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# Risk Factors Associated with Vitamin A Deficiency among Children 12-59 Months Old Attending Ard El Insan Association-Gaza


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**Palestine**

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# Risk Factors Associated with Vitamin A Deficiency among Children 12-59 Months Old Attending Ard El Insan Association-Gaza


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**Dedication**

*My sincerest and warmest appreciation and gratitude go to my family, particularly my beloved parents, who never stopped encouraging me, for my father spirit, and my mother whose prayers never stopped for my sake. May God bless them both.*

*Lot of thanks and love to my wife Eman, without her understanding, support and encouragement the thesis would not have been completed.*

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*Greatest regards coupled with thanks for my sisters and brothers who believed in supporting me and enriched my enthusiasm.*

*To everyone who contributed to get this study being a reality.*

*To the hope for peace and fairness prevailing all throughout the world.*

*Mohammad Abdel Kadder Abu Rayya*

## Declaration

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

Signature ……………………….

*Mohammed A. M. Abu Rayya*

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# Risk Factors Associated with Vitamin A Deficiency Among Children Aged 12-59 Months Attending Ard El Insan Association, Gaza


## Abstract

*Vitamin A is an essential micronutrient needed by humans for the normal functioning of visual system; growth and development; and maintenance of epithelial cellular integrity, immune function, and reproduction.*

*The overall aim of this study is to identify the common risk factors associated with vitamin A deficiency among apparently healthy children aged 12-59 months attending Ard El Insan association, Gaza. The present study is a cross section study which comprised 150 children. Interview questionnaire with mothers is specially designed and prepared to compile information relating to the objectives. Blood samples were drawn for determination of serum vitamin A and hemoglobin concentrations by using CBC test. Serum vitamin A was measured by ELISA technique using human vitamin A, ELISA kit. Statistical analysis was performed using SPSS version 18.*

*Depending on the scientific classification of vitamin A, it's divided into 3 groups. Results, indicated that (57.3%) of children had vitamin A (deficiency) 200-500 nmol/L, (20.7%) of children had vitamin A (marginal deficiency) 501-699 nmol/L and (21.3%) of children had vitamin A (normal) >700 nmol/L. The mean ±SD of vitamin A and hemoglobin was 532.5 ±298.2 and 10.14 ±0.76 respectively. There was a significant relation between vitamin A category and address (P=0.013).Another significant relation appeared between the mean levels of vitamin A and gender (P=0.030) which showed that male were more than females. There was a significant decreases in the mean levels of vitamin A in anemic children (P=0.011). A significant relation between discontinuation of breastfeeding before 12 months and vitamin A deficiency (P=0.008).The relationship between vitamin A deficiency and child clinical status was not statistically significant (P-value>0.05).*

*This study provides information on the nutritional status of children as a risk factor for vitamin A deficiency. Results, demonstrated that there are significant statistical relationships between anemia, gender, breastfeeding practices and vitamin A deficiency. And provides a set of recommendation such as exclusive breast feeding in the first six months, fortification of staple foods and supplementation program should be put in place at least for the short term.*

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| | |
|---|---|
| AEI | Ard El Insan Palestinian Benevolent Association |
| ARTI | Acute Respiratory Tract Infection |
| ELISA | Enzyme Linked Immune Sorbent Assay |
| IVACG | International Vitamin A Consultative Group |
| M&E | Monitoring and Evaluation |
| MI | Micronutrient Initiative |
| MN | Micro-Nutrient |
| MOH | Ministry of health |
| NGOs | Non-Governmental Organizations |
| PCBS | Palestinian Central Bureau of Statistics |
| PEM | Protein Energy Malnutrition |
| SPSS | Statistical Package for Social Science |
| UNICEF | United Nations Children's Fund |
| UN-OCHA | United Nations Office for the Coordination of Humanitarian Affairs |
| UNRWA | United Nations Relief and Work Agency |
| VAD | Vitamin A Deficiency |
| VADD | Vitamin A Deficiency Disorder |
| VAFSP | Vitamin A Field Support Project |
| VMDs | Vitamin and Mineral Deficiencies |
| WHO | World Health Organization |

# Chapter 1

## 1.1 Introduction

Micronutrients are vitamins and minerals that are essential for healthy growth and development but required only in small amounts. Micronutrients play very important roles in the body and they influence adult and child growth, productivity, tissue integrity, work as antioxidants, resistance to illness, educational achievement, child survival and maternal health. Iron, Vitamin A and Zinc are very important micronutrients. Children get micronutrients from the foods that they eat. In order to get enough micronutrients, children must have access to nutrient rich foods that are prepared and consumed in the right way and they can also get micronutrients from supplements. These substances are the “magic wands” that enable the body to produce enzymes, hormones and other substances essential for proper growth and development. As tiny as the amounts are, however, the consequences of their absence are severe. Iodine, vitamin A and iron are most important in global public health terms; their lack represents a major threat to the health and development of populations the world over, particularly children and pregnant women in low-income countries (WHO 2007).

Worldwide, about 852 million people are classified as undernourished by the Food and Agricultural Organization (FAO, 2004) in 2000-2002. However, another 2.5 times as many people suffer from “hidden hunger”. People suffering from hidden hunger appear to get enough to eat – at least in terms of calories – but are lacking in micronutrients such as vitamins and minerals including iron or iodine. These micronutrients are essential for human health, and their lack can lead to lifelong physical and cognitive disabilities (FAO, 2004).

The effects and symptoms of *Vitamin and Mineral Deficiencies* (VMDs) are often general and vague. They include listlessness, increased severity or frequency of illnesses, poor eyesight and/or impaired cognitive development and physical growth. Thus, these symptoms can often go unrecognized, especially for children already living in poor conditions, hidden hunger has been present throughout history, although is now largely overcome in the industrialized countries (UNICEF et al. 2004). This is mainly due to a relatively high level of food security, (preventive) healthcare focusing on risk groups such as infants or pregnant women, and food fortification and supplementation. In many developing countries, however, hidden hunger still remains a major source of public health problems. VMDs are thought to affect some 40% of the world Population (MI & UNICEF 2004). Micronutrient deficiencies are most prevalent where there is poverty, environmental deprivation and social disparity. Micro-nutrient deficiencies, the hidden hunger, are widespread. This briefing examines one such micronutrient, vitamin A, and details the steps that have been taken to combat this deficiency in a sustainable way.

Globally, 21% of children have vitamin A deficiency and suffer increased rates of death from diarrhea, measles, and malaria. About 800,000 deaths in children and women of reproductive age are attributable to VAD which accounts for 1.8% of the global burden of disease (Food *and Agriculture Organization*/World Health Organization, FAO/WHO expert, 2001).

A study conducted in Palestine by the MARAM project (2004) found that 22% of children from 12-59 months were found to have low vitamin-A plasma level < 200ug/l.

In addition, results showed a significant difference between the prevalence of vitamin A deficiency in the west Bank (18,9%) compared to Gaza Strip (26,5%).(MARAM 2004).

## 1.2 Problem Statement

Vitamin A deficiency disorder (VADD) and related risk factors with complications have been studied in developed and developing countries including the neighboring ones. In the Gaza strip, few studies were carried out on vitamin A deficiency and risk factors without evaluation, the role of micronutrients VAD. Although in the absence of improvement in the economic and nutrition situation of the Palestinian children, they are at risk of experiencing higher rates of vitamin A deficiency, yet it is very important to consider it such as extremely vulnerable population. Palestinian children are protected falsely from vitamin A deficiency because it can occur at any age, with consequences ranging from sub-clinical effects that increase risk morbidity and mortality to blinding malnutrition. This will be the first study for risk factors of vitamin A deficiency in the Gaza city. It could help establish the future management strategy prevent or control micronutrient deficiency specially vitamin A.

Also, there is a lack of enough studies, interest and information about risk factors for vitamin A deficiency in Gaza Governorates. Therefore, this study is designed to be carried out to assess childhood vitamin A deficiency and related risk factors as a cross section study in order to improve the health status in the Gaza Governorates. The overall goal of the present study is to protect childhood and the human health from the adverse effects of vitamin A deficiency.

### 1.3 Justification of the study

Vitamin A deficiency is a serious international public health problem. It remains the most common and societal divesting micronutrient deficiency disease of children. Vitamin A deficiency is a hidden hunger and simultaneously a factor which threatens the health of all children everywhere. Children who suffer from vitamin A deficiency disorders (VADD) present with physiological disturbances, including clinical signs and symptoms as well as subclinical manifestation. Vitamin A deficiency can occur at any age, resulting in two primary factors. The first is a persistent low intake of vitamin A inadequate to satisfy physiological needs. The second factor is a high frequency of infection. Infection depresses appetite and prompts an elevation in the body's vitamin A utilization, leading to inefficient conservation of the nutrient (WHO, vitamin A deficiency, Advocacy, 2003).

Vitamin A deficiency impairs growth and cognitive development and predisposes to, poor birth outcomes, anemia, cretinism, and blindness. Children are commonly affected and they are the most vulnerable. Children can still suffer from VAD non-specific symptoms that include increased morbidity and mortality, increased risk of anemia and contributions to slowed growth and development. Because these non-specific adverse consequences may occur from other nutrient deficits as well, it is difficult to attribute non-ocular symptoms specifically to VAD in the absence of biochemical measurements reflective of vitamin A status (WHO, 1995).

Prevention of vitamin A deficiency is essential. Therefore this study is urgently needed for the Gaza Governorates in order to identify risk factors associated with vitamin A deficiency that might help to control and prevent VAD, and informed adoption of strategies for preventing VAD.

## 1.4 The aim of the study

The aim of the study is to establish baseline information on the nutritional status relative to vitamin A deficiency and its risk factors among children 12 to 59 months of age in Gaza city. This study will lead to develop recommendations and provide information required to prevent and reduce vitamin A deficiency towards a healthy Palestinian community.

## 1.5 General objective of the study

The general objective of the study is to identify the common risk factors associated with vitamin A deficiency among children aged 12-59 months attending Ard El Insan association health center. The present study also aims to protect children and human health from the adverse effects of vitamin A deficiency.

### 1.5.1 Specific objectives:

1. To examine the association between socio-demographic variables and VAD in children's attending AEI clinic, Gaza center.
2. To determine serum levels of vitamin A in children by ELISA and determine the hemoglobin level by doing CBC test.
3. To explore the relation between VAD, anemia and poor breastfeeding.
4. To provide recommendations in order to develop an effective public health policy and measures to promote public health and safe environment

## 1.6 Study questions

- Q1: Dose vitamin A deficiency in Gaza City lead to childhood illness?
- Q2: Is vitamin A deficiency a real threat to children's health in Gaza City?
- Q3: Is there a relationship between socioeconomic factors and vitamin A deficiency among children?
- Q4: Does child food habit and behavior associate with vitamin A deficiency?
- Q5: Does parents' education level reinforce children VAD?
- Q6: Which of the risk factors is a potential one for vitamin A deficiency?
- Q7: Is there a relationship between anemia and breastfeeding factors and vitamin A deficiency among children?

## 1.7 Background of the study

### 1.7.1 The Gaza Strip:

The Gaza Strip is one of the territorial units forming the Palestinian Authority territories located in the Eastern coast of the Mediterranean Sea. It is bounded by Israeli entity from the north, east and southeast and by Egypt from the southwest. Gaza Strip comprises a narrow zone of land, 45 kilometers long, 7.9 kilometers wide at northern end, 12.5 kilometers wide at southern end, and 5.5 kilometers wide at its narrowest point encompassing a total area of approximately 365 square kilometers. Gaza Strip is divided into five governorates that are, North Gaza, Gaza, Middle Zone, Khan Yunis and Rafah (PCBS, 2010).

### 1.7.2 Demographic context:

The Gaza Strip is one of the most densely populated areas in the world. The total number of residents in the Gaza Strip is 1,561,906 (PCBS, 2010). Density rate in the Gaza Strip is about 4,279 inhabitants per one square kilometer. Regarding gender, the number of male population is 792,850, while the number of female population is 769,056, sex ratio of 103.1 (PCBS, 2010). In the Gaza Strip children less than 15 years old comprise about

44.2% of the total population. Young people aged between 15 and 30 years comprise about 29.6% of the total population, with total number of 461,322 (PCBS, 2010).

Recently, obtained data indicate a slight rise in the median age in Gaza Strip. The median age rose from 14.8 years in 1997 to 17.2 years in 2010 (PCBS, 2010). Crude birth rate estimated during 2010 in the Gaza Strip 37.1 births per 1000 people (PCBS, 2010). Rate of natural increase of population in mid-2010 was 3.3% in Gaza Strip (PCBS, 2010). Crude death rate estimated in 2010 in the Gaza Strip 4 deaths per 1000 population (PCBS, 2010).

### 1.7.3 Socio-economic context:

In the Gaza Strip, there are three main types' localities of residency urban, rural and camps. The big proportion of population in Gaza Strip is refugees; they comprise about 67.4% of total population. The socio-economic status of the Gaza Strip is severely hampered by high population density, limited land access, strict internal and external security controls. Effects of Israeli military operations and restrictions on labor and trade access across the border by imposing the siege in 2007. These factors have dramatically increased the rates of unemployment and poverty in the Gaza Strip. More than 140,000 persons, comprising more than 40% of the workforce in the Gaza Strip, are unemployed because of the collapse of economic activity. In the under-30 age group, unemployment has reached almost 60% (UN-OCHA, 2009). The deteriorating socioeconomic conditions among Palestinians living in the Gaza Strip have caused a rise in the number of people living below the poverty line (2.8 US$ per capita daily expenditure). More than 1.1 million persons of population in the Gaza Strip are living below the poverty line (UN-OCHA, 2009). The siege policy has led in recent years to the development of a tunnel-based economy between the southern Gaza Strip and Egyptian Rafah. A variety of goods has brought into the Gaza Strip through the tunnels. Nevertheless, smuggling goods cannot replace a stable local economy. In addition, the tunnel-based economy significantly contributed to smuggle banned goods like legal and illegal drugs. The effects of mentioned socioeconomic conditions in the last years on the whole population in the Gaza Strip are considerable, but young people who are especially vulnerable were the most affected (UN-OCHA, 2009).

### 1.7.4 Political context:

Gaza Strip is one of the territorial units forming the Palestinian territories. Since July 2007, following the 2006 Palestinian legislative election and the interior unfortunate events of Gaza, which contributed to the separation of the Palestinian unity in the two geographical parts of the Palestinian Authority territories. Recently many of the basic aspects of life in Palestinian society have been adversely affected as a result of the division and political fragmentation in the Palestinian political arena. The main effects of internal Palestinian division reflected on the health care system through the collapse of some institutions of the health service, the duplication of administrative instructions, restriction of extension of the national health authorities, and lack of planning health and identify priorities in the sector. The current reality of a negative impact on performance and outputs of the health care system in the Gaza Strip will have negative consequences both in the medium or long term. In addition, the internal division affects the social life of Palestinians through family relationships in every home and marital relations (UNDP, 2009).

The last war on Gaza which started on December 27$^{th}$ 2009 had further deteriorated the already miserable situation. The consequences of the war and the siege had manifested itself in thousands of casualties, demolition of thousands of houses, destruction of health facilities and civil institutions, disruption of ordinary work systems, denying access to health services, suspension of developmental activities, interruption of the capacity building activities and so on (Palestinian Non-Governmental Organizations “PNGO”, 2009).

Israel still holds overall sovereignty over the Gaza Strip. It has the upper hand over borders, movement of goods and travelers in and out of Gaza, particularly the Palestinians themselves. It also controls trade, the commercial market, water, the main sources of energy, the means of communications and the overall security. Hence, it still has a hold over the Palestinian economy (Hamad, 2009).

### 1.7.5 Health context:

The main health providers in the Gaza Strip are Ministry of health (MOH), United Nations Relief and Work Agency (UNRWA), Palestinian Non Governmental Organizations (NGOs), and the Private Sector. The closure of the Gaza Strip is undermining the functioning of the health-care system, hampering the provision of medical supplies and the training of health staff and preventing patients with serious medical conditions receiving timely specialized treatment outside the Strip. The Israeli military operations in December 2008 – January 2009 damaged 15 of the Gaza Strip's 27 hospitals and damaged or destroyed 43 of its 110 primary health care facilities. The ban on construction materials has meant that the health authorities have been unable to rebuild or repair these facilities. The lack of building materials is also affecting other essential health facilities: for example, the new surgical wing in Shifa hospital, the Gaza Strip's main facility, has remained unfinished since 2006. Many facilities urgently need maintenance and repair as well as expansion in some cases to cope with the growing population (WHO, 2010). While supplies of drugs and disposables have generally allowed into the Gaza Strip, there are often shortages on the ground with 15%–20% of essential medicines commonly out of stock. Certain types of medical equipment, such as X-ray equipment and electronic devices have proved very difficult to bring in, and there are often shortages of essential spare parts, with the result that clinical staff frequently lack the medical equipment they need. Medical devices are often broken, missing spare parts, or out of date (WHO, 2010). Health professionals in the Gaza Strip have been cut off from the outside world. Since 2000, very few doctors, nurses or technicians have been able to leave the Gaza Strip for training to update their clinical skills. This is severely undermining their ability to provide quality health care. Many specialized treatments (e.g. for complex heart surgery and certain types of cancer) are not available in the Gaza Strip. Many patients who were referred for treatment to hospitals outside the Gaza Strip have had their applications for exit permits denied or delayed by the Israeli authorities and have missed their appointments. Several have died while waiting for referral (WHO, 2010).

### 1.7.6 Primary health care in Gaza Strip:

Primary Health Care (PHC) is one of the most important components of the Palestinian health care system. PHC centers provide accessible and affordable health services for all Palestinians, especially for children and other vulnerable groups. MOH is working with other health sectors in providing the primary health services, mainly UNRWA and NGOs the total number of registered PHC centers in Palestine is 731 centers. Distribution by provider shows that, there are 413 centers owned and supervised by the MOH, 53 centers by the UNRWA and NGOs have 265 centers. In Palestine, the average ratio of persons per center is 4.976 (MOH, 2006).MOH is the main health care provider; it provides primary, secondary, and tertiary services and purchases some services from private providers domestically and abroad (MOH, 2006). MOH plays the main role in providing and controlling immunizations scheme, public health activities, licensing and registration of health facilities. Health care financing is mainly provided through the government, apart from the out-of-pocket health financing which is the first source of health financing in Palestine (MOH, 2006).

### 1.7.7 Non-Governmental organization (NGOs) in Gaza Strip:

In the Gaza Strip, NGOs are considered as second providers of health services in Palestine (MOH, 2003). In 2004, the health sector in NGOs owns and operates 265 mini PHC centers in Palestine. Some centers include medical laboratories to perform simple diagnosis, and many pharmacies that provide the attendants with low cost medication (MOH, 2004).

The NGOs sector operates about 50 centers (WHO, 2009). The private for-profit health sector also provides the three levels of care through a wide range of practices (WHO, 2009).

### 1.7.8 Ard El Insan (AEI):

Ard EL Insan Benevolent Association is a Palestinian Non Governmental Organization which provides nutritional and health services to the most needy and marginalized children under age five, their mothers and families. Over the years AEI has become the leading community health and nutrition services provider in the Gaza Strip. This has been achieved through adopting consistent technical intervention strategies in: medical intervention, nutrition therapy, counseling, health and nutrition awareness, psychological support, promotion of breast-feeding, and conducting research related to nutrition, community, and environmental health.

## 1.8 Definitions of terms

**VAD (vitamin A deficiency):** is not simply defined. WHO defines it as tissue concentrations of vitamin A low enough to have adverse health consequences even if there is no evidence of clinical disorder. Plasma level of Vitamin A < 200 nmol/L is a reference to low vitamin A level in the body (FAO */WHO expert, 2001).*

**Vitamin A deficiency disorders (VADD):** The Vitamin A deficiency disorders (VADD) refers to all physiological disturbances caused by low vitamin A status, including clinical signs and symptoms as well as subclinical manifestations (Report of the XXI IVACG, 2003).

**Anemia:** Anemia is the reduction of normal number of red bloods cells and quantity of hemoglobin in blood. The level of hemoglobin in the blood is widely accepted as the method for diagnosing anemia. It is defined by WHO as a hemoglobin concentration below 11 g/dL (WHO, 2005).

# Chapter 2

# Literature Review

## 2.1 Conceptual framework of the study

The conceptual framework for this study built on the premises the risk factors of vitamin A deficiency and other variables, vitamin A deficiency and risk factors that lead to (VADD) vitamin A deficiency and risk factors for children's in the Gaza city. In addition, as shown in (Figure 2.1) below, these factors have a direct relationship among themselves. The conceptual framework and findings of this study had been matched with concepts derived from MARAM project (MARAM project June 2004**).**

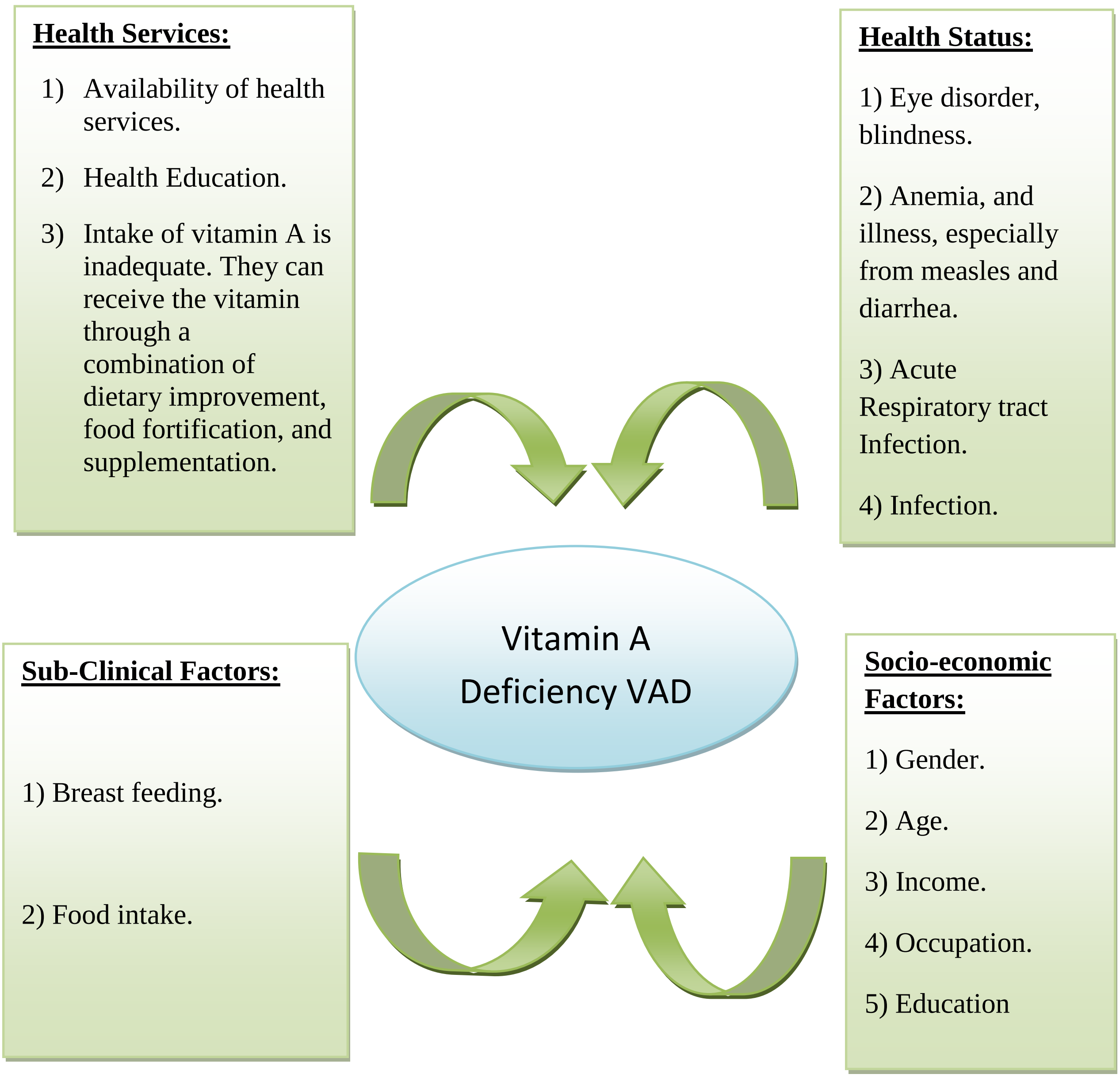


**Figure (2.1): Conceptual framework of the study**

### 2.1.1 Dependent variables of the study:

The study assesses the vitamin A deficiency among 12-59 months at Gaza city.

### 2.1.2 Independent variables of the study:

The main factors that current study were determine their impact on the dependent variables of the study are socio-demographic variables, anemia, breast feeding and risk factors that lead to vitamin A deficiency.

The socio-demographic variables include sex, age, level of education, and socio-economic status include income, occupation and others, such as health services and availability of health services, health education. Intake of vitamin A is inadequate, hence they can receive the vitamin through a combination of dietary improvement food fortification, and supplementation.

On other hand, health status such as eye disorder, blindness, anemia, and illness, especially from measles and diarrhea, acute respiratory tract infection and general infection, also subclinical factors like food intake and breast feeding.

## 2.2 Background of vitamin A (retinol):

Vitamin A is an essential nutrient needed in small amounts by humans for the normal functioning of the visual system; growth and development; and maintenance of epithelial cellular integrity, immune function, and reproduction .These dietary needs for vitamin A are normally provided for as preformed retinol (mainly as retinyl ester) and provitamin A carotenoids ( McLarenet and Frigg., 2001). Preformed vitamin A in animal foods occurs as retinyl esters of fatty acids in association with membrane-bound cellular lipid and fat-containing storage cells. Normal digestive processes free vitamin A and carotenoids from embedding food matrices, a more efficient process from animal than from vegetable tissues (Infant Nutrition and Feeding, 2008). Retinyl esters are hydrolyzed and the retinol and freed carotenoids are incorporated into lipid-containing, water-miscible micellar solutions. Products of fat digestion (e.g., fatty acids, monoglycerides, cholesterol, and phospholipids) and secretions in bile (e.g., bile salts and hydrolytic enzymes) are essential for the efficient solubilisation of retinol and especially for solubilisation of the very lipophilic carotenoids (e.g., α- and β-carotene, β-cryptoxanthin, and lycopene) in the aqueous intestinal milieu. Micellar solubilisation is a prerequisite to their efficient passage into the lipid-rich membrane of intestinal mucosal cells i.e., enterocytes ( McLarenet and Frigg., 2001).

Diets critically low in dietary fat (under about 5–10 g daily) or disease conditions that interfere with normal digestion and absorption leading to steatorrhea (e.g., pancreatic and liver diseases and frequent gastroenteritis) can therefore impede the efficient absorption of retinol and carotenoids. The liver parenchymal cells also take in substantial amounts of carotenoids. Whereas most of the body's vitamin A reserve remains in the liver, carotenoids are also deposited elsewhere in fatty tissues throughout the body. Usually, turnover of carotenoids in tissues is relatively slow, but in times of low dietary carotenoids intake, stored carotenoids are mobilized (FAO/WHO expert, 2001).

Vitamin A is now considered to be a subgroup of a class of compounds known as retinoid. All retinoid are derived from a monocyclic parent compound containing five carbon-carbon double bonds and a functional group at the end of the acyclic portion. The term Vitamin A is used generically for all β-ionone derivatives (other than carotenoids) that have the biological activity of all-trans retinol. Both vitamin A and carotenoids are soluble in most organic solvents but not in water. Like other hydrophobic substances their transport within the body, which is over 60% water, poses problems which have been overcome by a variety of means. Their sensitivity to oxidation, isomerization, and polymerization leads to their ready destruction especially when adsorbed as a thin surface film in the presence of light and oxygen. This has important implications for the storage and analysis of biological tissues (McLaren and Frigg, 2001).

## 2.3 Global distribution of VAD:

In 1996 WHO mapped the global distribution of VAD and categorized countries by degree of significance as a public health problem on the basis of both clinical and moderate and severe sub-clinical (prevalence of low blood levels of retinol) indicators of deficiency . In the early 1990s, WHO estimated that about 3 million children had some form of xerophthalmia annually and, on the basis of blood levels, another 250 million were subclinical deficient ( *FAO/WHO expert, 2001).*

VAD is the single most important cause of childhood blindness in developing countries. It also contributes significantly, even at subclinical levels, to morbidity and mortality from common childhood infections. VAD is the result of two primary factors: persistent inadequate intake of vitamin A that is frequently exacerbated by others dietary circumstances, and a high frequency of infections. An estimated 2.8 million preschool-age children are at risk of blindness from VAD, and the health and survival of 251 million others are seriously compromised. Heightened awareness of the role of vitamin A in human health has led to an international effort to eliminate vitamin A deficiency and its consequences as a public health problem by the year 2000. This is among the important end-of-decade micronutrient goals endorsed by the World Summit for Children (1990), the International Conference on Nutrition (1992), and the World Health Assembly (1993).

On a global basis, it is estimated that 75-140 million preschool children are affected by sub-clinical vitamin A deficiency, with the upper limit of this range thought to be more likely. The highest prevalence of both clinical and sub-clinical vitamin A deficiency occurs in South Asia and sub-Saharan Africa, where 30% to 40% of preschool children are at heightened risk of ill health and death because of this deficiency (Mason *et al*., 2001).

The prevalence of subclinical VAD was estimated to have risen to about 230 million. Data are still unavailable from a number of countries and these figures are likely to be a considerable underestimation (McLaren and Frigg, 2001).

In recent years it has been recognized that children with subclinical deficiency have an increased risk of dying. Many of these have severe measles, diarrhea, and/or PEM and have been recommended in the past for what has been termed “targeted prevention” with vitamin A supplementation. In these circumstances they should be considered to be subjects of treatment which includes vitamin A (McLaren and Frigg, 2001).

## 2.4 Regional spread of VAD:

In the Eastern Mediterranean Region, VAD is currently a major concern because it causes immune-compromise, respiratory infection and blindness. Only 4 countries in the Region still report clinical VAD, but 13 countries, including Oman, Egypt, Morocco and Jordan, have found that sub-clinical VAD is present. For controlling and eliminating VAD, improvement in dietary intake of vitamin A and its precursors through fortification of edible oils and distribution of high doses of vitamin A supplements as part of the national immunization days, will be necessary. (WHO, 2001)

## 2.5 Local spread of VAD:

In occupied Palestinian territory the situation showed a significant difference between the prevalence of VAD in the West Bank (18.9%) compared to the Gaza Strip (26.5%). On the other hand, results revealed no significant differences in VAD with respect to gender, age groups or whether children lived in camp or non-camp areas. The overall prevalence of anemia among children aged 12-59 months was 23%. The prevalence of anemia varied significantly between the West Bank (17.4%) and Gaza Strip (31.2%).

Results revealed that 33.9% of VAD children were anemic, indicating that Vitamin A deficient children are more likely to become anemic than children with normal levels of vitamin A. In conclusion, the prevalence of VAD in the West Bank and Gaza Strip, meets both the WHO (20%) and the IVACG (15%) criteria for a public health problem that requires immediate action. VAD is associated with infection/inflammation in all communities, and in the Gaza Strip, in addition to the former factor, low intake of this nutrient in the diet is an obvious contributing factor (MARAM, 2004).

## 2.6 VAD and health status:

Health status in this study is composed of anemia and illness especially from measles and diarrhea, and eye disorder in general, upper respiratory tract infection (URTI), and general trend of infections.

Vitamin A deficiency refers to a state in which liver stores of vitamin A are below 200 nmol/L (Report of the XXI IVACG, 2003) Vitamin A deficiency can occur at any age, with consequences ranging from sub-clinical effects that increase risk of morbidity and mortality to blinding malnutrition indicating clinical vitamin A deficiency is one of the most prevalent worldwide micronutrient insufficiencies, particularly for women and children. Unlike many other micronutrients, vitamin A is fat-soluble and can be stored in the body for extended periods of time. Yet a deficiency can occur when these stores of vitamin A in the body are depleted. Deficiency is the consequence of two primary factors: inadequate intake of vitamin A and an excessive use of vitamin A by the body. Adequate intake of vitamin A is impaired when insufficient dietary sources of vitamin A are consumed, when the vitamin A ingested is from plant foods, which is not as well absorbed as that from animal sources. Also, when the diet does not include enough fat or oil to assist with absorption, and when the lining of the intestine is damaged by parasites or diarrhea and thus remains unable to absorb vitamin A. Excessive use of the body's stores of vitamin A occurs during period of rapid growth, such as infancy, early childhood, pregnancy, and lactation, and during times of illness, including measles, diarrhea, and malaria (Vitamin A Facts for Health Workers 2008).

#### 2.6.1 VAD and eye disorder:

Eye disorder with Vitamin A deficiency most dramatically affects the eye (Mclaren and Frigg, 2001) in Fact, it is the leading cause of severe preventable visual impairment and nutritional Blindness among children in developing nations (Underwood and Arthur, 1996). The Earliest evidence of vitamin A deficiency is impaired dark adaptation or night blindness. Mild vitamin A deficiency may result in changes in the conjunctiva called Bitot's spots. Severe or prolonged vitamin A deficiency causes a condition called xerophthalmia, Characterized by changes in the cells of the cornea (clear covering of the eye) that ultimately result in corneal ulcers, scarring, and blindness (Semba, 2001; Brody, 1999).

### 2.6.2 VAD and anemia:

Anemia is defined by the WHO as a hemoglobin concentration below 11 g/dL (WHO, 2005). The global prevalence of anemia is high, and in developing countries about 42% of preschool children, 53% of school-age children, 44% of women of childbearing age, and 56% of pregnant women may be affected by anemia (United Nations, 2000). The causes of anemia are diverse, but among the leading etiologies in developing countries are iron deficiency, malaria, some infectious diseases, and other nutritional deficiencies that influence hemoglobin metabolism, including vitamin A. Although vitamin A deficiency is acknowledged among the causes of anemia (Oski, 1995; Lee & Herbert, 1998), the epidemiology and pathogenesis of the anemia of vitamin A deficiency have not been well characterized. The hematological picture of vitamin A deficiency anemia is still vaguely defined. Vitamin A appears to influence anemia via modulation of hematopoiesis, by enhancement of immunity to infectious diseases (Thurnham, 1993,Semba, 1998) and, hence, the anemia of infection (Means, 2000), and through the modulation of iron metabolism (Bloem, 1995).

The association between vitamin A deficiency and anemia is well established, although the mechanism is not yet fully understood. It has long been known that vitamin A deficiency and iron deficiency tend to exist together in population groups. This might be expected to occur because inadequate diets are usually deficient in more than a single nutrient. In controlled trials carried out in several countries vitamin A supplementation brought about significant increases in hemoglobin levels (Sommer and West, 1996).

While better understanding of the interrelationships between vitamin A and iron must be pursued, the prevention of vitamin A deficiency should be considered along with iron supplementation for the control of nutritional anemia (IVACG, 1998).

Vitamin A deficiency and anemia, 33.9% of vitamin A deficient children were also anemic, indicating that vitamin A deficient children are more likely to be anemic than children with normal levels of vitamin A. (MARAM ,2004)

Anemia and vitamin A deficiency in other study, place and finding in China (Ke Chen, 2009) Vitamin A and iron deficiency are still public health problems in some localities of China. Public health interventions in anemia control should be used to eliminate deficiencies of vitamin A, iron, and other micronutrients by deliberate supplementation. Attention must be paid to such deficiencies in high-risk groups, especially in preschool children. The most common nutritional disorder in the world iron deficiency anemia is a major problem affecting more than 2 billion people comprising more than one third of the entire world population. In the world about 25% of preschool children are deficient in iron and the proportion of children in Africa with anemia is 68%. In South Africa, about one in ten children have an iron deficiency (Draper, 1997).

Iron deficiency anemia is more common in situations of: 1. Social disadvantage (e.g. poverty, poor housing and overcrowding, and low levels of parental education), 2. Psychological disadvantage (e.g. lack of stimulation) and, 3.Biological disadvantage (e.g. low birth weight, high infection rates, and other nutritional deficiencies). The main nutritional causes of iron deficiency anemia are diets that provide too little iron, poor absorption of most dietary iron, and the presence of other dietary factors that inhibit iron absorption (Draper, 1996).

Iron deficiency anemia is associated with impaired development of mental and physical coordination skills and impaired school achievement in older children. It lowers resistance to disease and weakens a child's learning ability and physical stamina. It also slows mental and motor development and reduces work performance (Draper, 1996).

Anemia is a widespread public health problem, which is present due to many factors, nutritional or non-nutritional. Iron, vitamin A and growth status were assessed to investigate anemia of preschool children in suburb Chongqing, China a descriptive, cross-sectional survey was performed on 459 preschool children aged 2 to 7 years randomly chosen from the kindergartens in 6 suburban districts of Chongqing. Weight and height levels, hemoglobin, erythrocyte protoporphyrin, serum retinol, and ferritin concentrations were measured to evaluate the anthropometric and nutritional status. Serum retinol concentration was significantly lower in children with anemia than in those without anemia ($P=0.003$), and the retinol concentration was associated with hemoglobin (Pearson's correlation coefficient, $r=0.22$, $P<0.01$). Children with VAD had a significantly increased risk for anemia Vitamin A and iron deficiency are still public health problems in some localities of China. Public health interventions in anemia control should be used to eliminate deficiencies of vitamin A, iron, and other micronutrients by deliberate supplementation. Attention must be paid to such deficiencies in high-risk groups, especially in preschool children. (Ke Chen, 2009).

### 2.6.3 VAD and measles:

Measles occupies a unique position among common childhood infectious diseases and vitamin A deficiency. Measles generally takes a more serious form in the undernourished child, resulting in more frequent and more serious complications and a much higher death rate than in the well-nourished child (Mclaren and Frigg, 2001).

Supplementation with vitamin A has been found to decrease the severity of, and number of deaths, from measles in developing countries, where vitamin A deficiency is common (West, 2000) (MARAM, 2004)

In 2010, about 85% of the world's children received one dose of measles vaccine by their first birthday through routine health services exceeding those of 72% in 2000. Two doses of the vaccine are recommended to ensure immunity, as about 15% of the vaccinated children fail to develop immunity from the first dose (WHO, 2011).

According the Palestinian health annual report and Palestinian health information center PHIC, the incidence of measles in the past few years had been estimated about (0.1 per 100,000) as recorded cases of measles (single) in Hebron in 2006, while there has been no case since 2007 in both the West Bank and the Gaza Strip. The Ministry of Health has been able to reach the standards required to get rid of measles, according to the requirements of World Health Organization through high coverage with two doses for children against measles at the age of 9 and 15 months. In the ages of 12 months and 18 months, in addition to the work of vaccination campaigns against MMR months and two doses change in recent years to increase the immune community in Palestine against the disease.MMR measles (Palestine Annual Report, PHIC 2011).

### 2.6.4 VAD and ARTI, ddiarrhea & iinfection:

Vitamin A deficiency can play a rule even in children who are only mildly deficient in vitamin A and have a higher incidence of respiratory disease and diarrhea, as well as a higher rate of mortality from infectious diseases, compared to children who consume sufficient vitamin A (Field,2002). In fact, the strongest association between vitamin A and infection is found with diarrhea, especially when it is persistent, chronic, or severe. In countries where immunization programs are not widespread and vitamin A deficiency is common, millions of children die each year from complications of infectious diseases such as pneumonia and measles (Stephens, 1996]. When vitamin A stores are inadequate, cells lining the lung lose their ability to remove disease-causing microorganisms. This may contribute to the pneumonia associated with vitamin A deficiency (Ross, 1999; Semba, 1998; Ross, 1998) (MARAM, 2004).

Acute lower respiratory tract infections (ALRIs), in particular bronchiolitis and pneumonia which are the most severe forms of ALRIs, are the leading cause of mortality in children under the age of five. Children with vitamin A deficiency seem to be at greater risk of illness and death due to respiratory tract infections. Pre-existing deficiency appears to worsen infection and vitamin A supplementation has been shown to reduce the risk of death in 6–59 month old children by about 23–30%. In the case of pneumonia that is associated with measles, large doses of vitamin A have a clear protective effect (WHO, 2011).

Similar effects have not, however, been observed for ALRIs using high and low doses of vitamin A. For example, lower doses have been associated with decreased risk of respiratory infection, and high doses have been shown to have a negative effect. (WHO, 2011)

## 2.7 Health services:

Health services in this study include the availability of health services, health education and rational intake of vitamin A. This implies receiving vitamin A through a combination of dietary improvement, food fortification, and supplementation.

### 2.7.1 Availability of health services:

Primary Health Care (PHC) is one of the most important components of the Palestinian health care system. PHC centers provide accessible and affordable health services for all Palestinians, especially for children and other vulnerable groups. MOH is working with other health sectors in providing the primary health services, mainly UNRWA and NGOs (MOH, 2005).

The total number of registered PHC centers in Palestine is 731 centers. Distribution by provider shows that, there are 413 centers owned and supervised by the MOH, 53 centers by the UNRWA and NGOs have 265 centers. In Palestine, the average ratio of persons per center is 4,976 (MOH 2004)

According to the international vitamin A efforts. Health services should cover this area as complementary and necessary part of comprehensive approach. Such an approach includes advocacy and policy implementation via clear commitment by policy makers to a comprehensive program, with clear guidelines and targets for implementation. It should be combined with widespread consumer demand and critical elements of an effective and sustainable vitamin A program. Policy makers should include representatives of the MOH, UNRWA, NGO and donor communities. Comprehensively, this should include:

1) Protocols that include micronutrient practices, based both on Palestinian needs and international standards.

2) Behavior change strategies to inform and motivate - both the community and health providers - about the important-ce of vitamin A and other micronutrients. Issues to be addressed will include the safety of any supplements for the general population, the level of need in the overall population, the impact and effects of VAD, and international consensus/ experience with micro-nutrient MN programs (MARAM, 2004).

If dietary sources of vitamin A are not readily available to those at risk of deficiency, intervention activities should include improving their availability. Efforts may be needed to improve the production, processing, preservation, pricing and marketing of such foods. Bioavailability of the vitamin A should be increased by ensuring that diets contain sufficient fat and that intestinal parasites are controlled (The Micronutrient Initiative, VAD, 1995)

### 2.7.2 Health education:

Health education as one of the most globally and modern tools can be defined as, any "combination of planned learning experiences based on sound theories that provide individuals, groups, and communities the opportunity to acquire information and the skills needed to make quality health decisions." The World Health Organization defined Health Education as "comprising of consciously constructed opportunities for learning involving some form of communication designed to improve health literacy, including improving knowledge, and developing life skills that are conducive to individual and community health (WHO,2011)

Health education and training for health providers on the micro-nutrient MN protocols, program objectives and effective counseling , the creation of a micronutrient committee representing specialists and active stakeholders. The committee will help to coordinate all donor and program efforts to avoid duplication, gaps or diversion of funds, or efforts to projects that are of lower priority, or are not relevant to the national effort. Providing health education program about the important of vitamin A & D (MARAM, 2004)

Nutrition education is an essential component of programmes aimed at preventing vitamin A deficiency. Dietary modification can also be supported by other means, such as social marketing and promotion of home production (The Micronutrient Initiative, VAD, 1995)

### 2.7.3 Intake of vitamin A is inadequate. They can receive the vitamin through a combination of dietary improvement, food fortification, and supplementation:

Fortification of staple foods, the MOH should move forward with plans to fortify wheat flour and possibly staples, such as oils or milk. The active involvement of the private sector in the production and marketing of such fortified products is strongly recommended, as it adds to feasibility as well as sustainability to the effort. A private sector initiative has already developed fortified biscuits, now in production, that include vitamin A with other micro-nutrients. The private sector makes an essential contribution in other countries, including the United States and Britain, in the fight against MN deficiencies. Palestinian efforts should support this model.(MARAM, 2004)

Supplementation: Vitamin A supplementation is highly cost effective, and has been proven relatively easy to deliver. A supplementation program should be put in place at least for the short term, until improvement of economic status, access to diversified foods, and fortification can be assured. Possibly, supplementation will be always necessary for infants and young children (MARAM, 2004).

On other hands, dietary modifications that increase vitamin A intake will often improve the status of other micronutrients, particularly iron and vitamin C. For example, many foods that promote iron absorption (especially green leafy vegetables, animal products and some fruits) are also good sources of vitamin A. Furthermore, improving vitamin A status can also improve iron status through an interaction between these two nutrients. Therefore, a combined food-based approach to deficiencies of vitamin A and of iron should be pursued. Where feasible, food fortification is a highly recommended intervention for the prevention of vitamin A deficiency. Consumption of processed foods by the target population, food technology expertise, and multispectral commitment are requisites for successful food fortification programmers. Social marketing may also have an important role in increasing awareness of the problem and creating demand for action. Early participation of the food industry in this process and an effective food control system are essential (The Micronutrient Initiative, VAD, 1995).

### 2.7.4 Sub-clinical factors:

The sub-clinical factors in this study composed of breastfeeding and food intake, which playing the important silent hidden rules of hunger in the risk factors of vitamin A deficiency. On a global basis, it is estimated that 75-140 million preschool children are affected by sub-clinical vitamin A deficiency, with the upper limit of this range thought to be more likely. The highest prevalence of both clinical and sub-clinical vitamin A deficiency occurs in South Asia and sub-Saharan Africa, where 30% to 40% of preschool children are at heightened risk of ill health and death because of this deficiency (Mason, 2001).

### 2.7.5 Breastfeeding:

Breastfeeding or breast milk with adequate vitamin A is the most reliable food for children under two, so increasing breast milk consumption and promotion of breastfeeding during this period should be strongly promoted. Consumption of vitamin A rich foods should also be stressed for pregnant and lactating women, for infants and children, and for children who are recuperating from illness. While improvement in food consumption patterns is an important part of the overall strategy to reduce MN deficiencies, many of the products richest in absorbable vitamin A (foods from animal origin) are expensive. Consumption of these foods in adequate amounts will require improvement in the economy, as well as in more reliable access to these foods. (Report of the IVACG, 2003)

Breast milk is virtually the only source of vitamin A the first few months for many infants and often continues to be one of the most important sources through age 2. Without breast milk, newborns can maintain optimal vitamin A nurtures for no more than a few weeks. Although vitamin A concentrations in human milk are dependent on the mother's vitamin A status, vitamin A deficiency is rare among breastfed infants, even in parts of the world where vitamin A deficiency is endemic. Promotion of exclusive breastfeeding for 4-6 months and continued breastfeeding with complementary foods thereafter should form part of any dietary intervention to improve vitamin A status (The Micronutrient Initiative, VAD, 1995).

The relation of Vitamin A and breastfeeding during the first hour after delivery indicating that colostrum and breast milk are important sources of vitamin A for infants, particularly in the first weeks of life. For the vitamin A status of lactating women, the effect of her vitamin A status on breast milk content, and the adequacy of breast milk as a vitamin A source for an infant. In the end, breast milk is a major source of vitamin A, even for mothers in developing countries with lower levels of vitamin A in their milk (Newman, V. 1993) (The Micronutrient Initiative, VAD, 1995).

A study of breastfeeding practices in developing countries has revealed that vitamin A intakes from non-breast milk sources were extremely low at all ages. The study has reported that during the second year of life, vitamin A intake among non-breastfed children met only 60% of the reference-recommended dietary intake. In contrast, the intake of breast-fed children met approximately 90% of the reference value. Maternal education and socioeconomic status were positively associated with both vitamin A and retinol intake (Ramakrishnan et al., 1999) (MARAM, 2004)

Almost all infants are born with low vitamin A stores, although even low levels of vitamin A offer highly beneficial contributions to infants' immune status. To meet a newborn's immediate need, nature has designed colostrum with three times as much vitamin A and ten times the amount of retinol as ordinary breast milk. This transitional milk is two times richer in vitamin A, all in an easily digested and absorbable form [Breast milk, Facts for Feeding, 2001]. However, amounts of vitamin A in breast milk are dependent upon maternal stores; therefore where VAD is present it must be assumed that breast milk may lack sufficient vitamin A. The risk of VAD is greater for young children whose mothers are vitamin A deficient (Breast milk, Facts for Feeding, 2001) for this reason, WHO recommends:

1) All infants receive as much colostrums and transitional milk as possible.

2) All mothers receive vitamin A supplementation at delivery (WHO, Distribution of vitamin A, 1998).

3) All mothers should receive counseling on MN rich foods during lactation (Breastmilk, Facts for Feeding, 2001).

In all circumstances the promotion and protection of breastfeeding is a fundamental aspect of preventing vitamin A deficiency.

### 2.7.6 Food intake:

Sufficient vitamin A-rich foods are simply not available in some communities, particularly at certain times of the year. In these situations, programs must either rely on supplementation or fortification or they can help people increase the availability of these foods, most commonly through home gardening and/or food preservation, as well as teach and promote appropriate consumption.

In other situations, vitamin A-rich foods may be available in the community but not be consumed in sufficient quantities by some families for economic or cultural reasons, or they may be available in the family but not be consumed by young children or pregnant or lactating women. In such circumstances, program planners must decide, ideally based on qualitative research, including trials, how feasible it is to overcome the barriers to appropriate consumption. They then must decide whether the intervention program should increase availability of vitamin A-rich foods or increase consumption of currently available foods (The Micronutrient Initiative, VAD, 1995)

Food production, availability and access, and food preparation and conservation practices factors that can all affect what is actually eaten. There is global agreement on the need to combat VAD, More than 70 countries have formal intervention programs, although only a few (Nepal, Indonesia, Tanzania, Bangladesh, Vietnam) have made significant, discernible progress. Three basic strategies exist for increasing vitamin A intake: increasing the consumption of foods rich in vitamin A and provitamin A; fortifying commonly consumed dietary items with vitamin A (or beta-carotene); and providing large, periodic, vitamin A supplements to high-risk populations. (Sommer, 2001)

Dietary diversification and many nutritionists consider increasing the consumption of natural dietary sources of vitamin A to be the logical long-range solution to deficiency. Despite occasional demonstration projects and correlational analyses, little definitive evidence exists that vitamin A sufficiency can be achieved — let alone sustained — through traditional food sources, particularly those available to poor, rural, high-risk populations. As noted, vegetables are poor sources of provitamin A beta-carotene. Although they contain considerable quantities of beta-carotene, these are not readily bioavailable. It needs to be shown that vulnerable children can consume quantities of dark-green leafy vegetables sufficient to normalize their vitamin A status. (Sommer, 2001)

Adults may be able to obtain sufficient vitamin A by consuming far larger amounts of vegetables and fruits than children consume or through the greater diversity of their diet, but this too needs documentation. In at least two studies, women provided daily with large helpings of dark-green leafy vegetables failed to significantly improve their vitamin A status in contrast to those fed cookies containing pure synthetic (therefore readily absorbed) beta-carotene. Introducing animal sources of preformed vitamin A (e.g., eggs) into the diet might make a significant difference but remains beyond the resources (and cultural patterns) of many of the populations at highest risk. Good food sources of vitamin A include liver, kidney, butter, egg yolk, whole milk and cream, and fortified skim milk.

Good food sources of beta-carotene (pro-vitamin A) include yellow and dark leafy green vegetables (carrots, collards, spinach, sweet potatoes, and squash) and yellow fruit (apricots, peaches, and cantaloupe). Cod liver oil and halibut fish oil contain high levels of vitamin A. (Sommer, 2001)

## 2.8 Socio-economic factors:

The sub-clinical factors in this study composed of Income, occupation, sex, age and parents Education, which playing the important silent hidden rules of hunger in the risk factors of vitamin A deficiency.

### 2.8.1 Economic, income and occupation factors:

Vitamin A deficiency is a parameter of poor socioeconomic condition. A poor economy determines individual's purchasing power and ability to make healthful choices like fresh fruits and vegetables and immunizations. A trap that keeps families in cyclical patterns of poor health, poverty limits dietary choices, education, access to care, and access to information (Glassman A, 1999)

If we had a look for Palestinian situation, 19.9% of Palestinian households are childless, while the vast majority of Palestinian households; 80.1% are with children. Hence, meaningful comparisons in poverty status should be carried out for households with a different number of children rather than merely between childless households and the rest. The poverty rate in 2010 indicated that the rate of the total distribution of poverty among Palestinian households in the Palestinian Territory was 21.4% in 2010 (using consumption data), of which 22.8% is among households with children and 15.8% is among households without children. More significant is the fact that the poverty data indicated that 16.0% of the households in the West Bank were suffering from poverty in 2010 (16.4% among households with children and 14.6% among households without children), while 31.9% of households in Gaza Strip were suffering from poverty in 2010 (34.4% among households with children and 18.8% among households without children).(PCBS, 2011) which affects the income, and impact health and nutrition.

Furthermore, there are significant associations between vitamin A deficiency and the level of family income, where more than 90% of the vitamin A deficient children come from families with average monthly incomes of 2000 NIS and less. Even 8, 23.4% and 22.8% of children belonging to families with an average income of <1000 and 1100-2000 respectively were found to be vitamin A deficient (P = 0.002) (MARAM, 2004)

Poverty is a root, though not invariable cause of VAD in public health terms. Because only foods of animal origin contain preformed sources of vitamin A, that are generally relatively expensive, VAD is confined largely to impoverished countries, neighborhoods and families that rely on less expensive provitamin A sources to meet their requirements. Provitamin A sources must be converted to retinol before they can provide protection from VAD. The series of events between consumption of provitamin A and its conversion to retinol include several steps that are dependent on normal physiological functions. For reasons discussed below under Host factors, it is more difficult to satisfy vitamin A-activity needs of infants and young children from foods of vegetable origin than from other food sources. Poverty contributes in other ways, some already noted, to inadequate living conditions that are associated with high death rates among infants and young children. Unemployment and low-wage jobs are major obstacles to overcoming VAD in depressed environments (Underwood BA, 1993).

### 2.8.2 Social and education factors:

In addition to its association with a poor socioeconomic environment, Vitamin A deficiency has known age and sex predictors of risk as well. Vitamin A deficiency is predominantly a problem of young children, usually under five years of age. During the first five years of life, many children, particularly in impoverished communities, lack variety in diet and access to the fresh foods high in vitamin A. Deficiency appears to depend heavily on the particular child feeding practices in the local situation. Furthermore, the rapid growth during early childhood and high rates of infections that can occur when access to health care is limited will contribute undoubtedly to rapid depletion of vitamin A stores. While rates are highest in children, the deficiency is rarely exhibited in infancy, suggesting a protective effect of vitamin A secretion in breast milk against xerophthalmia—severe drying of the eye—and other symptoms of deficiency. (Beaton G.H.,1993)

Furthermore, relation between VAD and mothers education in Palestine (around 98% of the mothers had some kind of education), 12% of the mothers' completed up to the sixth grade, 31.9% between 7-9 grades, 40.5% up to 10-12 grades, and 13.4% had more than 13 years of education. The prevalence of vitamin A deficiency among children of illiterate mothers was 41.7%, compared to 23.5% among children of mothers that had completed up to 12 years of education. The prevalence dropped to 11.5% among children with mothers who had higher education. There is a significant decrease in the prevalence of VAD among children relative to increased years of education attained by their mothers (P=.003). Income and education are correlated. With increasing educational attainment, the sample's income level also increases. This confirms the relationship to VAD, and also postulates that maybe not all vitamin A deficiency is related to current economic and political realities .(MARAM,2004)

Social underdevelopment within a country limits accessibility to health and social services, including education. Under-educated, impoverished women tend to follow traditional ideas and practices, and are less confident in engaging in social interactions where more modem concepts and practices are promoted. Due to under -education, they are less likely to learn from educational materials typically displayed at health centers and used in health related community educational activities, including those concerned with appropriate child care and feeding practices. Under-educated males also are less likely to adopt within their households new ideas and practices related to family care and feeding. A socially backward, impoverished environment also favors large families with consequent overcrowding that is associated with poor environmental sanitation and personal hygiene. As noted above, these are prime conditioning factors for VAD and malnutrition (Underwood BA, 1993).

Maternal education and socioeconomic status were positively associated with both vitamin A and retinol intake (Ramakrishnan *et al*., 1999).

### 2.8.3 Age and gender factors:

Varying levels of VAD can occur at any age, from subclinical effects that increase risk of morbidity and mortality to blinding malnutrition (keratomalacia). As a public health problem, however, VAD affects children of preschool age because of their great susceptibility to infections and due to an increased demand for the micronutrients by the body to support their rapid growth. The potentially blinding corneal disease is most prevalent among children under 3 years of age and is usually associated with (PEM) Protein Energy Malnutrition. An increased risk of death of at least 60% is associated with severe, potentially blinding VAD malnutrition (WHO, 1992).

The mortality risk associated with VAD of lesser severity extends at least from 6 months to 5 years of age, and perhaps beyond. The elevated risk of death among those less severely clinically affected, and severe to moderately subclinical affected, is estimated to be about 23% (Beaton GH, 1993)

There is little information regarding the health consequences of VAD among school-age children. The prevalence of mild xerophthalmia, notably Bitot's spots, may be highest in the school-age group, although this may be more a reflection of past rather than current vitamin A status (Sommer A, 1980)

Results in the Palestinian former experiences revealed no significant differences in vitamin A deficiency with respect to gender, age groups or whether children lived in camp or non-camp areas. Gender-specific vitamin A deficiency showed that VAD prevalence among male children (22.6%) is similar to that of female children (21.4%) with no significant difference between the two groups. As for age-specific vitamin A deficiency, results indicated no significant difference among the different age groups of children 12-59 months of age, or across the different levels of vitamin A deficiencies. (MARAM, 2004)

No consistent sex difference in vulnerability is demonstrated based on physiological parameters. Differences have been reported from some cultures, which are more likely to be related to sex differences in cultural practices of feeding and care rather than to physiological differences (Sommer A, 1980)

## 2.9 Intervention Polices of VAD:

A combination of interventions is usually needed to prevent and eliminate VAD. Measures to combat VAD are generally grouped into the following: dietary modification (e.g., improving food availability through the production and preservation of vitamin A-rich foods, and increasing food consumption), breastfeeding protection and promotion, food fortification, supplementation, and pertinent public health measures such as primary health care and safe drinking water. (The Micronutrient Initiative, VAD, 1995)

Vitamin A field support project VITAL, the activities and interventions should be following these steps. Prevalence assessment assistance to countries in planning and conducting vitamin A status surveys (vitamin A deficiency prevalence assessments) became the most prominent type of activity, strategy development needs assessments, including formal surveys to establish areas of high risk was, in many countries, the first step in developing country strategies for addressing VAD. Program management, data collection (EPI), logistics and supplies, distribution and supplementation, food technology and fortification, horticulture, social marketing and nutrition education (VITAL, 1994)

### 2.9.1 Advocacy and Policy:

A clear commitment by policy makers to a comprehensive program, with clear guidelines and targets for implementation, combined with widespread consumer demand, are critical elements in an effective and sustainable vitamin A program. Policy makers should include representatives of the MOH, UNRWA, NGO and donor communities such as Protocols that include micronutrient practices, based both on Palestinian needs and international standards. Behavior change strategies to inform and motivate - both the community and health providers about the importance of vitamin A and other micronutrients. Education and training for health providers on the MN protocols, program objectives and effective counseling is rather crucial. The creation of a micronutrient committee representing active stakeholders and specialists is highly recommended. The committee will help to coordinate all donor and program efforts to avoid duplication, gaps or diversion of funds, or efforts to projects that are of lower priority, or even not relevant to the national effort. (MARAM, 2004)

### 2.9.2 Dietary modification:

The ACC/SCN Consultative Group (1994) pointed out that there are four types of strategies aimed at achieving the goal of dietary modification:

1) Nutrition education or communication, often using a social marketing approach, to improve practices related to the consumption of available vitamin A-rich food sources.

2) Horticultural interventions (or home food provisioning), e.g. home gardening, that aim to increase availability of vitamin A-rich foods.

3) Economic/food policies affecting availability, price and effective demand of vitamin A-rich foods.

4) Technological advances concerning food preservation, plant breeding etc.

Strategies 2–4 aim to improve the availability of vitamin A-rich foods. Strategy 1 aims to improve their consumption. (McLaren and Frigg, 2001)

## 2.10 Prophylaxis:

Periodic high-dose vitamin A distribution or supplementation in the community may be viewed as a prophylactic extension of treatment in hospital. The form of vitamin A is usually the same – capsules. The aim here is short-term prevention. The measure, like treatment of the established case, is an emergency one, to be superseded or supplemented by something of longer-term effect as soon as possible. (McLaren and Frigg, 2001)

### 2.10.1 Supplementation:

Vitamin A supplementation is highly cost effective, and has been proven relatively easy to deliver. A supplementation program should be put in place at least for the short term, until improvement of economic status, access to a diverse diet, and fortification can be assured. Possibly, supplementation will be always necessary for infants and young children (MARAM, 2004).

### 2.10.2 Food fortification:

In industrialized countries food fortification has long been an accepted strategy for improving micronutrient nurtures, including that of vitamin A. In Denmark, during World War I, an epidemic of xerophthalmia paralleled the substitution of butter by margarine, which lacked vitamin A. Today, margarine is among those food items most frequently fortified with vitamin A in the world. Potentially, food fortification offers a direct, effective and sustainable way to correct VAD. However, in practice it has sometimes proved difficult to meet all the necessary criteria. In the early efforts to fortify staple foods technological obstacles had to be overcome. Today such problems are not considered to be limiting factors. Although technologically possible, implementation of food fortification has proved to be a complicated and long lasting process. A food item to be fortified should be consumed regularly by most of the target population in certain quantities. There should be no risk of overdosing for those consuming the highest quantities. Further criteria are that vitamin A should not affect the appearance, color, texture, or organoleptic properties of the food in order to be acceptable to the consumer. The stability of the vitamin A should remain at an acceptable level during processing, transport, storage and cooking. In developing countries many foods have been fortified with vitamin A or imported as fortified products. These include wheat, rice and other grain products, tea, dairy foods (especially dried skim milk), margarine, edible oils, formula foods and specialty items. Sugar in Latin America and monosodium glutamate (MSG, a popular flavor enhancer) in South-East Asia were the first vehicles for vitamin A fortification to be extensively tested, widely distributed and evaluated for their public health impact (Sommer, West, 1996).

Neither of these food substances is an ideal vehicle from the nutritional point of view, but even so sugar fortification is in operation at the present time in several countries in Central America and is in the process of being introduced in some countries in Latin America and in Africa (McLaren and Frigg, 2001)

Multi micronutrient fortification is rapidly on the increase. For example, biscuits for primary school children in South Africa are being fortified with iron, iodine, and β-carotene (Van Stuijvenberg, et al, 1999)

### 2.10.3 Monitoring and Evaluation:

Experience has shown that effective nutrition programs require the setting up and systematic monitoring of clear targets. Coverage, compliance and impact of relevant programs needs to be followed, reported and acted upon. There has been successful experience in monitoring and reporting on immunization coverage. Therefore a similar dedication to detail and systematic follow-up should be applied to monitoring vitamin A supplementation. (MARAM, 2004)

# Chapter 3

# Methodology

This chapter presents the study methodology. The researcher presents in this chapter description of the study design, study population, eligibility criteria, place of the research, ethical consideration, and the instrument of the study are presented systematically. Also, the researcher points at the applied pilot study, data entry and analysis, and limitation of the study.

## 3.1 Study design

The design of the present study is a cross section hybrid with follow-up analysis of descriptive data used to achieve the main objective of the study. Based on this; the questionnaire (Annex 1) had been developed. In addition to measuring the risk factors associated with VAD among children aged 12-59 months, this study allows and helps the researcher examine the variety of associations and relationships amongst variables of the study. On other hand the cross section study is relatively easy to conduct, economical, carried out over a short period of time, and useful for investigation of different variables or exposures as well as the policy and intervention.

## 3.2 Study population

The study population was performed among children aged 12-59 months living in Gaza city in different districts (table 3.1) and attending Ard El Insan association they include all cases that had attended and apparently healthy individuals attending AEI Gaza center. After medical assessment at Ard El Insan association Gaza clinic center, during May 2011 until September 2011, parents of the children (12-59 months old) mainly mothers were interviewed by the researcher to answer the questionnaire. The total number estimated of children 12-59 months in Gaza City is 543195 in Gaza Governorates (PCPS, 2010)(Municipality of Gaza, 2011)(PHIC,2011)

## 3.3 Eligibility criteria

### 3.3.1 Inclusion criteria:

1. All children who are apparently healthy male and female attending at Ard El Insan association Gaza clinic center.
2. Children residing in the selected governorates of Gaza Strip during May 2011 until September 2011.
3. Eligible to be included in the study targeting age group from 12-59 months old.

### 3.3.2 Exclusion criteria:

1. Children below or above the age of 12-59 months.
2. Children who are not resident of the Gaza city e.g. visitors (staying less than 6 months)
3. Children who are not attending Ard El Insan association Gaza center.

## 3.4 Setting of the study

The setting of the current study took place in Ard El Insan association Gaza clinic center, which is located at the western site of Gaza city. The data was collected by using questionnaires from sampled children who were distributed through previously mentioned areas.

## 3.5 Sample Size

Epidemiological Information Statistical Program version 3.4.3 (Epi-info 3.4.3) was used for calculation the sample size, based on number of Gaza city population 543195, with assumption that the prevalence of VAD among the population is 25% and at confidence interval 95%, the sample size was 150 children's. Taking in consideration the non-respondents of parents during the data collection in the fieldwork, the sample size was increased to be 169 children in order to allow for non respondents amongst the interviewed parents.

## 3.6 Sampling process

Subjects of the current study were selected randomly and proportionally allocated among the main district area at Gaza city. In order to ensure that the sample is representative for all main areas in Gaza city, the percentage of children included in the sample of the study from each area was computed according to the distribution of the percentage of the total number of population in each district. The total number of population in the main areas and their distribution percentage are shown in table (3.1).

**Table 3.1: Distribution of total number of population in the main district in Gaza city**

| Main Districts<br>Gaza city | | | Total population |
|---|---|---|---|
| 1. Shejaeah + | Shdedah + | Torkman | 91,490 |
| 2. Zaytoon + | Sabra + | | 99,840 |
| 3. Daraj + | Tofah + | Old city | 89,145 |
| 4. Al-Nasar + | Sheakhradwan | +Al –awda | 97,776 |
| 5. Rimal + | Sheakh ajlean | +Tal al hawa | 85,444 |
| 6. AL-Shataa | - | - | 79,500 |

Taking in consideration the distribution of percentage of total number of population of children 12-59 months, for the main area in Gaza city, the researcher can compute the distribution of the sample population through the main district area in Gaza city. The number of cases that will be included in the sample population and their distribution through the main area in Gaza city shown in Figure (3.1)

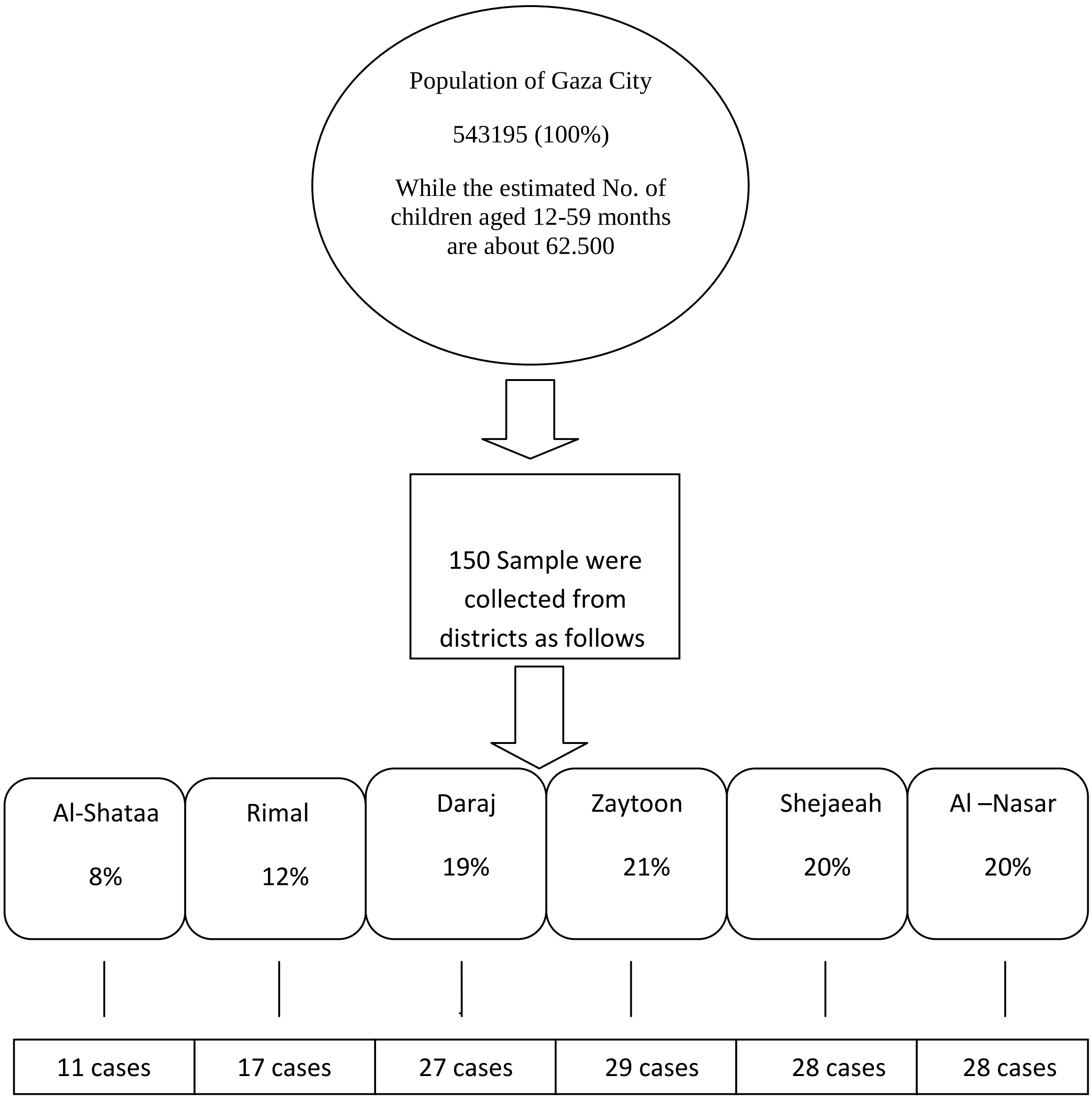


**Figure (3.1): Data collection & distribution of the sample population through the main areas in Gaza city**

### 3.7 Ethical considerations

- An official letter of approval to conduct the study was obtained from Helsinki committee (ethical committee in Gaza strip) (Annex2)
- The study proposal was approved by the School of Public Health.
- An official letter was obtained from Ard El Insan association to conduct the study in Ard El Insan clinic.
- Every participant in this study received complete explanation about the purpose of the study, instrument, period of interview, voluntary and optional participation, and confidentiality, and signed informed consent.
- All the ethical concepts were taken into consideration: respect of people, dignity, and privacy.
- Findings of the study will be shared with others who are interested as relevant or required.

### 3.8 Research instrument

The questionnaire for the study is specially designed and prepared to compile information relating to the objectives of the study. The questionnaire includes information on the background of child data which includes Socio-demographic characters and chemical tests that are considered as an indicator for diagnosing and controlling the risk factors. The questionnaire collection of basic data covered household demographics and the child's normal intake of vitamin A supplements, iron supplements, child data, family information, child breastfeeding, clinical data, child illness and laboratory investigation. The questionnaire was modified from MARAM 2004.

In addition, researcher was used questionnaire in Arabic language because it is the mother language for the participants, annex 1. The average times for filling the questionnaire were been from 15 to 20 minutes. Total period of data collection will be four months.

### 3.9 Questionnaire design:

The questionnaire used for the study was prepared and designed to interpret and reflect the information relating to the objectives of the study. An adapted questionnaire from various international sources was utilized in the current study. The questionnaire has been matched and adapted from MARAM 2004. The researcher redesigns the questionnaire to suit the current study. The items of the questionnaire were formulated to tap into the main dimensions or themes relevant to the study. The questionnaire was translated in Arabic language and constructed using common local popular language to avoid language difficulties and misunderstanding by participants.

### 3.10 Validity of the questionnaire:

The study tools are checked for validity when the pilot study was conducted. The pilot study participants were asked to give their opinions about the format, layout, structure and type-writing clarity of the study instruments. Interviewer questionnaire was sent by the researcher to 10 experts to assess the instrument from clarity, relevancy to the topic, and holism point of view. The experts were persons who have a good experience in fields of medicine, nutrition, public health and research. Those experts were asked to add any suggested modifications which are the content validity. Other contents were added based on local situation. In order to ensure the high reliability, the data collection was done by the researcher himself, and systematic checking and follow up for the collected data were conducted throughout the study. Meanwhile, the used instruments were considered as an important issue and tried to guarantee it through filling the whole number of question using the same way in asking questions for the responders. Tools and implementations were standardized. Field checking and data entry day by day also took place in consultation with the supervisor in order to achieve high content validity.

### 3.11 Pilot study

Pilot study conduction is very important for improving the internal validity, reliability, and response rate of the used research instrument in the current study the questionnaire. In addition, it is useful for assessing the feasibility of the study, establishing whether the sampling frame and technique are effective and giving feedback on the logistics of data collection. Appropriate number of children was accurately selected for conducting the pilot studies. The pilot study had already covered the four main district area of Gaza city included in the study. After conducting the pilot study, some modifications and changes regarding the used questionnaire were made.

### 3.12 Data collection

The data collection in the current study, had been made by the researcher himself to identify the cases and abstract available sampling design which were prepared in coordination with the AEI. The study sample consisted of 150 children selected from the different regions of the Gaza city. The sample was calculated based on the probability proportional to population size (PPS) method.

Children aged 12-59 months were samples from Gaza city which included shejaeah, Zaytoon, Daraj, Al-Nasar, Rimal and Al-shataa districts. Cases were collected from these districts as follows: 28, 29, 27, 28, 17 and 11 respectively. Within selected districts, localities were divided into six categories according to the Palestinian Central Bureau of Statistics (PCBS, 2010) and classification of municipality of Gaza (Figure 3.1)

### 3.13 Determination of serum vitamin A and hemoglobin

Blood samples were collected for determination of vitamin A and hemoglobin concentration. Analysis was carried out at the laboratory of Ard EL Insan Benevolent Association, Gaza. Venous blood sample was collected from child “5ml” and divided into EDTA tube (1.0 ml) and vacutainer plain tube (4.0 ml). Vacutainer plain tubes were left for short time to allow blood to clot, and then clear serum samples were obtained by centrifugation at 1000 rpm for 20 minutes. CBC was done in the same day of collection. The separated serum was placed in plain tubes and sealed. Samples used within 5 days were stored at 2-8$^{O}$C, otherwise samples stored at -20$^{O}$C to avoid loss of bioactivity and contamination.

Vitamin A was measured by ELISA technique using human vitamin A, vitamin A ELISA kit. Microplate Reader was used to perform qualitative or quantitative determination of samples in accordance with Lamber-Beer law (Mr-96a, Shenzhen mindray bio-medical electronics co, ltd.). All biochemical and hematological analyses were done in the laboratory of Ard EL Insan Benevolent Association, Gaza center.

### 3.14 Statistical analysis

Statistical Package for Social Science program version 13.0 (SPSS 13.0 for Windows) was used for introducing and analyzing the collected data in the current study. In order to manage the collected data, all the necessary data analysis techniques and methods were taken into consideration. The plan of data management for the study includes checking and verifying of data, data entry and coding, data cleaning and recoding, data processing, and the use of appropriate statistical examination tests to assess relationships among different dependent and independent variables of the study. In order to simplify the analysis process of different variables of the study and to review how different categories of values were distributed in the sample, the frequency tabulation was used. Cross tabulation was used for examining the frequencies of observations that belong to different specific categories on more than one variable of the study. By using different statistical tests such as Chi-square and ANOVA in process of examining association between the study variables, the relations between the main dependent variables of the study and different independent variables of the study can be identified.

### 3.15 Limitations of the study

- The study included only the attending children 12-59 months old at Ard El Insan Gaza clinic.
- Limited resources about the study like books and journals.
- Frequent electricity cut affected the ability to accomplish the work in a timely manner.

# Chapter 4

# Result and Discussion

## 4.1 Characteristics of study population

The present data were collected through interview face to face with 150 mothers of children aged between 12 -59 months. Those questionnaires were filled by mothers of children from different areas in Gaza city. Out of the 150 children, 149 mothers freely accepted to give their children's blood samples for hemoglobin and vitamin A tests.

Distribution of the study population by sociodemographic variables is presented in table (4.1).Figure (4.1) illustrates the distribution of study population who filled questionnaire by various areas of the Gaza city. According to the number of children in each area, a sample size of 150 children was distributed as follows: Al Zytoon (22.0%), AL Shejaee (21.4%), AL Nasser (20.0%), AL Daraj (18.0%), AL Remal (11.3%), Al Shateaa (7.3%). The study populations encountered in our study were males (52.7%) and female (47.3%) as shown in Figure (4.2). Table 4.1 shows that (62.1%) of mother study population had more than 7 year's education level while (45.4%) of father study population had more than 7 year's education level. More than half of father study population had employment (56.7%). This result is consistent with the previous study which was done in Palestine on 1,107 cases (MARAM, 2004)

**Table 4.1: Distribution of the study population by Sociodemographic Variables**

| Variable | Frequency | Percent (%) |
|---|---|---|
| **Address** | | |
| Al Daraj | 27.0 | 18.0 |
| Al Remal | 17.0 | 11.3 |
| Al Zetoon | 33.0 | 22.0 |
| Al shejaeaa | 32.0 | 21.4 |
| Al Nasser | 30.0 | 20.0 |
| Al shateaa | 11.0 | 7.3 |
| Total | 150 | 100 |
| **Gender** | | |
| Male | 79 | 52.7 |
| Female | 71 | 47.3 |
| Total | 150 | 100 |
| **Mother education level** | | |
| Less than 7 years | 57 | 37.9 |
| More than 7 years | 93 | 62.1 |
| Total | 150 | 100 |
| **Father education level** | | |
| Less than 7 years | 82 | 54.6 |
| More than 7 years | 68 | 45.4 |
| Total | 150 | 100 |
| **Father employment** | | |
| Yes | 85 | 56.7 |
| No | 65 | 43.3 |
| Total | 150 | 100 |
| **Mother employment** | | |
| Yes | 2 | 1.3 |
| No | 148 | 98,7 |
| Total | 150 | 100 |
| **Child age** | | |
| 12-35 months | 66 | 44.0 |
| 36-59 months | 81 | 54.0 |
| Total | 147 | 98.0 |

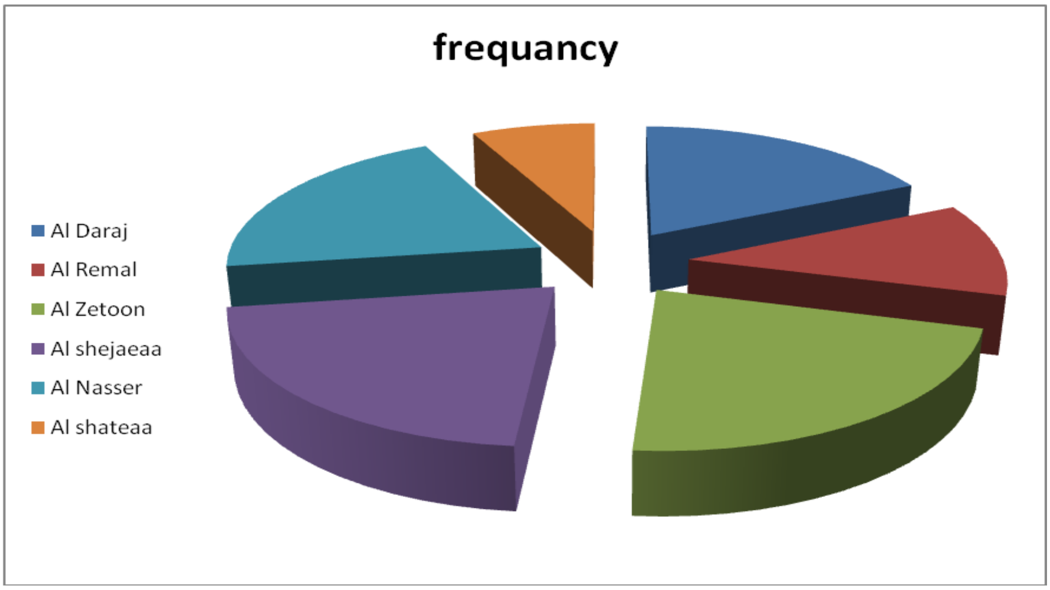


**Figure (4.1): Distribution of the study population by geographic area**

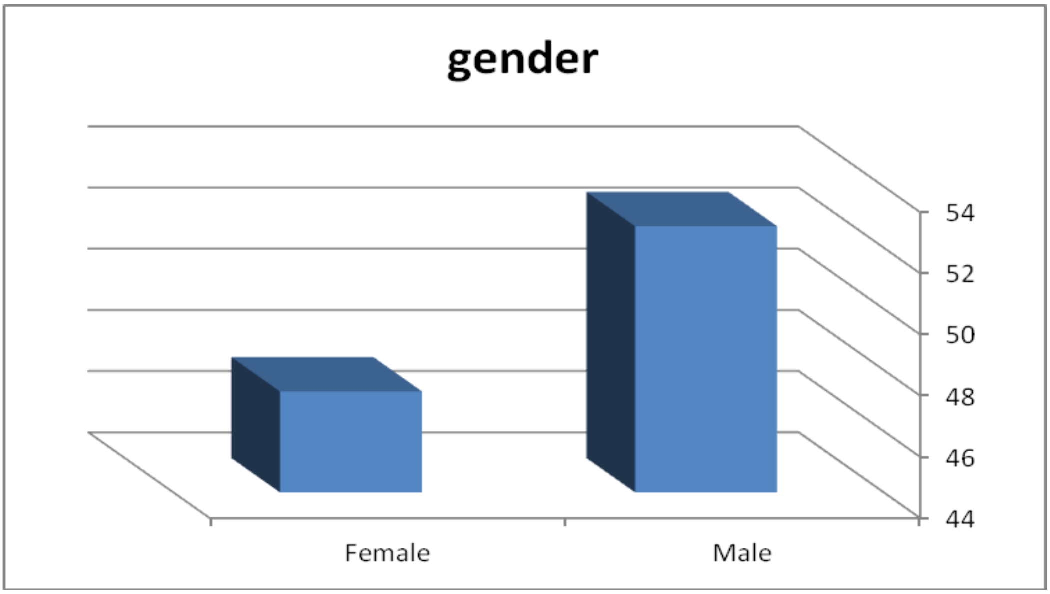


**Figure (4.2) Distribution of study population by gender**

Table 4.2 illustrates the distribution of study population by family income. It is clear from table (4.1) that most parents are working (56.7%), but the incomes of families are concentrated in lower financial income (76.7%) below 1000NIS. These results were consistent with (MARAM, 2004) and the new United Nation Gaza blockade anniversary report which found unemployment is the highest all over the world (UNRWA, 2011).

**Table 4.2: Distribution of the study population by family income**

| Family income | Frequency | Percent (%) |
|---|---|---|
| Less than 1000 NIS | 115 | 76.7 |
| Between 1000-2000 NIS | 32 | 21.3 |
| More than 2000 NIS | 3 | 2.0 |
| Total | 150 | 100 |

Table (4.3) shows the distribution of study population by household members. It's clear that most families in Gaza areas had family members from 5-8 members (64.0%), while (76.0%) of the study population family had one-two children aged between 12-59 months.

**Table 4.3: Distribution of the study population by number household members**

| Variable | Frequency | Percent (%) |
|---|---|---|
| **family members** | | |
| **Total number of household members** | | |
| Less than 4 members | 24 | 16.0 |
| From 5 -8 members | 96 | 64.0 |
| More than 9 members | 30 | 20.0 |
| Total | 150 | 100 |
| **Number of child from12-59 months** | | |
| One-Two children | 114 | 76.0 |
| >Three children | 36 | 24.0 |
| Total | 150 | 100 |

## 4.2 Child feeding status

**Table 4.4: Distribution of the study population by the child feeding status**

| Variable | Frequency(n=150) | Percent (%) |
|---|---|---|
| **Does your family receive any nutritional help or donation** | | |
| Yes<br>Regular<br>Interrupted | 101<br>93<br>8 | 67.3<br>62.0<br>5.3 |
| No | 49 | 32.7 |
| **Immediate breast feeding** | | |
| Yes | 103 | 68.7 |
| No | 47 | 31.3 |
| **Exclusive breast feeding** | | |
| Yes | 97 | 64.7 |
| No | 53 | 35.3 |
| **Duration of breast feeding** | | |
| Below 12 month | 55 | 36.7 |
| After 12 month | 91 | 60.6 |
| Missing value | 4 | 2.7 |
| **Time of introducing of complementary feeding** | | |
| Before 6 month | 64 | 42.7 |
| After 6 month | 86 | 57.3 |
| **Child eat behavior** | | |
| Drinking tea<br>Yes<br>No | <br>99<br>51 | <br>66.0<br>34.0 |
| **Childs appetite** | | |
| Good<br>Poor<br>Fair<br>Missing value | 57<br>64<br>28<br>1 | 38.0<br>42.7<br>18.6<br>0.7 |
| **Number of meals/day** | | |
| 1-3<br>4-6<br>>6 | 117<br>32<br>1 | 78.0<br>21.3<br>0.7 |

The child feeding status of the study population is presented in Table (4.4). More than half of the children (67.3%) were found to receive nutritional help and donation, whereas (62.0%) and (5.3%) of those children take it regularly and irregularly, respectively.

As indicated in Table (4.4), (68.7%) of the study population got immediate breast feeding, whilst, (64.7%) got exclusive breast feeding. It's clear in the same table that the duration of breast feeding collected according to 2 categories: (36.7%) who given breast feeding below 12 months, whilst (60.6%) got it after 12 month.

However, (42.7%) and (57.3%) of the study population had been receiving complementary feeding before 6 months and after 6 months, respectively.

Analysis of the child eating behavior of the study population showed that (66.0%) had been drinking tea with meals, (38.0%) (42.7%) and (18.6%) had appetite good, poor and fair, respectively. In addition, most of the child study population got 1-3 meals/day (78.0%). Result is in agreement with the report of The State of Nutrition: West Bank and Gaza Strip which shows the needs of continued focus on both short-term (e.g. supplementation) and long-term (e.g. dietary and health) solutions (MOH, 2005).

## 4.3 Supplementation information

**Table 4.5: Distribution of the study population by the supplementation information**

| Items | Frequency(n=150) | Percent (%) |
|---|---|---|
| **Did the child take vitamin A,D drops** | | |
| Yes | 111 | 74.0 |
| Within 1-12 month of age | 88 | 58.7 |
| Within 13-36 month of age | 23 | 15.3 |
| Within 37-59 month of age | 0 | 0.0 |
| No | 39 | 26.0 |
| Total | 150 | 100 |
| **How long have you given drops to child** | | |
| ≤ 3 month | 76 | 50.7 |
| From 4 – 6 month | 24 | 16.0 |
| From 7 – 12 month | 11 | 7.3 |
| Total | 111 | 74.0 |
| **If the child Currently (For at 3-4 weeks) continuously given Vitamin A,D drops** | | |
| Yes | 6 | 4.0 |
| No | 105 | 70.0 |
| Total | 111 | 74.0 |
| **If yes, how old was the child when you first started giving him Vitamin A,D drops** | | |
| ≤ 12 month | 2 | 1.3 |
| ≥ 12 month | 4 | 2.7 |
| Total | 6 | 4.0 |
| **How frequent do you give your child vitamin A,D drops per day** | | |
| 2-3 times | 45 | 30.0 |
| one time | 57 | 38.0 |
| less than one time (Irregular) | 9 | 6.0 |
| Total | 111 | 74.0 |
| **Iron supplementation** | | |
| Yes | 112 | 74.7 |
| No | 38 | 25.3 |
| Total | 150 | 100 |

Table (4.5) lists the supplementation information of the study population. The percent of child study population who mentioned that they take vitamin A, D drops was (74.0%), while (58.7%) and (15.3%) of them take it within 1- 12 month of age, and 13-36 months of age respectively. It worth mentioning that none of them was taking it within 37-59 months of age. The table also showed that (50.7%), (16.0%) and (7.3%) of those children mothers mentioned that they gave it for their children ≤3 months, from 4-6 month and from 7 -12 month, respectively. The table also indicated that (38.0%) of children study population mothers give vitamin A,D frequently one time per day, (30.0%) 2-3 times and (6.0%) less than one time. whilst (74.7%) of study population received iron supplementation. This study is in consistent with previous study which was done in Zimbabwe by AJFAND, about supplementation information such as National Vitamin A days backed by vigorous information and education campaigns would help the parents to understand the need for their children to receive vitamin A supplements (Gadaga TH, et al.,2009)

## 4.4 Clinical data

**Table 4.6: Distribution of the study population by the Clinical data**

| Items | Frequency | Percent (%) |
|---|---|---|
| **Fever within the last 2 weeks** | | |
| Yes | 57 | 38.0 |
| No | 93 | 62.0 |
| Total | 150 | 100 |
| **Cough within the last 2 weeks** | | |
| Yes | 68 | 45.3 |
| No | 82 | 54.7 |
| Total | 150 | 100 |
| **Diarrhea with the last 2 weeks** | | |
| Yes | 32 | 21.3 |
| No | 118 | 78.7 |
| Total | 150 | 100 |
| **Continuous diarrhea** | | |
| Yes | 4 | 2.7 |
| No | 146 | 97.3 |
| Total | 150 | 100 |
| **Has the child ever been affected with measles** | | |
| Yes | 0 | 0.0 |
| No | 150 | 100.0 |
| Total | 150 | 100 |

Clinical data which related to deficiency in vitamin A is indicated in table (4.6). The clinical data were indicated by symptoms that the children may be affected within the last 2 weeks and these symptoms are suspected to have a relation with deficiency in vitamin A.

It was found that (38.0%) had fever, (45.3%) had cough, (21.3%) had diarrhea, and (2.7%) had continuous diarrhea. None of the study population mentioned that they had measles. It is consistent with the report of The State of Nutrition: West Bank and Gaza Strip which shows that clinical signs of vitamin A deficiency (night blindness and xeropthalmia) are not reported in the occupied Palestinian territory. A recent and only survey on sub-clinical vitamin A deficiency found that 22 percent of children aged 12-59 months had serum retinol levels <200ug/l (The MARAM Project 2004).A Sub-clinical vitamin A deficiency is a serious public health problem in the occupied Palestinian territory. This requires further investigation and the reason for low retinol levels in young children is highly related to infection mainly cough and fever, and may also be related to low vitamin A Intake (MOH, 2005).

### 4.5 Vitamin A classification and Hemoglobin concentration

Table (4.7) illustrates the distribution of the study population according to their vitamin A levels as: (57.3%) of children had vitamin A deficiency (200-500 nmol/L), (20.7%) of children had vitamin A marginal deficiency (501-699 nmol/L) and (21.3%) of children had vitamin A normal(≥700 nmol/L).

(83.3%) of children had hemoglobin <11.0 g/dl, (35.3%) and (16.7%) of children had hemoglobin > 11.0 g/dl table (4.7). This study is in consistent with others studies and researcher, such as the anemia of vitamin A deficiency: epidemiology and pathogenesis. Epidemiological surveys show that the prevalence of anemia is high in populations affected by vitamin A deficiency in developing countries. Improvement of vitamin A status has generally been shown to reduce anemia, but the actual public health impact on anemia is unclear which done in Department of Ophthalmology Johns Hopkins University School of Medicine, Baltimore, Maryland, USA (Semba and Bloem , 2002).

Results are also consistent with more reports indicating that vitamin A deficient children are more likely to be anemic than Children with normal levels of vitamin A. (MARAM, 2004).

**Table 4.7: Distribution of the study population by Vitamin A classification**

| Vitamin A nmol/L | Frequency | Percent (%) |
|---|---|---|
| Deficiency (200-500 nmol/L) | 86 | 57.3 |
| Marginal deficiency (501-699 nmol/L) | 31 | 20.7 |
| Normal ( ≥ 700 nmol/L) | 32 | 21.3 |
| Total | 149 | 100 |

**Table 4.8: Distribution of the study population by Hemoglobin concentration**

| Hemoglobin | Frequency | Percent (%) |
|---|---|---|
| Less than 11.0 g/dl | 124 | 83.2 |
| ≥ 11.0 g/dl | 25 | 16.7 |
| Total | 149 | 100 |

Table (4.8) shows the distribution of study population by hemoglobin concentration. The majority of population are concerned anemic with less than (11.0 g/dl) and was found that (83.3%) and the rest of hemoglobin concentration with more than (11.0 g/dl) was found that (16.7%).

Anemia is a widespread public health problem, which is due to many factors, nutritional or non-nutritional (Ke Chen, 2009).

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children. In 2002, iron deficiency anemia (IDA) was considered to be among the most important contributing factors to the global burden of disease (WHO,1993,2005)

**Table 4.9: Distribution of the study population by Hemoglobin and vitamin A**

| Vitamin A Intervals (nmol /L) | Hb Levels (g/dl) | | | | Total | |
|---|---|---|---|---|---|---|
| | Anemic Hb < 11 | | Normal Hb ≥ 11 | | | |
| | Number (N) | Percent (%) | Number (N) | Percent (%) | Number (N) | Percent (%) |
| 200-500 | 75 | 87.2 | 11 | 12.8 | 86 | 100 |
| 501-699 | 27 | 87.1 | 4 | 12.9 | 31 | 100 |
| ≥700 | 22 | 68.8 | 10 | 31.3 | 32 | 100 |
| Total | 124 | 83.2 | 25 | 16.8 | 149 | 100 |

Table (4.9) illustrates the distribution of the study population by hemoglobin and vitamin A. The majority of studied population is considered anemic. It was found that (87.2%) are anemic and have vitamin A deficiency with level from (200-500nmol/L) and the normal of hemoglobin was found (12.8%), the second category of VAD with level of (501-699nmol/L) included (87.1%) as anemic besides (12.9) with normal hemoglobin. Last category of the same table with vitamin A level more than (700nmol /L**)** included (68.8%) and the normal of hemoglobin was found (31.3%).

Result is in agreement with several studies, it has long been known that vitamin A deficiency and iron deficiency tend to exist together in population groups. This might be expected to occur because inadequate diets are usually deficient in more than a single nutrient. In controlled trials carried out in several countries vitamin A supplementation brought about significant increases in hemoglobin levels (Sommer and West, 1996).

While better understanding of the interrelationships between vitamin A and iron must be pursued, the prevention of vitamin A deficiency should be considered along with iron supplementation for the control of nutritional anemia (IVACG, 1998).

Vitamin A deficiency and anemia, 33.9% of vitamin A deficient children were also anemic, indicating that vitamin A deficient children are more likely to be anemic than children with normal levels of vitamin A.(MARAM ,2004)

Figure (4.3) the stem and leaf plots show that the study population concentrated below 700nmol/l which means a high frequency with vitamin A deficiency.Figure (4.4) shows that most of study population appeared with anaemia Hb below 11.0 g/dl.

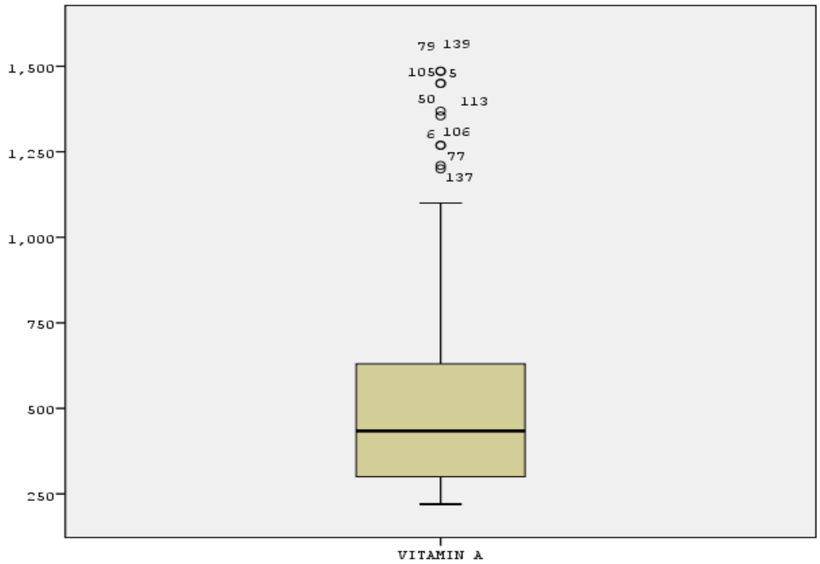


**Figure (4.3): Vitamin A distribution descriptive plot stem and leaf**

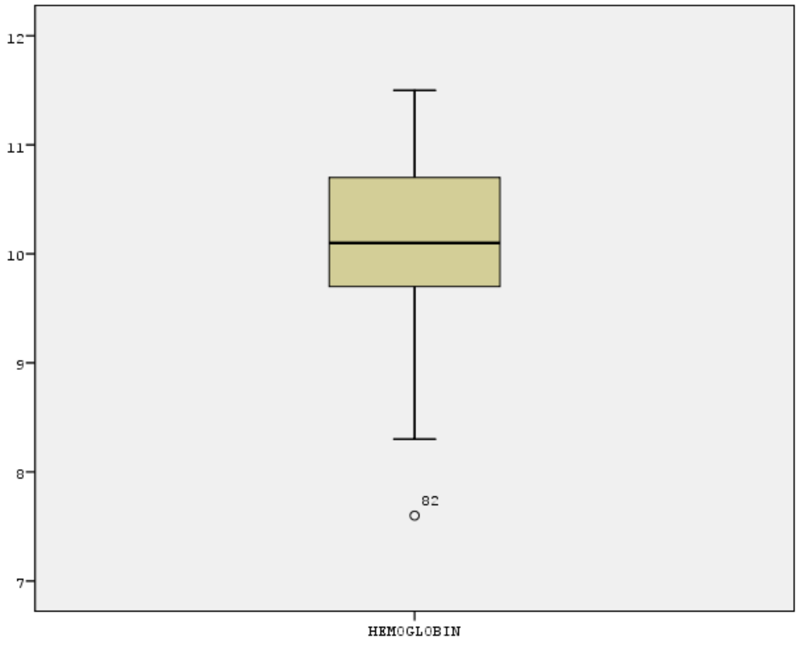


**Figure (4.4): Hemoglobin distribution descriptive plot stem and leaf**

### 4.6 Vitamin A and Socio-demographic characters

**Table 4.10: The relationship between Vitamin A and Socio-demographic characters**

| Socioeconomic information | VITAMIN A nmol/L | | | | | | P –value |
|---|---|---|---|---|---|---|---|
| | 200-500 | | 501-699 | | ≥700 | | |
| | N | % | N | % | N | % | |
| **Address** | | | | | | | |
| AL DARAJ | 9 | 33.3 | 6 | 22.2 | 12 | 44.4 | 0.013 |
| AL REMAL | 9 | 52.9 | 4 | 23.5 | 4 | 23.5 | |
| AL ZAETOON | 19 | 57.6 | 10 | 30.3 | 4 | 12.1 | |
| AL SHATEAA | 5 | 45.5 | 2 | 18.2 | 4 | 36.4 | |
| AL SHEJAA | 23 | 74.2 | 3 | 6.5 | 6 | 19.3 | |
| AL NASER | 21 | 70.0 | 7 | 23.3 | 2 | 6.7 | |
| **Gender** | | | | | | | |
| MALE | 46 | 58,2 | 11 | 13.9 | 22 | 27.8 | 0.030 |
| FEMALE | 40 | 57.1 | 20 | 28,6 | 10 | 14.3 | |
| **No. of children from12-59 month** | | | | | | | |
| 1-2 child | 66 | 58.4 | 25 | 22.1 | 22 | 19.5 | 0.520 |
| More than 3 child | 20 | 55.6 | 6 | 16.7 | 10 | 27.8 | |
| **Mother education level** | | | | | | | |
| Less than 7 years | 34 | 59.6 | 15 | 26.3 | 8 | 14.0 | 0.151 |
| More than 7 years | 52 | 56.5 | 16 | 17.4 | 24 | 26.1 | |
| **Father education level** | | | | | | | |
| Less than 7 years | 45 | 54.9 | 21 | 25.6 | 16 | 19.5 | 0.272 |
| More than 7 years | 41 | 61.2 | 10 | 14.9 | 16 | 23.9 | |
| **Father employment** | | | | | | | |
| Yes | 49 | 57.6 | 18 | 21.2 | 18 | 21.2 | 0.989 |
| No | 37 | 57.8 | 13 | 20.3 | 14 | 21.9 | |
| **Mother employment** | | | | | | | |
| Yes | 2 | 100 | 0 | 0.0 | 0 | 0.0 | 0.476 |
| No | 84 | 57.1 | 31 | 21.1 | 32 | 21.8 | |
| **Family income** | | | | | | | |
| <1000 | 63 | 55.3 | 25 | 21.9 | 26 | 22.8 | 0.595 |
| 1000-2000 | 20 | 62.5 | 6 | 18.8 | 6 | 18.8 | |
| >2000 | 3 | 100 | 0 | 0.0 | 0 | 0.0 | |
| **Age** | | | | | | | |
| 12-35 months | 38 | 57.6 | 15 | 22.7 | 13 | 19.7 | 0.758 |
| 36-59 months | 47 | 58.0 | 15 | 18.5 | 19 | 23.5 | |

The relationship between Vitamin A categories and socio-demographic characters are presented in table (4.10). Cross tabulation was used to determine the relationship between dependent variable (vitamin A deficiency among 12-59 months at Gaza city), and independent variable (domains from the questionnaire) (table 4.10).

Depending on the scientific classification of vitamin A. It was divided into three categories deficiency stage (200-500 nmol/L), marginal deficiency stage (501-699 nmol/L) and normal stage (≥700 nmol/L).

In general, there is no statistical significant relation between vitamin A categories and socioeconomic information except address (P= 0.013) and gender (P= 0.03) (74.2%), (70.0%), (57.6%) and (52.9%) of children in AL Shejaa, AL Nasser, AL Zytoon and ALRemal respectively, were located in VAD category. Result also showed that (58.2%) and (57.1%) of study population were males and females respectively, and located in VAD category (200-500nmol/L).

This result is consistent with another study in west Bengal, India which involved distribution of prevalence of VAD among pre-school children by age group and gender and it showed that VAD among boys was more than girls (N ARLAPPA, N BALAKRISHNA, et al., 2010).

Although the result shows high percent of children with mother education level in VAD there is no statistical significant relationship (P-value=0.151) and the same situation for father education level (P-value=0.272).

## 4.7 Vitamin A and child feeding pattern

**Table 4.11: The relationship between vitamin A and child feeding pattern**

| Child feeding status | VITAMIN A nmol/L | | | | | | P –value |
|---|---|---|---|---|---|---|---|
| | 200-500 | | 501-699 | | ≥700 | | |
| | N | % | N | % | N | % | |
| **Receive nutritional help** | | | | | | | |
| Yes | 57 | 57.0 | 25 | 25.0 | 18 | 18.0 | 0.116 |
| No | 29 | 59.2 | 6 | 12.2 | 14 | 28.6 | |
| **If yes** | | | | | | | |
| Regular | 53 | 57.6 | 23 | 25.0 | 16 | 17.4 | 0.856 |
| Interrupted | 4 | 50.0 | 2 | 25.0 | 2 | 25.0 | |
| **Immediate breast feeding** | | | | | | | |
| Yes | 63 | 61.8 | 21 | 20.6 | 18 | 17.6 | 0.209 |
| No | 23 | 48.9 | 10 | 21.3 | 14 | 29.8 | |
| **Exclusive breast feeding** | | | | | | | |
| Yes | 52 | 54.2 | 24 | 25.0 | 20 | 20.8 | 0.232 |
| No | 34 | 64.2 | 7 | 13.2 | 12 | 22.6 | |
| **Duration of breast feeding** | | | | | | | |
| < 12month | 39 | 70.9 | 4 | 7.3 | 12 | 21.8 | 0.008 |
| >12 month | 45 | 50.0 | 25 | 27.8 | 20 | 22.2 | |
| **Time of introducing complementary** | | | | | | | |
| < 6month | 40 | 62.5 | 10 | 15.6 | 14 | 21.9 | 0.387 |
| >6 month | 46 | 54.1 | 21 | 24.7 | 18 | 21.2 | |
| **Drinking tea** | | | | | | | |
| Yes | 62 | 62.6 | 19 | 19.2 | 18 | 18.2 | 0.213 |
| No | 24 | 48.0 | 12 | 24.0 | 14 | 28.0 | |
| **Child appetite** | | | | | | | |
| Good | 31 | 54.4 | 8 | 14.0 | 18 | 31.6 | 0.216 |
| Poor | 37 | 58.7 | 16 | 25.4 | 10 | 15.9 | |
| Fair | 17 | 60.7 | 7 | 25.0 | 4 | 14.3 | |
| **No. of meals/day** | | | | | | | |
| 1-3 | 69 | 59.5 | 23 | 19.8 | 24 | 20.7 | 0.797 |
| 4-6 | 16 | 50.0 | 8 | 25.0 | 8 | 25.0 | |

Table (4.11) illustrated the relation between Vitamin A and child feeding status. The cross tabulation indicated that from all the studied variables There is only statistical significant relationship between duration of breast feeding and vitamin A (P-value=0.008).

This result is in consistent with other international studies about vitamin A deficiency disorder in The Johns Hopkins University Bloomberg School of Public Health which shows the origins of the problem and approaches to its Control such as breast feeding. Children begin life with an urgent need for vitamin A during the first six months of life they need at least 125 mg of retinol equivalents daily to prevent xerophthalmia and about 300 mg to thrive (Sommer A, 2001).

### 4.8 Vitamin A and Supplementation Information

**Table 4.12: The relationship of Vitamin A Supplementation Information**

| **Supplementation Information** | VITAMIN A nmol/L | | | | | | P –value |
|---|---|---|---|---|---|---|---|
| | 200-500 | | 501-699 | | ≥700 | | |
| | N | % | N | % | N | % | |
| **Take vitamin A,D drops** | | | | | | | |
| Yes | 64 | 57.7 | 25 | 22.5 | 22 | 19.8 | 0.556 |
| No | 22 | 57.9 | 6 | 15.8 | 10 | 26.3 | |
| **How long have you given drops to the child** | | | | | | | |
| Less than 3 month | 39 | 53.4 | 20 | 27.4 | 14 | 19.2 | 0.065 |
| 4-6 | 12 | 50.0 | 4 | 16.7 | 8 | 33.3 | |
| 7-12 | 12 | 85.7 | 2 | 14.3 | 0 | 0.0 | |
| **IF yes** | | | | | | | |
| Within 1-12 month of age | 51 | 57.9 | 21 | 23.9 | 16 | 18.2 | 0.631 |
| Within 13-36 month of age | 13 | 56.5 | 4 | 17.4 | 6 | 26.1 | |
| If the child currently (for at least 3-4weeks) continuously given vitamin A, D drops | | | | | | | |
| Yes | 4 | 66.7 | 0 | 0.0 | 2 | 33.3 | 0.407 |
| No | 60 | 57.1 | 21 | 20.0 | 24 | 22.9 | |
| **How frequent do you give your child vitamin A, D drops? Time of day** | | | | | | | |
| 2-3 times | 32 | 51.1 | 8 | 17.8 | 14 | 31.1 | 0.113 |
| One time | 34 | 59.6 | 15 | 26.3 | 8 | 14.0 | |
| Less than one time | 7 | 77.8 | 2 | 22.2 | 0.0 | 0.0 | |
| **Iron supplementation** | | | | | | | |
| Yes | 66 | 59.5 | 23 | 20.7 | 22 | 19.8 | 0.675 |
| No | 20 | 52.6 | 8 | 21.1 | 10 | 26.3 | |

Table (4.12) illustrated the relation between Vitamin A and supplementation information. The studied variables include Vitamin A, D drops and iron supplementation. None of the studied variables of supplementation information indicate significant relationship.

Result is almost is in agree with MARAM, 2004, they found that Vitamin A supplementation is highly cost effective, and has been proven relatively easy to deliver. A supplementation program should be put in place at least for the short term, until improvement of economic status, access to a diverse diet, and fortification can be assured. Possibly, supplementation will be always necessary for infants and young children.

## 4.9 Vitamin A and child clinical status

**Table 4.13: The relationship between vitamin A and child clinical status**

| **Clinical status** | VITAMIN A nmol/L | | | | | | P –value |
|---|---|---|---|---|---|---|---|
| | 200-500 | | 501-699 | | ≥700 | | |
| | N | % | N | % | N | % | |
| **Fever within the last 2 weeks** | | | | | | | |
| Yes | 36 | 63.2 | 11 | 19.3 | 10 | 17.5 | 0.538 |
| No | 50 | 54.4 | 20 | 21.7 | 22 | 23.9 | |
| **Cough within the last 2 weeks** | | | | | | | |
| Yes | 37 | 54.4 | 17 | 25.0 | 14 | 20.6 | 0.512 |
| No | 49 | 60.5 | 14 | 17.3 | 18 | 22.2 | |
| **Diarrhea within the last 2 weeks** | | | | | | | |
| Yes | 19 | 59.4 | 5 | 15.6 | 8 | 25.0 | 0.677 |
| No | 67 | 57.3 | 26 | 22.2 | 24 | 20.5 | |
| **Continuous diarrhea** | | | | | | | |
| Yes | 2 | 50.0 | 0 | 0.0 | 2 | 50.0 | 0.293 |
| No | 84 | 57.9 | 31 | 21.4 | 30 | 20.7 | |

Across tabulation was done to study the relationship between vitamin A and child clinical status which illustrated in (Table4.13). Child clinical status included fever, cough, diarrhea within the last two weeks and continuous diarrhea. It is clear that among all studied variable that there was no statistically significant relationship (P-values=0.538 for fever, 0.512 for cough, 0.677 for diarrhea and 0.293 for continuous diarrhea).

(The MARAM project 2004) indicate that a surprisingly high level of infection/inflammation in the sample population. Over half of the children had an infection in the past two weeks, and such children were significantly more likely to be vitamin A deficient. This not only suggests that a therapeutic vitamin A policy is needed, but that stronger medical intervention for prevention and management of childhood diseases should be in place. Media and educational materials on home management of colds and fevers and in season, diarrhea, is also needed. Most of these illnesses are seasonal. During the summer months, illness is weighted towards diarrhea. Hygiene, and environmental health and home management of illnesses, should be a priority of local health authorities. This is consistent with this study.

### 4.10 Vitamin A and Hemoglobin

**Table 4.14: The relationship between vitamin A and Hemoglobin**

| Items | Hemoglobin g/dl | | | P-value |
|---|---|---|---|---|
| | N | % | Mean ±SD | |
| **Deficiency** | 86 | 57.3 | 9.99±0.75 | 0.011 |
| **Marginal deficiency** | 31 | 20.7 | 10.24±0.70 | |
| **Normal** | 32 | 21.3 | 10.43±0.76 | |
| **Total** | 149 | 99.3 | 10.14±0.76 | |

The relationship between vitamin A and hemoglobin is presented in table (4.14). ONE WAY ANOVA Analysis, shows that there is a direct correlation between the level of hemoglobin and vitamin A. (57.3%) of the children who had anemia has also vitamin A deficiency (200-500nmol/l) with mean (9.99±0.75 g/dl) in the study population and this relationship is statistically significant (P-value = 0.011). Anemia is considered to be as risk factor of VAD as revealed in this result.

Anemia is a widespread public health problem, which is due to many factors, nutritional or non-nutritional (Ke Chen, 2009).

Anemia is a global public health problem affecting both developing and developed countries with major consequences on human health as well as social and economic development. It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children. In 2002, iron deficiency anemia (IDA) was considered to be among the most important contributing factors to the global burden of disease (WHO,1993,2005)

(The MARAM PROJECT 2004) illustrated that (33.9%) of vitamin A deficient children were also anemic, indicating that vitamin A deficient children are more likely to be anemic than children with normal levels of vitamin A. this is in agreement with this results.

# Chapter 5

## 5.1 Conclusion

Vitamin A deficiency is one of the most prevalent worldwide micronutrient insufficiencies, particularly amongst children. Unlike many other micronutrients, vitamin A is fat-soluble and can be stored in the body for extended periods of time. Yet a deficiency can occur when these stores of vitamin A in the body are depleted. Deficiency is the consequence of two primary factors .Inadequate intake of vitamin A and an excessive use of vitamin A by the body. The purpose of this study was to assess risk factors associated with vitamin A deficiency among children aged 12-59 months in Gaza governorate.

In our study, the population areas according to the geographical distribution were as follow; Al Zytoon, AL Shejaee, AL Nasser, AL Daraj, AL Remal and Al Shateaa. Most of the study population gender was males and majority of the child parents were medium level education. Most of children fathers are working while the family income was less than 1000 NIS.

More than half of families in study population received nutritional help. The immediate and exclusive breastfeeding showed high percent. Most of children received breastfeeding for more than 12 months, and (42.7%) were given complementary feeding before six months and child eating behavior was poor.

The supplementation information of the study population were high for children who took vitamin A, D drops, most of them take it within 1- 12 month of age. (50.7%) of those children took it for ≤3 months.

Furthermore, more than half of the children included in this study had levels of vitamin A in the range of 200-500nmol/L, while 48.0% of the study population had levels of hemoglobin in the range below 10.0 g/dl.

## 5.2 Recommendations

1. Advocacy and policy: clear commitment by policy makers to a comprehensive program, with clear guidelines and targets for implementation, combined with widespread consumer demand, are critical elements in an effective and sustainable vitamin A program. Policy makers should include representatives of the MOH, UNRWA, NGOs and donor communities. To be comprehensive, this policy should include:

1.1 Protocols that include micronutrient practices, based both on Palestinian needs and international standards.

2.1 Behavior change strategies to inform and motivate - both the community and health providers - about the importance of vitamin A and other micronutrients. Issues to be addressed will include the safety of any supplements for the general population, the level of need in the overall population, the impact and effects of VAD, and international consensus/ experience with MN programs.

3.1 Education and training for health providers on the MN protocols, program objectives and effective counseling.

4.1 The creation of a micronutrient committee representing active stakeholders and specialists. The committee will help to coordinate all donor and program efforts to avoid duplication, gaps or diversion of funds, or efforts to projects that are of lower priority, or are not relevant to the national effort.

2. Providing health education program about the importance of vitamin A & D.

3. Fortification of staple foods: The Palestinian Ministry of Health is in need to move forward with plans to fortify wheat flour and possibly staples, such as oils or milk. The active involvement of the private sector in the production and marketing of such fortified products is strongly recommended, as it adds to feasibility as well as sustainability to the effort. A private sector initiative has already developed fortified biscuits, which include vitamin A with other micro-nutrients. The private sector makes an essential contribution in other countries, including the United States and Britain, in the fight against MN deficiencies. Palestinian efforts should support this model.

4. Encourage exclusive breast feeding of infants (without supplementary liquid, formula, or food) for 6 months after birth. Efforts must be more for the importance and health education about breastfeeding and the exclusive breast feeding in the first six months.

5. Supplementation: Vitamin A supplementation is highly cost effective, and has been proven relatively easy to deliver. A supplementation program should be put in place at least for the short term, until improvement of economic status, access to a diverse diet, and fortification can be assured. Possibly, supplementation will be always necessary for infants and young children.

6. Annually assess children aged 12-59 months for risk factors of iron-deficiency anemia (e.g., a low-iron diet, limited access to food because of poverty or neglect, or special health-care needs). Screen these children if they have any of these risk factors.

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**Annexes (1):**
**Questionnaire**

أنا الباحث / **محمد عبد القادر محمد أبوريا**. أقوم حاليا بدراسة بحثية حول نقص فيتامين أ لدى الأطفال الفلسطينيين بمدينة غزة والأسباب المؤثرة التي قد تكون ذات تأثير على حدوث نقص فيتامين أ. و سيتم اختيار الأطفال الذين تتراوح أعمارهم ما بين اثنتي عشر و تسع و خمسون (59 -12) شهرا. ويقوم بالإشراف على هذه الدراسة برنامج الدراسات العليا، قسم الصحة العامة، فرع علم الأوبئة بجامعة القدس- أبوديس فرع غزة.

المشاركة في الدراسة من خلال هذه الاستبانة طوعية. اشكر مشاركتكم معنا لان إجابتكم لها قيمة علمية مهمة بالنسبة للبحث.

أرجو مساعدتي في الإجابة على بعض الأسئلة المتعلقة بالطفل والأسرة ككل. وسأقوم بسحب عينة دم وريدية من الطفل إذا كان يلبي شروط البحث لعمل بعض التحاليل اللازمة المتعلقة بالدراسة.

المعلومات المعطاة سوف تبقى طي الكتمان ولن يطلع عليها احد، وتستخدم لأغراض البحث العلمي فقط.

Agreement:

I agree to complete this questionnaire concerning my child health statement.

أنا موافقة على تعبئة هذه الاستبانة التي تتعلق بصحة طفلي وعلى سحب عينة الدم الوريدية المحددة من طفلي.

التوقيع:------------------------ التاريخ:----------------

شكرا لكم على حسن تعاونكم

**الباحث / محمد عبد القادر محمد أبوريا**

| A) Child data | |
|---|---|
| 1. Serial no. | ------ |
| 2. Date of interview | -----/-----/----- |
| 3. Child's name | |
| 4. Governorate / District | Gaza ◯ ----------- |
| 5. Address | |
| 6. Telephone/ Mobile | |
| 7. Date of birth | -----/-----/----- |
| 8. Sex | Male ◯ female ◯ |
| **B) Family information** | |
| 9. Total number of household members | -------------- |
| 10. No. of children's from 12-59 months | -------------- |
| 11. Mother's education | Illiterate Primary Preparatory<br>Secondary University or Diploma |
| 12. Father's education | Illiterate Primary Preparatory<br>Secondary University or Diploma |
| 13. Father's employment | Yes ◯ No ◯ |
| 14. Mother's employment | Yes ◯ No ◯ |
| 15. Age of mother | ----------------------years |
| 16. Average of family income per month | <1000 NIS ( ), 1000-2000 NIS ( ), >2000 NIS ( ) |
| 17. Does family receive any nutritional help or donation | Yes ◯ No ◯<br>***If yes:*** Regular ◯ interrupted ◯ |
| **C) Child's feeding status** | |
| 18. Immediate breast feeding (within the first half an hour) | Yes ◯ No ◯ |

| | |
|---|---|
| 19. Exclusive breast feeding in the first 6 months | Yes ◯ No ◯ |
| 20. Duration of breast feeding | ◯ ≤ 12 months ◯ > 12 months |
| 21. Time of introducing complementary feeding | ◯ ≤ 6 months ◯ > 6 months |
| 22. Drinking tea | Yes ◯ No ◯ |
| 23. Child's appetite | Good ◯ Poor ◯ Fair ◯ |
| 24. No. of meals per day | 1-3 ◯ 4-6 ◯ >6 ◯ |
| **D) Supplementation** | |
| 25. Did the child take vitamin A&D drops | Yes ◯ No ◯<br>***If yes***<br>Within 1-12 months of age ( )<br>Within 13-36 months of age ( )<br>Within 37-59 months of age ( ) |
| ❖ How long have you given drops to the child | -------------------------**months** |
| ❖ Is the child currently (for at least 3-4 weeks) continuously given vitamin A&D drops | Yes ◯ No ◯ |
| ❖ If Yes, how old was the child when you first started giving him/her vitamins A&D drops | ---------------------------months |
| ❖ How frequent do you give your child vitamin A&D drops | ---------------------------times a day<br>---------------------------times a week<br>---------------------------times a month<br>◯ Irregular |
| 26. Iron | Yes ◯ No ◯ |
| **E) Clinical data** | |
| 27. Fever within the last 2 weeks | Yes ◯ No ◯ |

| | |
|---|---|
| 28. Cough within the last 2 weeks | Yes ◯ No ◯ |
| 29. Diarrhea within the last 2 weeks (**Diarrhea it's an abnormal increase in the frequency & liquidity of stool)** | Yes ◯ No ◯ |
| 30.Continuous diarrhea **(for a minimum of 2 weeks within the last 3 months)** | Yes ◯ No ◯ |
| 31.Has the child ever been affected with Measles | Yes ◯ No ◯<br>***If yes***<br>How old was the child -------------------- months |
| **F) Laboratory examinations** | |
| 32. Hemoglobin | ---------------g/dl |
| 33. Vitamin A | ---------------µmol/L |

## Arabic Questionnaire

| أ) بيانات الطفل | |
|---|---|
| 1. رقم التسلسل | ------ |
| 2. تاريخ المقابلة | -----/-----/----- |
| 3. اسم الطفل | |
| 4. منطقة / محافظة | غزة ( ) ----------- |
| 5. عنوان | |
| 6. الهاتف / الجوال | |
| 7. تاريخ الولادة | -----/-----/----- |
| 8. الجنس | أنثى ( ) ذكر ( ) |

| ب) معلومات عن العائلة | |
|---|---|
| 9. مجموع عدد أفراد الأسرة | -------------- |
| 10. عدد الأطفال 12-59 شهرا | -------------- |
| 11. تعليم الأم | الابتدائي تحضيري أمي<br>جامعة أو دبلوم الثانوية |
| 12. تعليم الأب | الابتدائي تحضيري أمي<br>جامعة أو دبلوم الثانوية |
| 13. عمل الأب | لا ( ) نعم ( ) |
| 14. عمل الأم | لا ( ) نعم ( ) |
| 15. عمر الأم | ----------------------- سنوات |
| 16. متوسط دخل الأسرة في الشهر | <1000 شيكل ( ), 1000-2000 شيكل ( ), >2000 شيكل NIS ( ) |
| 17. هل تتلقى الأسرة مساعدات غذائية أو التبرع الغذائية | لا ( ) نعم ( )<br>إذا كانت الإجابة بنعم<br>منتظم ( ) منقطع ( ) |

| | |
|---|---|
| **ج (تغذية الطفل** | |
| 18. الرضاعة الطبيعية المباشرة (في غضون الساعة الأولى ونصف) | نعم ◯ لا ◯ |
| 19. الرضاعة الطبيعية الحصرية في أول 6 أشهر | نعم ◯ لا ◯ |
| 20. مدة الرضاعة | ◯ شهر 12 > ◯ شهر 12 ≤ |
| 21. وقت إدخال التغذية التكميلية | ◯ شهر 6 > ◯ شهر 6 ≤ |
| 22. شرب الشاي | نعم ◯ لا ◯ |
| 23. شهية الطفل | ◯جيد ضعيف ◯ معتدل ◯ |
| 24. عدد الوجبات اليومية | >6◯ 4-6 ◯ 1-3 ◯ |
| **د) المكملات الغذائية** | |
| 25. هل أخذ الطفل قطرات فيتامين أ د | نعم ◯ لا ◯<br>***اذا نعم***<br>( ) في غضون 1-12 شهراً من العمر<br>( ) في غضون 13-36 شهراً من العمر<br>( ) في غضون 37-59 شهراً من العمر |
| ❖ منذ متى وأنت تعطي قطرات للطفل | شهر ------------------------- |
| ❖ هل الطفل أعطي قطرات فيتامين أد باستمرار (آخر 3-4 أسابيع) | نعم ◯ لا ◯ |
| ❖ اذا نعم، كم كان عمر الطفل عندما بدأت لأول مرة بإعطائه | اشهر --------------------------- |
| ❖ كم مرة تعطيه قطرات فيتامين أ د | مرة يوميا--------------------------<br>.مرات في الأسبوع--------------------------<br>مرة شهريا--------------------------<br>◯غير منتظم |
| 26. الحديد | نعم ◯ لا ◯ |
| **هـ) البيانات الطبية** | |
| 27. الحمى في غضون الأسابيع الأخيرة (أسبوعان) | نعم ◯ لا ◯ |

| | |
|---|---|
| 28. السعال في غضون الأسابيع الأخيرة ( أسبوعان ) | لا ◯ نعم ◯ |
| 29. الإسهال في غضون الأسابيع الأخيرة ( أسبوعان )<br>(الإسهال غير طبيعي وزيادة في سيولة البراز) | لا ◯ نعم ◯ |
| 30. الإسهال باستمرار<br>(على الأقل كحد أدنى أسبوعان في آخر 3 شهور) | لا ◯ نعم ◯ |
| 31. هل تعرض الطفل للحصبة مسبقاً | لا ◯ نعم ◯<br>***نعم***<br>كم كان عمر الطفل ---------- أشهر |
| **و) الفحص المخبري** | |
| 32. الهيموغلوبين | ---------------g/dl |
| 33. فيتامين (أ ) | ---------------nmol/L |

**Annexes (2):**
**Ethical approval :Helsinki Committee**

**Palestinian National Authority**
**Ministry of Health**
**Helsinki Committee**

**السلطة الوطنية الفلسطينية**
**وزارة الصحة**
**لجنة هلسنكي**

التاريخ : **07/03/2011**

Name: **Mohammed Abu Rayya**

الاسم: محمد أبو ريا

I would like to inform you that the committee has discussed your application about:
**" Risk factors associated with vitamin A Deficiency among children 12-59 months old attending Ard El Insan Association-Gaza."**

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

In its meeting on March 2011
and decided the Following:-
To approve the above mention research study.

و ذلك في جلستها المنعقدة لشهر 3 2011
و قد قررت ما يلي:-
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.

**Annexes (3):**
**Map of Palestine**

**Annexes (4):**
**Distribution of PHC centers of MOH**

**Annexes(5):**
**Gaza city map**

**Annexes(6):**
**Arabic abstract**

## عوامل الخطر المصاحبة لنقص فيتامين ا في الأطفال الذين تتراوح أعمارهم من 12-59 شهرا في جمعية أرض الإنسان الفلسطينية الخيرية بمركز غزة


**الملخص**

فيتامين ا هو احد أهم المغذيات الدقيقة والتي يحتاجها الجسم من اجل أداء وظائفه الحيوية. فيتامين ا له دور كبير في الجهاز البصري و في النمو والتطور وخاصة عملية تجديد وتكامل الخلايا خاصة الابيثيلية. فيتامين ا مهم جدا للجهاز المناعي و أيضا الجهاز التناسلي وعملية التكاثر.

تهدف الدراسة إلى تحديد عوامل الخطر الشائعة والمصاحبة لنقص فيتامين ا في الأطفال الذين تتراوح أعمارهم من 12-59 شهرا في جمعية أرض الإنسان الفلسطينية الخيرية بمركز غزة.

تشمل الدراسة على 150 طفل. تم إجراء مقابلة مع أمهات الأطفال لتعبئة الإستبانة كما تم سحب عينات دم وريدية من الأطفال من اجل قياس مستوى فيتامين ا والذي تم قياسه عن طريق تقنية ELISA ونسبة خضاب الدم التي تم تحديدها باستخدام فحص الدم الكامل. كما تم استخدام برنامج SPSS النسخة18 لعمل التحاليل الإحصائية اللازمة للدراسة.

بناءً على التصنيف العلمي لنقص فيتامين أ الذي تم تقسيمه إلى ثلاث مجموعات. أوضحت النتائج أن57.3% من الأطفال لديهم نقص فيتامين أ ( 200-500 نانومول/لتر). في حين أن 20.7% من الأطفال كان تركيز فيتامين أ(501-699 نانومول/لتر) و21.3% من الأطفال كان تركيز فيتامين أ طبيعي (700< نانومول/لتر). كان متوسط تركيز فيتامين ا و الهيموجلوبين كالتالي 298.2 ± 532.5 0.76 ± 10.14علىالتوالي. لقد بينت الدراسة بأنه كانت هناك علاقة ذات دلالة إحصائية معنوية بين مكان السكن ونوع الجنس ونقص فيتامين أ (P=0.013) و (P=0.030)على التوالي. كما ان النقص فى تركيز فيتامين أ عند الأطفال الذين يعانون من فقر الدم ذو دلالة إحصائية معنوية (P=0.011). بينما كانت العلاقة ذات دلالة إحصائية معنوية بين قطع الرضاعة الطبيعية قبل مرور عام ونقص فيتامين ا (P=0.008). أما بالنسبة للعلاقة بين الحالة الصحية للأطفال ونقص فيتامين ا فلم تكن العلاقة ذات دلالة إحصائية(P-value>0.05)

لقد ساهمت هذه الدراسة بتسليط الضوء على الحالة التغذوية للأطفال وعوامل الخطر المرتبطة بنقص فيتامين أ حيث تم إيجاد علاقة إحصائية معنوية ما بين فقر الدم ونوع الجنس وممارسات الرضاعة الطبيعية من جهة وبين نقص فيتامين ا عند الأطفال من جهة أخرى.