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AL-Quds University

**Risk Factors for Malnutrition among Children Less than Five Years:
The Role of Environment and Socio-demographic Factors**

Yehia Ahmed Musameh Abu Musameh

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The Role of Environment and Socio-demographic Factors**

By

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MCH

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**Risk Factors for Malnutrition among Children Less than Five Years:
The Role of Environment and Socio-demographic Factors**

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November, 2004

Declaration

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

Signed.....

Yehia Ahmed Abu Musameh

Date: 26 /11/2004

Dedication

I wish to dedicate this humble work to my country and to all the
Palestinian Children

Acknowledgment

I am most grateful to the many individuals who contributed to make this study possible:

I am indebted to all those mothers and children who participated in the study.

I am indebted to my teachers and supervisors for their guidance, support and suggestions, Dr. Abdul Rahman Issa and Mr. Sadi Abu Awwad.

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Abstract

The aim of this study is to investigate environment and socio-demographic risk factors and other risk factors associated with malnutrition among children under five years of age in the Gaza Strip. The study population consists 90 children who were diagnosed and confirmed as cases of malnutrition according to WHO standards “Z scores less than -2 was the case definition of malnutrition”. Controls were 180 children, Z scores ± 2 standard deviation matched with cases for sex, age and locality.

A structured questionnaire was administrated to mothers to obtain information on potential risk factors (socioeconomic status, breast feeding and diet patterns, maternal variables, environmental factors and child health status). Anthropometric measurements of weight and height were conducted for controls in order to exclude those children who were malnourished. The equipment used was digital scale and supine length boards. Stunting, wasting and underweight were used as indicators of malnutrition. Chi square and odd ratio and a 95% CI were used and calculated.

Factors positively associated with malnutrition identified by the study were low parent’s education, low household monthly income, low money spent on food purchasing, crowded houses, rice pudding as common complementary food, drinking tea, low birth weight babies, preterm babies, child morbidity, pregnancy disorder and caesarian delivered babies. Factors negatively associated with malnutrition identified by the study were working parents, living in nuclear family, living in concrete house, owning the house, having a refrigerator, having a separate kitchen, having a flush toilet and breast feeding during the 1st three days.

The study contributes in highlighting malnutrition risk factors providing hints for implementing strategies that could contribute in the prevention of malnutrition. These preventive measures include; improving socioeconomic conditions, promoting breast

feeding and dietary pattern, increasing maternal health education and improving housing condition.

ملخص الدراسة

إن هدف هذه الدراسة هو تحديد عوامل الخطر المصاحبة لسوء التغذية عند الأطفال في محافظات غزة والإسهام في تطوير قاعدة معلومات تساعد في توجيه ورسم سياسات التغذية للحد من سوء التغذية.

الأهداف الخاصة:

من أجل تحقيق الهدف العام فإن الدراسة تسعى إلى استكشاف عوامل الخطر المحتملة التي تسهم في حدوث سوء التغذية في غزة وتطوره وذلك من خلال فحص العلاقة الارتباطية بين الشروط الاجتماعية والاقتصادية والبيئية و سوء التغذية وكذلك فحص العلاقة بين بعض المتغيرات المختارة المتعلقة بصحة الأم والطفل و سوء التغذية بالإضافة إلى فحص العلاقة بين الرضاعة و أنماط التغذية عند الأطفال و سوء التغذية.

منهجية الدراسة:

هذه الدراسة هي استكشافية درست الحالات المرضية في وجود مجموعة ضابطة وجمعت فيها بيانات كمية على النحو التالي:

أ. عينة الدراسة

كون جمهور الدراسة ٩٠ حالة مرضية من الأطفال التي تم تشخيصهم حديثا وتم اختيارهم عشوائيا من الأطفال المترددين على عيادات جمعية أروض الإنسان في قطاع غزة وتم اختيار ١٨٠ طفلا صحيحا غير مصاب بالمرض تم اختيارهم أيضا عشوائيا من جميع مناطق قطاع غزة، متناظرين بالأطفال المرضى من حيث الجنس والعمر ومكان الإقامة.

ب. أداة جمع المعلومات

تم تصميم استمارة خاصة كأداة استقصاء لجمع المعلومات وصممت الاستمارة بحيث تشمل تفاصيل عن الأبوين كالسن و الوظيفة والمستوى التعليمي و متوسط الدخل الشهري. وكذلك تاريخ الحمل والولادة مثل وزن الطفل عند الولادة، وعمره عند الولادة و العمر عند الحمل الأول و عدد مرات الحمل والتباعد بين الأحمال وأنماط الإطعام وأمد الرضاعة الطبيعية والأطعمة المكملة. معلومات عن البيئة حول الطفل مثل نوع الأسرة، عدد الأشخاص في الغرفة، حالة الصرف الصحي. معلومات عن رضاعة وتغذية الطفل مثل فترة الرضاعة والأطعمة المكملة وبداية تناولها، طريقة الفطام، عدد الوجبات في اليوم، الشهية للطعام. معلومات عن صحة الطفل مثل التاريخ المرضي وسبب دخول المستشفى والإصابة بالديدان.

علما بأنه كان قد تم إرسال الاستبانة إلى بعض المختصين للتحكيم، كذلك تم تجريب الاستمارة ميدانيا على عدد ١٠ حالة مرضية متناظرة مع عدد ٢٠ طفلا صحيحا. وبناء عليه أجريت بعض التعديلات اللازمة على الاستمارة قبل استعمالها.

النتائج:

دللت النتائج على وجود العديد من العوامل التي ارتبطت بقوة بسوء التغذية بين الأطفال في قطاع غزة.

أولاً: العوامل الاجتماعية والاقتصادية

بينت الدراسة أن نسبة حدوث سوء التغذية بين الأطفال تقل مع زيادة مستوى التعليم عند الوالدين، وتزداد مع زيادة معدل البطالة، كما تزداد بين الأسر الفقيرة، والأسر التي تحصل على مساعدات إنسانية، ويشير ذلك إلى أن الأسر التي تحصل على مساعدات إنسانية هي الأكثر فقرا. بينما توجد علاقة عكسية بين درجة القرابة و سوء التغذية.

ثانياً: البيئة

أوضحت الدراسة أن سوء التغذية تتناسب عكسيا مع صحة البيئة حيث قل معدل سوء التغذية في البيت الواسع كثير عدد الغرف والبيت المملوك للأسرة والبيت المصنوع من الباطون كذلك وجود ثلاجة ومطبخ مستقل وكل ذلك يعكس أن الوضع الاقتصادي لهذه الأسر جيد ومن ثم تقل الأعباء على الأسرة كما يمكن توفير الغذاء المناسب للأسرة. كما بينت الدراسة أن نسبة حدوث سوء التغذية تزداد مع زيادة عدد الأفراد في البيت مما يعكس زيادة الأعباء والمتطلبات على الأسرة.

ثالثاً: الرضاعة وأنماط التغذية

بينت الدراسة أن نسبة حدوث سوء التغذية تقل بين الأطفال الذين رضعوا من أمهاتهم في الثلاث أيام الأولى من حياتهم. في حين أن سوء التغذية تزداد بين الأطفال الذين يتناولون الأطعمة المكملة قبل سن أربع شهور. كما بينت الدراسة أن نسبة حدوث سوء التغذية تزداد بين الأطفال الذين يتناولون الأطعمة المكملة للرضاعة "مهلبية الأرز والفاكهة المهروسة. كذلك تزداد سوء التغذية بين الأطفال الذين يشربون الشاي والذين يعانون من فقدان الشهية.

رابعاً: عوامل الأمومة والطفل

دللت نتائج الدراسة على قوة العلاقة والارتباط الايجابي بين الأطفال الخدج والأطفال الذين كانت ولادتهم قيصرية والأطفال الذين مرضت أمهاتهم أثناء الحمل وحدث سوء التغذية.

كما بينت الدراسة أن الأطفال المصابين بالتهابات في الجهاز التنفسي والهضمي وكذلك الأذن والمصابين بالديدان والأطفال الذين يدخلون المستشفى كانوا أكثر عرضة للإصابة بسوء التغذية.

التوصيات

العمل في اتجاهات متعددة من أجل تحسين الحالة الاجتماعية والاقتصادية مثل السكن والظروف المعيشية، كذلك الجهود في عدة مجالات يجب أن تؤخذ لضمان توفير الطعام الصحي بكمية كافية خاصة لأولئك الذين يعيشون أوضاعاً اجتماعية واقتصادية صعبة، العمل على زيادة الوعي الجماهيري عن سوء التغذية وأثارها السيئة والتركيز على النواحي المتعلقة بالثقافة مثل عادات طهي الطعام وعادات تناول الطعام ورضاعة الأطفال وتقليل تناول الشاي، تقوية خدمات صحة الأم والطفل خاصة العناية قبل الولادة مع التركيز على العوامل المتعلقة بالتغذية، بالإضافة إلى معالجة أمراض الأطفال لأنها تزيد من خطر التعرض لسوء التغذية والعكس صحيح.

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List of Abbreviations

ACC/SCN	Administrative Committee on Coordination(of the United Nations) / Sub-Committee on Nutrition
AEI	Ard El Insan
CI	Confidence Interval
DM	Diabetes Mellitus
FAO	Food and Agriculture Organization of the United Nations
GIT	Gastro Intestinal Tract
GNI	Gross National Income
GNP	Gross National Product
KAP	Knowledge, Attitude and Practice
LBW	Low Birth Weight
MCH	Mother Child Health
MOH	Ministry of Health
NCHS/WHO	National Center for Health Statistics / World Health Organization
NGOs	Non-Governmental Organizations
NIS	New Israeli Shekel
OR	Odds Ratio
ORS	Oral Rehydration Solution

PEM	Protein Energy Malnutrition
PHC	Primary Health Care
SD	Standard Deviation
SPSS	Statistical Package for the Social Science
UNICEF	United Nations Children's Fund
UNRWA	United Nations Relief and Works Agency for Palestinian Refugees
US\$	United States Dollars
USA	United States of America
WHO	World Health Organization

Chapter 1
Introduction

Chapter 1

Introduction

Malnutrition, one of the most important global health problems, affects large numbers of children in developing countries (Victoria et al, 1986). Information on child growth is helpful in monitoring trends, determining priorities, and evaluating the effectiveness of nutritional intervention programs (Al-Sayed et al, 2001). Malnutrition is a serious global issue, each year; some 24 million babies are born too small to lead healthy lives because their mothers were either ill or malnourished, United Nations Children's Fund (UNICEF, 1998). Among children under five years of age in the developing world, 206 million are stunted, 50 million are wasted and 167 million are underweight due to lack of food and the presence of disease (De Onis et al, 1997).

World Health Organization (WHO) defined malnutrition as the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions. Malnutrition prescribes a state of poor intake or utilization of the daily nutritional requirements including; calories, macro and micro-nutrients, which are required for maintaining all life activities, physical as well as mental growth patterns (WHO, 2000b). Consequently, growth declines below the median figures, and the daily energy expenditure is minimized in order to allow keeping the integrity of extremely vital organs aiming at supporting life chances until nutritional supplements are available or better utilized by the body (WHO, 2000b).

Because of the link between malnutrition and social factors, the nutritional status of a population is a sensitive indicator of the quality of life in the community (De Onis et al, 1993). Stunting, wasting and underweight are nutritional diseases that have been the focus of attention worldwide. They have attracted significant consideration by researchers and policy makers, because all three diseases are preventable (Frongillo et

al, 1997). About 200 million children under 5 are affected by protein energy malnutrition and some 36 million are underweight (WHO, 1995a).

Malnutrition of children less than five years of age is influenced more by environmental factors, particularly diet, than genetic or ethnic origins (Martorell and Habicht, 1996). Malnutrition continues to be a problem of considerable magnitude in most of the developing countries. Children aged 0-3 years are nutritionally the most vulnerable, more than half of the children in India are unable to grow to their full physical and mental potential owing to malnutrition (Chaudry, 1994).

A consequence of various factors of malnutrition, is often related to poor quality of food, insufficient food intake, and severe and repeated infectious diseases, or, frequently, combinations of the three (De Onis and Blossner, 1997).

Locally, the number of malnourished children was apparently increasing during the year 2001 and several forms of nutritional disorders were reported in Ard El Insan (AEI) centers. An increase of 125% has been reported and the malnourished cases were 2-3 folds over in the year 2000, (AEI, 2002). Therefore the overall aim of this study is to estimate the risk factors associated with malnutrition among children in the Gaza Strip.

1.1 Objectives

The overall aim of this study was to identify the environment and socio-demographic risk factors and other risk factors associated with malnutrition among children who attend ARI health centers in the Gaza Strip. The study aims to conduct an analysis of the current situation to provide insights into specific factors associated with malnutrition.

Specific objectives

The objectives of this study were:

1. To assess the potential factors contributing to the development of malnutrition among children in the Gaza Strip.
2. To investigate the association between socio-demographic and socioeconomic factors and malnutrition among children in the Gaza Strip.
3. To estimate the association between selected environmental variables and malnutrition among children in the Gaza Strip.
4. To examine the relationships between child feeding patterns and selected maternal variables and malnutrition among children in the Gaza Strip.
5. To assess the relationships between selected child health attributes and malnutrition among children in the Gaza Strip.

1.2 Research hypotheses

- 1- There are significant differences between cases and controls related to socioeconomic and socio-demographic variables, such as parent age, monthly income, parent education, parent's occupation, and family size.
- 2- There are significant differences between cases and controls related to environment variables, such as place of residency, housing condition, water supply, sewage system, room's number, and number of people living at home.
- 3- There are significant differences between cases and controls related to dietary factors such as infant feeding, exclusive breast feeding, complementary feeding breast feeding and weaning age.
- 4- There are significant differences between cases and controls in relation to maternal factors such as maternal age, age at first delivery, parity, age at intended child delivery, birth spacing, child rank and maternal health status.

5- There are significant differences between cases and controls related to child morbidity and other attributes such as birth weight, morbidity and prematurity.

1.3 Justification of the problem

Nutrition is a cornerstone that affects and defines the health of all people, rich and poor. It paves the way for us to grow, develop, work, play, resist infection and aspire to the realization of fullest potential as individuals and societies. Conversely, malnutrition makes all more vulnerable to disease and premature death. Malnutrition is the single most important risk factor for disease. When poverty is added to the picture, it produces a downward spiral that may end in death (Parizkova, and Hills, 2001).

At least 70% of the malnourished people of the world are children, at the best estimates, forty thousand children a day die of starvation Food and Agriculture Organization of the United Nations (FAO, 1989).

Children do not have the ability to forage for themselves, and their nutritional needs are exceptionally high. Hence, they are unable to survive for long on their own, especially in lean times. Moreover, they are especially susceptible to diseases and conditions which are the staple of undernourished people: simple infections and simple diarrhea (UNICEF, 1993). Unless others provide adequate food, water and care, children will suffer and die. This fact must frame any moral to search the cause of the problem. Eliminating hunger and malnutrition is technically feasible. The challenge lies in generating the requisite political will, developing realistic policies and taking concert actions nationally and internationally (WHO, 1974).

In 1995, in the Gaza Strip 15.1% of children were underweight, 14.2% were stunted and 5.7% of them were wasted (Kumar, 1995). Recently in 2002, the prevalence of acute malnutrition is 13.3% among children 6-59 months of age in the Gaza Strip

and 4.3% in the West Bank and the prevalence of chronic malnutrition is 17.5% in the Gaza Strip and 11.7% in the West Bank. Significant proportion of children are chronically malnourished with ratios in Gaza more than double those of the West Bank and three folds of acute malnourished children (John Hopkins and Al-Quds Universities, 2002). In 2003 the prevalence of wasting and stunting among governmental primary schools children in the Gaza governorates was 5.1% and 16.5% in both Gaza and North Gaza governorates (Skeik, 2003).

Determination of risk factors associated with malnutrition of the Palestinian children will enable policy makers and other health providers to set up appropriate intervention plans that could prevent and promote nutritional status of the children. It is not only preventing some leading causes of illness and death but also decreasing direct health care cost and improving the people's quality of life.

1.4 Background to the study

Geography

The Gaza Strip is a narrow piece of land lying on the coast of the Mediterranean Sea. Its position on the crossroads from Africa to Asia makes it a target for occupiers and conquerors over the centuries. The last of these was Israel who occupied the Gaza Strip from the Egyptians in 1976. Gaza Strip is a very crowded place with an area of 360 square kilometers. The population is mainly concentrated in the cities, small villages, and eight refugee camps that contain two thirds of the population. The main income source for Gaza population was working in Israel, in addition to some agriculture products that have to be exported via Israel, Ministry of Health (MOH, 2003).

The length of the Gaza Strip from Beit Hanoun in the north to Rafah in the south is about 50 Km; its width is 5-7 Km in the northern section and reaches a maximum of

12 Km in the south. The land area is essentially a plain, the coastline, however has an area of dunes besides its sandy beaches all long its length and an altitude of 0-40 meters above the sea level. It has a subtropical climate with four distinct seasons. The Gaza Strip is administratively divided into five governorates North, Gaza city, Mid-zone, Khan Younis and Rafah, (MOH, 2003).

Demography of the Gaza Strip

Population

According to Palestinian Annual Report (MOH, 2003) the estimated number of Palestinian population all over the world is 9,209,773. In the Gaza Strip, the population size is estimated at 1,261,909 (36.4%) of total population in Palestine and 13.7% from the total Palestinian Population (MOH, 2003). About 49.6% of population is under 15 years and 19.4% is under five years in Gaza Strip. Dependency ratio 101.6% (108% for Gaza Strip Vs 92% for West Bank), the median age was 15.2 years in 2002 in Gaza Strip (MOH, 2003). Birth rate in the Gaza Strip still is one of the highest birth rates in the world, crude birth rate of the population was 33.1 per 1000 in the Gaza Strip in 2002 (MOH, 2003).

Population density

Population density is 3,505 inhabitants per one square km. In Gaza Strip, it must be taken into consideration that a sizable area of the Gaza Strip is still occupied by Israeli settlers; therefore, the actual density rates are higher than the estimated figures (MOH, 2003).

Fertility

Total fertility rate in Palestine is one of the highest rates in the world; some of the causes of high fertility are early marriage, the political situation, the desire of having

many children, the norms, values and traditions in the society. Total fertility rate is calculated to be 3.85 in 2002 (MOH, 2003).

Mortality rate

Crude death rate 3.5 per 1000, infant mortality rates 23.3 per 1000 in Gaza Strip in 2002. The primary cause of infants death in the Gaza strip in 2002 was prematurity (35.0%), congenital anomalies (22.6%), acute respiratory infection (13.2%) and infectious disease (6.4%). Maternal mortality ratio was 21.6 per 100.000 live births among women aged 15-49 years (MOH, 2003).

Socioeconomic status

Although partial autonomy for Palestinians has started since 13 September 1993, Israel still controls borders, means of communication, security, commercial market, goods and travelers movement in and out of Gaza. It also controls the internal and external export and import, water and the sources of energy.

The Gaza Strip is considered a poor area. There are no natural economic resources. Gross National Income (GNI) in 2002 declined to 40% less than in 2000. Real per capita incomes are now only half of their September 2000 level. Unemployment stands at 40% of the workforce; Physical damage resulting from Israeli aggression was United States Dollars (US\$) 728 million by the end of August 2002. Between June 2000 and June 2002, Palestinian exports declined by 45% in value, and imports contracted by a third.

Overall GNI losses reached US\$ 5.4 billion after 27 months of the Intifada; the estimated cost of the crisis is now equivalent to one full year of Palestinian wealth creation (MOH, 2003).

The Palestinian National Authority fiscal position remains precarious. As a result of rising unemployment, reduced demand, and the withholding by the Government of Israel of taxes collected on the Palestinian National Authority behalf, monthly

revenues fell from some US\$ 91 million in late 2000 to just US\$ 19 million by mid-2002 (MOH, 2003).

The proximate cause of Palestinian economic crisis is caused by the government of Israel's imposition of restrictions on the movement of Palestinian goods and people across borders and within West Bank and Gaza. The restrictions take two major forms: internal restrictions reinforced by curfews, and external closure of the border between Israel and the Palestinian territories, in addition to limitations on the entry of Palestinian workers (MOH, 2003).

In September 2000, an estimated 128,000 Palestinians worked in Israel and the Israeli settlements. With the outbreak of the Intifada, Government of Israel at first cuts back heavily on the issuance of work permits, but in recent months it has begun to provide considerable numbers once again. Some 32,000 were being issued by the end of 2002; though only about half of these were being used, internal closures make it hard for many workers to move through the West Bank and Gaza to the designated workplace. Many families have endured long period without work or incomes. Coping with the situation has meant selling assets, borrowing from neighbors and shopkeepers and cutting consumption, including food (MOH, 2003). Using a poverty line of US\$ 2 per person a day, the World Bank estimated that 60% of the Palestinian population was poor by December 2002. More than 75% of the population in the Gaza Strip is poor now (MOH, 2003).

Environmental situation

Palestine can be divided into five main ecological sub-regions: the Mediterranean shoreline coastal plain, the upper coastal plain, the central highlands, the semi-arid eastern slope steppes and the arid semi-tropical Jordan valley MOH (2003).

Climate: The climate in the Mediterranean region has four months of hot humid summer and a short winter with rain from December to March MOH (2003).

Water resources: About 95% of Gaza residents receive water service, which means that most of the population has access to an indoor tap, also the use of rooftop tanks with 1-2 M³ capacity is a common practice in all houses in Gaza. There is no advance treatment of water in Palestine, except for using chlorine to disinfect domestic municipal wells. Even in municipal wells the efficiency of chlorination is not always up to the required acceptable levels, since chlorinating machines are often in bad condition with poorly functioning pumps. It has been shown that disinfection efficiency has low as 28% in the summer period for some wells in Gaza, in most of Gaza's municipalities, water consumption average 75 liters per capita per day. Most municipalities use groundwater without any treatment except for disinfection. Some municipalities buy water from Israeli water company (Mekorot), (MOH, 2003).

Waste water: in the Gaza City area, sewage from non-functioning treatment plants is discharged onto neighboring land. Also, in Gaza, access to sewage facilities is about 66.3% of the population; about 70-80 % of the domestic water waste produced in Gaza is discharged into the environment without treatment. Cesspits are emptied by vacuum tankers, which usually dump their contents onto open ground, or into wadis, sewerage networks, irrigation channels, or solid waste disposal sites. Israeli settlements in Gaza discharge large quantities of wastewater directly into Palestinian land or into coastal waters without treatment (MOH, 2003).

In some areas, water is not only unfit for human consumption but also for agricultural uses as well. Sewage networks did not cover the total residential areas in the Gaza Strip. So far the use of septic tanks to drain wastewater is still

widespread causing water contamination. The rest of sewage is collected in sewage collecting pools without treatment or discharged into the Mediterranean Sea (Safi, 1998).

About 65% of water wells in the Gaza Strip are chemically polluted, and about 13% of water wells are bacteriologically contaminated (MOH, 2003).

The other environmental problem in Gaza is air pollution; there is large number of transportation means which are the major source of air pollution (Safi, 1998). Solid waste collection and transportation to landfills are highly affected by Israeli siege policy which leads to overcrowd garbage in streets and cities and forced municipalities to rebuild new unhealthy temporary collection sites.

This impact affected human health and environment, increased the spread of insects and contamination of ground water (MOH, 2003).

1.5 Health services

Primary health Care (PHC)

PHC is the basic level of care provided equally to everyone, it is considered the backbone of the health system. Although PHC system is unique, well established and functioning but due to high population density and overcrowded population, the ratio of persons per center was with an average ratio 13,145 persons per center. In the Gaza Strip, there were 96 PHC centers in 2002; MOH owns and operates 47 PHC centers, United Nations Relief and Works Agency for Palestinian Refugees (UNRWA) owns and operates 17 PHC centers and Nongovernmental Organizations (NGOs) own and operate 32 PHC centers (MOH, 2003).

Hospitals: In the Gaza Strip, there are 24 hospitals. The population/hospital ratio is 52,579; the average bed capacity per hospital is 85.83 beds (MOH, 2003). MOH

owns and operates 12 hospitals with 1,135 beds, 20.4% of the total bed pool was labeled as pediatric medicine beds (MOH, 2003).

Ard El-Insan

AEI is a local Palestinian non-governmental health institution. It was established in 1984 as an affiliate of Swiss agency “Terre Des Hommes” until it has become an independent local organization on 1999. AEI works mainly with children suffering from nutritional problems, providing services to most needy, deprived and marginalized families in Gaza Strip. AEI activities are medical and nutritional assessment which include anthropometric (physical), measurements, clinical and nutritional assessment, also include medical treatment, health and nutritional advice and provision of medicine. There are four centers that belong to AEI in the Gaza Strip: Rafah, Khanyounis, Mid zone and Gaza (AEI, 2002).

AEI conducts a community based program targeting the rural and deprived areas as well as the vulnerable communities in the Gaza Strip (AEI, 2002).

AEI also conducts research studies in nutrition and training to Palestinian professionals’ community (AEI, 2002).

The services provided by AEI are preventive and curative such as medical and nutritional consultation, child growth monitoring and follow up, breast feeding promotion and support, community health education, special care of certain illnesses such as rickets, celiac disease, anemia and others, community health education and lastly research and training (AEI, 2002).

PHC services in nutrition include: nutritional surveillance, nutritional education, food supplementation, specific nutrient supplementation and treatment of malnutrition. There are related activities which include: management of diarrhea by

oral rehydration solution (ORS), control of parasitic diseases and health education in women nutrition and breast feeding, (AEI, 2002).

Nutritional services

On the 1st of January 2002, MOH established food and nutrition department within the ministry that will administrate and coordinate all work within the area of food and nutrition in Palestine.

Its long term goal is to reduce the number of diseases caused by malnutrition and imperfect nourishment through increasing the knowledge of the Palestinian population about the importance of food and nutrition for good health (MOH, 2003).

1.6 Operational definitions

Malnutrition: The researcher adopted malnutrition to be measured by:

Weight for age “underweight”

Weight for height “wasting”

Height for age “stunting”

Wasting: indicates a deficit in tissue and fat mass compared with amount expected in a child of the same height or length, in other words literally translated it means thinness. It is measured by comparing the weight of child to that of a reference child of the same height. Statistically this is then expressed in standard deviations and moderate and sever wasting is classified as below -2 standard deviations from the mean weight for height of the reference population, it is estimated as less than 90% of the reference value of weight for height for children of the same age, National Health Center for Health Statistics (NCHS/WHO). Wasting is related to acute malnutrition (WHO, 1995b).

Stunting: signifies slowing in skeletal growth, literally it can be also translated as shortness. Moderate and severe stunting is below -2 standard deviations from the

mean height for age of the reference population, it is measured by comparing the length of a reference child of the same age, and it is estimated as less than 95% of the reference value of height for age for children of the same age, (NCHS/WHO). Stunting is attributable to chronic malnutrition (WHO, 1995b).

Underweight: this compares the weight of a child to the reference weight of a child of the same age, Moderate and severe refers to below -2 standard deviations from the mean weight for age of the reference population, and it is estimated as less than 90% of the reference value of weight for age for children of the same age, (NCHS/WHO). Underweight is attributable to acute or chronic malnutrition (WHO, 1995b).

Odds ratio: the ratio of the odds of a condition or disease in an exposed population to the ratio of the same condition or disease in a non-exposed population.

Undernutrition: a condition in which the body contains lower than normal amounts of one or more nutrients (WHO, 1995b).

Weight-for-age: an indicator of the degree of underweight of a child defined as his/her weight in relation to the mean weight of a reference population of that age (WHO, 1995b).

Weight-for-height: an indicator of the degree of wasting of a child defined as his/her weight in relation to the mean height of a reference population of that age (WHO, 1995b).

Height-for-age: an indicator of the degree of stunting of a child defined as his/her height in relation to the mean height of a reference population of that age (WHO, 1995b).

Complementary feeding: is defined as the period during which foods or liquids are provided along with continued breastfeeding. Complementary food is the term used

to describe any nutrient-containing foods or liquids, other than breast-milk, that are given to young children during the period of complementary feeding which include special “transitional” foods that are prepared especially for the infant and increasingly as the child becomes older (Brown et al, 1998).

Chapter 2
Literature Review

Chapter 2

Literature Review

Malnutrition is one of the pediatric problems. It is a major health problem, especially in developing countries; malnutrition in all its forms increases the risk of disease and early death (WHO, 2000a). Epidemiological evidence suggests that the first response to a nutritional and/or infectious insult is wasting, followed by stunting (Walker et al, 1996).

Studying possible risk factors that might affect children's health in specific area enable health care providers to improve health care for children; however, it is important to know the risk factors for malnutrition locally as well as internationally.

2.1 Definition of malnutrition

The literature points to different definition of malnutrition. One of them is "malnutrition results from inadequate intake of nutrients and/or from disease factors that affect digestion, absorption, transport and utilization of nutrients, however, there are also economic, social, political and cultural causes of malnutrition, which underscore the close link between malnutrition, the general standard of living, and whether a population is able to meet its basic needs, such as food, housing, and health care" (UNICEF, 1990).

However, in this study the researcher adopted the WHO definition (2000), "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions. Malnutrition prescribes a state of poor intake or utilization of the daily nutritional requirements including; calories, macro and micro-nutrients, which are required for maintaining all life activities, physical as well as mental growth patterns. Consequently, growth declines below the median figures, and the daily energy expenditure is minimized in

order to allow keeping the integrity of extremely vital organs aiming at supporting life chances until nutritional supplements are available or better utilized by the body” (WHO, 2000b).

2.2 Classification of malnutrition

2.2.1 Primary and Secondary malnutrition

Primary malnutrition: refers to the situation where the nutrient requirements are not met by the diet, mostly related to environmental factors (Antonsson-Ogle et al, 2000).

Secondary malnutrition: refers to the situation where any disease or pathological conditions disturb the intake and metabolism of the nutrients as gastrointestinal disease or due to increased losses as a result of surgical wounds, burned patients, diarrhea and vomiting or increased needs as infections with high fever, or blood losses as malaria or hook worms (Antonsson-Ogle et al, 2000).

2.2.2 Macronutrient and Micronutrient malnutrition

Micronutrient malnutrition: refers to deficiencies in vitamins and trace elements (Antonsson-Ogle et al, 2000).

Macronutrient malnutrition: means that a person is consuming too little energy for his/her needs and will therefore lose the body stores of energy (lose weight) (Antonsson-Ogle et al, 2000).

2.2.3 Type I and Type II nutritional deficiencies

Type I deficiency: leads to the classical concept of events where the deficient intake is compensated for by mobilizing the potential resources in tissue stores. This leads to successive reduction in tissue concentrations until a critical level is reached and metabolic disturbances occur in which more or less characteristic symptoms and signs as vitamins and minerals (Golden, 1996).

Type II deficiency: It represents essential nutrients that are needed for a normal growth and development. However, they will result in a non-specific catabolism of the tissues leading to growth failure in the growing individual as essential amino acids (Golden, 1996).

2.3 Measuring malnutrition

2.3.1 Wasting: indicates a deficit in tissue and fat mass compared with amount expected in a child of the same height or length, in other words literally translated it means thinness. It is measured by comparing the weight of child to that of a reference child of the same height. Statistically this is then expressed in standard deviations and moderate and severe wasting is classified as below -2 standard deviations from the mean weight for height of the reference population, it is estimated as less than 90% of the reference value of weight for height for children of the same age, (NCHS/WHO). Wasting is related to acute malnutrition (WHO, 1995b).

2.3.2 Stunting: signifies slowing in skeletal growth, literally it can be also translated as shortness. Moderate and severe stunting is below -2 standard deviations from the mean height for age of the reference population, it is measured by comparing the length of a reference child of the same age, and it is estimated as less than 95% of the reference value of height for age for children of the same age, (NCHS/WHO). Stunting is attributable to chronic malnutrition (WHO, 1995b).

2.3.3 Underweight: this compares the weight of a child to the reference weight of a child of the same age, Moderate and severe refers to below -2 standard deviations from the mean weight for age of the reference population, and it is estimated as less than 90% of the reference value of weight for age for children of the same age,

(NCHS/WHO). Underweight is attributable to acute or chronic malnutrition (WHO, 1995b).

2.4 Global prevalence of malnutrition

The global prevalence of stunting, underweight and wasting in children under 5 years is estimated at about 33%, 26.7% and 9.4% respectively, in developing countries, but varies widely among them, Administrative Committee on Coordination of the United Nations/Sub-Committee on Nutrition (ACC/SCN, 2000).

The WHO Global Database on Child Growth, which covers 87% of the total population of under-5-year olds in developing countries, reported that the worldwide distribution of protein-energy malnutrition, based on nationally representative cross-sectional data gathered between 1980 and 1992 in 79 developing countries in Africa, Asia, Latin America and Oceania (FAO/WHO, 1992).

The findings confirmed that more than a third of the world's children are affected by all indicators (wasting, stunting, and underweight). Generally, the prevalence of underweight, stunting and wasting among children under 5 years in developing countries in general were 35.8%, 42.7% and 9.2% respectively. According to this data, the risk of being underweight is 1.5 times higher in Asia than in Africa and 2.3 times higher in Africa than in Latin America. The prevalence of underweight, stunted, and wasted children is far higher in southern Asia than in any other region. South-eastern Asia ranks second in the descending order of prevalence of underweight and third for wasting and stunting. Western Africa ranks second for wasting, third for underweight, and fifth for stunting. Eastern Africa ranks second for stunting and fourth for wasting and underweight. Melanesia ranks fourth for stunting, fifth for underweight, and sixth for wasting. Eastern Asia (China and Mongolia) comes next in the descending order of prevalence of underweight and

stunting, but ranks closer to the less-affected (Latin American) regions as far as wasting is concerned. The results of these surveys carried out between 1980 and 1992 in the developing countries in Africa, Asia and Latin America were summarized in appendix 8, (FAO/WHO, 1992).

The phenomenon of malnutrition is widespread in all of the countries in the Near East, but is more common in low-income countries. Many studies have shown the presence of such problems in middle-income and even high-income countries. This is because of the huge disparity of individual incomes within some of these countries, which leads to the presence of less affluent areas within the middle-income and high-income countries. In many of these countries, not only rural areas did not get their share of the relative prosperity that affected urban areas, but also their situation deteriorated leading to an increase in poverty. Also, poverty did increase in some urban and peri-urban areas where many people do not earn enough money to satisfy their needs (World Bank, 2001).

In Africa

East Africa has the highest prevalence of stunting in the world 48%, West Africa 35%, North Africa 20%, while West Africa has the highest prevalence of wasting in the world 15.6% (ACC/SCN, 2000).

In Africa a combination of moderate and high prevalence of malnutrition, a total 15% of malnourished children live in Africa. Generally, the prevalence of underweight, stunting and wasting among children under 5 years in Africa were 27.4%, 38.6% and 7.2% respectively. The situation in Northern Africa (Algeria, Egypt, Morocco, and Tunisia) is mostly affected by moderate prevalence of underweight. In Western and Eastern Africa countries are mostly affected by high prevalence of underweight (FAO/WHO, 1992).

Children in Libya suffer from stunting to a lesser extent where the reported percentage was 15%. And also in both of Tunisia and Morocco the prevalence was 23%. Wasting, on the other hand was reported to be 9% Algeria and 6% in Egypt (World Bank, 2001). The prevalence of nutritional wasting among children under five years of age in Africa was 7.2% (Fernandez et al, 2002).

Al-Sayed et al, (2001) conducted a study in Alexandria, to assess the current status of malnutrition among pre-school children age 6-71 months, the study found that the prevalence of stunting was 15% of the total study sample; of them, 16.8% males, 13.1% females. The prevalence of wasting was 3.6% of the total study sample; of them, 3.8% males, 3.4% females, the prevalence of underweight was 7.3% of the total study sample; of them, 8.6% males, and 5.5% females.

Another study conducted in Uganda, to determine the risk factors for early Childhood malnutrition among children 30 months of age in a central Uganda community; found that the prevalence of stunting was 23.8% of the total study sample, underweight 24.1% (Kikafunda et al, 1998).

A cross-sectional study aimed to estimate the level of malnutrition and identify factors associated with the high level of stunting in breast-fed infants aged 5–11 months living in Ethiopia, found that 47% of the total study sample were boys, compared to 53% of girls. Of them, 36% were stunted compared with national data for the same age range 57%, the boys are more likely to be stunted than girls, the prevalence of underweight was 41.0% and the prevalence of wasting was 13.0%, very high if compared with estimates for Eastern Africa 7%, and the national figure for Ethiopia was 8%. Wasting reflects a problem of current or recent starvation, insufficient or inappropriate supplementary foods, or it may be a consequence of acute infectious disease (Umeta et al, 1996).

Another study conducted in Ethiopia found that the prevalence of stunting, wasting and underweight among children under 5 was 45.7%, 7.1% and 43.1%, respectively (Asfaw and Goitom, 2000).

In Asia

South Central Asia has the highest prevalence of underweight and wasting in the world 43.6%, 15.4% respectively, and the second highest prevalence of stunting in the world 44%. In South-East Asia the prevalence of stunting, wasting and underweight was 33%, 10.4% and 28.9% respectively (ACC/SCN, 2000).

In Asia most countries have high prevalence of (wasting, stunting, and underweight), a total 80% of malnourished children live in Asia mainly in Southern Asia. Generally, the prevalence of underweight, stunting and wasting among children under 5 years in Asia were 42.0%, 47.1% and 10.8% respectively. In Southern Asia (Bangladesh, India, Pakistan, and Sri Lanka) the prevalence of underweight is high. In Eastern Asia, China has a high prevalence of underweight. And contrasting results moderate prevalence of underweight in Jordan, Kuwait and Iraq and high prevalence of underweight in Oman, and Yemen. While the high prevalence of both stunting and wasting is commonly found in countries in Asia (FAO/WHO, 1992).

Stunting was a serious problem in Yemen and in Djibouti where its prevalence was 44% in the former and 26% in the latter. Children in Iran and Bahrain suffer from stunting to a lesser extent where the reported percentages were 19% and 10%, respectively. Wasting, on the other hand was reported to be 13% in both of Yemen and Djibouti, 9% in Syria and 7% in Iran (World Bank, 2001).

The prevalence of nutritional wasting among children under five years of age in Asia was 24.0% (Fernandez et al, 2002).

Another study was carried out to determine the nutritional status of school-aged children living in an urban squatter settlement in Islamabad among children aged 5-10 years old, the prevalence of underweight was 29.5%, wasting 13% and stunting 35%, overall 44% of the children had one or more of underweight, wasting or stunting, however, malnutrition was present in 15.4% of the children (Mian et al, 2002). Additionally, the prevalence of stunting among Tibetan children was 51% (Harris et al, 2001).

In America

The prevalence of stunting in Central America was 24%, South America 13% (ACC/SCN, 2000). The most moderate prevalence of (wasting, stunting, and underweight) occurs in Latin America, a total 5% of malnourished children live in Latin America. Generally, the prevalence of underweight, stunting and wasting among children under 5 years in Latin America were 11.9%, 22.2% and 2.7% respectively. The situation in Latin America is mostly affected by moderate prevalence of underweight, stunting and wasting (FAO/WHO, 1992).

The prevalence of nutritional wasting among children under five years of age in Latin America was 3.03% (Fernandez et al, 2002).

2.5 Prevalence of malnutrition in Gaza

The prevalence of acute malnutrition (wasting) among children 6-59 months of age was 13.3% in the Gaza Strip and 4.3% in the West Bank and the prevalence of chronic malnutrition (stunting) is 17.5% in the Gaza Strip and 7.9% in the West Bank. Chronically malnourished children in Gaza were significantly more than those of the West Bank as well as acute malnourished children (John Hopkins and Al-Quds Universities, 2002). According to AEI, survey (2003) the prevalence of acute malnutrition (wasting) was 1.7% among children (6-59 months) in the Gaza

Strip, while the prevalence of chronic malnutrition (stunting) was 6.7% in the Gaza Strip and 5.2% of the children were underweight (AEI, 2003).

The prevalence of wasting and stunting among governmental primary school children in the Gaza governorates revealed that, the prevalence of wasting and stunting was 5.1% and 16.5% in both Gaza and North Gaza governorates; geographical differences indicated that wasting was more prevalent in Gaza governorate than North Gaza governorate 5.6%, 4.6% respectively. Contrary, to that stunting was more prevalent in North Gaza governorate than Gaza governorate 18.5%, 14.4% respectively (Skeik, 2003). Furthermore, the prevalence of stunting among adolescents in the Gaza Strip was 9.7%, of them, 13.4% males and 6.3% females (Abudayya, 2003).

2.6 Risk factors associated with malnutrition

The overall aim of this study was to identify the potential risk factors associated with malnutrition among children who attend AEI health centers in the Gaza Strip. These risk factors includes, socioeconomic factors, child feeding patterns and breast feeding, maternal factors, environmental factors and child health factors. Assessing these risk factors could help eliminate or prevent malnutrition.

2.6.1 Socio-economic status

Age group

There were no significant differences found between younger children ages 6-23 months and older children 24-59 months for acute or chronic malnutrition (John Hopkins and Al-Quds Universities, 2002). However, the prevalence of stunting and wasting among children was higher in the young age group than the old group (Shubair et al, 2000). Contrary, Mian et al, (2002) signified that the prevalence of malnutrition was significantly higher among older children. Consistently, with

other studies Al-Sayed et al, (2001) found that the prevalence of both underweight and wasting increased with the age of a child, Kikafunda et al, (1998) signified that the older children showed a higher incidence of stunting than younger children, but the age had no effect on underweight. Furthermore, the proportion of stunting, underweight and wasting increased with age, with the highest proportion in the 9 to 11 months old group (Umeta et al, 1996). In Ethiopia, Asfaw and Goitom, (2000) claimed that the prevalence of stunting, wasting, and underweight were significantly associated with the age group of children; both highest prevalence of stunting and wasting and underweight were observed among the age group of 12-24 months whereas the lowest prevalence of stunting, wasting, and underweight were observed among the 0-6 months age group, and found that the prevalence of malnutrition peaks among the 12-24 months old children.

Gender

Harris et al, (2001) claimed that the patterns of stunting according to age were similar in girls and boys among Tibetan children in China. However, Skeik, (2003) observed that both stunting and wasting were more among males than females, consistent with other studies of Abudayya, (2003); John Hopkins and Al-Quds Universities, (2002) and Umeta et al, (1996). Additionally, In Mozambique, Prista et al, (2003) found that the prevalence of wasting was significantly higher in the males (27.2%) than in the females (20.7%), while the prevalence of overweight was significantly higher in the females (7.7%) than in the males (4.8%). Also in South Africa, Zere and McIntyre, (2003) observed that the rate of stunting was significantly higher in male children. However, no statistically significant difference was observed in underweight and wasting between the two gender groups.

Contrary, other studies revealed that malnutrition was more prevalent among females than males (Al-Sayed et al, 2001) and (Shubair et al, 2000).

Parent education

Several studies found an inverse relationship between the level of maternal education and malnutrition; lack of education is linked to a general lack of knowledge regarding child feeding practices; also lower income levels were correlated with lower levels of education (John Hopkins and Al-Quds Universities, 2002). In Asian countries the prevalence of stunting associated with female literacy was the most important factor explaining national differences in stunting (Frongillo et al, 1997). Consistently, De Souza et al, (1999) found that there was an association between female illiteracy and malnutrition among Brazilians children. Also, Al-Sayed et al, (2001) claimed that the education of parents was significantly associated with low prevalence of stunting. Fernandez et al, (2002) found that parent's education was risk factor for prevalence of wasting, which was decreased with high educated parents. Additionally, Abudayya, (2003) observed that the prevalence of stunting was higher among adolescents who had parents with low education than those with higher education, the difference was statistically significant in regard to the mother's education. Skeik, (2003) found that the prevalence of stunting and wasting is higher in children to fathers of lower level of education. In contrast, Kikafunda et al, (1998) signified that the risk factor for stunting was poor education of fathers, but the education of the mother had no significant influence on the nutritional status of the children.

Employment status

Skeik, (2003) argues that both wasting and stunting children were siblings to housewives; fathers who are not employed have higher levels of wasting and

stunting. However, Al-Sayed et al, (2001) found that mother's working status was significantly associated with low prevalence of stunting. Contrary, Kikafunda et al, (1998) claimed that the occupation of the mother had no effect on the prevalence of stunting or underweight.

Household income

John Hopkins and Al-Quds universities, (2002) found that the prevalence of acute malnutrition (wasting) among low income households was more than those with high income households. In the Gaza Strip, the prevalence of acute malnutrition (wasting) among low income < 1800 New Israeli Shekel (NIS) per month households was 14.3% compared to 5.0% in high income \geq 1800 NIS households; while in the West Bank, the prevalence of acute malnutrition among low income households was 4.5% compared to 3.7% in high income households. Another study showed that those households with low income had higher levels of wasting and stunting among their children than households with high income. It was observed that those students having pocket money had lower levels of wasting and stunting, compared to those having no pocket money (Skeik, 2003). Frongillo et al, (1997) in Asian countries showed that the prevalence of stunting associated with gross national product (GNP) was the most important factor explaining national differences in stunting. Consistency, Al-Sayed et al, (2001) signified that higher GNP was the most important factor associated with the lower prevalence of stunting and wasting. Additionally, the prevalence of underweight was more among low income households (Shubair et al, 2000). The findings of a study on protein-energy malnutrition (PEM) in Upper Egypt indicated that low income was associated with an increased risk of under-weight, stunting and wasting (Al-Sayed et al, 2000). Additionally, Mian et al, (2002) revealed that the prevalence of malnutrition was

significantly higher among children from poorer households. Al-Sayed et al, (2001) found that low-income was associated with higher risk of under-weight. Kikafunda et al, (1998) observed that the children from very low economic status families being more stunted than those from middle status families. Consistency, Prista et al, (2003) showed that the high socioeconomic status group had a significantly lower prevalence of stunting and wasting than did the low socioeconomic groups, but a significantly higher prevalence of overweight. In South Africa, Zere and McIntyre, (2003) found that stunting and underweight increased with low socio-economic status of the household, wasting did not appear to be affected. Children from the poorest households had high rates of underweight and stunting.

Abudayya, (2003) found that the prevalence of stunting among adolescents in families who received additional financial support was more than in families who did not receive any financial support; the prevalence of stunted adolescents in families who received food support was higher than in families who did not receive any food support.

2.6.2 Breast feeding and dietary factors

Breast feeding

Hautvast et al, (2000) found that breast feeding during the first 6 months of life would protect children to be at risk of being stunting or underweight. Consistently, Asfaw and Goitom, (2000) found that breast-feeding during first 6 months was protective against malnutrition. In contrast, Kikafunda et al, (1998) claimed that children who were breastfed for prolonged periods > 18 months and up to 24 months have greater incidences of stunting. Moreover, the study revealed that neither current breastfeeding nor the age of weaning influenced the incidence of stunting or underweight but duration of breastfeeding influenced stunting.

Dietary intake

Shubair et al, (2000) observed that the prevalence of stunting and wasting was related to inadequate nutritional education, improper dietary intake such as vitamins and minerals. In accordance, Kikafunda et al, (1998) noticed that the risk factors for stunting were consumption of small meals, and lack of milk consumption but the most important risk factor for underweight was children who take foods with low energy.

Umata et al, (1996) claimed that children given cow's milk tended to be less stunted, furthermore, low zinc and calcium concentration of breast milk also contributed to stunting of infants, which may also be caused by low energy intake, while wasting reflects insufficient or inappropriate supplementary foods, the frequency, quantity and type of supplementary feeding were strongly associated with stunting, whereas the age of introduction of supplementary foods was not, also he found the small amounts consumed and low feeding frequency are probably important determinants of stunting. In addition, poor appetite contributed to the stunting of infants.

Fernandez et al, (2002) found that inadequate dietary intake and number of meals per day were risk factors for prevalence of wasting, which increased with inadequate dietary intake and decreased with the increase of the number of meals (more than 4 times per day). Asfaw and Goitom, (2000) claimed the promotion of adequate complementary feeding, and micronutrients were protective against malnutrition. Al-Sayed et al, (2001) found that Poor feeding practices were strongly associated with stunting. Skeik, (2003) observed that the prevalence of wasting and stunting among children who drink tea after lunch were more than those children who did not drink tea after lunch.

2.6.3 Environmental factors

Harris et al, (2001) claimed that the children in urban areas had the lowest risk of stunting; nomadic children had a significantly greater risk of stunting than did all other children, urban children had lower stunting than did non-urban children living at the same altitude. Consistency, Al-Sayed et al, (2001) signified that wasting was low among children who were living in non-squatter areas, Kikafunda et al, (1998) found that children from rural areas were more underweight than those from urban areas. Abudayya, (2003) observed that the prevalence of stunting among adolescents in the local citizen group was higher than those in the refugee group in the Gaza Strip, and the prevalence of stunting in extended families was higher than in nuclear families; however, this was not statistically significant. Additionally, Mian et al, (2002) argued that the prevalence of malnutrition was significantly higher among children from larger households. Shubair et al, (2000) also found that there was direct relationship between a large family size and under-weight malnutrition. However, Skeik, (2003) observed that the prevalence of stunting among school children did not show significant differences between malnutrition and family size. Contrary, Al-Sayed et al, (2001) reported that the crowding index was significantly associated with low prevalence of stunting which means that there was protective relationship between un-crowding index status and stunting, furthermore, good sewage disposal system was significantly associated with low prevalence of stunting; it means that there was protective relationship between (good sewage disposal system status and good source of drinking water status) and stunting. The prevalence of nutritional wasting among children under five years of age increased with bad house conditions and bad separate kitchens (Fernandez et al, 2002). Children whose families used water from unprotected source were more

underweight; however, the source of water had no effect on the incidence of stunting, and wasting decreased with accessibility to safe water supply (Kikafunda et al, 1998).

2.6.4 Maternal factors

Kikafunda et al, (1998) found that there was a positive significant relationship between the number of children and the prevalence of stunting or underweight and a negative significant relationship between child order and the prevalence of stunting or underweight among children under 5 years of age, malnutrition was more among first or second child than third and above, also he found that parity had no effect on the prevalence of stunting or underweight among children under 5 years of age. Contrary, Al-Sayed et al, (2001) showed that increased birth order was associated with the increased prevalence of stunting. Umeta et al, (1996) claimed that Infants born <24 months after the birth of the previous sibling were more likely to be stunted than those born >24 months, greater spacing of children would enable mothers to provide better nutrition, care and attention to their children, furthermore he claimed that the prevalence of malnutrition was less among good nutritional status of mothers. Consistently, Fernandez et al, (2002) observed that nutritional status of mother during pregnancy was risk factor for prevalence of wasting, which increased with poor nutritional status of mother during pregnancy, moreover, he observed that maternal health during pregnancy was risk factor for prevalence of wasting, wasting increased with poor maternal health during pregnancy.

Abudayya, (2003) found that there was no difference in the prevalence of stunting among adolescents whose mothers had previous medical history; such as, previous history of under-five child death or previous history of abortion and those mothers who did not have such history. However, John Hopkins and Al-Quds Universities,

(2002) signified that there was no statistical correlations were found between undernourished women and malnourished children.

2.6.5 Child health status

Fernandez et al, (2002) Found that low birth weight was risk factor for prevalence of wasting, which increased with low birth weight, and found that preterm was an important risk factor for prevalence of wasting and there was a negative relationship between preterm and wasting among children under five years of age, however, he found that incidence of respiratory infections, diarrhea and measles were risk factors for prevalence of wasting among children, wasting increased with diseases of children.

Skeik, (2003) observed no significant differences between malnutrition among school children and birth weight or preterm babies or history of disease.

Kikafunda et al, (1998) found that the risk factors for stunting and underweight were poor health of child and presence of eye pathology, poor health status was important in increasing the incidence of both stunting and underweight.

Umeta et al, (1996) claimed that wasting was prevalent more among children who had a consequence of acute infectious disease. Asfaw and Goitom, (2000) found a positive relationship between malnutrition and the overall prevalence of infection. The prevalence of stunting and wasting was related to parasitic infection (Shubair et al, 2000). In accordance, Monica et al, (1997) reported that there was a positive relationship between parasite infestation and malnutrition.

Chapter 3
Methodology

Chapter 3

Methodology

3.1 Study design

The design of this study was a clinic based case control study with neighborhood control subjects.

A case control study is a type of observational analytic epidemiological investigation in which subjects are selected on the basis of whether they do (cases) or do not (controls) have a particular disease under study. Case control study offers a number of advantages for evaluating the association between an exposure and disease. Case control study is efficient in both time and costs, relative to the other analytic approaches, it also allows for the evaluation of a wide range of potential etiologic exposures that might relate to a specific disease as well as the interrelationships among affected and non-affected individuals (Charles and Julie, 1999).

3.2 Setting of the study

The study was carried out at AEI health centers which are special referral centers providing health services for children suffering from different nutritional problems.

3.3 Sample size

The target population was that age group of children, who are confirmed by anthropometric measurements as a case of malnutrition (incident case), the researcher chose incident cases rather than prevalent cases to overcome recall biases.

The sample size was calculated using a sample size calculator software computer (Epi Info Program), a sample of 90 Patients and 180 control subjects was sufficient for achieving a relative risk of 2 with 80% power as significant at 0.05 levels if the prevalence of exposure among control subjects rang from 5-60%.

3.4 Sampling method

Selection of cases

All malnourished children who were referred to AEI centers between September to December 2003. Subjects confirmed as cases of malnutrition by anthropometric measurements. Cases were fit the study criteria of weight for age below minus two standard deviation (< -2 SD) of the (NCHS/WHO) were considered eligible for this study. However, cases have been chosen randomly. Anthropometric measurements are obtained for all sampled children. Children with underlying conditions such as cystic fibrosis, celiac disease and mal-absorption syndrome were excluded.

Selection of control

Two neighborhood control subjects were randomly selected for each case, matched for age and sex. After locating the case home, the researcher asks the mother enumerate 4 neighborhood children in the same age group within \pm one month. Two children normal weight out of 4 were selected randomly as controls, their mothers were asked about the health history of the child to exclude any health disorders that might interfere and disrupt the inclusion criteria.

3.5 Questionnaire design and materials:

I Questionnaire (appendix 3)

A structured questionnaire developed mainly with closed-ended question. However, the questionnaire included information on six main areas as follows:

- **Personal Information:** such as address, citizenship, governorate, birth date and sex.
- **Socioeconomic and demographic factors:** such as monthly income, father education, father occupation, mother occupation and mother education.

- **Breast feeding and feeding patterns:** such as type of feeding, duration of breast feeding and complementary food.
- **Environmental factors:** such as place of residency and housing condition.
- **Maternal factors:** such as maternal age, age at first delivery, parity, pregnancy disorders and spacing.
- **Child health status:** such as morbidity, prematurely, and birth weight.

II Anthropometric measurements (Molarius et al, 1998)

Length

Up to age 2 years the child is measured supine. One examiner holds his head in contact with a fixed board and a second person stretches him out to his maximum length and then brings a moving board into contact with his heels. This measurement called supine length. Average about 1 cm more than the measurement of standing height taken on the same child, even when, in the best techniques, the child is urged to stretch upwards to the full, and is aided in doing so by a measurer applying gentle upward pressure to his mastoid process.

Weight was measured by digital balance scale to the nearest 100mg. The scale checked for accuracy every time before measurement. The child was weighed wearing at most a light gown.

3.6 Pilot study

Pilot study was done to ensure that the researcher's ability to perform his task satisfactorily in order to avoid errors. Also pilot testing was done prior to the beginning of data collection for checking validity and reliability of questionnaire and evaluating the outcome. Piloting was done for 10 subjects randomly selected. The researcher was interview and evaluates the suitability of the questionnaire and

corrected the areas of ambiguity and misunderstanding. Pilot study excluded from the study.

3.7 Ethical consideration

The researcher obtained the necessary approval to conduct the study from Helsinki Committee in the Gaza Strip. The Committee is the authorized professional body for giving permission to researchers to conduct studies in the area (appendix 4). Confidentiality was maintained at all times during study. Approval letters to conduct the study on the children in AEI Centers was obtained (appendix 5) Children mothers were given full explanations about the purpose of the study and assurance about confidentiality of the information and participation is completely optional. Consent forms were signed by the mothers (appendix 6).

3.8 Data collection

After explanations to the mother about the research purposes and after obtaining consent forms, the data was collected through a structured questionnaire. At the end of every interview, the researcher must be sure that all information is complete. Concerning data collection the first case was randomly chosen then cases were taken every other two cases.

3.9 Standardization of measurements

Standardization of weight and height measurement (Molarius et al, 1998)

- **Removal of clothes:** all participants were asked to remove shoes and heavy garments before the measurements of weight and height.
- **Type of scale:** only accurate balance scales were used. Testing with standard weight was done and is considered with particular importance.
- **Accuracy of weight measurement:** accuracy of recording the body weight to full kg.

- **Accuracy of height measurement:** recording the body height to the nearest centimeter.
- **The scale** was checked at least once at the start using standard weights.
- **The zero level** was checked every day before starting measurements and immediately afterwards.

Inclusion criteria

Cases were considered to be eligible if they confirmed as a case of malnutrition and treated in Ard El Ensan clinics and were delivered and resided in the Gaza Strip.

Exclusion criteria

- Hormonal or hereditary diseases should be excluded.
- Children who are not delivered and resided in the Gaza Strip.
- Children who complain of chronic mal-absorption disease.
- Children who complain of major congenital malformation.

3.10 Statistical analysis

The findings were computed through the statistical package for the social science for data cleaning and analysis {SPSS software windows version 8, SPSS Chicago, IL, United States of America (USA)}.

Data analysis was carried out as follows:

- Data entry.
- Data cleaning.
- Frequency table for all study variables.
- Advanced statistical analysis, odds ratio, Chi-Square and confidence interval (CI) were the statistical tests used to assess the association between variables. The statistical level of significance was 0.05.

3.11 Limitations

- Due to limitations of time and lack of resources the researcher was unable to investigate other contributing factors such as parasites infestation.
- Recall biases.
- Because the study sample was from a certain health center, and does not include cases from other health settings, the generalization of results is questionable.

Chapter 4

Results

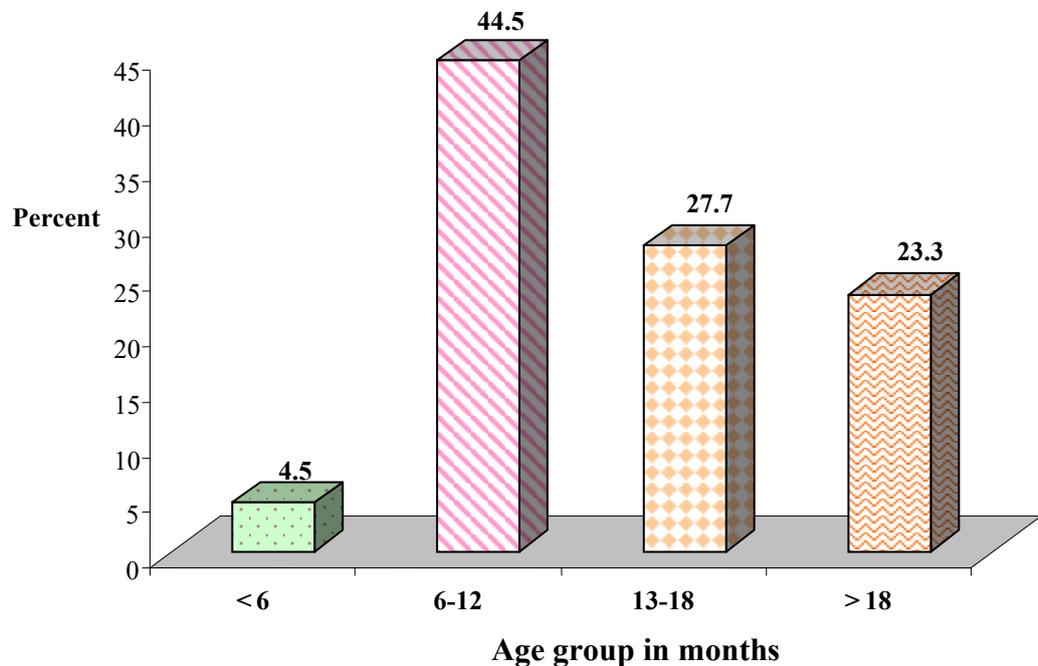
Chapter 4

Results

This chapter presents the results of the study data; the first part of this chapter presents the descriptive analysis of frequency and percentage distribution which provide a description and summary of the data. The second part presents the Chi-Square and other relevant statistical tests which were conducted as a major component of the analysis to infer the relationship between the study variables and malnutrition. Worth noting that Fisher exact test was used where it is appropriate for small sample statistics.

4.1 Characteristics of the study population

Figure 1: Distribution of study population by age.



As depicted in figure 1, the majority of study population age was between 6-12

months and the second age group was between 13-18 months, while the least age group was those less than 6 months. The mean age was $16.24 \pm SD 10.90$ months.

Figure 2: Distribution of study population by sex.

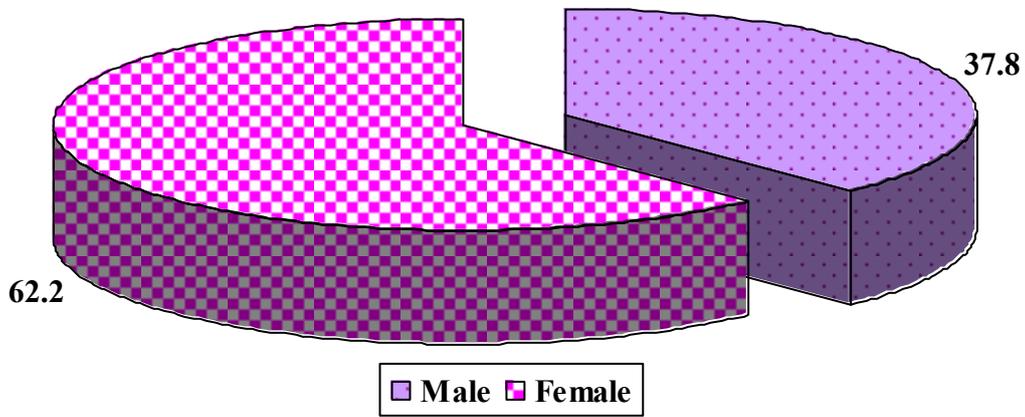
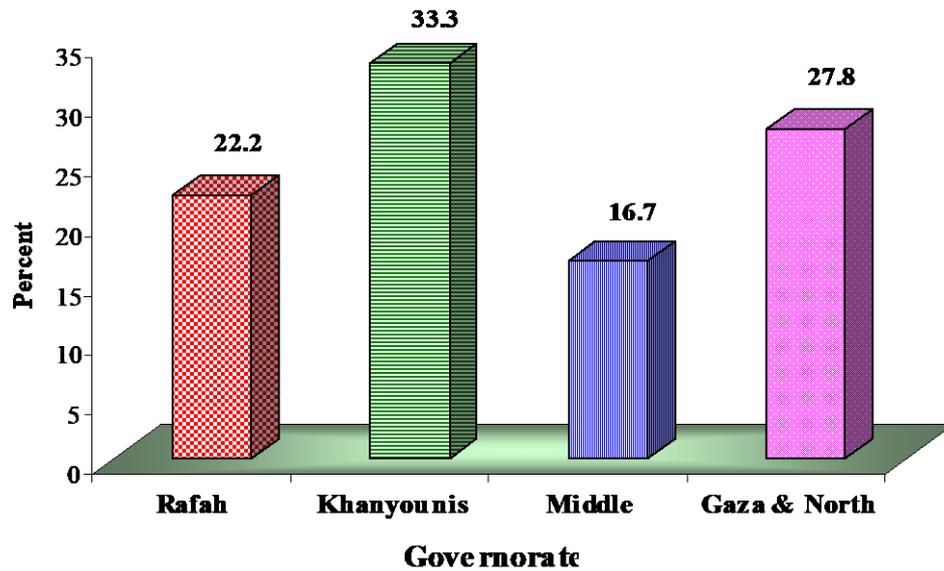


Figure 2 shows that 62.2% of the total subjects were females, while males represent 37.8% of the sample population.

Figure3: Distribution of study population by governor



As shown in figure 3, subjects are distributed in all provinces of the Gaza strip; subjects from Rafah represents 22.2%, Khanyounis 33.3%, middle provinces 16.7% and Gaza Strip & north provinces represent 27.8%.

Figure 4: Distribution of study population by living area.

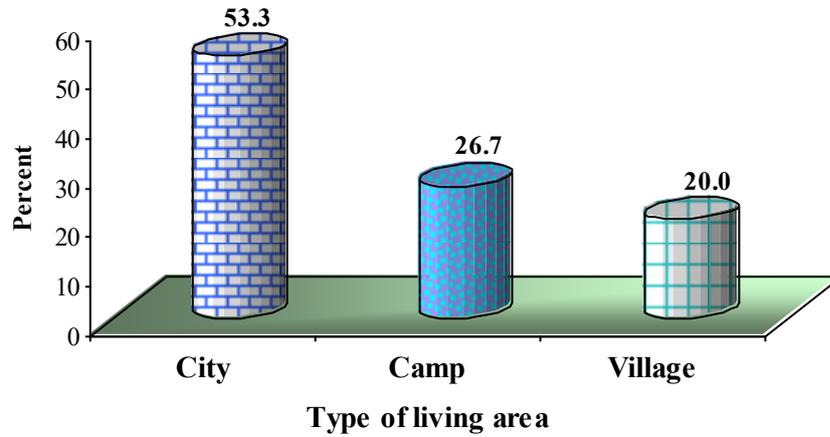


Figure 4 shows that the majority of study population (53.3%) are living in cities, while the rest of the study sample are living in camps and villages, 26.7%, 20.0% respectively.

Figure 5: Distribution of study population by residential status.

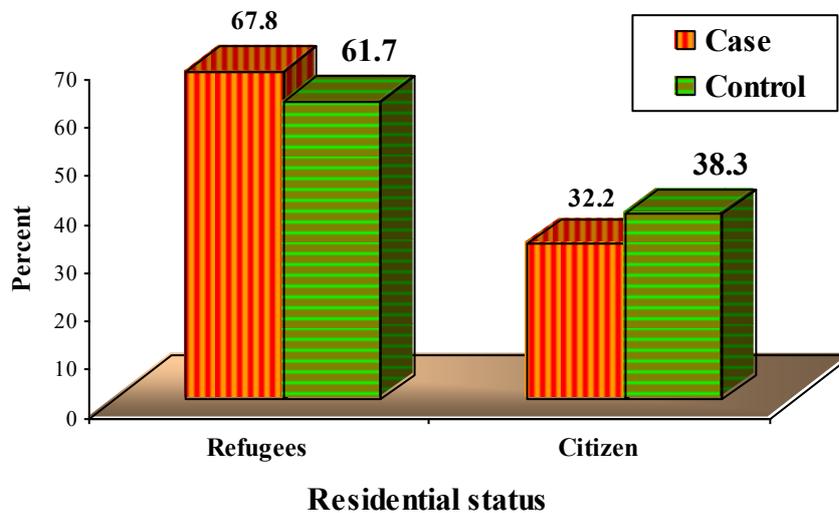


Figure 5 shows that the majority of study population are refugees; of those control group 61.7% are refugees and 38.3% are citizens, compared to 67.8% and 32.2% of cases respectively.

4.2 Distribution of malnutrition among children by risk factors

Table 1: Distribution of children by birth weight, gestational age and residential status.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Birth weight							
• ≤2500	43	47.8	10	5.6	53	19.6	0.001*
• >2500	47	52.2	170	94.4	217	80.4	
Total	90	100%	180	100%	270	100%	
Gestational age							
• Pre-term	44	48.9	12	6.7	56	20.7	0.001*
• Full term	46	51.1	168	93.3	214	79.3	
Total	90	100%	180	100%	270	100%	
Residential status							
• Refugee	61	67.8	111	61.7	172	63.7	0.325
• Citizen	29	32.2	69	38.3	98	36.3	
Total	90	100%	180	100%	270	100%	

* *Statistical significant*

Table 1 shows that 19.6% of the total subjects, weight at birth were less than 2500gm or actually 2500gm, cases represented 47.8% compared to 5.6% of controls, while 52.2% of cases weight at birth were more than 2500gm compared to 94.4% of controls. The mean weight at birth was $3128.15 \pm \text{SD } 524.02$ gm. The result revealed a positive relationship between low birth weight and malnutrition (OR = 15.553, 95% CI = 7.273, 33.262, P value = 0.001), meaning that malnutrition more prevalent among low birth babies. The same table shows that 20.7% of the total children were born preterm; cases represented 48.9 % compared to 6.7 % of controls, while 51.1 % of cases were full term compared to 93.3 % of controls. Thus, the result revealed a positive relationship between preterm and malnutrition (OR = 13.39, 95% CI = 6.22, 29.33, P value = 0.001), meaning that malnutrition more prevalent among preterm babies. Regarding the residential status; the study indicates that 63.7% of the total study population was refugees. Among refugees, cases represented 67.8% compared to 61.7% of controls, while among citizens; cases represented 32.2% compared to 38.3% of controls. The

study revealed no significant relationship between residential status and malnutrition ($P = 0.325$).

Table 2: Distribution of children parents socio-demographic variables

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Mother's age							
• ≤24	26	28.9	56	31.1	82	30.4	0.928
• 25-30	33	36.7	63	35.0	96	35.6	
• >30	31	34.4	61	33.9	92	34.0	
Total	90	100%	180	100%	270	100%	
Mother's educational level							
• ≤6 year	26	28.9	8	4.4	34	12.6	0.001*
• >6 year	64	71.7	172	95.6	236	87.4	
Total	90	100%	180	100%	270	100%	
Mother's employment							
• Employed	1	1.1	35	19.4	36	13.3	0.001*
• Unemployed	89	98.9	145	80.6	234	86.7	
Total	90	100%	180	100%	270	100%	
Father's age							
• ≤24	6	6.7	13	7.2	19	7.0	0.959
• 25-30	35	38.9	67	37.2	102	37.8	
• >30	49	54.4	100	55.6	149	55.2	
Total	90	100%	180	100%	270	100%	
Father's educational level							
• ≤12 year	78	86.7	102	56.7	180	66.7	0.001*
• >12 year	12	13.3	78	43.3	90	33.3	
Total	90	100%	180	100%	270	100%	
Father's occupation							
• Employed	61	67.8	165	91.7	226	83.7	0.001*
• Unemployed	29	32.2	15	8.3	44	16.3	
Total	90	100%	180	100%	270	100%	
Consanguinity							
• First cousin	21	23.3	75	41.7	96	35.6	0.003*
• Second cousin	17	18.9	50	27.8	67	24.8	
• Others	52	57.8	55	30.6	107	39.6	
Total	90	100%	180	100%	270	100%	
Type of family							
• Nuclear	50	55.6	125	69.4	175	64.8	0.03*
• Extended	40	44.4	55	30.6	95	35.2	
Total	90	100	180	100	270	100	
Current household monthly income							
• ≤1500 NIS	75	98.7	75	42.6	150	59.5	0.001*
• >1500 NIS	1	1.3	101	57.5	102	40.5	
Total	76	100%	176	100%	252	100%	
Past 6 month household monthly income							
• More	2	22	26	14.4	28	10.4	0.001*
• Less	41	45.5	18	10.0	59	21.9	
• Usual	47	52.2	136	75.6	183	67.8	
Total	90	100%	180	100%	270	100%	

* Statistical significant

Table 2 shows that 35.6% of mothers age was between 25-30 years, followed by the age group more than 30 years, then those age group less than 24 years or actually 24 years old, both cases and controls mothers have approximately the same percentage in all age groups. The mean age of mothers was $28.61 \pm SD 6.1$ years. The study revealed no significant relationship between mothers age and malnutrition ($P = 0.928$).

The same table shows that 12.6% of the total mothers' subjects were educated less than 6 years or actually 6 years; cases represented 28.9% compared to 4.4% of controls, while 71.1% of cases mother were educated more than 6 years compared to 95.6% of controls mothers. The mean educational years of mothers was $10.85 \pm SD 3.35$ years. The result highlighted a positive relationship between low maternal education and malnutrition ($OR = 8.734$, $95\% CI = 3.760, 20.288$, $P \text{ value} = 0.001$), meaning that malnutrition more prevalent among low educated mothers.

The same table shows that 13.3% of the total subjects mothers were employed, cases represented 1.1% compared to 19.4% of controls, while 98.9% of cases mother were unemployed compared to 80.6% of controls mothers. The result revealed a negative relationship between employed mothers and malnutrition ($OR = 0.047$, $95\% CI = 0.006, 0.346$, $P = 0.001$). That is, malnutrition was less prevalent among employed mothers.

The same table illustrates that 37.8% of father's age was between 25-30 years, followed by the age group more than 30 years which represented 55.2%, then those age group less than 24 years or actually 24 years old, both cases and controls fathers have approximately the same percentage in all age groups. The mean age of fathers was $33.74 \pm SD 7.71$ years. The study revealed no significant differences between both age group ($P = 0.928$).

Additionally, the same table shows that 66.7% of the total subjects fathers were educated less than 12 years or actually 12 years, 86.7% of cases fathers were educated

less than 12 years compared to 56.7% of controls fathers, while 13.3% of cases fathers were educated more than 12 years compared to 43.3% of controls fathers. The mean educational level of fathers was $11.81 \pm SD 4.14$ years. The result revealed a positive relationship between low educational level of fathers and malnutrition (OR = 4.971, 95% CI = 2.530, 9.767, P value = 0.001). This means that the proportion of malnutrition is more prevalent among illiterate or partially educated fathers.

Also, the same table shows that 83.7% of the total subjects fathers were employed, fathers of cases represented 67.8% compared to 91.7% of controls fathers, while 32.2% of cases fathers were unemployed compared to 8.3% of controls fathers. The result indicates a negative relationship between fathers employment status and malnutrition (OR= 0.261, 95% CI= 0.152, 0.448, P= 0.001). This means malnutrition is less prevalent among employed fathers.

The result shows that 35.6% of the total parents of the study subjects were first cousin consanguineous marriage, cases represented 23.3% compared to 41.7% of controls, while second cousin consanguineous marriage represented 24.8% and other types of marriage represented 39.6% of the total study population; cases represented 57.8% compared to 30.6% of controls. Thus, the result indicates an inverse relationship between consanguineous and malnutrition (OR = 0.32, 95% CI = 0.18, 0.56, P value = 0.003), meaning that malnutrition more prevalent among relative parents.

Moreover, table (2) shows that 64.8% of the total subjects belong to nuclear families; cases represented 55.6% compared to 69.4% of controls. While the rest of the sample belongs to extended families; cases represented 44.4% of extended families compared to 30.6% of controls. The result revealed an inverse relationship between types of family and malnutrition (OR = 0.550, 95% CI = 0.326, 0.928, P value = 0.03). That is, malnutrition was less prevalent among nuclear families.

The table also shows that, 59.5% of the total subject's household monthly income was less than 1500 NIS or actually 1500 NIS, cases represented 98.7 compared to 42.6% of controls, while 1.3% monthly income of cases was more than 1500 NIS compared to 57.5% of controls. The median monthly income was 1400 NIS. The result revealed a positive relationship between low average monthly income and malnutrition (OR = 101.0, 95% CI = 13.731, 742.927, P value = 0.001). The proportion of malnutrition was more prominent among that group of household whose monthly income was less than 1500 NIS.

Moreover, the same table depicts that the majority of the families household monthly income (67.8%) was as usual, while 21.9 was less than usual. The result indicates a significant relationship between status of income within the past 6 months and malnutrition (P = 0.001).

Table 3: Distribution of children by breast-feeding and weaning patterns.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Currently breast-fed							
• Yes	49	54.4	107	59.4	156	57.8	0.433
• No	41	45.6	73	40.6	114	42.2	
Total	90	100%	180	100%	270	100%	
Ever breast-fed							
• Yes	37	90.2	69	94.5	106	93.0	0.391
• No	4	9.8	4	5.5	8	7.0	
Total	41	100%	73	100%	114	100%	
Breast feed during 1st three days							
• Yes	71	82.6	171	97.2	242	92.4	0.001*
• No	15	17.4	5	2.8	20	7.6	
Total	86	100%	176	100%	262	100%	
Duration of breast feeding							
• < 6 months	21	14.0	28	15.9	40	15.3	0.914
• 6-12 months	45	52.3	91	51.7	136	51.9	
• > 12 months	29	33.7	57	66.3	86	32.8	
Total	86	100%	176	100%	262	100%	
Bottle feeding during the 1st six months							
• Yes	37	67.3	67	63.2	104	64.6	0.609
• No	18	32.7	39	36.8	57	35.4	
Total	55	100%	106	100%	161	100%	
Weaning manner							
• Gradually	13	31.7	30	30.9	43	31.2	0.928
• Abruptly	28	68.3	67	69.1	95	68.8	
Total	41	100%	97	100%	138	100%	

**Statistical significant*

Table 3 illustrates the distribution of malnutrition by breast feeding and weaning patterns. As depicted in the table, 57.8% of the study population was still breast fed at the time of data collection, while the rest of the sample was not. The study revealed no significant differences between both groups (P = 0.433). However, 93% of the total subjects were ever breast-fed; of cases 90.2% were ever breastfed compared to 94.5% of controls. Therefore, statistical test does not seem significant (P = 0.391). The same table shows that 92.4% of the total subjects were breast-fed during the 1st three days after delivery, cases represented 82.6% compared to 97.2% of controls, while 17.4% of cases were not breast-fed during the 1st three days compared to 2.8% of controls. The

result revealed a protective relationship between breast feeding during the 1st three days and malnutrition (OR = 0.138, 95% CI 0.048, 0.395, P = 0.001), meaning that malnutrition more prevalent among children were not breast-fed during the 1st three days of life.

Worth noting, those infants who were not breastfed during the first three days (No = 20), about 90% of them received infant formula and the rest received glucose. Additionally, 15.3% of the total subjects were fed for less than 6 months, while more than half of the study population was breastfed for 6 to 12 months and the rest were breastfed for more than one year. The mean duration of breast feeding for those ever breastfed and those who still breastfed was $11.11 \pm \text{SD } 4.55$ months. The result indicates no significant differences between both groups (P = 0.914).

However, the result indicates that 64.6% of the study population were given bottle formula beside breast feeding during the first six months; the proportion of cases and controls were not significantly different regarding bottle feeding beside breast feeding during the first 6 months of age (P = 0.609). Also, the same table shows that, 31.2% of total subjects were gradually weaned, both cases and controls were approximately equally distributed; 31.7% and 30.9% respectively.

Also, 68.8% of the total subjects were abruptly weaned; both cases and controls were approximately equally distributed, 68.3% and 69.1% respectively, therefore the statistical test does not seem significant(P = 0.928).

Table 4: Distribution of children by age of complementary feeding and the most common complementary foods.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Age of complementary feeding							
• < 4 months	30	34.1	47	27.5	67	29.7	0.024*
• 4-5 months	8	9.1	39	22.8	46	18.2	
• > 5 months	50	56.8	85	49.7	171	52.1	
Total	88	100%	171	100%	259	100%	
Common complementary food							
Rice pudding							
• Yes	51	58.0	57	33.3	108	41.7	0.001*
• No	37	42.0	114	66.7	151	58.3	
Total	88	100%	171	100%	259	100%	
Stewed fruits							
• Yes	61	69.3	71	41.5	132	51.0	0.001*
• No	27	30.7	100	58.5	127	49.0	
Total	88	100%	171	100%	129	100%	
Milk starch pudding							
• Yes	50	56.8	105	61.4	155	59.8	0.505
• No	38	43.2	66	38.6	104	40.2	
Total	88	100%	171	100%	259	100%	
Cereal gruel							
• Yes	40	45.5	68	39.8	108	41.7	0.425
• No	48	54.5	103	60.2	151	58.3	
Total	88	100%	171	100%	259	100%	
Family food							
• Yes	38	43.2	67	39.2	105	40.5	0.593
• No	50	56.8	104	60.8	154	59.5	
Total	88	100%	171	100%	259	100%	

* *Statistical significant*

Table 4 shows that 29.7% of the study sample received complementary feeding early and 18.2% received complementary feeding when their age was 4-5 months, while 52.1% received complementary feeding late. The mean age of complementary feeding was $5.92 \pm \text{SD } 2.19$ months. However, Cases were significantly different from controls ($P = 0.024$).

Additionally, the same table indicates that 41.7% of the total subject's complementary foods were rice pudding; cases represented 58% compared to 33.3% of controls. The result revealed a positive relationship between children who received rice pudding as a complementary food and malnutrition ($\text{OR} = 2.727$, $95\% \text{ CI} = 1.624, 4.681$, $P \text{ value} =$

0.001). This means that malnutrition was more prevalent among children who were complemented with rice pudding.

Congruently, the same table shows the same result for stewed fruits; nearly half (51%) of the total subjects were given stewed fruits as a complementary food, cases represented 69.3% compared to 41.5% of controls. The result revealed a positive relationship between children who were complemented with stewed fruits as most complementary food and malnutrition (OR = 3.182, 95% CI = 1.844, 0.492, P value = 0.001). This means the proportion of malnutrition is more among children who were complemented mainly with stewed fruits.

Contrary, the same table shows no significant differences between both cases and controls regarding the other types of complementary food; milk starch pudding, cereal gruel and family food (P value = 0.505, 0.425, and 0.593, respectively). There were no statistical significant relationship between these variables and malnutrition.

Table 5: Comparison between cases and controls by the age of introduction of selected complementary foods.

Independent variable	Dependent variable	N	Mean	S.D	t	P value
Milk pudding	Cases	67	6.40	3.20	0.738	0.461
	Controls	150	6.14	1.99		
Cereal gruel	Cases	41	5.22	1.67	-2.06	0.043*
	Controls	96	5.86	1.71		
Rice pudding	Cases	57	6.60	2.15	-1.62	0.093
	Controls	123	7.20	2.42		
Fruit juice	Cases	67	7.39	3.26	2.239	0.023*
	Controls	144	6.54	2.05		
Stewed juice	Cases	41	7.24	2.87	0.519	0.606
	Controls	132	6.98	2.53		
Yogurt	Cases	64	5.97	1.93	-1.76	0.062
	Controls	155	6.54	2.25		
Copped meat	Cases	41	10.95	4.78	0.844	0.400
	Controls	106	10.42	2.68		
Poached eggs	Cases	64	7.98	2.94	-1.51	0.131
	Controls	147	8.46	1.57		
Fish	Cases	44	10.05	3.56	0.046	0.963
	Controls	127	10.02	2.36		
Mashed vegetables	Cases	38	8.61	2.99	1.248	0.217
	Controls	97	7.92	2.57		
Family Food	Cases	80	9.04	4.01	-1.26	0.209
	Controls	137	9.61	2.70		

* *Statistical significant*

As illustrated in table 6, statistical t test was used to estimate the differences between both cases and controls regarding the age of introduction of complementary foods. The result revealed that there was a real difference between both cases and controls regarding cereal gruel and fruit juice only (P value 0.043 and 0.023 respectively). However, the result indicates no significant difference between both groups regarding the other types of complementary foods.

Table 6: Comparison between cases and controls by use of medical supplements.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Medical supplements							
• Received	70	77.8	72	40.0	142	52.6	0.001*
• Not received	20	22.2	108	60.0	128	47.4	
Total	90	100%	180	100%	270	100%	
Vitamin A & D							
• Yes	22	31.4	35	48.6	57	40.1	0.041*
• No	48	68.6	37	51.4	85	59.9	
Total	70	100%	72	100%	142	100%	
Tonics							
• Yes	19	27.1	8	11.1	27	19.0	0.019*
• No	51	72.9	64	88.9	115	81.0	
Total	70	100%	72	100%	142	100%	
Iron							
• Yes	43	61.4	41	56.9	84	59.2	0.612
• No	27	38.6	31	43.1	58	40.8	
Total	70	100%	72	100%	142	100%	

* *Statistical significant*

Table 6 indicates that, 52.6% of the total subjects received medical supplements, of cases 77.8% received medical supplements compared to 40% of controls, while 22.2% of cases did not receive medical supplements compared to 60% of controls. The result revealed a positive relationship between children who received medical supplements and malnutrition (OR = 5.250, 95% CI = 2.941, 9.372, P value = 0.001). Surprisingly, malnutrition was more prevalent among children who received medical supplements. The result revealed a positive relationship between children who received Tonics and malnutrition (OR = 2.980, 95% CI = 1.207, 7.362, P value = 0.019). That is, malnutrition was more prevalent among children who received Tonics.

In contrast, 40.1% of the total children received vitamin A&D; of cases 31.4% received vitamin A&D compared to 48.6% of controls, while 68.6% of cases did not receive vitamins A&D compared to 51.4% of controls. The result revealed a protective relationship between children who received vitamin A&D and malnutrition (OR = 0.485, 95% CI = 0.244, 0.960, P value = 0.041). That is, the proportion of malnutrition

was less among children who received vitamin A&D. However, the study revealed no statistical significance between iron supplement and malnutrition (P value = 0.612).

Table 7: Comparison between cases and controls by consumption of tea.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Drink tea							
• Yes	68	75.6	69	38.3	137	50.7	0.001*
• No	22	24.4	111	61.7	133	49.3	
Total	90	100%	180	100%	270	100%	
Tea frequency							
• Once a day	27	39.7	47	68.1	74	54.0	0.001*
• More	41	60.3	22	31.9	63	46.0	
Total	68	100%	69	100%	137	100%	

* *Statistical significant*

Table 7 indicates that 50.7% of the total subjects drank tea, of cases 75.6% drank tea compared to 38.3% of controls, while 24.2% of cases did not drink tea compared to 61.7% of controls. The result revealed a positive relationship between drinking tea and malnutrition (OR = 4.912, 95% CI = 2.821, 8.765, P value = 0.001). Meaning that, malnutrition was more prevalent among children whom drink tea.

Also, the same table illustrates that, 54% of the total study population drank tea once a day, while the rest (46%) drank tea more than once. The study indicates a negative relationship between frequency of tea consumption and malnutrition (OR = 0.308, 95% CI = 0.153, 0.622, P value = 0.001). Meaning that, malnutrition was more prevalent among children whom drinking tea more than once a day.

In contrast, there were no significant differences between both groups regarding the age of tea introduction (P= 0.444).

Table 8: Comparison between cases and controls by appetite, number of meal per day and eating status.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Appetite							
• Good	42	46.7	140	79.5	182	68.4	0.001*
• Poor	48	53.3	36	20.5	84	31.6	
Total	90	100%	180	100%	270	100%	
No. of meal per day							
• ≤ 3 meal	48	55.2	50	29.9	98	38.6	0.001*
• > 3 meal	39	44.8	117	70.1	156	61.4	
Total	87	100%	167	100%	254	100%	
Enough meal							
• Usually	40	46.0	149	88.7	189	74.1	0.001*
• Occasionally	36	41.4	9	5.4	45	17.6	
• Rarely	11	12.6	10	6.0	21	8.3	
Total	90	100%	168	100%	255	100%	

* *Statistical significant*

Table 8 shows that 68.4% of the total subjects had a good appetite, of cases 46.7% were with good appetite compared to 79.5% of controls, while 53.3% of cases had a poor appetite compared to 20.5% of controls. The result revealed a negative relationship between children who had good appetite and malnutrition (OR = 0.225, 95% CI = 0.129, 0.391, P value = 0.001). This means good appetite was a protective factor against malnutrition in this study.

Concerning the number of meals per day, the same table shows that 38.6% of the total subjects ate less than 3 times per day or actually 3 times daily, cases represented 55.2% compared to 29.9% of controls, while 44.8% of cases ate more than 3 times daily compared to 70.1% of controls. The result revealed a positive relationship between low number of meals per day and malnutrition (OR = 2.880, 95% CI = 1.684, 4.926, P value = 0.001). That is, malnutrition was more prevalent among children who ate less than 3 times per day or actually 3 times daily.

Consistently, the result shows that 74.1% of the study sample ate enough as their mothers replay subjectively, while 17.6% and 8.3 % of the subjects were occasionally

and rarely ate enough. The result indicates significant differences between both groups (P=0.001).

Table 9: Comparison between cases and controls by the responsibility of food purchasing, preparation, feeding and money spent on food.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Responsibility of purchasing food							
• Mother	35	38.9	50	27.8	85	31.5	0.046*
• Father	30	33.3	88	48.9	118	43.7	
• Others	25	27.8	42	23.3	67	24.8	
Total	90	100%	176	100%	266	100%	
Responsibility of food preparation							
• Mother	83	92.2	171	97.2	254	95.5	0.066
• Others	7	7.8	5	2.8	12	4.5	
Total	90	100%	176	100%	266	100%	
Responsibility of feeding							
• Mother	87	96.7	166	94.3	253	95.1	0.552
• Others	3	3.3	10	5.7	13	4.9	
Total	90	100%	176	100%	266	100%	
Money spent on food purchasing							
• < 900 NIS	77	85.6	120	66.7	197	73.0	0.001*
• > 900 NIS	13	14.4	60	33.3	73	27.0	
Total	90	100%	180	100%	270	100%	

* Statistically significant

Table 9 shows that 31.5% of the total subjects mother were responsible for purchasing the household food, cases represented 38.9% compared to 27.8% of controls, while 43.7% of the total subject fathers were responsible for purchasing the household food; cases represented 33.3% compared to 48.9% of controls. Meanwhile, other family members (24.8%) of both groups were responsible for that. Cases represented 27.8% compared to 23.3% of controls. The study revealed significant differences between cases and controls (P = 0.046).

The same table shows that 95.5% of the total subject mothers were responsible for food preparation; cases represented 92.2% compared to 97.2% of controls. Also, the table illustrates that, the major responsibility of child feeding of both groups were the

mothers; cases represented 96.7% compared to 94.3% of controls respectively. Therefore, the relationship between food preparation and malnutrition was not significant (0.066).

Consistently, the same table illustrates that, about 95% of the subject mothers were responsible for feeding their children, while only about 5% of the subject family members share the responsibility. The statistical test does not seem significant (0.552).

Contrary, money spent on food per month was significantly associated with malnutrition. The result indicates that 73% of the total study population families spent less than 900 NIS, cases represented 85.6% compared to 66.7 of controls. While among those subject families who spent more than 900 NIS; cases represented 14.4% compared to 33.3% of controls. The study revealed a positive relationship between low money spent on food purchasing and malnutrition (OR = 2.962, 95% CI = 1.524, 5.755, P value = 0.001).

Table 10: Comparison between cases and controls by humanitarian assistance, type of assistance and mode of assistance.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Humanitarian assistance							
• Yes	74	82.2	92	51.1	166	61.5	0.001*
• No	16	17.8	88	48.9	104	38.5	
Total	90	100%	180	100%	270	100%	
Type of assistance							
• Cash money	2	2.7	1	1.0	3	1.8	0.586
• Raw material	64	86.4	85	92.5	149	89.8	
• Mixed	8	10.9	6	6.5	14	8.4	
Total	74	100%	92	100%	166	100%	
Mode of assistance							
• Regular	10	13.5	5	5.4	15	9.0	0.071
• Irregular	64	42.4	87	57.6	151	91.0	
Total	74	100%	92	100%	166	100%	

* *Statistical significant*

Table 10 shows that 61.5% of the total subject families received food assistance, case families represented 82.2% compared to 51.1% of control families, while 17.8% of case families did not receive food assistance compared to 48.9% of control families. The

result indicates a positive relationship between receiving food assistance and malnutrition (OR = 4.424, 95% CI = 2.393, 8.177, P value = 0.001). Meaning that, malnutrition was more prevalent among families who were received food assistance. Among those subject families who received assistance, only 1.8% had received cash money, 89.8% had received raw material and 8.4% had received mixed assistance. Furthermore, 9% of the subject families had received assistance on regular basis, while the rest of the subject families received humanitarian assistance irregularly. Both independent variables were not significantly associated with malnutrition (P value 0.586 and 0.071 respectively).

Table 11: Chi square for trend and Odds ratio for selected food items.

Food items	Cases	Controls	OR (95% CI)	P-value
	No	No		
Meats			Trend 34.049	0.00001
• Once/week (ref)	12	92	1.0	
• 2-3 time/ month	17	14	9.31(3.36-26.37)	
• Once/month	13	8	12.46(3.83-41.99)	
Poultry			Trend 37.115	0.00001
• Once/week (ref)	9	82	1.0	
• 2-3 time/ month	11	20	5.01(1.65-15.48)	
• Once/month	19	10	17.31(5.56-56.31)	
Fish			Trend 25.002	0.00001
• Once/week (ref)	6	76	1.0	
• 2-3 time/ month	19	38	6.33(2.15-19.49)	
• Once/month	17	19	11.33(3.56-37.74)	
Eggs			Trend 8.008	0.0046
• Daily (ref)	23	70	1.0	
• 3-4/week	17	51	1.01(0.46-2.22)	
• 1-2/week	17	18	2.87(1.18-7.03)	
• 2-3/month	8	8	3.04(0.91-10.27)	
Beans & legumes			Trend 0.673	0.412
• Daily (ref)	20	48	1.0	
• 3-4/week	11	27	0.98(0.37-2.55)	
• 1-2/week	20	21	2.29(0.95-5.54)	
• 2-3/month	7	19	0.88(0.28-2.69)	
Vegetables			Trend 0.206	0.649
• Daily (ref)	9	17	1.0	
• 3-4/week	5	36	0.26(0.06-1.04)	
• 1-2/week	18	57	0.60(0.20-1.75)	
• 2-3/month	9	17	1.0(0.27-3.65)	
Fruit juice			Trend 65.605	0.00001
• 3-4/week (ref)	5	79	1.0	
• 1-2/week	8	41	3.08(0.84-11.72)	
• 2-3/month	34	11	48.8(14.18-181.7)	
Milk			Trend 71.08	0.00001
• 3-4/week (ref)	10	122	1.0	
• 1-2/week	22	23	11.67(4.53-30.73)	
• 2-3/month	19	5	46.36(12.7-182.8)	
Starchy foods			Trend 6.761	0.0093
• Daily (ref)	34	33	1.0	
• 3-4/week	15	67	0.22(0.10-0.48)	
• 1-2/week	24	58	0.40(0.19-0.83)	
Butter or oil			Trend 0.123	0.726
• Daily (ref)	8	36	1.0	
• 3-4/week	7	16	1.97(0.53-7.41)	
• 1-2/week	5	30	0.75(0.19-2.90)	

(ref) Reference Category

Ordinal variables were tested for trend in risk across categories. Striking differences for some food items did emerge for trends in food consumption patterns for the case and

control children. Table 11 shows odds ratios and 95% confidence intervals for some food items. As frequency of meat, poultry and fish decreased, there was a statistically significant increasing trend in malnutrition risk (P value 0.00001). Additionally, the same result was found with eggs, milk and fruit juice; decreasing the frequency of such foods significantly increases malnutrition risk (P 0.0046, 0.00001 and 0.00001 respectively). In contrast, a decrease frequency of starchy foods as bread significantly decreases the risk of malnutrition (P 0.0093).

However, tests of trend were not statistically significant in beans and legumes, vegetables and butter or oil (P 0.412, 0.649 and 0.726 respectively).

Table 12: Comparison between cases and controls by selected environmental variables.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Type of house							
• Concrete	42	46.7	132	73.3	174	64.4	0.001*
• Others	48	53.3	48	26.7	96	35.6	
Total	90	100	180	100	270	100	
House ownership							
• Owned by family	72	80.0	168	93.3	240	88.9	0.002*
• Owned by others	18	20.0	12	6.7	30	11.1	
Total	90	100	180	100	270	100	
Number of room							
• ≤ 3 room	70	77.8	102	56.7	172	63.7	0.001*
• >3 room	20	22.2	78	43.3	98	36.3	
Total	90	100	180	100	270	100	
Number of persons per room							
• ≤ 3 person	19	21.1	144	80.0	163	60.4	0.001*
• > 3 person	71	78.9	36	20.0	107	39.6	
Total	90	100	180	100	270	100	
Refrigerator ownership							
• Yes	75	83.3	177	98.3	252	93.3	0.001*
• No	15	16.7	3	1.7	18	6.7	
Total	90	100	180	100	270	100	
Separate kitchen							
• Yes	84	93.3	179	99.4	263	97.4	0.006*
• No	6	6.7	1	0.6	7	2.6	
Total	90	100	180	100	270	100	
Type of toilet							
• Flush	26	28.9	95	52.8	121	44.8	0.001*
• Pit	64	71.1	85	47.2	149	55.2	
Total	90	100	180	100	270	100	
Kind of sewage							
• Closed/central	38	42.2	84	46.7	122	45.2	0.518
• Close pits	52	57.8	96	53.3	148	54.8	
Total	90	100	180	100	270	100	
Source of water							
• Municipilicity	82	91.1	169	93.9	251	93.0	0.452
• Well	8	8.9	11	6.1	19	7.0	
Total	90	100	180	100	270	100	

* *Statistical significant*

As shown in table 12, more than two thirds of the study population (64.4%) lived in concrete houses, cases represented 46.7% compared to 73.3% of controls, while 53.3% of cases lived in non-concrete houses compared to 26.7% of controls. The result

revealed a negative relationship between concrete houses and malnutrition (OR = 0.318, 95% CI = 0.187, 0.540, P value = 0.001). Meaning that, malnutrition was less prevalent among children who live in concrete houses.

The same table shows that 88.9% of the total subjects houses were owned by the family, of cases 80% of cases compared to 93.3% of controls, while 20% of cases their houses were owned by others compared to 30% of controls. The result revealed a negative relationship between house ownership and malnutrition (OR = 0.286, 95% CI = 0.131, 0.624, P value = 0.002). Meaning that, malnutrition was less prevalent among children who live house ownership to the family.

Additionally, the same table shows that 63.7% of the families houses contain less than 3 rooms or actually 3 rooms; cases families represented 77.8% compared to 56.7% of controls families, while 22.2% of cases families had more than 3 rooms compared to 43.3% of controls families (The mean was $2.81 \pm SD 1.17$ and $3.43 \pm SD 0.89$ for cases and controls respectively). The result revealed a positive relationship between low number of rooms in the house and malnutrition (OR = 2.676, 95% CI = 1.502, 4.770, P value = 0.001).

Congruently, the same table shows that 60.4% of the total subjects had three or less persons per room; cases represented 21.1% compared to 80% of controls, while 78.9% of cases had more than 3 persons per room compared to 20% of controls (The mean was $5.38 \pm SD 2.19$ and $2.87 \pm SD 1.31$ for cases and controls respectively). The result revealed a negative relationship between number of persons per room and malnutrition (OR = 0.067, 95% CI = 0.036, 0.125, P value = 0.001). This means malnutrition was more prevalent among children who had three or more persons living per room.

Also this table shows that 93.3% of the total subjects had a refrigerator, of cases 83.3% compared to 98.3% of controls, while 16.7% of cases had no refrigerator compared to

1.7% of controls. The result revealed a strong negative relationship between refrigerator ownership and malnutrition (OR = 0.085, 95% CI = 0.024, 0.301, P value = 0.001).

The same table shows that 97.4% of the total subjects had a separate kitchen; cases represented 93.3% compared to 99.4% of controls, while 6.7% of cases have no separate kitchen compared to 0.6% of controls. The result revealed a negative relationship between families having separate kitchen and malnutrition (OR = 0.078, 95% CI = 0.009, 0.660, P value = 0.006).

Additionally, the same table shows that 44.8% of the total subjects houses had flush toilet; cases represented 28.9% compared to 52.8% of controls, while 71.1% of cases houses had pit toilet compared to 47.2% of controls. The result revealed a negative relationship between both variables (OR = 0.363, 95% CI = 0.211, 0.625, P value = 0.001).

In contrast, the same table shows that 45.2% of the total subject's houses had a closed/central sewage; of cases houses 42.2% had closed central sewage compared to 46.7% of controls, while 57.8% of cases had closed pits compared to 53.3% of controls. However, the result indicates that there were no statistical significant relationship between the kind of sewage and malnutrition (P = 0.518). The same table shows that 93% of the total subjects have municipality source of water, cases represented 91.1% compared to 93.9% of controls, while 8.9% of cases have a well as a source of water compared to 6.1% of controls. Also, the result revealed no statistical significant relationship between the source of water and malnutrition (P= 0.452).

Table 13: Comparison between cases and controls by mothers disorders during intended pregnancy.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Pregnancy disorders							
• Yes	28	31.1	18	10.0	46	17.0	0.001*
• No	62	68.9	162	90.0	224	83.0	
Total	90	100%	180	100%	270	100%	
Hypertension							
• Yes	3	10.7	4	22.2	15	15.2	0.407
• No	25	89.3	14	77.8	31	84.8	
Total	28	100%	18	100%	46	100%	
Anemia							
• Yes	18	64.3	11	61.1	12	63.0	0.828
• No	10	35.7	7	38.9	34	37.0	
Total	28	100%	18	100%	46	100%	
Preclampsia							
• Yes	4	14.3	1	5.6	5	10.9	0.144
• No	24	85.7	17	94.4	41	89.1	
Total	28	100%	18	100%	46	100%	
D M							
• Yes	3	10.7	2	11.1	5	10.9	0.659
• No	25	89.3	16	88.9	41	89.1	
Total	28	100%	18	100%	46	100%	
Vomiting							
• Yes	7	25.0	1	5.6	8	17.4	0.094
• No	21	75.0	17	94.4	38	82.6	
Total	28	100%	18	100%	46	100%	

* *Statistical significant*

Table 13 shows that 17% of the total subject mothers had suffered from certain disorder during the intended pregnancy, case mothers represented 31.1% compared to 10% of controls, while 68.9% of cases mothers were healthy during intended pregnancy compared to 90% of controls. The result revealed a positive relationship between pregnancy disorders during pregnancy and malnutrition (OR = 4.065% CI = 2.100, 7.868, P value = 0.001). Meaning that, malnutrition was more prevalent among children mothers suffer from pregnancy disorder.

However, about one quarter (15.2%) of subject mothers had pregnancy induced hypertension; case mothers represented 10.7% compared to 22.2% of control mothers. The result revealed no statistical significant relationship between pregnancy induced

hypertension and malnutrition (P value = 0.407). Consistently, the same table shows that 63.0% of subject mothers complained of Anemia, case mothers represented 64.3% compared to 61.1% of control mothers. The result revealed no statistical significant relationship between anemia during pregnancy and malnutrition (P value = 0.828). Also, the same table shows that 10.9% of mothers who had pregnancy disorders complained of Preclampsia, case mothers represented 14.3% compared to 5.6% of control mothers. The result revealed no statistical significant relationship between Preclampsia during pregnancy and malnutrition (P value = 0.125). Additionally, the same table shows that 10.9% and 17.4% of the total subject mothers who had pregnancy disorders complained of Diabetes Mellitus (DM) and vomiting respectively; case mothers represented 10.7% and 11.1% compared to 25% and 5.6% of control mothers. The result revealed no statistical significant relationship between DM and vomiting during pregnancy and malnutrition (P value = 0.659 and 0.094 respectively).

Table 14: Comparison between cases and controls by obstetric factors.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Mode of delivery							
• Normal	71	78.9	165	91.7	236	87.4	0.003*
• Caesarian	19	21.1	15	8.3	34	12.6	
Total	90	100%	180	100%	270	100%	
Number of living children							
• ≤ 2 children	25	27.8	68	37.8	93	34.4	0.260
• 3-5 children	41	45.6	69	38.3	110	40.7	
• > 5 children	24	26.7	43	23.9	67	24.8	
Total	90	100%	180	100%	270	100%	
Child birth order							
• ≤ 3	45	50.0	93	51.7	138	51.1	0.796
• >3	45	50.0	87	48.3	132	48.9	
Total	90	100%	180	100%	270	100%	
Number of pregnancies							
• ≤ 3 time	37	41.1	82	45.6	119	44.1	0.755
• 3-5 time	22	24.4	43	23.8	88	24.1	
• > 5 time	31	34.4	55	30.6	63	31.9	
Total	90	100%	180	100%	270	100%	
Age at first delivery							
• ≤ 18 year	28	31.1	47	26.7	75	27.8	0.387
• >18 year	62	68.9	133	73.9	195	72.2	
Total	90	100%	180	100%	270	100%	
Interval between pregnancies							
• ≤ 12 months	40	46.5	65	40.9	105	42.9	0.395
• >12 months	46	53.5	94	59.1	140	57.1	
Total	86	100%	159	100%	245	100%	

* Statistical significant

Table 14 shows that 87.4% of the total subjects were delivered normally, of those case subjects 78.9% were delivered normally compared to 91.7% of controls, while 21.1% of cases were born by caesarian section compared to 8.3% of controls. The result revealed a negative relationship between normal delivery and malnutrition (OR = 0.340, 95% CI = 0.163, 0.706, P value = 0.006). Meaning that malnutrition more prevalent among children who born by caesarian section.

However, among maternal obstetric history; number of living children, child birth order, number of pregnancy, age at first delivery and interpregnancy interval were not

significantly associated with malnutrition (P value 0.260, 0.796, 0.755, 0.387 and 0.395 respectively).

Table 15: Comparison between cases and controls by hospitalization, reasons for admission and antiparasitic medicine.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
Hospitalization							
• Yes	38	42.2	28	15.6	66	24.4	0.001*
• No	52	57.8	152	84.4	204	75.6	
Total	90	100%	180	100%	270	100%	
First admission reason							
• GIT	22	57.9	2	21.4	28	42.4	0.012*
• Respiratory	9	23.7	13	46.4	22	33.3	
• Others	7	18.4	9	32.1	16	24.2	
Total	38	100%	28	100%	66	100%	
Received anti-parasitic drugs within the last 6 months							
• Yes	40	44.4	33	18.3	73	27.0	0.001*
• No	50	55.6	147	81.7	197	73.0	
Total	90	100%	180	100%	270	100%	

* *Statistical significant*

Table 15 shows that 24.4% of the total subjects were admitted to the hospital; cases represented 42.2% compared to 15.6% of controls, while 57.8% of cases were never hospitalized compared to 84.4% of controls. The result revealed a positive relationship between child hospitalization and malnutrition (OR = 3.654% CI = 2.060, 6.482, P value = 0.001), meaning that malnutrition more prevalent among hospitalized children. The same table shows that 42.4% of the total subjects were admitted due to gastroenteritis, among cases 57.9% were hospitalized due to gastroenteritis compared to 21.4% of controls. Moreover, 33.3% of the total subjects were admitted due to respiratory infection, cases represented 23.7% compared to 46.4% of controls, while 18.4 of cases were admitted due to other disorders compared to 32.1% of controls. The result indicates significant statistical relationship between reasons of hospitalization and malnutrition (P value = 0.012).

Additionally, the same table shows that 27% of the total subjects had received anti-parasitic drugs within the last 6 months; among cases, 44.4% received anti-parasitic drugs compared to 18.3% of controls, while 55.6% of cases did not receive any anti-parasitic drugs during the last 6 months compared to 81.7% of controls. The result revealed a positive relationship between children who received anti-parasitic drugs during the last 6 months and malnutrition (OR = 3.564, 95% CI = 2.032, 6.249, P value = 0.001), meaning that malnutrition more prevalent among children who received anti-parasitic drugs during the last 6 months.

Table 16: Comparison between cases and controls by child health status during the last 6-12 months.

Variables	Cases		Control		Total		P-value
	No	%	No	%	No	%	
GIT infection							
• Yes	47	52.2	19	10.6	66	24.4	0.001*
• No	43	47.8	161	89.4	204	75.6	
Total	90	100	180	100	270	100	
Ear infection							
• Yes	20	22.2	8	4.4	28	10.4	0.006*
• No	70	77.8	172	95.6	242	89.6	
Total	90	100	180	100	270	100	
Respiratory infection							
• Yes	37	41.1	37	20.6	74	27.4	0.001*
• No	53	58.9	143	79.4	196	72.6	
Total	90	100	180	100	270	100	

* *Statistical significant*

Table 16 shows that 24.4% of the total subjects suffered from GIT infection during the last 6-12 months, cases represented 52.2% compared to 10.6% of controls, while 47.8% of cases did not complain of GIT infection compared to 89.4 % of controls. The result revealed a positive relationship between GIT infection and malnutrition (OR = 9.26 95% CI = 4.72, 18.32, P value = 0.001). This means, malnourished children suffered from GIT infection.

Also, the same table shows that 10.4% of the total subjects suffered from ear infection during the last 6-12 months, of cases 22.2% were affected compared to 4.4% of

controls, while 77.8% of cases did not complain of ear infection compared to 95.6 % of controls. The result revealed a positive relationship between ear infection and malnutrition (OR = 6.14 95% CI = 2.42, 16.2, P value = 0.006). This means, malnourished children suffered from ear infection.

Additionally, the same table shows that 27.4% of the total subjects suffered from respiratory infection during the last 6-12 months, cases represented 41.1% compared to 20.6% of controls, while 58.9% of cases did not complain of respiratory infection compared to 79.4 % of controls. The result revealed a positive relationship between respiratory infection and malnutrition (OR = 3.26, 95% CI = 1.82, 5.87, P value = 0.001). This means, malnourished children suffered from respiratory infection.

Chapter 5

Discussion

Chapter 5

Discussion

As part of a case control study of risk factors for malnutrition, this study considers the risk factors as cited in the literature such as socio-economic status, breast feeding and diet patterns, maternal factors, environmental factors and child health disorders.

This is the first case control study conducted in the Gaza Strip to estimate those risk factors which were studied elsewhere. Most of the previous nutritional studies that have taken place in the area were prevalence studies. This study aims to assess the risk factors associated with malnutrition among children. However, it can be concluded that the results were matched with other similar studies in some findings and contradicted others.

This chapter overviews the most important risk factors identified by the present study.

5.1 Socio-demographic variables

The results of this study identify variation across levels of basic socioeconomic variables. Although some results did not identify any association with socio-demographic factors as parent's age and residential status. Some results show positive association with malnutrition, such as parent's education, current and past household monthly income, money spent on food purchasing and receiving humanitarian aids. However, some variables were negatively associated with malnutrition as parent's employment and consanguinity.

This study showed that low parents' education has a positive effect on malnutrition. This observation is not surprising; hence parent's education might affect the knowledge and attitudes of parents, therefore affects their access to information and

health services and thereby feeding practices. The result was in accordance with other studies, (Abudayya, 2003; Skeik, 2003; John Hopkins and Al-Quds universities, 2002; Fernandez et al, 2002; Al-Sayed et al, 2001; De Souza et al, 1999; Kikafunda et al, 1998 and Frongillo et al, 1997) have found that the education level of the parents relates directly to the nutritional status of the child.

The results of this study revealed a negative relationship between parent's employment status and malnutrition. This means, malnutrition was less prevalent among employed parents because it could be related to increasing family income. This result is congruent with other studies, (Skeik, 2003 and Al-Sayed et al, 2001) and incongruent with another study Kikafunda et al, (1998) who claimed that the occupation of mothers had no effect on the prevalence of stunting or underweight.

Although the experience of parents is expected to increase with age, so the prevalence of malnutrition is expected to decrease, this study revealed no significant relationship between parent's age and malnutrition. The explanation of the result is that the older the parents are the more children they have, and therefore the larger the family size which neutralized the effects of the experience of parents.

The study identifies a protective relationship between consanguineous marriage and malnutrition. Malnutrition was more prevalent among non consanguinity; it's not clear whether malnutrition is associated with consanguineous marriage directly or due to other factors. However, the result could be related to high frequency of consanguinity among the study population rather than the effects of consanguinity on malnutrition.

The results revealed no significant statistical relationship between malnutrition and residential status. However, it shows the percentage of refugees is more than citizens which is explained by the poor living conditions and less income of

refugees. Abudayya, (2003) claimed that the prevalence of stunting among adolescents in the local citizen group was higher than in the refugee group in the Gaza Strip.

The data presented here suggests a positive relationship between household monthly income and malnutrition. This means the proportion of malnutrition was more prominent among those groups of household having monthly income less than 1500 NIS. The results of this study also indicated a significant relationship between the status of income within the past 6 months and malnutrition; the majority of the families household monthly income was as usual. This might explain families who receive higher incomes have fewer constraints in feeding their children. Several studies reported a positive relationship between household monthly income and malnutrition (Skeik, 2003; John Hopkins and Al-Quds Universities, 2002; Al-Sayed et al, 2001; Shubair et al, 2000 and Frongillo et al, 1997).

The study indicates an inverse relationship between types of family and malnutrition. Malnutrition was less prevalent among nuclear families; because of less family members. In a nuclear family the size is smaller and this gives better chances of care and better feeding for their children than extended families, in which all resources are strained by the large family numbers. This result was consistent with other studies (Abudayya, 2003; Main et al, 2002; Al-Sayed et al, 2001 and Shubair et al, 2000).

The results of this study revealed significant relationship between the responsibility of purchasing food and malnutrition, among cases mothers were responsible for purchasing the household food more than fathers, while, among controls fathers were responsible for purchasing the household food more than mothers. This might be explained by fathers have freedom and ability more than mothers to choose

proper food. May be usually the unemployed fathers are irregular un-technical workers whom work all the day, so the wife is responsible for purchasing. While the employed fathers have regular working hours per day and have time to purchasing.

In view of the findings, the relationship between “responsibility of food preparation and responsibility of feeding the children” and malnutrition were not significant. However, the result could be related to high frequency of responsibility of mothers for food preparation and feeding their children among the study population rather than the effects of these factors on malnutrition.

The evidence provided by this study strongly suggests that money spent on food per month was significantly associated with malnutrition; meaning that, malnutrition was less among groups who spent more money on food purchasing. This could be related to the more money spent on food purchase providing more chances to buy larger quantities and better quality foods.

The results of this study indicate a significant positive relationship between families who received humanitarian assistance and malnutrition. The result could be related to the fact that families who received humanitarian assistance were poor families. Among those subject families who received assistance, both (type of assistance and mode of assistance) were not significantly associated with malnutrition. However, the result could be related to low frequency of families who received cash money and families who regularly received humanitarian assistance among the study population 3, 15 families respectively of the total subjects studied. Contrary, Abudayya, (2003) who found that the prevalence of stunting among adolescents in families who received additional financial support was more than in families who did not receive any financial support; the prevalence of stunted adolescents in

families who received food support was higher than in families who did not receive any food support.

5.2 Breast feeding and diet patterns

The results of this study identify variation across levels of basic breast feeding and diet patterns. Although some results did not show any association with breast feeding and diet patterns as currently breast-fed, ever breast-fed, duration of breast feeding, bottle feeding during the 1st six months, weaning manner, common complementary food (milk starch pudding, cereal gruel and family food) and iron medical supplements. Some results show positive association with malnutrition, such as common complementary food (rice pudding and stewed fruits), medical supplements, drinking tea and number of meals per day. However, some variables were negatively associated with malnutrition as breast feeding during 1st three days, vitamin A&D supplement, frequency of tea consumption and appetite.

Breast feeding and weaning patterns

The results of this study claimed no significant differences between the children who were still breast fed at the time of data collection and those who were not. However, the result could be related to the different ages of subjects. This is consistent with the findings of (Kikafunda et al, 1998).

The statistical test does not reach significant values between children who were breast fed and children who never breast feed. The result could be related to low frequency of children who never breast-fed among the study population, there were 8 subjects only, 4 of them, were cases.

The result demonstrated a protective relationship between breast feeding during the 1st three days and malnutrition. This shows the protective effects of early breast feeding on malnutrition.

The results of this study indicate no significant relationship between duration of breastfeeding and malnutrition, contrary, with some studies Hautvast et al, (2000); Asfaw and Goitom, (2000) and Kikafunda et al, (1998) who claimed that breastfeeding during first 6 months was protective against malnutrition. This study revealed also that there was no significant difference between subjects who were given bottle feeding besides breast feeding during the first 6 months of age and children who were not. It could be related to cultural, social and economical factors. Also this study revealed no significant relationship between weaning manner and malnutrition; it could be the result of both cases and controls were approximately equally distributed.

Diet patterns

The result indicates a significant relationship between age of complementary feeding and malnutrition. It is clear that malnutrition was more prevalent among children who received complementary food at age under 4 months; and less prevalent among children who received complementary food at age after 5 months. This might be explained by the inappropriate timing for introducing complementary foods before the age of 4 months which could be an important cause of diarrhea, intolerance poor appetite, gastric upset and food allergy, and then malnutrition. Contrary, to that Umeta et al, (1996) observed that there was no relationship between the ages of introduction of complementary foods and malnutrition.

The results of this study signified a positive relationship between children who received (rice pudding and stewed fruits) as a complementary food and malnutrition. This means that malnutrition is more prevalent among children who were complemented mainly with rice pudding or stewed fruits. However, the results show no significant relationship between (milk starch pudding, cereal gruel and

family food) and malnutrition. That is, children who are fed with diet that do not meet the recommended dietary allowances for energy and nutrient will definitely suffer from protein energy malnutrition (PEM). However, Umeta et al, (1996) found that there was strong positive association between insufficient or inappropriate complementary food, frequency, quantity and type of complementary feeding and malnutrition.

Although the results of this study revealed no statistical differences between cases and controls regarding the age of introduction of other some types of complementary foods and malnutrition; these complementary foods were (milk pudding, rice pudding, stewed juice, yogurt, chopped meat, poached eggs, fish, mashed vegetables and family food). The study revealed that there was a real difference between both cases and controls regarding the age of introducing cereal gruel and fruit juice as complementary food. There was protective relationship between the age of introduction of cereal gruel “5 months” and malnutrition and a positive relationship between the age of introduction of fruit juice “6 months” and malnutrition. It might be explained that fruit juice as a complementary food can not replace other foods containing proteins and attribute for poor appetite and consequently, malnutrition.

Striking differences for some food items did emerge for trends in food consumption patterns for the case and control children. As frequency of meat, poultry and fish decreased; there were a statistically significant increasing trend in malnutrition risk. Additionally, decreasing the frequency of such foods as: eggs, milk and fruit juice significantly increase malnutrition risk. In contrast, a decrease frequency of starchy foods as bread significantly decrease the risk of malnutrition. However, tests of

trend were not statistically significant in beans and legumes, vegetables and butter or oil.

The result revealed a positive relationship between consumption of tea and malnutrition. This means malnutrition was more prevalent among children who drank tea. However, the study indicates significant relationship between frequency of tea consumption and malnutrition. Malnutrition was more prevalent among more frequency of tea consumption. This might be explained as tea after meals decreases the absorption of iron and possibly protein. Moreover, the use of sugar in the tea as a sweetener will block the child's appetite towards other nutrient foods if any. In contrast, there were no significant differences between both groups regarding the age of introduction of tea. It could be explained that families start with little and light tea for children. This result was congruent with the study of Skeik, (2003).

The evidence provided by this study strongly suggests that a negative relationship between children who had good appetite and malnutrition. This means that good appetite was a protective factor against malnutrition in this study. Concerning the number of meals per day, the result revealed a relationship between number of meals per day and malnutrition. It showed that malnutrition was more prevalent among children who ate less than 3 times per day or actually 3 times daily. Good appetite gives the child a chance to eat enough of different types of food.

Congruent with other studies Al-Sayed et al, (2001) and Umeta et al, (1996) that claimed poor appetite contributed to stunting of infant. However, Fernandez et al, (2002) found that there was a negative relationship between number of meals and malnutrition, stunting and wasting with 2 meals was more than stunting and wasting with 4 meals.

The result revealed a positive relationship between children who received medical supplements and malnutrition. Surprisingly, malnutrition was more prevalent among children who received medical supplements and the result revealed a positive relationship between children who received tonics and malnutrition. Therefore, malnutrition was more prevalent among children who received tonics. An explanation to that is the prescription of multivitamins by the doctors to malnourished children. Also it can be practiced as a trend by family who give multivitamins to their undernourished children without medical prescription.

In contrast, the result revealed a protective relationship between children who received vitamin A&D and malnutrition. That is; the proportion of malnutrition was less among children who received vitamin A&D. this could be explained by family compliance to give the oral vitamin A&D supplements provided by MCH centers during vaccination visits for all children. Thus, reflecting positive and protective knowledge, attitude and practice (KAP) of the family towards the child health and nutrition which might explain a better nutritional status concomitant with Vit. A&D supplements. However, the study revealed no statistical significance between iron supplement and malnutrition. This might be explained as mothers gave medical supplements to children who looked weak and ill.

5.3 Maternal variables

The results of this study identify variation across levels of basic maternal variables. Some of the results did not show any association with maternal obstetric history as number of living children, child birth order, number of pregnancies, age at first delivery and inter-pregnancy intervals. Other results show positive association with malnutrition, such as pregnancy disorder. Also, some variables were negatively associated with malnutrition as the mode of delivery.

The results of this study signified a strong positive relationship between pregnancy disorder during pregnancy and malnutrition. This means that malnutrition was more prevalent among children of mothers who had suffered from certain disorder during the pregnancy. This is not surprising; these diseases may interfere in fetal growth. This result was congruent with other results Fernandez et al, (2002).

However, the results of this study revealed no statistical significant relationship between (pregnancy induced hypertension, anemia during pregnancy, preclampsia, DM and vomiting) and malnutrition. However, the result could be related to low frequency of these disorders among the study population rather than the effects of those disorders on malnutrition. These results were inconsistent with another study which found that there was no difference in the prevalence of stunting among adolescents whose mothers had previous medical history; such as, previous history of under-five child death or previous history of abortion and those mothers who did not have such history (Abudayya, 2003).

The study indicates a negative relationship between mode of delivery and malnutrition. This means that malnutrition was more prevalent among children who were born by caesarian section. It might be explained that the baby who was delivered by caesarian section could be low birth weight, unable to suck well or delay starting of breast feeding.

Maternal obstetric history; number of living children, child birth order, number of pregnancy, age of mother at first delivery and interpregnancy intervals were not significantly associated with malnutrition. Another study found that parity had no effect on the prevalence of stunting or underweight among children under 5 years of age (Kikafunda et al, 1998).

Other studies cited that there was a positive significant relationship between number of children and the prevalence of stunting or underweight among children under 5 years of age. And there was a negative significant relationship between child order and the prevalence of stunting or underweight among children under 5 years of age, (Al-Sayed et al, 2001 and Umata et al, 1996).

5.4 Environmental variables

The results of this study identify variation across levels of basic environmental variables. Although some results did not show any association with environmental variables as the kind of sewage and sources of water.

Other results show positive association with malnutrition, such as the number of rooms in the house. However, some variables were negatively associated with malnutrition as the type of family, type of house, house ownership, number of persons living per room, refrigerator ownership, separate kitchen and type of toilet.

The results of this study revealed an inverse relationship between concrete house and malnutrition. That means malnutrition was less prevalent among children who live in concrete houses. It might be explained by the possibility of rich ones live in concrete houses while poor one do not and a concrete house keep the family members out of the changes in environmental conditions as being cold or hot with less chances of getting diseases. This result is congruent with (Fernandez et al, 2002).

The study indicates an inverse relationship between house ownership and malnutrition. This means malnutrition was less prevalent among children who lived in a house owned by the family. Ownership of the house by the family leads to stability and saves more money which increases the purchasing power, and this

affects the nutritional status. Also ownership of the house pointed to a rich family than a poor one.

The result revealed a positive relationship between number of rooms in the house and malnutrition, and a negative relationship between number of persons living per room and malnutrition. This means malnutrition was less prevalent when there are more than 3 rooms in the house, and more prevalent among children who had three or more persons per room. This shows that increasing the number of rooms in the house leads to decreased crowding, which decrease the possibility of cross and recurrent infection. The results were consistent with another study (Al-Sayed et al, 2001).

The study indicates a strong negative relationship between (refrigerator ownership and separated kitchens) and malnutrition. That is, malnutrition was less prevalent among children who had a refrigerator and a separate kitchen. The refrigerator could keep the food available for long time and less chance of getting contaminated. Also separation of kitchens could prevent contamination of food. This study is congruent with (Fernandez et al, 2002).

The result revealed a relationship between type of toilet and malnutrition. This means malnutrition was less prevalent among children who had flush toilet. People using flush toilet are more protected from parasite infestation than those using pit toilet.

The results of this study found that there was no statistical significant relationship between kind of sewage disposal system and malnutrition. Malnutrition was more prevalent in families with closed pits though it is statistically not significant. Al-Sayed et al, (2001) reported that a good sewage disposal system was significantly

associated with low prevalence of stunting. It means that there was protective relationship between good sewage disposal system status and stunting.

The result cited that there was no statistical significant relationship between sources of water and malnutrition. However, the result could be related to high frequency of municipality source of water among the study population rather than the effects of source of water on malnutrition.

This result was contrary with other studies Al-Sayed et al, (2001) reported that there was protective relationship between good sources of drinking water status and stunting. Kikafunda et al, (1998) claimed that children whose families used water from unprotected sources were more underweight and Fernandez et al, (2002) observed that wasting decreased with accessibility to safe water supply.

5.5 Child health status

The results of this study identify variation across levels of basic child health status. These results show positive association with malnutrition, such as birth weight, child hospitalization and preterm babies.

The results of this study signified a positive relationship between “preterm and low birth baby” and malnutrition. That is, malnutrition was more prevalent among preterm and low birth weight babies. This is because preterm babies could have been subjected to delayed breastfeeding especially during first 3 days and small babies at first life can't feed well and could be more vulnerable for diseases, Congruent with Fernandez et al, (2002). Contrary, Skeik, (2003) observed that there was no significant difference between malnutrition and preterm and low birth babies.

The study claimed a positive relationship between child hospitalization and malnutrition. That is; malnutrition was more prevalent among children who needed

hospitalization. Sick children lose appetite and get less nutritional care from mothers during hospitalization. In contrast, Skeik, (2003) observed that there were no differences between children who were admitted to hospital and others who were not admitted.

The study revealed a positive relationship between children who received anti-parasitic drugs during the last 6 months and malnutrition. That is; malnutrition was more prevalent among children who suffer from parasitic infection. Intestinal parasite may have adverse effects on nutritional status, and consequences of parasitic infection could lead to diarrhea and anorexia. This result was congruent with other studies (Shubair et al, 2000 and Monica et al, 1997).

The result indicates a positive relationship between (GIT infection, ear infection and respiratory infection) and malnutrition. This means that malnutrition was more prevalent among children who suffer from GIT infection or ear infection or respiratory infection. Those types of infection could affect the child's appetite; absorption of food and body utilization of diet.

This result is congruent with other studies (Fernandez et al, 2002; Asfaw and Goitom, et al, 2000; Kikafunda et al, 1998 and Umeta et al, 1996). And incongruent with Skeik, (2003) who found no significant difference between malnutrition and history of disease.

Chapter 6

Conclusions and Recommendations

Chapter 6

Conclusions and Recommendations

Conclusions

Malnutrition, one of the most important global health problems, affects large numbers of children in developing countries. Malnutrition is one of the pediatric problems. It is a major health problem, especially in developing countries: where malnutrition in all its forms increases the risk of disease and early death.

WHO defined malnutrition as the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions. Malnutrition prescribes a state of poor intake or utilization of the daily nutritional requirements including: calories, macro and micro-nutrients, which are required for maintaining all life activities: physical as well as mental growth patterns. As a result of malnutrition, growth declines below the median figures, and the daily energy expenditure is minimized in order to allow for keeping the integrity of extremely vital organs aiming at supporting life chances until nutritional supplements are available or better utilized by the body.

Determination of risk factors associated with malnutrition of the Palestinian children will enable the policy makers and other health providers to set up appropriate intervention plans that could prevent and promote nutritional status of the children. It is not only preventing some leading causes of illness and death but also decreasing direct health care cost and improving people's quality of life.

The aim of this study is to investigate environment and socio-demographic risk factors and other risk factors associated with malnutrition among children under five years of age in the Gaza Strip.

The study was carried out at AEI health centers which are special referral centers providing health services for children suffering from different nutritional problems.

A clinic based case control study was conducted at AEI clinics, in the Gaza Strip, Palestine. The study population constituted 90 cases suffering from different nutritional problems who are confirmed by anthropometric measurements as a case of malnutrition and 180 healthy children matched with cases for sex, age and locality.

Pilot study was done to ensure: the researcher's ability to perform his task satisfactorily in order to avoid errors; to check the validity and reliability of questionnaire; to evaluate the outcome and to correct the areas of ambiguity and misunderstanding. Pilot study excluded from the study.

Ethical consideration measures were taken: approval from Helsinki Committee in the Gaza Strip; approval letters to conduct the study on the children in AEI centers; consent forms were signed by mothers and confidentiality was maintained at all times during study.

Data was collected through a self-constructed structured questionnaire administered to subjects' parents at their houses. Response rate was as high as 100%. Anthropometric measures needed were: height for age for stunting, weight for height for wasting and weight for age for underweight < -2 SD according to NCHS/WHO Standards. The findings were computed through SPSS using Chi-square, odds ratio, CI, P-value and t test trends.

The results of this study identify variation across levels of basic socioeconomic variables. Although some of the results did not show any association with socio-demographic factors such as parent's age, residential status, responsibility for feeding children and responsibility for food preparation. Some of these results show

positive association with malnutrition, such as low parent's education, low current and low past household monthly income, low money spent on food purchasing and families who were receiving humanitarian aids. Other variables showed negative association with malnutrition as working parents and consanguinity.

For breast feeding, some results did not show any relationship between malnutrition and breast feeding and diet patterns: currently breast-fed, ever breast-fed, duration of breast feeding, bottle feeding during the 1st six months, weaning manner, common complementary foods (milk starch pudding, cereal gruel and family food) and iron medical supplements. Some of these results show positive association with malnutrition, such as common complementary foods (rice pudding and stewed fruits), medical supplements, drinking tea and low number of meals per day.

But other results show negative association with malnutrition as breast feed during 1st three days, vitamin A&D supplement, low frequency of tea consumption and good appetite.

Also the results of this study identify great variability across levels of basic maternal variables. Although some results did not show any relationship of malnutrition with maternal obstetric history as: number of living children, child birth order, number of pregnancy, age at first delivery and inter-pregnancy interval. Some of these results show positive association with malnutrition, such as preterm babies and pregnancy disorder. But other results show negative association with malnutrition as normal delivery.

For environmental factors, some results did not show any relationship between malnutrition and environmental variables as: kind of sewage disposal, source of water, type of humanitarian aids and mode of humanitarian aids. Some of the results show positive association with malnutrition, such as living in less number of

rooms in the house. But other results show negative association with malnutrition as: living in nuclear family, less number of persons living per room, living in concrete house, owing the house, having a refrigerator, having a separate kitchen and having a flush toilet.

At last the results of this study show a statistical significant association between child health status and malnutrition. Some of these results show positive association with malnutrition, such as low birth weight, child hospitalization, children who received anti-parasitic drugs during the last 6 months and children who suffer from GIT infection, ear infection and respiratory infection during the last year.

The study contributes in highlighting malnutrition risk factors providing hints for implementing strategies that could contribute in the prevention of malnutrition. These preventive measures include; improving socioeconomic conditions, promoting breast feeding and dietary, increasing maternal health education and improving housing condition.

Recommendations

1. Multi-sectoral and multidisciplinary actions need to be taken to improve socioeconomic status such as housing and living conditions.
2. Multi-disciplinary efforts are needed to increase the availability of adequate amount of healthy food “food security” particularly for those living in bad socioeconomic conditions.
3. Increasing public awareness about malnutrition and its negative consequences focusing on cultural aspects such as cooking habits, eating habits and feeding practices.
4. Promoting healthy feeding practices such as exclusive breast feeding, decreasing tea intake and proper supplementation.

5. Tackling children morbidity as it increases the risk for developing malnutrition and visa versa.
6. Strengthening of MCH services particularly antenatal care focusing on the nutrition component of the antenatal care program.
7. Taking general measures that affect nutrition status such as birth spacing, public awareness and best nutrition practices.

Further research

1. Qualitative and quantitative studies of feeding practices are needed. Mothers' perception of breast feeding, complementary feeding and weaning should be studied.
2. More research studies are needed for deeper understanding of the determinants of the nutritional status.

Chapter 7

References and appendixes

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Appendices

Appendix 1: Map of Palestine



Source: [Htt://www.Alburaq.net/cities/cities.CFM](http://www.Alburaq.net/cities/cities.CFM), 3/1/2004.

Appendix 3: Questionnaire

Risk Factors Associated with Malnutrition among Children in the Gaza Strip.

Case Control Study

Serial No..... Case Control Date: / /2003.

Personal information:

Name:..... Address:.....

1.1 Residential status: Refugee. Citizen.

1.2 Governorate: North Gaza City Middle

Khanyounis Rafah

1.3 Age.....Months.

1.4 Sex: Male. Female.

1.5 Gestational age at birth: Full term. Pre-term.

1.6 Birth weight.....gm.

1.7 Area of living. City. Camp. Village.

Socioeconomic And Socio-demographic Status:

A. Mother

2.1 Age.....Years.

2.2 Age at marriage.....Years.

2.3 Consanguinity.

First cousin marriage. Second cousin marriage

Others.....

2.4 Years of education.....Years.

2.5 Mother employment status Employed. Unemployed.

B. Father

2.6 Age.....Years.

2.7 Years of education.....Years.

2.8 Occupation of father.

Professional. Skilled. Unskilled.

Merchant. Unemployed. Others.

2.9 Household monthly income:

.....NIS. Do not know. Refuse to answer.

2.10 Is this the usual income of the household?

Yes (Skip to Q 3.1) No

3.13 Does the baby have any medical supplements?

- Yes No (Skip to Q3.15)

3.14 If yes specify.

- Iron. Vit. A&D. Multi-vitamins.
 others, specify.....

3.15 Was the baby under special food?

- Yes No (Skip to Q 3.17)

3.16 If yes specify?.....

3.17 Did you avoid giving the baby certain food staff?

- Yes No (skip to Q3.20)

3.18 What type of food ingredient did you avoid?.....

3.19 Why you were avoiding that food?

- Allergy Not beneficial Harmful
 Digestive problems Others, specify.....

3.20 At what age did you start each of the following food staff?

Food Staff	Age in months
Milk pudding with starch	
Cereal gruel	
Rice pudding	
Fruit juice	
Stewed juice	
Yogurt	
Copped meat	
Poached eggs	
Fish	
Mashed vegetables	
Bread / biscuits	
Family Food	

3.21 Does the child drink sweetened tea?

Yes

No (Skip to Q 3.24)

3.22 If yes at what age did you start to give the child tea at regular basis?.....

3.23 On average how many cups/day does he drink?

Once a day

More than once/day

Most days

At least once a week

More than once a week

3.24 How would you describe the variety of foods that the child generally eats?

Eat most things.

He is faddy.

He is a fussy.

3.25 Number of meals the child eats per day.....

3.26 How would you describe the child appetite?

A good appetite.

An average appetite

A poor appetite.

3.27 How often does the child eat a meal that is different from the member of your family? Never.

Rarely.

Sometimes.

Often.

3.28 In general, does the child eat enough?

Usually.

Occasionally.

Rarely.

Never.

3.29 Nowadays, does the child have milk as a drink at regular basis? (Weaned child)

Yes

No (Skip to Q 3.31)

3.30 If yes what kind of milk does the child usually have?

Fresh.

Humanized.

Others, specify.....

3.31 I will ask you about the type of food the child has been eating during the last six months. Please tell me if the child eats the food and how often the child eats it?

Food Group	Food Type	Once a month	2-3/ month	1-2/ week	3-4/ week	Daily
protein Source	Meat					
	Poultry					
	Fish					
	Eggs					
	Beans					
	Legumes					
Starch	Bread					
	Rice					
	Boiled potato					
	Cereal sweetened					
	Biscuits					
	Pasta					
Fruits and vegetables	Raw fruits					
	Fruit juice					
	Dried fruit					
	Vegetable Soup					
	Tomato Sauce					
	Cooked vegetable					
	Row vegetable					
Dairy products	Milk					
	Yogurt					
	Cheese					
Fats and sweets	Ice cream					
	Potato chips					
	Cake					
	Chocolate					
	Hard candy					
	Cream cheese					
	Butter or oil in cooking					

3.32 Who is mainly responsible for food preparation for the child?

- Mother. Grandmother. Brother.
 Sister. Father. Others.

3.33 Who decides on what types of food are bought for the house?

- Mother. Father. Others.

3.34 Who is mainly responsible for feeding the child?

- Mother. Grandmother. Brother.
 Sister. Father. Others.

3.35 Money spent on food per Month.....

IV- Environmental Data:

4.1 Type of family. Nuclear Extended

4.2 What type of house do you live in?

- Concrete. Asbestos/Brick. Tin
 Others.

4.3 Number of rooms in the house (exclude bathrooms. Toilet and kitchen).....

4.4 Number of people living per room?.....

4.5 House ownership.

- Owned to the family. Rent. Owned by others.

4.6 Is there separate Kitchen? Yes No

4.7 Is there a bathroom? Yes No

4.8 What Kind of sewage system do you have?

- Closed central Open / closed pits.

4.9 What type of toilet does your house has?

- Flush. Pit. Other,.....

4.10 What is the source of water in your house?

- Municipilicity. Well. Other,.....

4.11 Is there electricity in the house? Yes No

4.12 Is there refrigerator? Yes No

4.13 Does the family take any food assistance?

- Yes No (Skip to Q 5.1)

4.14 If Yes Regular. Irregular.

4.15 Types of help. Cash. Material.

V- Maternal factors

- 5.1 Are you currently pregnant? Yes No
- 5.2 Are you currently breast-feeding? Yes No
- 5.3 How many times have you been pregnant?.....
- 5.4 Number of living children.....child
- 5.5 No of abortions.....
- 5.6 Age at first delivery.....Years.
- 5.7 What was the interval between your last two pregnancies?.....months.
- 5.8 Age of the mother of this child.....Years.
- 5.9 Birth order of this child.....
- 5.10 Delivery status?
 Normal Caesarian. Others, specify.....
- 5.11 Did you have any health disorders in the intended pregnancy?
 Yes No (Skip to Q 5.13)
- 5.12 If yes specify the disease.
 DM. Hypertension. Pre-clampsia
 Heart disease. Anemia. Persistent vomiting
 Others.....
- 5.13 Did the mother have any supplement during this pregnancy?
 Yes No (Skip to Q 6.1)
- 5.14 If yes what is it?
 Iron Vitamins Calcium
 Others, specify.....

VI- Child health status

- 6.1 Since birth, has the child ever been hospitalized?
 Yes No (Skip to Q 6.4)
- 6.2 If yes specify?
 Intensive neonate care units. General pediatric hospital.

6.3 What was the reason?

- First admission Gastroenteritis. Respiratory infection.
 Failure to thrive. Others,

specify.....

- Second admission Gastroenteritis. Respiratory infection.
 Failure to thrive. Others, specify.....

6.4 Has the child received medicine to control parasite infection in the past six month?

- Yes No

6.5 In the Past 6-12 months how many times the child suffered from?

- GIT infection. Ear infection. Respiratory infection.
 Other, specify.....

Appendix 4: Helsinki Committee

Palestinian National Authority
Ministry of Health
Helsinki Committee



السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

Date: 21/12/2003

التاريخ: 2003/12/21

Mr./ Yehia Abo Msameh

السيد: يحيى أبو مسامح

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 Malnutrition
among Children in the Gaza Strip.

عوامل الخطر المصاحبة لسوء التغذية بين اطفال قطاع غزة

In its meeting on december 2003
and decided the Following:-

و ذلك في جلستها المنعقدة لشهر ديسمبر 2003
و قد قررت ما يلي:-

To approve the above mention research study.

الموافقة على البحث المذكور عاليه.

Signature

توقيع

Member

عضو

Member

عضو

Chairperson



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.

Gaza Etwam – Telefax 972-7-2878166

Appendix 5: Approval letter from Ard El Insan

بسم الله الرحمن الرحيم

الأخ الدكتور / عدنان الوحيدي حفظه الله

المدير الطبي لجمعية ارض الإنسان الخيرية

الموضوع / دراسة عوامل الخطر المصاحبة لمرضى سوء التغذية بين الأطفال في محافظات غزة

تحية طيبة وبعد

أرجو التكرم بالعلم بأنني أرغب في إجراء هذه الدراسة كمتطلب للحصول على درجة الماجستير في صحة الأم و الطفل من جامعة القدس. علما بأن عينة البحث ستكون من الأطفال المرضى المترددين على مراكز جمعية أرض الإنسان في غزة. لذلك أتوجه إلى سيادتكم بالموافقة و عمل اللازم لتسهيل مهمة الباحث.

و اقبلوا فائق الاحترام

يحيى أحمد أبو مسامح

Appendix 6: Consent Paper

بسم الله الرحمن الرحيم

عزيزتي الأم:

ارجوا التكرم بالإجابة على أسئلة الاستبيان الذي تم إعداده لجمع المعلومات اللازمة لدراسة
الخطر المصاحبة لسوء التغذية بين الأطفال في محافظات غزة.
يتم هذا البحث بالتنسيق مع جمعية ارض الإنسان و جامعة القدس, وذلك كمتطلب تخرج
لإنهاء درجة الماجستير في صحة الأم والطفل.
إن تعاونكم و موافقتكم على المشاركة و الإجابة على أسئلة الاستبيان سيكون له أهمية
بالغة لإنجاز هذا البحث, و كذلك للارتقاء بصحة الأطفال, علما بأن المعلومات الخاصة بكم
وبنتائج البحث ستكون في سرية تامة.

شاكرين تعاونكم

الباحث: يحيى احمد أبو مسامح

بسم الله الرحمن الرحيم

إقرار شهادة

التاريخ: ١ ١

اسم والدة الطفل:

أشهد بأن المذكورة عالية قد اختارت الإجابة على أسئلة الاستبيان بمحض إرادتها بعد أن علمت

بأن المعلومات ونتائج البحث ستكون سرية.

اسم وتوقيع الشاهد.....

Appendix 7

Appendix 7: Distribution of risk factors among study population

variables	Exposure among cases		Exposure among controls		Bivariate analysis		P-value
	No	%	No	%	OR	95%CI	
Birth weight					15.553	7.273-33.262	0.001*
• ≤ 2500	43	47.8	10	5.6			
• > 2500	47	52.2	170	94.4			
Total	90	100%	180	100%			
Gestational age					13.39	6.22-29.33	0.001*
• Pre-term	44	48.9	12	6.7			
• Full term	46	51.1	168	93.3			
Total	90	100%	180	100%			
Mother's education level					8.734	3.760-20.288	0.001*
• ≤ 6 year	26	28.9	8	4.4			
• > 6 year	64	71.7	172	95.6			
Total	90	100%	180	100%			
Mother's employment					0.047	0.006-0.346	0.001*
• Employed	1	1.1	35	19.4			
• Unemployed	89	98.9	145	80.6			
Total	90	100%	180	100%			
Father's education level					4.971	2.530-9.767	0.001*
• ≤ 12 year	78	86.7	102	56.7			
• > 12 year	12	13.3	78	43.3			
Total	90	100%	180	100%			
Father's occupation					0.261	0.152-0.448	0.001*
• Employed	61	67.8	165	91.7			
• Unemployed	29	32.2	15	8.3			
Total	90	100%	180	100%			
Consanguinity					0.32	0.18-0.56	0.003*
• First cousin	21	23.3	75	41.7			
• Second cousin	17	18.9	50	27.8			
• Others	52	57.8	55	30.6			
Total	90	100%	180	100%			
Type of family					0.550	0.326-0.928	0.03*
• Nuclear	50	55.6	125	69.4			
• Extended	40	44.4	55	30.6			
Total	90	100%	180	100%			
Current household monthly income					101.0	13.731-742.927	0.001*
• ≤ 1500 NIS	75	98.7	75	42.6			
• > 1500 NIS	1	1.3	101	57.5			
Total	76	100%	176	100%			
Past 6 month household monthly income							0.001*

• More	2	2.2	26	14.4			
• Less	41	45.5	18	10.0			
• Usual	47	52.2	136	75.6			
Total	90	100%	180	100%			
Breast feed during 1st three days					0.138	0.048-0.395	0.001*
• Yes	71	82.6	171	97.2			
• No	15	17.4	5	2.8			
Total	86	100%	176	100%			
Age of complementary feeding							
• < 4 months	30	34.1	47	27.5			0.024*
• 4-5 months	8	9.1	39	22.8			
• > 5 months	50	56.8	85	49.7			
Total	88	100%	171	100%			
Common complementary food “Rice pudding”					2.727	1.624-4.681	0.001*
• Yes	51	58.0	57	33.3			
• No	37	42.0	114	66.7			
Total	88	100%	171	100%			
“Stewed fruits”					3.182	1.844-0.492	0.001*
• Yes	61	69.3	71	41.5			
• No	27	30.7	100	58.5			
Total	88	100%	171	100%			
Medical supplements					5.250	2.941-9.372	0.001*
• Received	70	77.8	72	40.0			
• Not received	20	22.2	108	60.0			
Total	90	100%	180	100%			
Vitamin A & D					0.485	0.244-0.960	0.041*
• Yes	22	31.4	35	48.6			
• No	48	68.6	37	51.4			
Total	70	100%	72	100%			
Tonics					2.980	1.207-7.362	0.019*
• Yes	19	27.1	8	11.1			
• No	51	72.	64	88.9			
Total	70	100%	72	100%			
Drink tea					4.912	2.821-8.765	0.001*
• Yes	68	75.6	69	38.3			
• No	22	24.4	111	61.7			
Total	90	100%	180	100%			
Tea frequency					0.308	0.153-0.622	0.001*
• Once a day	27	39.7	47	68.1			
• More	41	60.3	22	31.9			
Total	68	100%	69	100%			
Appetite					0.225	0.129-0.391	0.001*
• Good	42	46.7	140	79.5			
• Poor	48	53.3	36	20.5			
Total	90	100%	180	100%			
No. of meal per day					2.880	1.684-4.926	0.001*

• ≤ 3 meal	48	55.2	50	29.9			
• > 3 meal	39	44.8	117	70.1			
Total	87	100%	167	100%			
Eat enough							
• Usually	40	46.0	149	88.7			0.001*
• Occasionally	36	41.4	9	5.4			
• Rarely	11	12.6	10	6.0			
Total	90	100%	168	100%			
Responsibility of food purchasing							
• Mother	35	38.9	50	27.8			0.046*
• Father	30	33.3	88	48.9			
• Others	25	27.8	42	23.3			
Total	90	100%	176	100%			
Money spent on food purchasing					2.962	1.524-5.755	0.001*
• < 900 NIS	77	85.6	120	66.7			
• > 900 NIS	13	14.4	60	33.3			
Total	90	100%	180	100%			
Humanitarian					4.424	2.393-8.177	0.001*
• Yes	74	82.2	92	51.1			
• No	16	17.8	88	48.9			
Total	90	100%	180	100%			
Type of house					0.318	0.187-0.540	0.001*
• Concrete	42	46.7	132	73.3			
• Others	48	53.3	48	26.7			
Total	90	100%	180	100%			
House ownership					0.286	0.131-0.624	0.002*
• Owned by family	72	80.0	168	93.3			
• Owned by others	18	20.0	12	6.7			
Total	90	100%	180	100%			
Number of room					2.676	1.502-4.770	0.001*
• ≤ 3 room	70	77.8	102	56.7			
• > 3 room	20	22.2	78	43.3			
Total	90	100%	108	100%			
Number of persons per room					0.067	0.36-0.125	0.001*
• ≤ 3 person	19	21.1	144	80.0			
• > 3 person	71	78.9	36	20.0			
Total	90	100%	180	100%			
Refrigerator ownership					0.085	0.024-0.301	0.001*
• Yes	75	83.3	177	98.3			
• No	15	16.7	3	1.7			
Total	90	100%	180	100%			
Separate kitchen					0.078	0.009-0.660	0.006*
• Yes	84	93.3	179	99.4			
• No	6	6.7	1	0.6			
Total	90	100%	180	100%			
Type of toilet					0.363	0.211-0.625	0.001*

• Flush	26	28.9	95	52.8			
• Pit	64	71.1	85	47.2			
Total	90	100%	180	100%			
Pregnancy disorders					4.065	2.100-7.868	0.001*
• Yes	28	31.1	18	10.0			
• No	62	68.9	162	90.0			
Total	90	100%	180	100%			
Mode of delivery					0.340	0.163-0.706	0.006*
• Normal	71	78.9	165	91.7			
• Caesarian	19	21.1	15	8.3			
Total	90	100%	180	100%			
Hospitalization					3.654	2.060-6.482	0.001*
• Yes	38	42.2	28	15.6			
• No	52	57.8	152	84.4			
Total	90	100%	180	100%			
First admission reason							
• GITI	22	57.9	2	21.4			0.012*
• URTI	9	23.7	13	46.4			
• Others	7	18.4	9	32.1			
Total	38	100%	28	100%			
Received anti-parasitic drugs within the last 6 months					3.564	2.032-6.249	0.001*
• Yes	40	44.4	33	18.3			
• No	50	55.6	147	81.7			
Total	90	100%	180	100%			
GIT infection					0.108	0.057-0.203	0.001*
• Yes	47	52.2	19	10.6			
• No	43	47.8	161	89.4			
Total	90	100%	180	100%			
Ear infection					0.163	0.068-0.387	0.001*
• Yes	20	22.2	8	4.4			
• No	70	77.8	172	95.6			
Total	90	100%	18/0	100%			
Respiratory infection					0.371	0.213-0.645	0.001*
• Yes	37	41.1	37	20.6			
• No	53	58.9	143	79.4			
Total	90	100%	180	100%			

* Statistical significant

Appendix 8

Appendix 8: Prevalence of underweight, stunting and wasting among under-5-year-olds in the developing countries, based on national surveys, 1980-92

	Survey performed	% under-weight	% wasting	% stunting
Algeria	1992	9.2	18.1	5.5
Bangladesh	1989-90	65.8	64.6	15.5
Brazil	1989	7.0	15.4	2.0
Cameroon	1991	13.6	24.4	3.0
Chile	1986	2.5	9.6	0.5
China	1987	21.3	32.1	3.6
Colombia	1986-89	10.1	16.6	2.9
Congo	1987	23.5	27.1	5.4
Djibouti	1989	22.9	22.2	10.7
Egypt	1990	10.4	30.0	3.5
Ethiopia	1992	47.7	64.2	8.0
Ghana	1987-88	27.1	30.5	7.3
India	1988-90	63.9	62.1	19.2
Iraq	1991	11.9	21.8	3.4
Jordan	1990	6.4	19.3	2.8
Kenya	1987	14.3	32.2	4.5
Kuwait	1983-84	6.4	11.3	2.7
Mali	1987	31.0	24.4	11.0
Mexico	1988	16.3	27.0	5.5
Morocco	1987	15.7	25.5	3.7
Nicaragua	1980-82	10.5	21.8	0.6
Niger	1992	36.2	32.3	15.8
Nigeria	1990	35.7	43.1	9.1
Oman	1991	24.3	20.7	7.3
Pakistan	1990-91	40.4	50.0	9.2
Panama	1980	15.7	22.0	6.4
Peru	1991-92	10.8	36.5	1.4
Philippines	1987	32.9	38.6	4.5
Senegal	1991-92	21.6	29.1	5.5
Sierra Leone	1990	28.7	34.7	8.5
Sri Lanka	1987	38.1	27.5	12.9
Tanzania	1991-92	28.8	42.6	6.0
Tunisia	1988	10.4	18.2	3.1
Uganda	1988-89	23.3	44.5	1.9
Venezuela	1981-82	10.2	6.4	1.3
Yemen	1991-1992	30.0	44.1	12.7
Zambia	1992	25.1	39.6	5.1