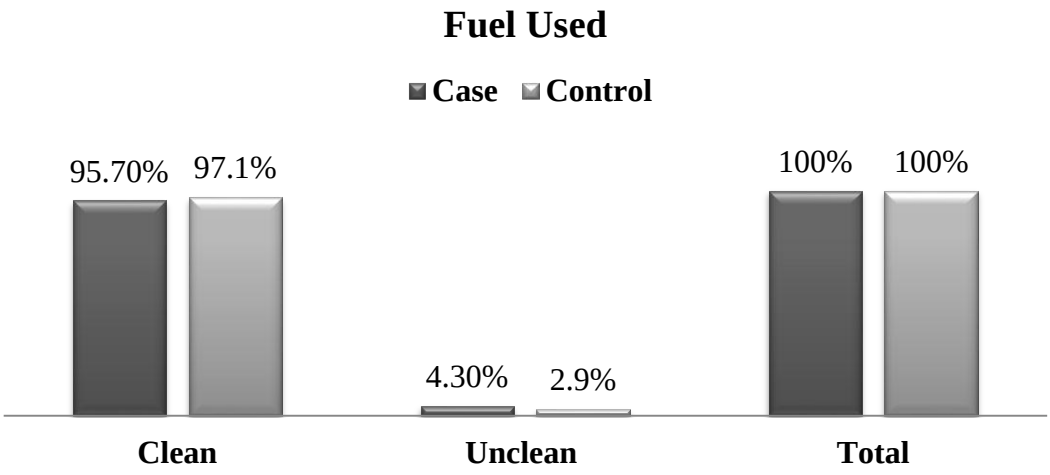

Figure (4.4): Distribution of Study Population according to the Fuel they used

Figure (4.4) shows that the majority (97.1%) of control, (95.7%) of cases are using clean fuel for cocking such as electricity and/or liquid gas, and (4.3%) of cases, (2.9%) of controls are using unclean fuel for cocking such as charcoal, kerosene wood.

4.2.7 Distribution of study population according to age of weaning

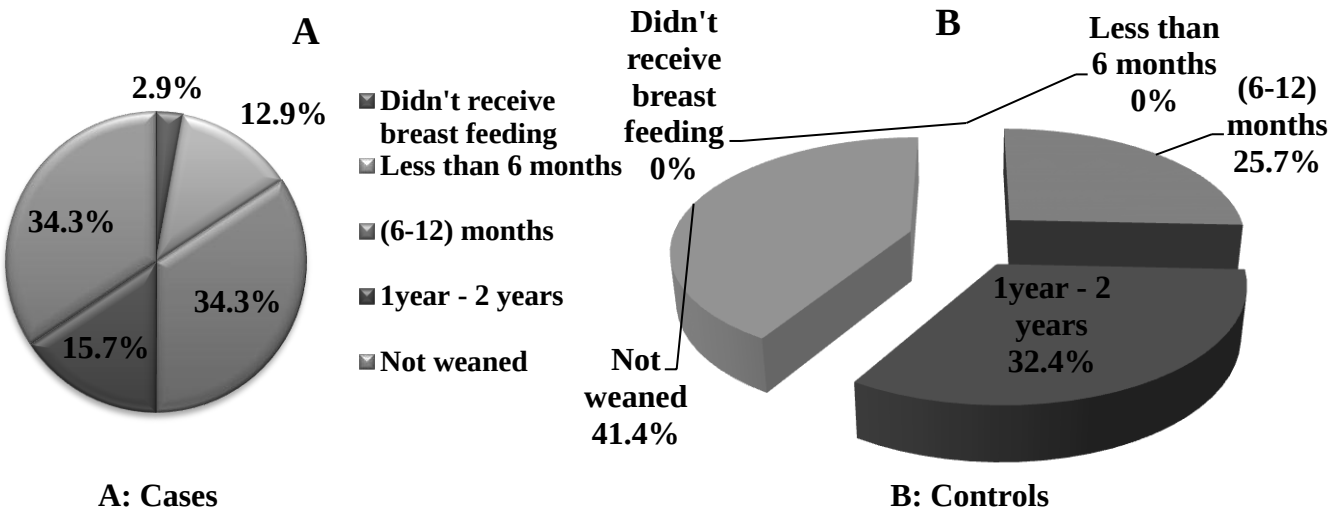

Figure (4.5): Distribution of Study Population According to Age of Weaning

Figure (4.5) shows that only (2.9%) of cases didn't receive breast feeding, (34.3%) weren't weaned, (34.3%) were weaned at age between (6-12) months, (15.7%) were weaned at age between (1-2) years and (12.9%) were weaned before 6 months.

On the other hand, the figure shows that (41.4%) among controls weren't weaned, (25.7%) were weaned at age between (6-12) months, (32.4%) were weaned at age between (1-2) years and (0.0%) among controls didn't receive breast feeding and/or were weaned before 6 months.

4.3 Bivariate analysis of socio-demographic risk factors of diarrhea among children aged less than 5 years

4.3.1 Association between socio-demographic factors (gender, age group, OVC status and type of family) and diarrhea among children aged less than 5 years (N=140)

Table (4.3): Association between socio-demographic factors (gender, age group, OVC status and type of family) and diarrhea among children aged less than 5 years (N=140)

Factor		Diarrhea		χ^2	*p* value
		Cases N (%)	Control N (%)		
Gender	Male	37 (52.9)	37 (52.9)	0.000	1.000
	Female	33 (47.1)	33 (47.1)		
Age group	(1) month – (1)year	34 (50.0)	34 (50.0)	0.000	1.000
	(1.1 – 2) years	26 (50.0)	26 (50.0)		
	(2.2 – 4.6) years	10 (50.0)	10 (50.0)		
OVC status	Orphaned	1 (1.4)	2 (2.9)	0.476	0.788
	Vulnerable	4 (5.7)	3 (4.3)		
	Not OVC	65 (92.9)	65 (92.9)		
Type of family	Nuclear family	46 (65.7)	50 (71.4)	0.530	0.466
	Extended family	24 (34.3)	20 (28.6)		

Table (4.3) shows that there was no significant association between gender and diarrhea as Chi-square value = 0.000 and *p* value = 1.000 and there was no significant association between age and diarrhea as Chi-square value = 0.000 and *p* value = 1.000. Also the table shows that there was no significant association between OVC status of child and diarrhea as

Chi-square value = 0.476 and *p* value = 0.788, and there was no significant association between family type and diarrhea as Chi-square value = 0.530 and *p* value = 0.466.

These results are inconsistent with Calsistus, 2009 which showed that there was a significant association between child's gender and diarrhea and it was higher in males than females and there was a strong association between child's age and diarrhea. These results are due to the type of the sample chosen as it is a convenience one, this affect the results.

Also the study of Calsistus, 2009 showed that there was no statistical significant difference in diarrhea rate among OVC and non OVC and among children less than 5 years in Thailand. The small sample size especially small number of orphaned (1 case) in this study can affect the results, thus the availability of societies in Gaza that adopt children who are orphaned can reduce the risk of diseases in this side.

On the other hand, these results are consistent with Okour and *et al.* 2012 which showed that there were no significant association between child gender and age and risk of diarrhea in Jordan but there was a significant association between the type of family and diarrhea, this is due to the nature of most of Palestinians families as nuclear families, overcrowding manifested in other studies by a higher crowding index which has been associated with unhygienic behaviors and illnesses considered a risk factor for diseases and diarrhea.

4.3.2 Association between socio-demographic factors (parent's education level) and diarrhea among case and control group

Table (4.4): Association between socio-demographic factors (parents education level) and diarrhea among case and control group (N=140)

Factor		Diarrhea		χ^2	*p* value
		Cases N (%)	Control N (%)		
Mother's education level	Illiterate	1 (1.4)	0 (0.0)	4.006	0.405
	Primary	5 (7.1)	2 (2.9)		
	Preparatory	15 (21.4)	14 (20.0)		
	Secondary	27 (38.6)	36 (51.4)		
	University	22 (31.4)	18 (25.7)		
Father's education level	Illiterate	2 (2.9)	0 (0.0)	7.370	0.195
	Primary	9 (12.9)	4 (5.7)		
	Preparatory	12 (17.1)	20 (28.6)		
	Secondary	29 (41.4)	23 (32.9)		
	University	17 (24.3)	21 (30.0)		
	High education	1 (1.4)	2 (2.9)		
Mother age	(17 – 25) years	34 (48.6)	33 (47.1)	3.041	0.219
	(26 – 34) years	29 (41.4)	23 (32.9)		
	(35 – 43) years	7 (10.0)	14 (20.0)		
Father age	(20 – 30) years	33 (47.1)	37 (52.9)	7.371	0.025*
	(31 – 40) years	34 (48.6)	22 (31.4)		
	(41 – 59) years	3 (4.3)	11 (15.7)		
Mother work	Employed	6 (8.6)	4 (5.7)	0.431	0.512
	Unemployed	64 (91.4)	66 (94.3)		

Table (4.4) shows that there was no statistical significant association between mother's education level and diarrhea as Chi-square value = 4.006 and *p* value = 0.405 which is not significant, also there was no statistical significant association between mother's age and diarrhea as Chi-square value = 3.041 and *p* value = 0.219 which is not significant and there was no statistical significant association between mother work and diarrhea as Chi-square value = 0.431 and *p* value = 0.512. These results are inconsistent with Okour and *et al.* 2012 which showed that there was statistical significant association between mother age and mother education with employment and diarrhea in Rural Community in the Jordan Valley.

Mother education is an essential determinant of a child's health, associated with hygienic behaviors and family feeding practices, many studies have indicated that the frequency of diarrheal diseases decreases significantly as the education level of the mother increases (Ozkan and *et al.* 2007 & Bozkurt and *et al.* 2003), this inconsistency in these results may be due to small sample size and/or the type of this study as most of previous studies were cross-sectional ones in comparison to this case-control study.

On the other hand, there was no significant association between father's education level and diarrhea as Chi-square value = 7.370 and *p* value = 0.195 which is not significant and there was significant association between father's age and diarrhea as Chi-square value = 7.371 and *p* value = 0.025 which is not significant, meaning that the risk of diarrhea is increased when father age increased. In Jordan, maternal age, but not father’s age, was significantly correlated with acute diarrhea morbidity as acute diarrhea was more likely to occur among children of younger mothers, less than 25years (Kolahi1, 2008). Also there was no significant correlation between the parents' age and acute diarrheal diseases in Tehran (Kolahi1, 2008).

4.4Bivariate analysis of household environment risk factors of diarrhea among children aged less than 5 years

4.4.1 Association between household environment risk factors (residence, main source of water before illness and source of drinking water)and diarrhea among children aged less than 5 years

Table (4.5): Association between household environment risk factors of diarrhea among children aged less than 5 years

Factor		Diarrhea		$\chi 2$	*p* Value
		Cases N (%)	Control N (%)		
Residence	**City**	31 (44.3)	51 (72.9)	18.273	0.000***
	Village	23 (32.9)	18 (25.7)		
	Camp	16 (22.9)	1 (1.4)		
Main source of water before illness	**Municipal water**	48 (68.6)	42 (60.0)	3.35	0.340
	Buying water tanks	14 (20.0)	12 (17.1)		
	UN agency	1 (1.4)	3 (4.3)		
	Household well	7 (10.0)	13 (18.6)		
Source of drinking water	**Filter**	16 (22.9)	25 (35.7)	2.87	0.238
	Bottle (Mineral water)	47 (67.1)	40 (57.1)		
	Same as source of water	7 (10.0)	5 (7.1)		

******* Significant at 0.001 level

Table (4.5) shows that there was statistical significant association between residence and diarrhea as Chi-square = (18.27), *p* value < 0.05. These results are inconsistent with Calsistus (2009) which showed that there was no statistically significant association between diarrhea

in two weeks prior to the survey in children under five years and residence, this may be due to the type of this study; case-control in comparison to the Calsistus study in 2009 which was a cross-sectional one, the differences of the study design can affect the results due to the differences in the sample chosen. On the other hand, the significant association of diarrhea and type of toilet facility is consistent with Gautam (2012) which showed that the odds of diarrhea are high for those children who live in households which have a pit toilet facility than those who didn't have such a facility and a significant association between diarrhea and residence in Madhya Pradesh.

A study of Abu Mourad (2004) showed that diarrhea was strongly associated with source of drinking water, a full-day water supply and cleaning of water tanks in Nuseirat refugee camp as a case study.

The importance of living conditions, toilet facility, clean water and a regular sewer on diarrheal diseases has been documented by different studies (Favin and *et al.* 1999; Abu Mourad, 2004 & Nguyen and *et al.* 2006). Gaza people lacks a public sewage system in many areas, most residents have a septic tank so this is a determinant of diarrhea and other infectious diseases, thus wastewater resulted from unimproved toilet facility constitutes a serious threat to health.

The table shows there were no statistical significant association between the main source of water before illness, source of drinking water and type of fuel used for cocking and risk of diarrhea as p value > 0.05. These results are consistent with Calsistus (2009) showed that there was no statistically significant association between diarrhea in two weeks prior to the survey in children under five years and (treatment of water to make it safe for drinking and main source of drinking water).

4.4.2 Association between household environment risk factors (type of toilet facility, child's feces disposal method, type of fuel used for cocking and number of children less than 5 years at home) and diarrhea among children aged less than 5 years

Table (4.6): Association between Household Environment Risk Factors of Diarrhea among Children Aged Less Than 5 Years

Factor		Diarrhea		$\chi 2$	*p* Value
		Cases N (%)	Control N (%)		
Type of toilet facility	**Improved**	54 (77.1)	64 (91.4)	5.39	0.017*
	Unimproved	16 (22.9)	6 (8.6)		
Child's feces disposal method	**Safe**	61 (87.1)	66 (94.3)	2.12	0.122
	Unsafe	9 (12.9)	4 (5.7)		
Type of fuel used for cocking	**Clean**	67 (95.7)	68 (97.1)	0.207	0.649
	Unclean	3 (4.3)	2 (2.9)		
Number of children less than 5 years at home	**One child**	27 (38.6)	19 (27.1)	2.310	0.315
	(2 – 3) children	40 (57.1)	46 (65.7)		
	(4 – 5) children	3 (4.3)	5 (7.1)		

* Significant at 0.05 level

Table (4.6) shows that there was a statistical significant association between type of toilet facility and diarrhea as Chi-square = (5.39), *p* value < 0.05.

These results are inconsistent with Calsistus (2009) which showed that there was no statistically significant association between diarrhea in two weeks prior to the survey in children under five years and type of toilet facility, this may be due to the type of this study; case-control in comparison to the Calsistus study in 2009 which was a cross-sectional one,

the differences of the study design can affect the results due to the differences in the sample chosen.

Also the table shows that there was no significant association between the number of children less than 5 years in the household and diarrhea as Chi-square = 2.310, *p* value > 0.05.

The table shows there were no statistical significant association between child's feces disposal method, type of fuel used for cocking and number of children less than 5 years at home and risk of diarrhea as p value > 0.05. These results are inconsistent with Calsistus (2009) showed that child's feces disposal method was significantly associated with diarrhea and about 12% of children whose households dispose of child feces unsafely reported diarrhea in the past two weeks compared to 9% among children whose household dispose of child feces safely. Unsafe disposal of child's feces is a family behavioral practice that has shown to increase the risk of diarrhea in children. In this study, method of disposal of child feces was not significantly associated with diarrhea may be due to small sample size, the type of sample chosen and the fact that most of children (45.8% of cases) in this study have a safe disposal method.

A significant association between the number of children aged less than 5 years in the household and diarrhea among children was observed in Calsistus study in 2009 in Thailand, the rate of diarrhea among children with one child under 5 years was 8.7% while the rate among children from households with more than one child under five years was 6.7%.

The absence of significant association between diarrhea and type of fuel used for cocking is consistent with Guatam (2012) which showed that the prevalence of diarrhea is more among the children living in households where kerosene/coal/charcoal is used as a cooking fuel than the households where bio-mass, wood or crop residues is used for cooking in Madhya Pradesh. Clean environments are less likely to transmit disease. Evidence indicates that

appropriate water, hygiene, and sanitation interventions can reduce diarrhea incidence by 26% and mortality by 65% (Clasen and *et al.* 2008).

There is no significant association between the type of fuel used for cocking and diarrhea as Chi-square = 0.207 and *p* value = 0.649, this is explained by the nature of Gaza people in cocking process as most of them (49.3% of cases) in this study are using clean fuel (Gas) as stated by mothers.

4.4.3 Association between number of rooms, family income and number of children under 5 years in the home and risk of diarrhea among children aged less than 5 years

Table (4.7): Association between family income, number of rooms and number of children less than 5 years in the home and risk of diarrhea among children aged less than 5 years

Factor		Diarrhea		$\chi 2$	*p* Value
		Cases N (%)	Control N (%)		
Family income	Less than 1800 NIS	9 (12.9)	25 (37.7)	14.971	0.002**
	1800-2300 NIS	22 (31.4)	12 (17.1)		
	More than 2300 NIS	9 (12.9)	15 (21.4)		
	No income	30 (42.9)	18 (25.7)		
Number of rooms	(1 -2) rooms	44 (62.9)	38 (54.3)	1.082	0.582
	(3 – 5) rooms	25 (35.7)	31 (44.3)		
	(6 – 8) rooms	1 (1.4)	1 (1.4)		
Household animals	Yes	17 (24.3)	14 (20.0)	0.373	0.684
	No	53 (75.7)	56 (80.0)		

** Significant at 0.01 level

Table (4.7) shows that there was statistical significant association between average family income and diarrhea as Chi-square = 14.971, *p* value = 0.007, the significant association between average family income and diarrhea is consistent with Guatam (2012) which showed that children belonging to richest wealth quintile is 61 percent less likely to have diarrhea than the children belonging to poorest wealth quintile in Madhya Pradesh India. Also this

result is consistent with Okour, *et al.* 2012 which showed that there was statistical significant association family income and diarrhea in Rural Community in the Jordan Valley.

Family income was significantly related to the occurrence of diarrhea in this study. This study took place in a predominantly poor area; about 12.9% of individuals were living below the deep poverty line in 2011, 7.8% in the West Bank and 21.1% in Gaza Strip (PCBS, 2012) where the average family income is at or below 2000NIS per family per month. The poverty line and deep poverty line for the reference household (two adults and three children) stood at 2,293 Israeli shekels ($637) and 1,832 shekels ($509) respectively (PCBS, 2012). which is below the average poverty line in Palestine. Sufficient family income has been reported as a main factor leading to better health outcomes.

On the other hand, there was no statistical significant association between number of rooms in the home and diarrhea as Chi-square = 1.082, *p* value = 0.582, this result is inconsistent with Okour, *et al.* 2012 which showed that there was no statistical significant association between number of rooms in household and diarrhea in Rural Community in the Jordan Valley.

The table also shows that there was no statistical significant association between having household animals at the home and diarrhea as Chi-square = 0.373, *p* value = 0.684. This result is consistent with Okour, *et al.* 2012 which showed that there was no statistical significant association between raising animals around the home and diarrhea in Rural Community in the Jordan Valley.

4.5 Bivariate analysis of child's feeding and nutritional status and health status (hospitalization) and diarrhea among children aged less than 5 years

4.5.1 Association between Childs's Feeding Status and Diarrhea among Children Aged Less than 5 Years

Table (4.8): Association between Childs's feeding status and diarrhea among children aged less than 5 years

Factor		Diarrhea		χ^2	*p* Value
		Cases N (%)	Control N (%)		
Immediate breast feeding (within the first half an hour)	Yes	60 (85.7)	58 (82.9)	0.216	0.642
	No	10 (14.3)	12 (17.1)		
Exclusive breast feeding (in the first 6 months)	Yes	24 (34.3)	37 (52.9)	4.910	0.027*
	No	46 (65.7)	33 (47.1)		
Complementary feeding	Yes	45 (64.3)	33 (47.1)	4.169	0.041*
	No	25 (35.7)	37 (52.9)		
Replacement feeding	Yes	32 (45.7)	27 (38.6)	0.732	0.392
	No	38 (54.3)	43 (61.4)		

*Significant at 0.05 level

Table (4.8) shows that there was a statistical significant association between exclusive breast feeding (in the first 6 months) and diarrhea as Chi-square = 4.910, *p* value = 0.027, and there statistical significant association between complementary feeding and diarrhea as Chi-square = 4.169, *p* value = 0.041.

The table also shows that there were no statistical significant association between immediate breast feeding (within the first half an hour), replacement feeding and diarrhea as Chi-square = 0.732, *p* value = 0.392.

These results are inconsistent with Calsistus (2009) which showed that there was a strong association between feeding practices and diarrhea, diarrhea rate was higher among children receiving replacement feeding than in those being exclusively breastfed or receiving complementary feeding.

4.5.2Association between (Number of Meals Per Day and Weaning Age) and Diarrhea among Children Aged Less Than 5 Years

Table (4.9): Association between (Number of Meals Per Day and Weaning Age) and Diarrhea among Children Aged Less Than 5 Years

Factor		Diarrhea		χ^2	*p* Value
		Cases N (%)	Control N (%)		
Number of meals per day	(1 – 3) meals	26 (37.1)	39 (55.7)	7.113	0.029*
	(4 -7) meals	38 (54.3)	30 (42.9)		
	(8 - 12) meals	6 (8.6)	1 (1.4)		
Weaning age	Less than 6 months	9 (12.9)	0 (0.0)	16.564	0.002**
	(6 - 12) months	24 (34.3)	18 (25.7)		
	(1 - 2) years	11 (15.7)	23 (32.9)		
	Still breast feeding	24 (34.3)	29 (41.4)		
	Didn't receive breast feeding	2 (2.9)	0 (0.0)		

*Significant at 0.05 level ** Significant at 0.01 level

Table (4.9) shows that there was statistical significant association between number of meals per day and diarrhea as Chi-square = 7.113, *p* value = 0.029 and there was statistical significant association between age of weaning and diarrhea as Chi-square = 16.564, *p* value = 0.002. This is explained by the fact that the breast milk alone cannot meet an infant's nutritional needs.

A study Clemens and *et al.* 1999 in rural Egypt showed that the infants who initiated breastfeeding within the first 3 days of life had a 26% lower rate of diarrhea during the first 6

months of life (adjusted rate ratio 0.74, 95% CI: 0.56–0.98) compared with infants who initiated after 3 days. On the other hand, these results are consistent with Nacify and *et al.* 1999 which showed that breastfeeding was significantly associated with the incidence of rotavirus diarrheal episodes in children aged < 1 year, but not in older children, the adjusted hazards ratio during the first year of life in infants receiving any breast milk, compared to those who were not breastfed in rural Egypt.

Another study has been conducted by Meremikwu and *et al.* in 1997 in Nigeria showed that there were no significant differences were found in the frequency of dysentery between breastfed and non-breastfed children, persistent diarrhea was significantly less common in breastfeeding children than in those who had stopped breastfeeding.

This is explained by the fact that the process of breastfeeding is a protective of severe infection which a measure for a protection from diarrheal disease. Because feeding practices are age dependent, they could therefore not be controlled for in children aged less than 5 years during multivariate analysis, however, a subset analysis for children aged less than 2 years where feeding patterns were controlled for revealed no association between it and diarrhea.

4.5.3 Association between Childs's nutritional status (weight for age, height for age and head circumference for age percentile) and diarrhea among children aged less than 5 years

Table (4.10): Association between Childs's nutritional status (weight for age, height for age and head circumference for age percentile) and diarrhea among children aged less than 5 years

Factor		Diarrhea		χ^2	*p* Value
		Cases N (%)	Control N (%)		
Weight for age z score	Severely underweight (<-3)	9 (12.9)	0 (0.0)	19.977	0.000***
	Moderately underweight (-3 to -2.01)	11 (15.7)	2 (2.9)		
	Normal (≥-2.0)	50 (71.4)	68 (97.1)		
Height for age z score	Severely stunted (<-3)	12 (17.1)	3 (4.3)	8.844	0.012*
	Moderately stunted (-3 to -2.01)	6 (8.6)	2 (2.9)		
	Normal (≥-2.0)	52 (74.3)	65 (92.9)		
Head circumference for age percentile	Microcephaly (percentile< 3)	5 (7.1)	5 (7.1)	2.137	0.344
	Normal head circumference (percentile ≥ 3 and < 97)	61 (87.1)	56 (80.0)		
	Macrocephaly (percentile ≥ 97)	4 (5.7)	9 (12.9)		

* Significant at 0.05 level *** Significant at 0.001 level

Table (4.10) shows that there was statistical significant association between weight for age and diarrhea as Chi-square = 19.977, *p* value = 0.000, and there was statistical significant association between height for age and diarrhea as Chi-square = 8.844, *p* value = 0.012.

The table also shows that there was no statistical significant association between head circumference for age percentile and diarrhea as Chi-square = 2.137, *p* value = 0.344.

These results are inconsistent with Calsistus (2009) which showed that there was no significant association between diarrhea and height for age z score and weight for age z score in children aged less than 5 years.

4.5.4 Association between Childs's body mass index and diarrhea among children aged less than 5 years

Table (4.11): Association between Childs's Body Mass Index and Diarrhea among Children Aged Less Than 5 Years

Factor		Diarrhea		χ^2	*p* Value
		Cases N (%)	Control N (%)		
Body mass index	18.5 and Less than (Underweight)	53 (75.7)	61 (81.7)	4.804	0.187
	18.5-24.9 (Normal)	15 (21.4)	7 (10.0)		
	25-29.9 (Pre-obese)	1 (1.4)	2 (2.9)		
	30-34.9 (Obese class I)	0 (0.0)	0 (0.0)		
	35-39.9 (Obese class II)	1 (1.4)	0 (0.0)		
	40 and more (Obese class III)	0 (0.0)	0 (0.0)		

Table (4.11) shows that there was no statistical significant association between body mass index and diarrhea as Chi-square = 4.804, *p* value = 0.187. This result is consistent with Capili and Anastasi, 2008 which showed that there was no significant association between diarrhea and BMI in New York. Also this result is consistent with Khoshbaten (2008) which showed that there was no significant association between diarrhea and BMI in Tehran, Iran. The absence of association may be due to some reasons that are not still clear; obesity can cause slow gastric emptying in some cases (Talley, 2003&Talley2001). Moreover, loss of the normal postprandial gastric feedback mechanisms in obesity may lead to increased pain and nausea. This might partly explain the cause of the increase in prevalence of upper abdominal pain in obese individuals.

4.5.5 Association between Childs's health status (previous hospitalization) and diarrhea among children aged less than 5 years

Table (4.12): Association between Childs's health status (previous hospitalization) and diarrhea among children aged less than 5 years

Factor		Diarrhea		χ^2	*p* Value
		Cases N (%)	Control N (%)		
Previous hospitalization	Yes	29 (41.4)	17 (24.3)	4.662	0.031*
	No	41(58.6)	53 (75.7)		

*Significant at 0.05 level

Table (4.12) shows that there was statistical significant association between previous hospitalization and diarrhea as Chi-square = 4.662, *p* value = 0.031. This could be attributed to the health problem child was admitted for.

4.6 Multivariate analysis of risk factors of diarrhea in children aged less than 5 years

Table (4.13): Multivariate Analysis of Risk Factors of Diarrhea in Children Aged Less than 5 Years (Final Model)

Factor		B	Crude OR[a] (95% CI)	Adjusted OR[b] (95% CI)	Wald statistics[b] (df)	*p* value[b]
Residence	Village	-0.759	0.476 (0.222 – 1.019)	0.468 (0.189-1.156)	2.709(1)	1.000
	Camp	-3.260	0.038 (0.005 – 0.301)	0.038 (0.005-0.326)	8.926(1)	0.003
	City ®					
Family income	1800-2300 NIS	-1.651	0.196 (0.070 – 0.554)	0.192 (0.057-0.644)	7.135 (1)	0.008
	More than 2300 NIS	-0.145	0.600 (0.195 – 1.846)	0.865 (0.226-3.311)	0.45 (1)	0.833
	No income	-1.169	0.216 (0.083 – 0.564)	0.311 (0.102-0.950)	4.205 (1)	0.040
	Less than 1800 NIS®					
Complementary feeding	No	-0.702	0.495 (0.252 – 0.976)	0.410 (0.171-0.983)	-1.374(1)	0.046
	Yes®					
Weaning age		-0.037	1.038 (1.008 – 1.069)	1.058 (1.018-1.100)	8.025(1)	0.005

[a]Simple logistic regression, [b]Multiple logistic regression (Final model)
The model reasonably fits well. Model assumptions are met. There are no interaction and multicolinearity problems.

® Reference group

Logistic regression analysis was employed to predict the probability that a child aged less than 5 years would suffer from diarrhea. Variables with $p \leq 0.25$ by bivariate analysis and which applied to all children under 5 years and which have statistical significance association

with diarrhea were selected as predictors. They were: residence, toilet facility, exclusive breast feeding, complementary feeding, weight for age z score, height for age z score, previous hospitalization, body mass index, father age, family income, source of drinking water, feces disposal method, number of meals per day and weaning age.

Table (4.13) shows that the children who are living in camps have decreased the odds of having diarrhea by 99.9% than children who are living in cities and the children who are living in villages have decreased the odds of having diarrhea by 53.2% than children who are living in cities. Also the table shows that the children who have families with income of (1800 – 2300NIS) have decreased odds of having diarrhea by 80.8% than children who have families with income less than 1800 NIS and the children who have families with no income have decreased odds of having diarrhea by 68.9% than children who have families with income less than 1800 NIS.

Children who didn't take complementary feeding have decreased odds of having diarrhea by 59.0% than children who did. On the other hand, children with increase in one month of weaning age, will have a decrease 1.058 times the odds to have diarrhea.

Model fitness was checked by Hosmer Lemeshow goodness-of-fit test, classification table and area under ROC (Receiving operating characteristics) curve. The null hypothesis for Hosmer Lemeshow goodness-of-fit test of the model is fit, the *p* value is 0.926 which is not significant, therefore the model is fit. Also the classification table by SPSS showed that 72.1% of cases are predicted correctly whether they had diarrhea or not (70% or above is considered a good model) (Norsaada, 2011). None of the interaction are significant, co linearity between the two variables was checked by linear regression as the variance inflation factor (VIF) for each independent variable was 1.033 (less than 10 which is considered acceptable).

Test for model coefficients was highly significant with $\chi 2 = 47.140$ at (1) df and $p = 0.000$

The prediction model of having diarrhea among children aged less than 5 years is:

Logit (P) = In{P/1-P} = -0.432 – {3.260*living in camp} – {1.651*income (1800-2300) NIS} – {0.702*didn't take complementary feeding} - {0.037*increase age of weaning}

This result is not consistent with Girma R, *et al*. 2008 which showed that only absence of refuse disposal facility and presence of feces around the pit-hole were found to be independently associated with under-five childhood diarrheal morbidity in multivariate logistic regression model to evaluate associations between factors and dichotomous variables designed to measure environmental risk factors and under-five childhood morbidity in the last two-weeks prior to survey.

A study of Calsistus (2009) showed that wealth index quintile, nationality of household head, house hold head's education level, main source of drinking water, number of children under 5 in the household, care takers age, child's gender and child's age were included in the model. Poverty has been related to unemployment, crowdedness, poor interactions, which all reflect on a family's health status, also sufficient family income has been reported as a main factor leading to better health outcomes (Bozkurt and *et al.* 2003). This finding is consistent with several studies which have found significant association between household economic status and diarrhea in children (Boadi&Kuitunen, 2005; Hatt& Waters, 2005; Ketema&Lulseged, 1997). Generally, children living in poor households have higher diarrhea rates than their wealthier counterparts, probably due to inadequate access to sanitary facilities, unsanitary environments in the home and poor child hygiene.

These results are consistent with Mahalanabis and *et, al.* (1996) which showed that In the logistic regression model the effect of maternal education remained high after adjustment for

several confounders. Based on the concept that socioeconomic variables operate through a set of proximate variables it is contended that maternal education, independently of economic power, through its impact on disease from acute diarrhea, favorably influences child survival.

Most families in this sample (29.3% in villages and 12.1% are in camps)lived in residences consisting of (1 - 2) rooms and 15.7% have bad or moderate household hygienic conditions due to unimproved toilet facility and lack of safe disposing sewage. Lack of access to preventive health messages and limited rights to access services can be risk factors of morbidity in the affected population. The type of sample chosen affects the results, so it is not strange to see these outputs.

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

This study aimed to know the main risk factors which are associated with diarrhea among hospitalized children in Gaza governorates. A case-control study was undertaken to hospitalized children in Naser Medical Complex and children attending Khanyounis primary health care center and Sheikh Radwan primary health care center. The target population consisted of two groups, the first group were cases (hospitalized children aged less than five years who are staying in pediatric ward at Naser Medical complex and Alnasser Pediatric Hospital during June and July 2012 and having diarrhea, the second group were controls who don't have diarrhea, a stratified cluster sample was consisted of 140 children (70 cases and 70 controls) matching was done for gender and age. A validated questionnaire was distributed to all 140 children during June and July 2012.

The study population consisted of 140 children, 70 (50%) were cases and 70 (50%) were controls. Seventy children (50%) (35 cases and 35 controls) were from Gaza and seventy (50%) (35 cases and 35 controls) were from Khanyounis. Thirty seven (50.0%) from males were cases, 37 (50.0%) from males were controls, 33 (50.0%) from females were cases and33 (50.0%) from females were controls.

Among household environmental factors; bivariate analysis was used by person's chi-square, results showed that there was a significant association between diarrhea and (residence, family income per month, source of drinking water, type of toilet facility) as p value < 0.05. On the other hand; the results showed that there was no significant association between diarrhea and main source of water, fuel used for cocking, child's feces disposal method,

household animals, number of children less than 5 years at home and number of rooms in the home as p value > 0.05.

Among socio-demographic factors; bivariate analysis was used by person's chi-square, results showed that there was significant association between diarrhea and father age as p value < 0.05 and there was no significant association between diarrhea and child gender, age of the child, OVC status, type of family, mother's education level, father's education level, mother age and mother work as p value > 0.05.

Other risk factors also was examined for the association between it and diarrhea by bivariate analysis, child's feeding status showed that there was a significant association between (Exclusive breast feeding {in the first 6 months, complementary feeding, number of meals per day and the age of weaning) and diarrhea as p value < 0.05. There was no significant association between diarrhea and (Immediate breast feeding {within the first half an hour} and replacement feeding) as p value > 0.05.

Association between child's nutritional status and diarrhea was examined by bivariate analysis using person's chi-square, results showed that there was a significant association between diarrhea and (weight for age z score and height for age z score) as p value < 0.01 and there was no significant association between diarrhea and (head circumference and body mass index) as p value > 0.05. The results also showed that there was a significant association between diarrhea and previous hospitalization as p value < 0.05 by bivariate analysis.

Multivariate analysis of risk factors of diarrhea in children aged less than 5 years was done using multiple regression. Results showed that there was significant association between diarrhea and (residence, family income, complementary feeding and age of weaning) as p value < 0.05. The results showed that the children who are living in camps have decreased the odds of having diarrhea by 99.9% than children who are living in cities and the children who are living in villages have decreased the odds of having diarrhea by 53.2% than children who

are living in cities. Also the table shows that the children who have families with income of (1800 – 2300NIS) have decreased odds of having diarrhea by 80.8% than children who have families with income less than 1800 NIS and the children who have families with no income have decreased odds of having diarrhea by 68.9% than children who have families with income less than 1800 NIS.

Children who didn't take complementary feeding have decreased odds of having diarrhea by 59.0%. On the other hand, children with increase in one month of weaning age, will have a decrease 1.058 times the odds to have diarrhea.

Model fitness was good, the classification table by SPSS showed that 72.2% of cases are predicted correctly whether they had diarrhea or not.

5.2 Recommendations

1. Supporting the scope of epidemiological studies and encouragement of further researches and studies in regard to child health and diarrheal diseases.
2. Encouragement of health policies and decision makers to visit the families who are living in remote areas to receive care and health education regarding diarrhea and other diseases.
3. Conduction a special health education programs for mothers and/or care takers regarding health practices, feeding practices, care of nutritional status and hygiene according to WHO lows and policies.
4. Social and financial support for families taking in consideration the families who have no family income and who have low income as it has a direct association with the child health.
5. Encourage breast feeding and supporting and adopting program to enhance it among mothers especially who are poorly educated.

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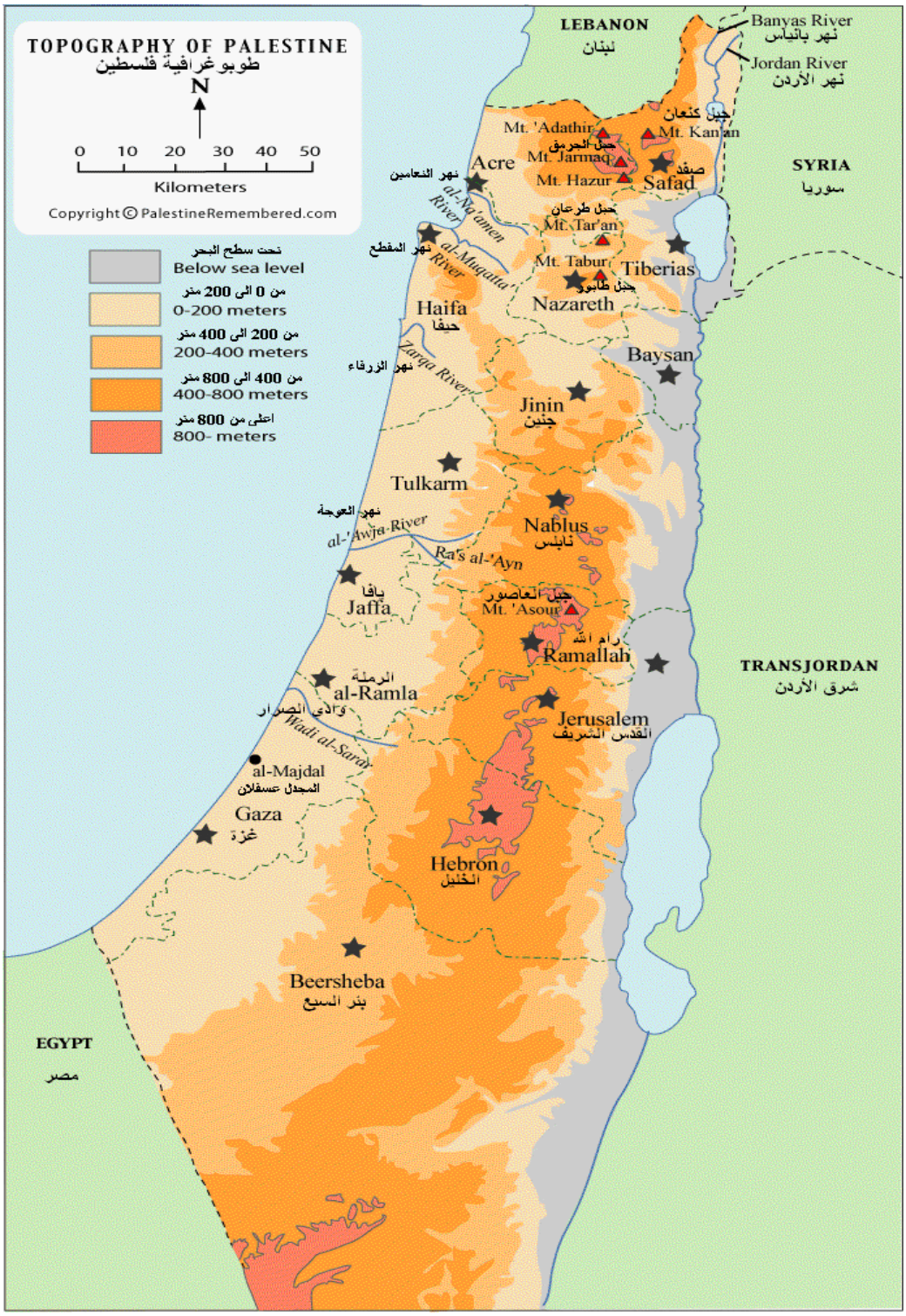
Annex (1): Map of Palestine



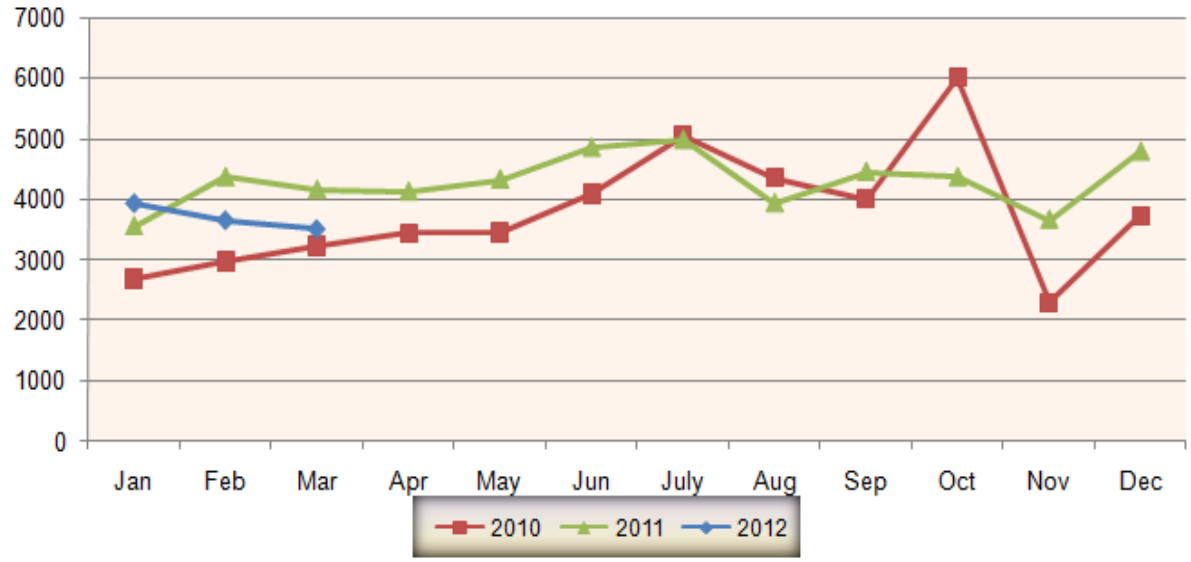
Source: (Agriculture project information system, 2011)

Annex (2): Map of Gaza Strip

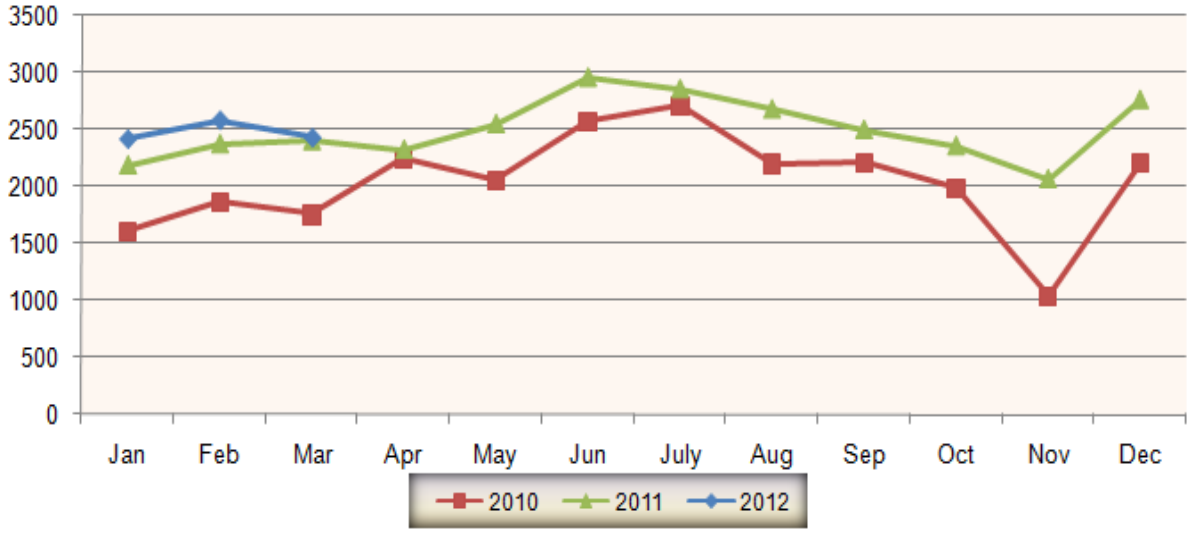
Places were visited

Source: (Perry Castaneda Library "Gaza Strip, March 1999"), www.lib.utexas.edu/maps/middle_east_and_asia/gaza_strip_1999.jpg

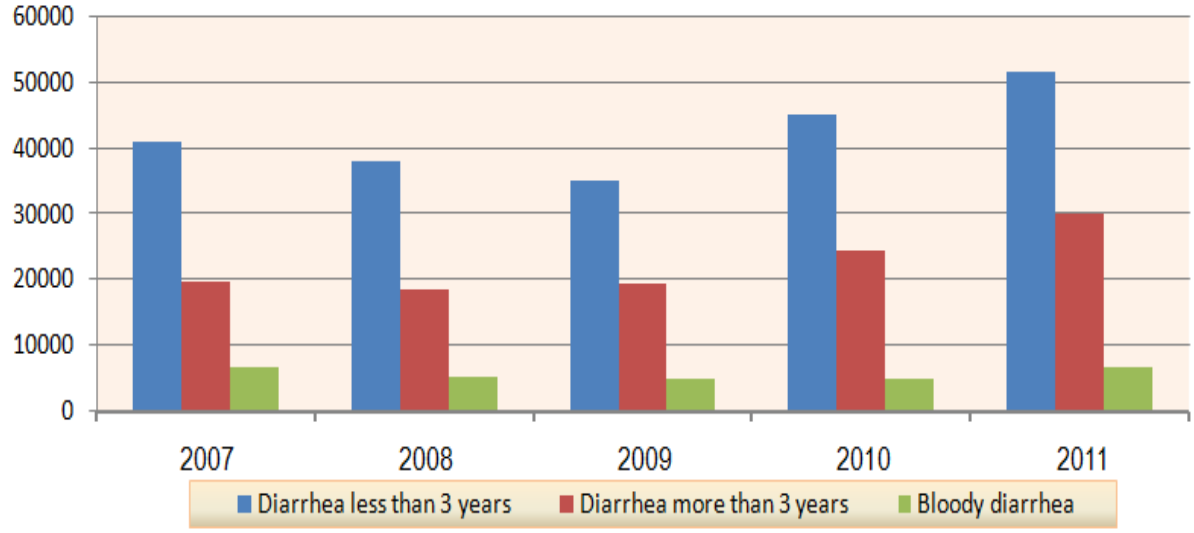
Annex (3): Distribution of diarrhea less than 3 years in Gaza strip, years 2010-2012



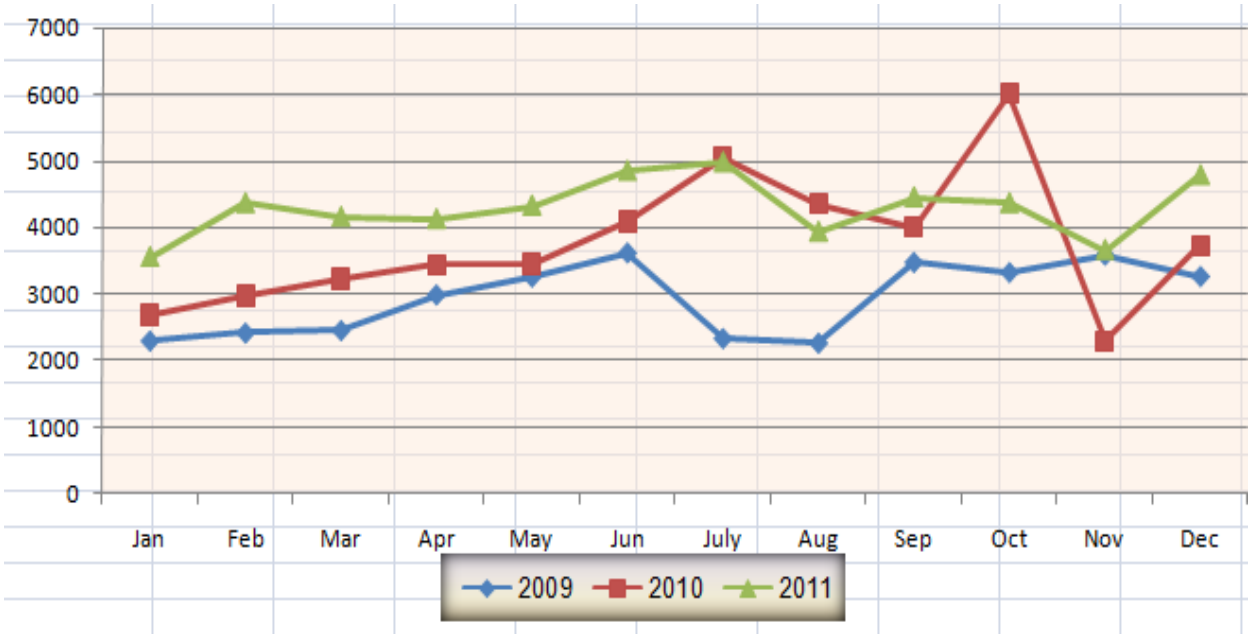
Distribution of diarrhea more than 3 years in Gaza strip, years 2010-2012



Annex (4): Distribution of diarrheal diseases in Gaza strip, years 2007-2011

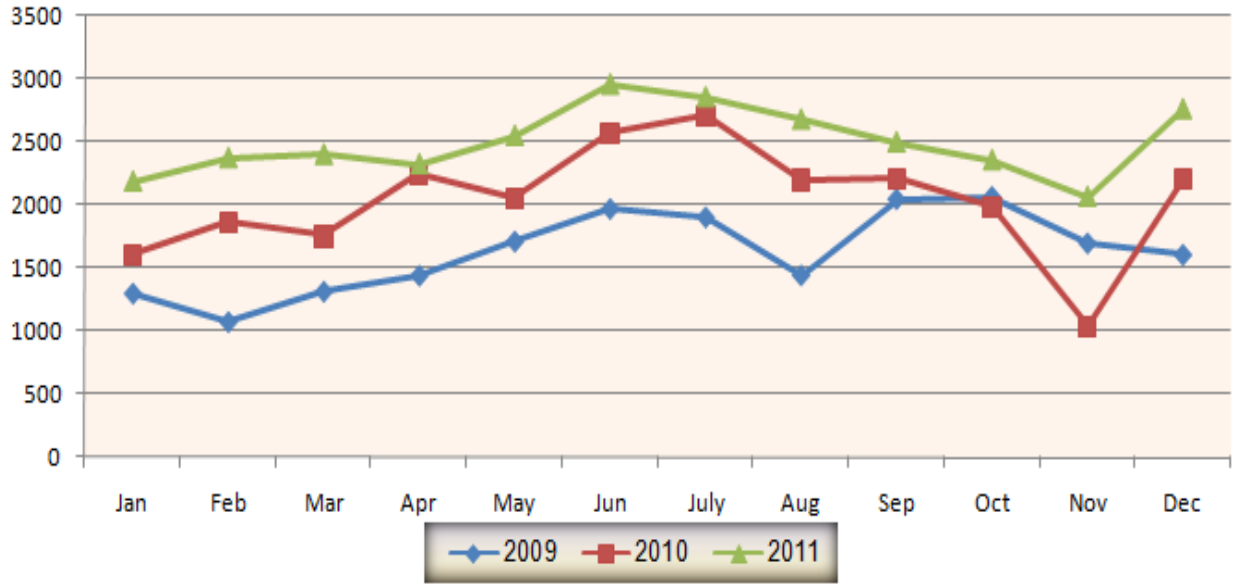


Distribution of diarrhea less than 3 years in Gaza strip during the years 2011

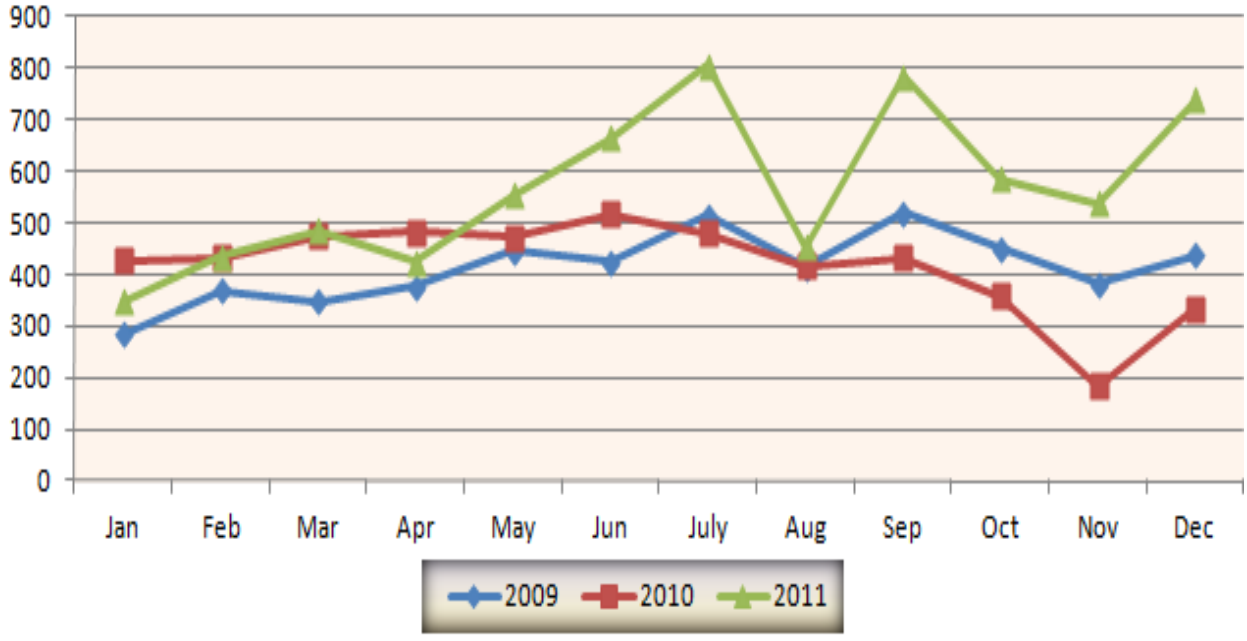


(Quarterly Epidemiological Report-Gaza, 2012).

Annex (5): Distribution of diarrhea for more than 3 years in Gaza strip, years 2009-2011



Distribution of Bloody diarrhea in Gaza strip, years 2009-2011



(Quarterly Epidemiological Report-Gaza, 2012)

Annex (6): Approval from Helsinki committee

Palestinian National Authority
Ministry of Health
Helsinki Committee

السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

التاريخ 5/3/2012

Name:

الاسم: غدير بكري

I would like to inform you that the committee has discussed your application about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

"Risk Factors Associated with Diarrhea among Hospitalized Children in Gaza Governorates: Case Control Study".

In its meeting on **March** 2012

و ذلك في جلستها المنعقدة لشهر **3** 2012

and decided the Following:-

و قد قررت ما يلي:-

To approve the above mention research study.

الموافقة على البحث المذكور عاليه.

Signature
توقيع

Member	Member	Chairperson
عضو	عضو	

Conditions:-

- Valid for 2 years from the date of approval to start.
- It is necessary to notify the committee in any change in the admitted study protocol.
- The committee appreciate receiving one copy of your final research when it is completed.

Annex (7): Approval from MOH

The Palestinian National Authority
Ministry of Health
Directorate General of Human Resources Development

السلطة الوطنية الفلسطينية
وزارة الصحة
الإدارة العامة لتنمية القوى البشرية

الرقم: ج س/12/82

التاريخ: 2012/05/31م

الأخ / د. مدحت محيسن المحترم،،،
مدير عام المستشفيات
السلام عليكم ورحمة الله وبركاته،،،

الموضوع/ تسهيل مهمة باحث

بخصوص الموضوع أعلاه، يرجى تسهيل مهمة الباحثة / غدير عبدو بكري الملتحقة ببرنامج ماجستير الصحة العامة – مسار علم الوبائيات _ كلية الصحة العامة – جامعة القدس في إجراء بحث بعنوان :-

"Risk Factor Associated with Diarrhea among Hospitalized Children in Gaza Governorates : Case- Control Study "

حيث الباحثة بحاجة للإطلاع على الملف الطبي و تعبئة استبانه من ذوي الأطفال الأقل من 5 سنوات الذين يعانون من الإسهال من الأطفال المنومين في مجمع ناصر الطبي و مستشفى النصر للأطفال ، بما لا يتعارض مع مصلحة العمل وضمن أخلاقيات البحث العلمي، و دون تحمل الوزارة أي أعباء.

وتفضلوا بقبول التحية والتقدير،،،

د. ناصر رأفت أبو شعبان
مدير عام تنمية القوى البشرية

وزارة الصحة
سجل رقم: 12/82
التاريخ: 2012/5/31

صورة/
– الإدارة العامة للرقابة الداخلية
– صاحب/ـة العلاقة

Gaza Tel / 08-2827298 Fax / 08-2868109 Email / hrd@moh.gov.ps

Annex (8): Approval from PHC

The Palestinian National Authority
Ministry of Health
Directorate General of Human Resources Development

السلطة الوطنية الفلسطينية
وزارة الصحة
الإدارة العامة لتنمية القوى البشرية

الرقم : 12.952 / 12

التاريخ:2012/06/25م

الأخ / د. فؤاد العيسوي المحترم،،،
مدير عام الرعاية الأولية
السلام عليكم ورحمة الله وبركاته،،،

الموضوع/ تسهيل مهمة باحث

بخصوص الموضوع أعلاه، يرجي تسهيل مهمة الباحثة / غدير عبدو بكري الملتحقة ببرنامج ماجستير الصحة العامة – مسار علم الوبائيات _ كلية الصحة العامة – جامعة القدس في إجراء بحث بعنوان :-

"Risk Factor Associated with Diarrhea among Hospitalized Children in Gaza Governorates : Case- Control Study "

حيث الباحثة بحاجة للإطلاع على الملف الطبي و تعبئة استبانه من ذوي الأطفال الأقل من 5 سنوات الذين لا يعانون من الإسهال من الأطفال المراجعين لمركز صحي الشيخ رضوان ومركز صحي شهداء خانيونس، بما لا يتعارض مع مصلحة العمل وضمن أخلاقيات البحث العلمي، و دون تحمل الوزارة أي أعباء.

وتفضلوا بقبول التحية والتقدير،،،

د. ناصر رأفت أبو شعبان
مدير عام تنمية القوى البشرية

وزارة الصحة
صحيفة نعوه
صادر: 12.952
التاريخ: 2012/6/25

صورة/
– الإدارة العامة للرقابة الداخلية
– صاحب/ـة العلاقة

Gaza Tel / 08-2827298 Fax / 08-2868109 Email / hrd@moh.gov.ps

Annex (9): Questionnaire

Risk Factors Associated With Diarrhea among Hospitalized Children in Gaza Governorate: Case-Control Study

Serial number: …….

Date of admission: ……/…../2012

Place of admission: ☐ Nasser medical complex ☐ Al-Nasser pediatric hospital

Diagnosis:…….

Chief Complain:……

How many times?.....

Result of stool analysis:……

Part A: child socio-demographic data

1. Governorate: ……..
2. Address: ……..
3. Telephone / mobile: ……..
4. Date of birth: ……/……/……
5. Age in years…….
6. Gender: ☐ Male ☐ Female
7. Mothers Age: ……
8. Fathers Age: ……..
9. Mother Work: ☐ Employed ☐ Unemployed
10. If employed, what is the type of job? .....
11. Where did you leave your child during your work? .....
12. Mother's education: ☐ Illiterate ☐ Primary ☐ Preparatory ☐ Secondary ☐ University ☐ High education

13. Father's education: ☐ Illiterate ☐ Primary ☐ Preparatory ☐ Secondary ☐ University ☐ High education

14. Orphan Vulnerable Child status: ☐ Orphaned ☐ Vulnerable ☐ Not OVC

Part B: Child Health and Nutritional Status

15. Weight: ……. Kg

16. Height: …….. cm

17. Head circumference: …….. cm

18. Nutritional status ☐ underweight ☐ overweight ☐ within normal (According to WHO scale, Z-score).

19. Did your child have any chronic disease? ☐ Yes, list: ……. ☐ No

20. Previous hospitalization? ☐ Yes ☐ No

Part C: Household characteristics

21. Total number of household members: ……..

22. Number of rooms in your house: ……

23. Average of family income per month ☐ <1800 Nis ☐ 1800-2300 Nis >2300Nis ☐

24. Mother status: ☐ Alive ☐ Ill ☐ Dead ☐ Divorced

25. Father status: ☐ Alive ☐ Ill ☐ Dead

26. Child is living within:

☐ Nuclear family ☐ Extended family ☐ Other (Specify): _____

27. Residence ☐ City ☐ Village ☐ Camp

28. Main source of water before illness?

☐ Municipal water ☐ Buying water tanks ☐ UN agency

☐ Household well (rainfall collection well)

29. The source of drinking water?

☐ Filter ☐ Bottle (Mineral water) ☐ The same as the source of water

30. Access to toilet facility ☐ Improved, new ☐ Unimproved, old

31. Number of children under 5 years in the household: ……..

32. Method of disposal of child's feces

☐ Safe method (in special place)

☐ Unsafe method (putting in the garbage, leaving in open area)

33. What is the type of fuel used for cooking?

☐ Clean (electricity, liquid gas) ☐ Unclean (charcoal, kerosene and wood)

34. Do you have household animals? ☐ Yes ☐ No

If Yes, please list:…….

Part D: Child's Feeding practice

35. Feeding practices

☐ Immediate Breast Feeding (within the first half an hour to one hour)

☐ Exclusive breast feeding in the first 6 months

☐ Complementary feeding

☐ Replacement feeding

36. Duration of breast feeding:……..

37. Age of weaning: ……

38. Number of meals per day:……

Annex (10): Control panel

No.	Name	Position
1.	Dr. Yehia Abed	Alquds University
2.	Dr. Bassam Abu Hamad	Alquds University
3.	Dr. Samir Abu Draz	European Gaza Hospital (Pediatric consultant)
4.	Dr. Nabeel Albarqooni	Director General of Alnasser pediatric Hospital
5.	Dr. Yousef Abu Reesh	Director General of Hospitals
6.	Dr. Abd Alrahman alhams	Palestine College of Nursing
7.	Dr. Baker Alzaboot	Islamic University – Gaza
8.	Dr. Abdalraoof Almanaama	Islamic University – Gaza
9.	Dr. Hamza Abd aljawwad	Palestine College of Nursing
10.	Dr. Majed Yassen	Islamic University – Gaza
11.	Dr. Ahmad Alfarra	Nasser Medical Complex (Pediatric consultant)
12.	Dr. Akram Abo Salah	Palestine College of Nursing

ملخص الدراسة

هذه الدراسة بعنوان " عوامل الاختطار لمرض الإسهال بين الأطفال دون سنة الخامسة في محافظات غزة: دِراسَةُ الحالاَتِ و الشَّواهِد"

على الصعيد العالمي يعتبر الاسهال من الأسباب المؤدية للوفاة في الدول النامية، هدفت هذه الدراسة إلى معرفة عوامل الاختطار لمرض الإسهال بين الأطفال دون سنة الخامسة في محافظات غزة ، استخدم الباحث دراسة مقارنة بين حالات مرضية وحالات سليمة وقد تكونت عينة الدراسة من 140 طفل أخذت بطريقة عينة طبقية عنقودية (70 طفل يعاني من اسهال و70 طفل سليم) وقد أخذت عينة الحالات من مجمع ناصر الطبي (35 طفل مريض بالاسهال) ومن مستشفى النصر للأطفال (35 طفل مريض بالاسهال) أما الحالات السليمة فقد أخذت من مركز شهداء خانيونس الصحي (35 طفل سليم) ومن عيادة الشيخ رضوان (35 طفل سليم). تكونت أداة الدراسة من استبانة تم إعدادها لقياس متغيرات الدراسة وقد قام الباحث بإجراء اختبارات الصدق والثبات للاستبانة من خلال عينة استطلاعية تكونت من 15 طفل وقد تم تضمينهم في عينة الدراسة. وقد تم استخدام بعض الاختبارات الاحصائية مثل مربع كاي، والانحدار المتعدد.

أظهر تحليل ثنائي المتغير باستخدام مربع كاي أن هناك علاقة ذات دلالة احصائية بين مرض الاسهال وبين العوامل البيئية المنزلية مثل (مكان السكن، معدل الدخل الشهري، مصدر مياه الشرب ونوع دورة المياه المستخدمة بالمنزل) كما وأظهرت النتائج انه لاتوجد هناك علاقة ذات دلالة احصائية بين الاسهال وبين (المصدر الرئيسي للمياه، وقود الطهي، طريقة التخلص من الفضلات لدى الطفل، وجود حيوانات منزلية، عدد الأطفال دون سن الخامسة بالمنزل، وعدد الغرف الموجودة بالمنزل).

أما من بين العوامل الديموغرافية التي أظهرتها النتائج انها على علاقة ذات دلالة احصائية بينها وبين الاسهال باستخدام مربع كاي هي (سن الأب)، وقد أظهرت النتائج أنه لاتوجد علاقة ذات دلالة احصائية بين الاسهال وبين العوامل الديموغرافية مثل (جنس الطفل، سن الطفل، حالة اليتم والضعف لدى الطفل، نوع العائلة، مستوى تعليم الوالدين، سن وعمل الأم). وقد أظهر مربع كاي وجود علاقة ذات دلالة إحصائية بين الاسهال وبين (الرضاعة الطبيعية الحصرية، التغذية المكملة، عدد الوجبات اليومية، سن الفطام، الوزن بالنسبة للسن و الطول بالنسبة للسن).

وقد أظهر اختبار الانحدار المتعدد لايجاد عوامل الاختطار لمرض الاسهال للأطفال دون سن الخامسة ان هناك علاقة ذات دلالة إحصائية بين الاسهال وبين (مكان السكن، معدل الدخل الشهري للأسرة، التغذية التكميلية وسن الفطام)، أظهرت النتائج أن الأطفال الذين يقطنون بالأرياف تقل معدل اصابتهم بالاسهال ما نسبته (53.2%) من الاطفال الذين يقطنون بالمدن، كما واظهر الانحدار المتعدد أن الأطفال الذين لدى عوائلهم معدل دخل شهري ما بين (1800-2300 شيكل) تقل معدل اصابتهم بالاسهال ما نسبته (80.8%) من الأطفال الذين لدى عوائلهم معدل دخل شهري أقل من 1800 شيكل. كما وأظهرت النتئائج أن الأطفال الذين يتلقون التغذية التكملية تزيد معدل اصابتهم بالاسهال ما نسبته (59.0%) من الذين لا يتلقونها وأنه كلما تأخر سن فطام الطفل بمعدل شهر واحد (بما لا يتجاوز الحد الطبيعي) كلما قل معدل الاصابة بالاسهال مرة واحدة. أظهرت نتائج الدراسة بان هناك حاجة ماسة للفت الانتباه للذين لا يتلقون معدل دخل الشهري كافٍ وإلى الاطفال الذين لا يتلقون الرضاعة الطبيعية.