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Assessment of Nutritional Status of Children Below 24 month of Age in the Town of Yatta with Special reference to Iron Deficiency Anemia

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By

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1- Dr. Khaldoun Bader Head of committee Signature-----------------

2- Dr. Ayesha Al – Rifai Internal examiner Signature-----------------

3- Dr. Awni Abu Yousef External examiner Signature-----------------

Al- Quds University
2006

Dedication

To all humanitarian services providers,
working against hunger in the world

With Love and respect

Declaration

I Certify that this thesis submitted for the degree of Master is the results of my own research, except where otherwise acknowledged, and that this thesis has not been submitted for a higher degree to any other university or institute.

Singed: Nihad Karaja

Date: 6 August, 2006

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Abstract

Malnutrition and anemia are common problems among children in Palestine. This study showed that infants and children in Yatta town, south of Hebron district, had a high prevalence rate of nutritional problems, particularly anemia and malnutrition. Such rates verified in a two-stage study. The first stage was a descriptive study among children aged 6-24 months and the second stage was a two phase cross sectional study for children under six months. This study was carried out to assess the prevalence of anemia and malnutrition for children in the age group 6-24 months children in the town of Yatta. To achieve this goal the prevalence of anemia and malnutrition was determined for 6-24 months in the town of Yatta. Factors associated were determined and anemia incidence rate for children below 6 months was studied. This study was done in two stages: Archival records review for 1565 child aged 6-24 months visiting Ard El Atfal, in which all nutritional status related variables (Socioeconomic situation, anthropometric measurements) and complete blood count were measured and registered from these files. The second stage was a two phases cross sectional study carried out among 200 infants below 6 months. This 2nd phase was carried out in light of the results of the first phase as 6-11 months showed the highest anemia rates. In this stage ferritin and hemoglobin were tested for children and their mothers to estimate the correlation between mothers and child anemia. socioeconomic variables were recorded for each infant by a questionnaire filling in addition to its weight and height. Results (group one 6-24m): Anemia prevalence rate was 66.4% among the 6-24 months children. An association with age, sex, child age groups, twins delivery, mother education and poor socioeconomic status were detected. The prevalence of malnutrition was also high among this age group. Stunting (wt-age) was prevalent at a level of 15.8 %(245) and it was significantly related to child sex, unhealthy home status, refugee status, feeding style, twins, mother education and poor socioeconomic situation of the child's family. Wasting (Wt-Ht) had a prevalence of 3.4% (52) among children aged 6-24m and was related significantly to child feeding style and birth type. Underweight (Wt-Age) was (165) 10.7 % showed significant relationship with twins, home status, number of breadwinners in the family and child feeding style. A significant relationship

was found between anemia and malnutrition (the three types together; wasting or stunting or underweight)

Second group results summary : About 66.5% of children aged 3-4 months were anemic with mean hemoglobin level of 10.56 g/dl ranged from 7.8-13.1g/dl. Anemia increased among these children when they reached the age of 6-7 months, as it reached 72.5% (145) with mean hemoglobin level 10.42g/dl ranging from 6.9-12.3g/dl. About 36.5% of children's mothers were anemic with mean hemoglobin level 12.1 g/dl ranging from 8.2-14.7g/dl. Out of the total 200 mothers, 32.5% had low ferritin level with a mean of 21.17mcg/100ml. Infants were also tested for their ferritin levels at the age of 3-4 months and showed 7% low ferritin levels (ferritin<20mcg/100ml). The mean infant ferritin level was 97.52mcg/100ml. About 45% of these infants were anemic when Hb cut value <10.5g/dl was used.

Child hemoglobin at the age of 3-4months and when it reached the age of 6-7months were strongly correlated. The child hemoglobin at the age 3-4months was correlated with both child birth weight and the feeding style. A positive correlation between mother ferritin and child ferritin was found. Also child ferritin was significantly related with child sex and type of family. A significant relationship was detected between mother ferritin and mother hemoglobin. Child ferritin at 3-4 months of age was related to the hemoglobin level when the child reached 6-7 months (OR=1.420).

When cut off value for ferritin was increased to 30mcg/dl it provided additional support for the significant relationship between child ferritin and sex, child first and second hemoglobin. It also showed a new significant relation ships with:

1- The refugee status 2- The family home status

الملخص

يعتبر سوء التغذية و حتى يومنا هذا من الأمراض الشائعة في فلسطين و خصوصا بين الامهات و الأطفال في السنوات الأولى من العمر. ويعرف بأنه حالة من عدم التوازن في الجسم اما بسبب الزيادة أو النقصان في تناول المواد الغذائية الضرورية مما يؤدي إلى نقص في بعض العناصر الغذائية الدقيقة في الجسم كالحديد أو البروتين. يعتبر فقر الدم الناتج عن نقص الحديد من أكثر أمراض سوء التغذية شيوعا، حيث يعرف بانه انخفاض في نسبة الهيموجلوبين (خضاب الدم) Hb < 11mg / dl

تشير الدراسة الى وجود هذه المشاكل الصحية(فقر الدم و سوء التغذية)بشكل مرتفع في بلدة يطا. ظهرت هذه النتائج من خلال الدراسة التي اجريت على أطفال يطا من خلال دراسة مجموعتين من الأطفال، المجموعة الاولى قامت بدراسة 1565 طفل من الفئة العمرية 6 – 24 شهر و هم جميع الأطفال الذين فحصوا في مشروع مكافحة فقر الدم للعام 2005في جمعية ارض الأطفال.

تم مراجعة ودراسة ملفات هؤلاء الاطفال و فحوصات الدم التي اجريت لهم مع دراسة المعلومات التي جمعت عن الاطفال و عائلاتهم و مدى تأثيرها على نسب سوء التغذية و فقر الدم لديهم.

المجموعة الثانية للدراسة تمت على مرحلتين من العمر للاطفال الذين تقل اعمارهم عن ستة اشهر. تم جمع المعلومات عن هؤلاء الاطفال و اجراء فحوصات دم لهم و لامهاتهم (Ferritin , CBC&S) على عمر3– 4 أشهر , أعيد فحص الأطفال على عمر 6 شهور لمعرفة مدى اصابتهم بفقر الدم (الانيميا)

تهدف هذه الدراسة الى الكشف عن مشاكل الوضع الغذائي للاطفال في منطقة يطا وتحديد نسبة فقر الدم لديهم اضافة الى دراسة الانيميا عند الاطفال في سن مبكر (ما قبل الشهر السادس). قد توفر هذه الدراسة معلومات تفيد في تحسين الخدمات المقدمة للاطفال في الاشهر الاولى من العمر ، خصوصا و أن هناك نقص في الدراسات و المعلومات عن وضع الاطفال في فلسطين لهذه الفئة العمرية و خاصة بما يتعلق بالأنيميا.

إن الدراسات التي اجريت في فلسطين حول هذا الموضوع تشير إلى انتشار هذه المشكلة الصحية و تزايد في نسبة الاصابة بمرض فقر الدم و سوء التغذية مما يتطلب العمل على الحد من هذه المشاكل الصحية و التخطيط لها على مستوى وطني .

<u>أهم النتائج التي أشارت إليها الدراسة كانت كما يلي:</u>

المجموعة الأولى (6–24 شهر)

نسبة فقر الدم كانت 66.4% أظهر التحليل وجود علاقة بين فقر الدم و كلا من : العمر, المجموعات العمرية, ولادة التوأم, تعليم الأم , الوضع الاجتماعي للأسرة .
سوء التغذية الناتج عن تراجع الطول للعمر (التقزم) 15.8 %
نسبة النحافة 3.4 %
نقص الوزن 10.7%

المجموعة الثانية (الأطفال الذين تقل أعمارهم عن 6 أشهر)

نسبة فقر الدم لدى الاطفال على عمر 3–4 شهور كانت 45%(Hb<10.5) و 66.5% اذا ما اعتمد (Hb <11g\dl). و عند تكرار فحص الدم لهؤلاء الاطفال على عمر 6 – 7 شهور ظهرت النتائج ارتفاع في نسبة فقر الدم الى 72.5 %(Hb <11g\dl)
نسبة فقر الدم لدى الأمهات كانت 36.5%مع متوسط هيموجلوبين بين 12.1% حيث أن النسبة كانت تتراوح بين 8.2 – 14.7 dl.
أظهر التحليل وجود علاقة بين الإصابة بفقر الدم على عمر 3–4 شهور و الإصابة به على عمر 6–7 شهور. فقر الدم كان مرتبط ب وزن الطفل على عمر الولادة و نوع الأطعمة التي يتناولها الطفل.
كانت نسبة الأمهات ذوات مخزون الحديد المنخفض Ferritin<12 mcg/100ml%32.5
هناك ارتباط بين مخزون الحديد في الكبد عند الأمهات و مخزون الحديد عند أطفالهن.
هناك ارتباط بين مخزون الحديد في الكبد عند الأطفال و كلا من : جنس المولود ونوع الأطعمة التي كان يتناولها.

هناك فروق ما بين نسبة الإصابة بفقر الدم عند الذكور و الإناث فقد كانت النسبة أعلى عند الذكور.

لقد أظهرت هذه الدراسة حجم المشكلة التغذوية و نسبة فقر الدم لدى الأطفال في منطقة يطا مع الإشارة إلى بعض العوامل التي تؤثر في زيادة نسبة فقر الدم و سوء التغذية.

تم التحليل للفرتين بناءا على تبني حدين فاصلين (2 cutoff values for ferritin were adopted (Ferritin > 20 mcg/100ml and 30 mcg/100 ml) وبناءا على ذلك كانت النتائج مختلفة.

لوحظ من خلال الدراسة أن الأطفال في الأشهر الاولى (اقل من 6 شهور) هم عرضة للإصابة بفقر الدم مما يتطلب اتخاذ الإجراءات الوقائية اللازمة على عمر مبكر .

منطقة يطا من المناطق الفلسطينية ذات تجمع سكاني كبير و هناك حاجة ماسة إلى العمل بشكل مخطط ومدروس على مستوى وطني لمكافحة فقر الدم و سوء التغذية.

Introduction

1.1 General Background

Adequate nutrition is essential for normal growth and development, particularly for infants, preschool age children and pregnancy. Nutrition is defined as food quality intake and not only quantity (Rizkallah,1991 ; Abdeen et. al, 2002). Malnutrition is a state resulting from either; low or excess dietary intake for prolonged periods of time. At a global level there is enough food for every one, but many people don't have access to their dietary needs. Malnutrition contributes to more than half of 12 million deaths in children under five in developing countries each year. About 800 million people haven't the access to sufficient food. (FAO,1999). The nutritional disorders among children are highly prevalent world wide, half of South Asia's children are malnourished and about one of every three children is underweight in Africa (UNICEF,1998).

Pregnant women and children under five years are among the high risk group to develop nutritional deficiencies and its consequences due to their increased dietary requirements(WHO, 1996). Several studies stated that high morbidity and mortality during the first three years of life are affected by the nutritional status of children as Mahjoub(2006) stated based on (WHO,1995). Over five million children die each year due to underweight, and almost all in poor countries. Child mortality, rates are increasing instead of falling. In 1990 the child mortality rate in Sub Saharan Africa was 180 per 1000 live births, compared to only 9 per 1000 live births in industrialized countries, a 20-fold differences. By 2000, the gap had increased to 29-fold.

Over a third of child deaths occur in the first 20 days of life, particularly the neonatal period(WHO) attributes 42% of deaths under five to the neonatal causes. (Mahgoub, et. al, 2006). Malnutrition could also be defined as a term used to cover a multiplicity of disorders, ranging from specific micronutrients deficiencies like vitamins and minerals to extremely nutrients intake (Obesity). (UNICEF and WHO, 1999). Iron deficiency anemia (IDA) is the most prevalent micronutrient deficiencies, affecting one third of the population worldwide

(UNICEF and WHO, 1999).

IDA occurs when there is inadequate intake or bioavailability of dietary iron (PCBS, et.al,2003). About 2.2 billion people world wide are anemic and half of them are estimated to be iron deficient type (WHO, 1991). Iron deficiency anemia in infants or even toddler could lead to mental, motor or behavioral problems which lasts after treating anemia. (American Academy of Family Physicians, 2003). IDA is the major nutritional problem in the West Bank and Gaza. About one third of children under five and women of child bearing age are anemic. Gaza strip and rural areas showed the higher rates of anemia. The main causes were poverty and the child birth pattern (Palestinian Authority, 2005).

If the child's weight and height measurements compare normal to the standard normal distribution of weights and heights of healthy children in the same age and sex we could considered him a well nourished child (Mahgoub et. al, 2006). Nutritional status survey measures allows to describe the current status of the child. In the USA, data were assembled by the National Center for Health Statistics (NCHS) that met the criteria for a reference population. The World Health Organization(WHO) had encouraged the use of NCHS charts by all countries, since children living under optimal conditions in different countries have similar growth patterns resembling those of the NCHS data as stated by the Palestinian Central Bureau of statistics survey joint by Birzeit University (PCBS et. al, 2003).

The most commonly used indicators are the numbers and proportion of children who's weight-for-age or weight-for-height are more than twice the standard deviation below the median value for the reference population, and the proportion of birth below a given standard weight (FAO, 2001) Nearly all studies of severe malnutrition have used the Gomez or Waterloo classification to define malnutrition. These classifications are considered as a varying mixture of clinical signs that may have differing etiologies and do not define the specific health problem. (Grantham – McGregor, 1987) as stated by (Al Rai , 2005). The three key anthropometric measures calculated from the age, height and weight data, are; weight-*for-height, height-for-age and weight-for-age* (FAO, 2001; PCBS,2002).These measures are expressed in the form of Z-scores, which is defined as the difference between the individual value and the median value of the population for the same age and height divided by the standard deviation of the population. It could be used to compare a child's weight and height with those of a similar child from a reference healthy population. Stunting and wasting are the preferable measurements of child nutritional status, as they can distinguish between long and short-run malnutrition (WHO Working Group, 1986). Stated in the Palestinian authority report(PCBS,2002 ; Palestinian Authority report,2005; Mahgoub et. al, 2006).

The severity of acute or chronic malnutrition was classified by the World Health Organization (WHO) based on the United State National Center for Health Statistics (NCHS) standards as several studies an surveys mentioned. Malnutrition varies in its degrees of deviation as follows as stated in the Edekeidek. S, 2005 and (PCBS,2002). Global acute or chronic malnutrition <-2 Z scores, were in the moderate category between -2 and -3 Z scores. As compared to severe category < -3SD, while mild malnutrition: equal or more than –2 to –1 Z scores and the distribution by normal equal or > -1 Z scores.

1.2 Research problems:

This research aimed to identify the anemia status of Yatta children at 2 years of age and less. This research studied the context (Socio political and cultural conditions) that may affect the anemia prevalence in Yatta area. The general situation surrounding the Palestinian children during the years of Al Aqsa Intifada increased the nutritional problems among children, due to the increase of closures and restrictions policies adopted by Israel. The existing families situation in Yatta areas might increase the prevalence of anemia and malnutrition among Yatta children. As the large family members, high unemployment rates and absence of family income, child birth status, birth weight and nutritional status are important factors contributing significantly to the prevalence of anemia in Yatta area. The higher percentages of anemia was among the children aged 6 months as the researcher noticed from the field experience. Absence of adequate information's about those children due to shortage of Palestinian researches studied or investigated the situation raised the question to study the second group of the study.

Research questions:

■ Are the factors (Young mother age, pre term , low birth weight baby, poor family socioeconomic status, unhealthy house situation) increase the prevalence of anemia

■ Are Yatta children at risk to develop high rates of anemia and nutritional problems?

■ Are children under six months at risk of early anemia and in need for early intervention?

1.3 Significance of the study

Several studies and surveys stated that, the nutritional disorders in infancy and childhood are associated with significant loss of cognitive abilities Retardation of physical development and impairment ability to resist diseases (Mahgoub.et.al,2005; Miller, 2006). The 2000 Intifada and the adopted policies by the Israeli authorities consisting of closures, curfews and limitation of movement imposed on the Palestinian areas, resulted in a high rates of unemployment and a sharp decrease in family income. This has lead to increased poverty, especially in the areas heavily dependent on work in Israel. The World Bank (2002) estimates that 60% of the Palestinian population lives today under the poverty line. In the Southern and South – Western area of the West Bank (Hebron district), Poverty coupled with a high prevalence of IDA reaching more than 50%, and increase in 2nd and 3rd degree of malnutrition among children has resulted in a health emergency with respect to children's nutritional status for children below 2 years. This situation could further deteriorate because of the reduced capacity of the Palestinian health institutions, mainly the MOH, to provide health care in a capillary way, as a result of closures, checkpoints and limited budget capacity. Within this framework, AEA as a Palestinian institution proposed an emergency intervention in Yatta area aimed at enhancing the health, nutritional status of Yatta children and reducing the prevalence of the anemia among them by 30%. through its community educational programs, diagnosis and treatment of anemia among children. In addition to preventive supplementation of ration and iron according to WHO protocols **.**

The researcher was one of AEA staff member; during the project phases he noticed that, children aged 6-7 months had the highest anemia rates. This observation raised the question of the anemia rates before the age of 6 months. The project targets were 6-59 months children. Data was collected on different issues related to nutritional status of children below five years of age in Yatta town. This situation and absence of information or evaluation concerning the children status specially those below six months of age, motivated to this study.

This study discussed the aspects of nutritional status for children below 24 months with special reference to anemia among children below 6 months to identify the epidemiological situation of the problem and defining its associated factors; describe the implemented intervention evaluation done by Ard El Atfal to reduce the problem in Yatta.. (For detailed information about the project see Appendix table 23).

Based on the above information about the importance, consequences of anemia and nutritional problem in WB, this study is expected to help in improving the children situation by providing more information on the details of the problem particularly children below six months of age. Further studies are needed to be carried out among this age group for better planning and intervention for those children. Another study requested to be carried out at a notional in order to generalize the findings at a national level.

This research studied several variables surrounding the children environment to know any of these variables had a relationship with the dependent variables of the study (Anemia and the nutritional status). The study independent variables were: age, sex, type of feeding they receive, birth status, birth weight, number of family members, household work, type of family, age of mother, level education of the mother, mother age of marriage, father age of marriage.

1.4 Goal of the study:

- To assess the epidemiological situation of malnutrition related to anemia and define its associated factors among children below two years of age. In addition to have base line data about the anemia and nutritional status of children below six months of age in Yatta area to identify their situation for control planning.

1.5 Objectives:

- To determine the prevalence of anemia among children in the age group 6-24 month in the town of Yatta
- To determine the prevalence of malnutrition among children in the age group 6-24 month in the selected localities.
- To explore the presence of association between anemia and nutritional status
- To determine the Incidence of anemia among children below six months of age
- To identify whether any of the risk factors is associated with anemia and malnutrition:

1.6 Assumptions

The researcher will face some difficulties in gathering information from records

The government health professionals will be cooperative in referring the cases

1.7 Hypothesis:

- The prevalence of anemia increases with the presence of many risk factors (mother illiteracy, very young mother age, large family members, low family income, low birth weight)

- Anemia is prevalent among children below six months of age, which requires earlier intervention
- The program of anemia detection and iron supplementation is effective in reducing anemia prevalence in Yatta.

1.8 Limitations of the study

- ☒ Inaccuracy of some information that is recorded in the 6-24 month group files.
- ☒ Difficulty to derive information form records and unavailability of certain information. Specially for the first sample, as some variables were not collected for the healthy people which make it difficult to compare with unhealthy people (malnourished or anemic children) e.g. Born status, birth weight , head circumference for healthy children who were not anemic , not malnourished
- ☒ Commitment difficulties. Not all mothers cooperated and came to do the second blood test for their children on the proper timing which make the researcher had to do some home visits to collect blood for the second hemoglobin test.
- ☒ Some Bedouin clusters, especially those located in far isolated areas or closer to Israeli settlements were unable to reach the clinic. So not all children from these areas were included in the samples.

CHAPTER TWO

LITRETURE REVIEW

2.1 Introduction

Nutritional disorders are more prevalent in the developing countries due to the food access problems. About one- sixth (800 million) of the developing countries are suffering from food access difficulties despite the presence of food for every one at the global level. (FAO, 1999). The most vulnerable population to food access difficulties are mainly distributed in South Asia, they reached about nearly 280 million, in East Asia with about 240 million and in Sub-Saharan Africa 180 million, and the rest are distributed in Latin America, Middle East, and North Africa (FAO,1999). (as sited in Al- Rai,2005).

Malnutrition rates have been falling over the last two decades in most regions of the developing world. The exception was in sub-Saharan Africa, where malnutrition rates increased during the early 1990s, following the regional economic decline in the late 1980s. (UNICEF,1998) and (FAO, 1999). High growth rates, large populations and economic decline are important factors affecting the food consumptions pattern negatively. Such conditions will disturb the availability and regularity of food at the market level and prevent the individuals from meeting their daily food requirements (FAO,1999) and UNICEF report (1998)

The population size and the growth rates are crucial factors affecting, the consumption and availability of food for the individuals as the case in the developing countries (WHO, 1995; Anderson, 1999). In developing countries it is estimated that more than 5 million deaths under five years of age occurs due to under nutrition (University of London, 2003). And researchers estimates that over 13 million children, and a ratio of more than one in every four under the age of 12, have a difficult time getting the food they need. In the United States over 20 per cent of children live in poverty, more than double the rate of most other industrialized countries(UNICEF,1998). In the United Kingdom, children and adults in poor families face health risks linked to diet, a recent study cited high rates of anemia in children and adults, and premature and low-weight births. In the Russian Federation, the prevalence of stunting among children under two years of age increased from 9 per cent in 1992 to 15 per cent in 1994. In the Central Asian republics and Kazakhstan, 60 per cent of pregnant women and young children were anemic(the same source)

2.2 Contextualization

2.2.1 Nutritional Problems in Arab Countries

Malnutrition have been studied in many Arab countries. In Oman, Musaiger (1993) reported that poor dietary habits, inadequate nutrients intake, infection and poor environmental situation are the factors contributing to the nutritional problems founded among children in the southern part of the country. According to the multi assessment surveys he carried out during 1988-1991, the prevalence of wasting was ranged from between 3.2% to 4.5% among children 2-4 years and it diminished at the age of five. On the other hand stunting was more prevalent among preschool age children and it increased from 18.2% at the age of two to 25.5% when the chilled reached the age of five. The prevalence of anemia was56% among the children aged 2-5years. The highest anemia prevalence was present at the age of 2 years as it represented 77% and decreased to 22% at the age of five years (Musaiger et al,1993)

In Al-Kuwait, a cross-sectional study was conducted among school and kindergarten student aging 6-59 months and their mothers by Amine and Al Awadi (1996). The study showed similar wasting prevalence among males10.1% and females 10.9% while stunting was biased towards males, 11.5% in comparison to 9.9% in females. Obesity was prevalent among females, it was 18.4 % while 16.1% in males. The prevalence of anemia was higher among males 32.9% than females 25.8%. According to the study results the students growth rate in general was close to the international standards which attributed to the high per capita income that affected food habits and dietary food intake.

Another study was conducted in Al-Bahrain among children aged 1-2 years by Al Bahrain Research Center (2003), showed 45% anemia prevalence with sex and age differences. Anemia was more prevalent in females than males, and the highest rate was recorded in the second year aged children which represent 43% from total anemic group. Mothers educational differences were noticed among children as university educated mothers had lower prevalence of anemic children while for illiterate mothers the prevalence was higher (36% vs 50%). Also working mothers children had a higher prevalence of anemia among their children (39%) in comparison to non-working mother's (47%) (Mussaiqer Abdel Rahman/ Al Bahrain research center, 2003).

Nutritional studies conducted in Jordan, Egypt, Syria, Lebanon and Iraq indicated the existence of nutritional problems in the region among children less than five years of age as in the table (3): Malnutrition prevalence in Palestine and its neighboring countries

Country	**Palestine**	**Jordan**	**Lebanon**	**Egypt**	**Syria**
Moderate and severe underweight	8.3%	5%	3%	12%	13%
Moderate and severe wasting	7.8%	2%	3%	6%	9%
Moderate and severe stunting	11.7%	8%	12%	25%	21%

(MOH-HIS, Palestinian Health care system, Health status in Palestine 2002, July 203).

A study conducted in 1999 among infants and children below three years of age with different samples in four countries and showed different anemia prevalence, the highest anemia prevalence was found in Gaza children 74.9% compared to 49.7% anemia prevalence among the West Bank children, 35.9% in Jordan Lebanon showed 29.6% While the lowest anemia prevalence, was 28% among the children in Syria (Madi,2001). Another study was carried out in Palestine among group of children aged 0-5 years in Ein Dyuk village, showed 59% anemia prevalence in addition to 44% malnourished prevalence higher in females (51%) than in males 34**%** (UPMRC, 1988).

2.2.2 Nutritional status in Palestine

Al- Aqsa Intifada started in September 2000. The Israeli attacks activities affected the

Palestinian population living situation, the socio economic and nutritional household status in Gaza strip and West bank. World bank estimates that more than 30% of the Palestinians in the West Bank and the Gaza Strip are dependent on food donations from the World Food Program, the ICRC or other NGOs. According to USAID analysis, about 50% of all Palestinians require external food assistance to meet their minimum daily caloric intake (World Bank, 2002). Several studies conducted among Palestinian children and women showed different rates of malnutrition. With the rates in females higher than that in males due to social discrimination. A study was conducted by Giacamon (1996) among Palestinian children in Zbeidat, showed that severe malnutrition prevalence was 7%, while moderate malnutrition prevalence was 20% and mild malnutrition was 25.1% among the studied children.

Growth parameters for children aged 5-10 years measured in 164 males and 87 females in the West Bank, showed that children from high socioeconomic groups weighed more and were taller than children in the medium and low groups despite no significant differences found in the blood values of the children from different socioeconomic groups in the same study (In Isaacs, 1988). According to a report presented by Yip et all, (1990) on the nutritional status of the Palestinian children and women in the child bearing age in the UNRWA fields, The prevalence of wasting was 1.8 in both West Bank and Gaza. The prevalence of underweight in the West Bank was 3.9% and 4.5% in Gaza. Anemia prevalence (Hb <11mg%) among Gaza children was 70.3% and was higher than the West Bank children (57.8%). Women in the third trimester had 11.4 mg % mean hemoglobin concentration in the West Bank compared to 10.8 mg% in Gaza. Another study was carried out among two groups of pregnant women from different age groups attending UNRWA health centers showed high anemia prevalence 73% and 76%. Early marriage, short intervals between pregnancies, low socioeconomic status, malnutrition were found to be associated with anemia.

The main cause of anemia according to the study was nutritional (Hmaid. S,1987). Malnutrition prevalence was 35.9% among surveyed children with significant differences between sexes (higher in females). Weaning age children had higher prevalence of malnutrition than the rest of the surveyed children in the sample. The prevalence of anemia among the children in the study was 25% (Hb<11mg %) and the lowest hemoglobin level was found to be among children aged 6-23 months . Children who were fed slowly on breast milk had the lowest anemia incidence(Abdel nour, 1991).Another study by Jabra (1984) was carried out among children drawn from UNRWA antenatal clinic registers, showed that half of surveyed children were anemic (Hb<11mg %). Wasting prevalence was2.5% in Gaza and 1.8 % in West Bank while the prevalence of stunting was 20.4% in Gaza and 15.1% in the West Bank (% below 2 SD). The study also showed high anemia prevalence (50%) among pregnant and lactating women. Rizkallah (1991) found that the prevalence of wasting and stunting among primary School children in refugee camps in the West Bank to be 18.8 % and 32% consequently. Family wealth had an effect on the wasting and stunting prevalence but no effect on the children' anemia status, anemia was higher among females than males. Poor family children had higher wasting prevalence (42.5%) compared to wasting prevalence among all the study children (18.8 %). The prevalence of wasting and stunting was not affected by the frequency of the eating. Mothers awareness and children wasting prevalence were significantly correlated according to the study findings.

A comparison made by Tulchinsky, (1994) between three cohorts of children aged up to 15 months, among five government clinics in Gaza city. It concluded that marked improvement was noticed in growth pattern in general with better growth pattern among high socio economic categories infants. No differences between males and females were found. Contradicting to these results by Kumar (1995) another survey conducted in Gaza strip among 1500 children (705males and 795females) showed that there was no significant differences between both sexes, while geographical differences were noticed. She also found that South Gaza children suffered from malnutrition more than the other areas and the over all underweight prevalence was 15.1% with a wasting prevalence of 5.7% while the stunting prevalence was 14.2%. The study emphasized the need for continuous monitoring and children nutritional status surveillance system (Kumar,1995). Another study conducted among children in the age group 0-18 months at five government clinics in Gaza strip showed no gender differences, while socioeconomic condition affected the anthropometric status of the children (Schoenbaum et al, 1995).

Malnutrition is considered a potential problem in the case of economic deterioration. Comprehensive national food and nutrition policy should be developed in such conditions and the nutritional capacity should be strengthened within MOH as well dietary related diseases prevention and anemia control programs should be established. Watson (1996) reported that malnutrition is a potential problem when the economic deterioration occurs and establishing nutrition information system within the MOH, is essential to compact the dietary related diseases and anemia. The highest anemia prevalence was found in the children below two years old among the surveyed 6-35 months. Palestinian refugee children registered at UNRWA health centers in north Jordan, showed anemia prevalence 29.6%, with no significant association between child hemoglobin level and weaning age, sex, family size and mother education while a statistically significant association was found between the child hemoglobin level and age, weight, family income and mother Hb level during pregnancy (Bashir,1996). Another survey of UNRWA clinic antenatal records emphasized the need for more attention should be directed towards dietary habits and the routine iron supplementation for all pregnant should be considered when severe anemia became prevalent (Pappagallo,1996).

Maternal illiteracy, weaning practices, lack of breast feeding, recurrent diarrhea and stunting were factors associated with anemia. The study recommended that breast feeding, weaning practices promotions as well as food fortification with iron were highly needed to for Palestinian children under 3 years of age and their mothers in West Bank, Gaza, Jordan, Lebanon and Syria refugee camps (Hassan et al, 1997)**.** Anemia was more common in the younger age groups and more prevalent in males than females (Shubair et al,2000). Two studies about the Palestinian children and women nutritional health status were carried out in 2002 by the Johns Hopkins and Al Quds University and the second one was conducted by the Palestinian Central Bureau of statistics (PCBS,2002). Despite the differences, both studies agreed that rates of stunting were higher than rates of wasting and underweight, and stunting in Gaza strip was more prevalent than in the West Bank

Table (1) showed the nutritional problems distribution among the Palestinian children

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Malnutrition indicators	PCBS Study 2002			John Hopkins Study2002		
Region	**Palestine**	**WB**	**GS**	**Palestine**	**WB**	**GS**
Under weight	3.5	4	2.6	8.3%	8.3	11.9
Wasting	2.5	2.9	2	7.8%	4.3	13.3
Stunting	9	8	10.5	11.7%	7.5	17.5

Source : PCBS 2002

The Nutritional Survey conducted by the Palestinian Bureau of Statistics (2002) jointly with the (Birzeit University / Johns Hopkins University) showed that 37.9 % of children aged 6-59 months were anemic with hemoglobin levels lower than 11gm/dl. Anemia was found to be at its highest prevalence (53.4%) among children 12-23 months old (cut off point 11gm/dl), followed by 42.2% for the age 6-11 months old (cut off point of 10.5gm/dl). In the Gaza strip children aging 12-59 months had a higher prevalence than the West Bank children as it was (38.7% Gaza strip compare to 33.5% in the WB). The highest prevalence was observed in the refugee camps children; the prevalence was 40.1% in the compared to 34.0% in the rural areas and 34.2% in urban settings.

Johns Hopkins and Al Quds university study 2002 revealed that the global acute malnutrition (moderate to severe acute malnutrition rate) was 7.8% in Palestine (13.3% in Gaza strip and 4.3% in West Bank) and the prevalence of acute malnutrition in the Gaza strip was (13.3%) was considered a humanitarian emergency according to WHO classification (10-14.9) and a severe public health problem. The global chronic malnutrition prevalence was 11.7% in Palestine (17.5% in Gaza strip and 7.9% in West Bank). The prevalence of global acute and chronic malnutrition was higher among refugees than non-refugee (9.6% among refugee and 8.8% among non-refugee) where chronic malnutrition was 15.1% among refugees and 10.6

among non refugees. The prevalence of anemia was 43.9% in Palestine (44.1% in Gaza strip and 43.7% in West Bank). While the results of PCBS revealed the following: The prevalence of stunting (height for age) was 9% while prevalence of wasting (weight for height) was 2.5%. The prevalence of underweight (weight for age) was 3.5%.

Table (2) Anemia prevalence's among children and women in Palestine

Anemia	**PCBS Study 2002**	**John Hopkins Study2002**
Region	**Palestine % WB GS**	**Palestine % WB GS**
Children 6-59 months	38 35.5 41.6	43.8 43.7 44.1
Women 15-49 years	33.2 31.4 36.5	48.6 43.8 52.8

Source : MOH-HIS, Palestinian Health care system, Health status in Palestine 2002, July 203 .

The Nutritional problems were varied between macro and micro nutrient deficiencies as the Johns Hopkins study revealed (2002). The study showed that the presented protein and micronutrient intake was different from the Recommended Dietary Allowances (RDA). Results showed energy intake deficiency among Palestinian children was 62.2% (64.3%in GS and 60.2% in WB) while Protein intake deficiency was 10% (9.8 in GS and 10.2 in WB). And Iron intake deficiency was 78.1 %(77.6% in GS and 78.7 in WB). On the other hands women in Palestine also suffering from nutritional deficiencies. The energy intake deficiency among Palestinian women was 63.3 %(66.8in GS and 61.5 in WB), Protein intake deficiency was 26.6 %(22.8 in GS and 28.6 in WB) while Iron intake deficiency was 73.5 %(71.5% in GS and 74.6 in WB) (MOH-HIS, 2002, 2003). The most important growth parameter in children affected by the deficiency was stunting rate. Its rate increased between the years 1996 and 2002 mainly in the rural areas and in the Gaza Strip. The problem of anemia is still prevalent in Palestine and increasing in its rate among women and younger children (Palestinian Authority, 2005) (PCBS, 2002)

2.3 Conceptualization

2.3.1 Malnutrition and anemia

Malnutrition is a term covers different deficiency state ranging from deficiencies of specific micronutrients, like minerals and vitamins and limited to protein and calorie malnutrition. Malnutrition or under nutrition could also be defined as the physical state resulting from inadequate food intake for long periods of time. In the case of malnutrition the body is lacking the raw materials from food for long periods of time, physiological and physical changes occur. Both unbalanced and inadequate diets could lead to malnutrition as stated in Abdeen,2002 and (UNICEF,1998). Some of the malnourished people appear healthy, as in the case with anemia (lack of iron). They may look overweight as in obesity; or underweight as in starvation. Children who are mildly underweight are twice as likely to die as the better nourished children. In the moderate to severe underweight children, the risk of death increases between five and eight times. Underweight increased the risk of mortality from infectious diseases. Researchers estimated 53% of child deaths a year attributable to underweight (UNICEF,1998; London School of Hygiene & Tropical Medicine, 2003). Behavioral abnormalities could be associated with severely malnourished children. They are more apathetic and less active and explorative of their environment (Grantham-McGregor et al. 1997)

2.3.2 Nutritional status assessment

Assessment Methods

To identify the individual needs, control the nutritional related disease, and help in further planning specially for policy makers assessment methods are widely used. Nutritional intake and nutritional assessment are the two possible methods that are used to assess the adequacy or deficiency of food intake among individuals or population groups. The nutritional status can be assessed by any of the four types of activities often called the **ABCD** approach referring to:

- **A**nthropometrics (the study of human body measurements on a comparative bases)
- **B**iochemical tests such as Hb, MCV, serum ferritin etc
- **C**linical observations
- **D**ietary and personal histories

There is no one single parameter that could alone measure the individual nutritional status directly, or determine the problems or the actual needs. Each part of this approach is important and should be considered.

Anthropometric measurements

The science that deals with body measurements called anthropometry, such as size, weight, and proportions. Growth charts and other clinical standards also could be used to monitor the child's growth. Anthropometry defined as “the measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degree of nutrition” (Jelliffe, 1966). It considered as the most practical field technique and the most common one used for the quantitative assessment of the nutritional status (WHO Working Group,1986). The usage of the nutritional anthropometry usage as stated by Gibson (1990) are the following: simple, safe, non invasive, precise and accurate if standardized techniques are used. Requiring non expensive equipment, portable, could be made or purchased locally and even unskilled personnel can perform measurement procedures.

The information could be generated on past nutritional history, and could be used to quantify the degree of malnutrition or over nutrition. It could also be used to evaluate and monitor the nutritional changes over time for large representative sample sizes. In nutrition emergency situations the techniques could be adopted as a screening method to identify risk groups (Gibson, 1990).On the other hand the inability to distinguish the effect of specific nutrient deficiencies like zinc and Iron is considered one of the disadvantages of the nutritional anthropometric methods use. Further more, these methods are unable to pinpoint the main cause of under nutrition. In addition weight can vary over a short period of time and a child can lose up to 20% of his/ her weight in a few weeks in emergency situations as stated in the above same source.

Tow types of anthropometric are used:

1. Stature: standing height, or recumbent length which is used in children up to 2 years.

2. Weight: which reflects long and current term status.

The nutritional status assessment measures that used in children according to their age and sex are Weight for age, which is influenced by height, represents longer term status. On the other hand, Weight for height, reflects the current nutrition status and body composition.(Cogill, 2003).

Child hood nutritional status assessment

Anthropometric indicators are using data on children's age, height and weight. It could be used also to assess the impact of programs intervention (FAO, 2001). Three key anthropometric measures are calculated based on a combination from age, height and weight data. These are weight-*for-height, (wasting) height-for-age (stunting) and weight-for-age.*

Weight for height (wasting): This index measures body mass in relation to body length. And generally associated with failure to gain weight or severe weight loss (thinness or wasted). Two indicators can measure this issue, Low weight for height or weight for age. If children weight for height two standard deviation below the median are too thin for their height, or wasted, if three standard deviation below the median they considered severely wasted and called acute malnourished. Wasting represents food shortage in the period immediately before survey, and it represents recent episodes of illness or acute food shortages.

Weight for age: It is an index of both heights for age and weight for height. If weight for age two-standard deviation below median child considered under weight for his age and severely under weight if his measures are three standard deviations below the median. A child may be under weight for his age, because he is stunted, because he is wasted, or because he is both stunted wasted.

Height for age (stunting): This index provides an indicator of linear growth retardation. Children with height for age, two standard deviations below the median considered short for there age or stunted and if their height or age three standard deviation below the median they are considered severely stunted. This situation mainly associated with poor over all economic conditions and repeated exposure to adverse condition. Due to the prolonged period of inadequate nutrition intake or recurrent or chronic illness. It doesn't vary appreciably with the season of data collection. This indicator is the most consistently correlated with children's mental development, in addition to delay neuron-sensory, IQ and school achievement in older children. Stunting is extremely prevalent in third word countries, reaching 60% in some areas. It found to be associated with children development. Many investigators have attempted to control for socio-economic conditions when studying the association between stunting and mental development in school-aged children. Nutritional supplementation given to stunted children for 2 years showed improvement in psychomotor development. While poor development found in stunted children due to poor nutrition (Grantham- McGregor et al,1996).

Classification of malnutrition

1- Acute malnutrition:

It is generally associated with failure to gain weight or a loss of weight (thinness or wasting). Two indicators can measure this issue, Low weight for height or weight for age. Children whose weight for height or weight for age below three standard deviations from the median of the reference population are considered acute malnourished.

2- Chronic malnutrition:

It is low height for age where height falls below one standard deviation from the median of the reference population (shortness or stunting). This situation is mainly associated with poor over all economic conditions and repeated exposure to adverse condition.

Iron deficiency anemia

Anemia: is a condition, which is characterized by a decrease in the concentration of hemoglobin in the blood and decrease in the blood cell volume lower than the established WHO cutoff figures ranges from Severe anemia when hemoglobin concentration was less than 7.0 g/dl, moderate anemia when hemoglobin concentration was 7.0 – 9.9 g/dl and mild anemia when hemoglobin concentration 10.0 – 11.9 g/dl (10 – 10.9 g/dl for pregnant and children under age three). In our study we considered the definition of mild anemia as (10 – 10.9 g/dl) (De Maeyer et al, 1989).

Anemia is one of the most widespread public health problems in the world. More than 2 billion people are affected by Iron deficiency anemia world wide. Its prevalence is highest among children and women in the childbearing age, particularly pregnant and lactating women.(WHO,1991; Denission et al,1995). Iron deficiency in children leads to behavioral disturbances and developmental delay. In pregnant women, it increases the risk for a preterm delivery and delivering a low-birth weight baby. (WHO, UNICEF, 1997) In the majority population countries the problem consequences extends to the welfare, social and economic status of the population. The deficiency may result in impaired cognitive development, reduced work capacity and, in complicated cases, increased the risk of mortality, particularly during the prenatal period.

There is also evidence that anemia may result in reduced growth and increased morbidity. It considered as a major cause for malnutrition, leads to loss of appetite, poor dietary intake which reflect negatively on the general health of the children and end up with malnutrition (Miller. 2006;UNICEF, 1998) There is a need to understand the under lying causes of anemia in the first years of life , particularly the first two years of age. Few studies were found to illustrate the factors that influence children's nutritional status at this age. Most of the nutritional studies among children were investigated children between the age of 3-5 years

Palestinian Bureau of statistics (2002) conducted a survey jointly with (Birzeit University / Johns Hopkins University) showed that 37.9 % of children aged 6-59 months were anemic, with hemoglobin levels lower than 11gm/dl. Anemia was found to be at its highest prevalence

(53.4%) among children 12-23 months old (cut off point 11gm/dl), followed by 42.2% for the age 6-11 months old (cut off point of 10.5gm/dl). In the Gaza strip children had a higher prevalence than the West bank children as it was (38.7% GS compare to 33.5% WB). The highest prevalence observed in refugee camps children (PCBS, 2002).

Micro nutrient deficiencies affect one third of the world populations (WHO, UNICEF, 1999). Anemia (IDA) is one of the most widespread micronutrient deficiency among the public health problems in the world. Anemia defined as a state of red blood cells quality and quantity reduction below the normal level (De Mayer and Adiels –Tegman, 1985). It could be also defined as a state that the hemoglobin concentration fallen below two standard deviations below the median for a healthy population of the same age, sex, and stage of pregnancy

(WHO/UNICEF/UNU 1997).It considered as an endemic problem for all classes of the population (WHO, 1991). More than 2 billion people are affected by Iron deficiency anemia world wide, the most common vulnerable groups to this deficiency are infants, children at pre-school age and pregnant and lactating women. In general, females are more vulnerable to anemia than males due to inadequate intakes of iron in their diet in addition to the social discriminations (Dennison et al, 1995).

Generally, men do not became anemic unless there is blood loose history (UNRWA,1999). Blood loosing could be pathological, as in the case of intestinal helminthes, infectious or physiological as in menstruation, pregnancy and delivery consequences (Scrimshaw, 1991). The consequences of the problem in the developing countries extend to the welfare, social and economic status of the population. It increases the poor pregnancy out come including prematurely, low birth weight and maternal mortality. Some studies showed the relation ship between anemia and number of pregnancies, as the prevalence of anemia in pregnancy doubled after the 3rd pregnancy (Bangkok,1972). There is also some evidence showing that anemia may result in impaired cognitive development and child growth reduction. Anemia is a final out come of a multi risk factors interaction. The most common risk factors are dietary factors. Iron, folate and vitamin B12 are examples for micro nutrient deficiency anemia.

Genetic hemoglobinpathies, race, geographical factors are also considered as anemia contributing factors (WHO/UNICEF/UNU,1997) smoking, sex, age, chronic bleeding, infections (malaria) and pregnancy status were found to be associated with the problem. The factors associated with the bioavailability of iron in the diet accounts for the majority of causes of anemia (INACG, 1979, 1989, De Mayer et al, 1989 Hercbergard Galan, 1992;Yip, 1994). Iron bioavailability is low in populations consuming high amounts of legumes and cereals due to phytate and tannin inhibitors(FAO/WHO, 1988). Anemia is defined as a condition, characterized by a decrease in the concentration of hemoglobin in the blood and a decrease in the blood cell volume, lower than the established cutoff value which ranges from110 g/l for pregnant women and children 6 months – 5 years of age, to 120 g/l for non pregnant women and to 130 g/l for men (WHO/UNICEF/UNU,1997) (WHO/ UNICEF,1999). Hemoglobin is an iron-containing protein in red blood cells that carries the oxygen from the lungs to cells throughout the body

Anemia occurs when the healthy red blood cells (RBCs) becomes low. As RBCs contains hemoglobin, which carries oxygen to the body's tissues. Untreated anemia can lead to several complications in the body including fatigue, apathy, impairment of growth and development and decreased resistance to infection (American Family Physician, 1995).

A study was conducted among infants in Akko sub-district to investigate the association between anemia and socio-demographic variables. The finding showed that 30.8% of these infants had a hemoglobin level below 11 g/dl, 24% had a hemoglobin level between 10.0-10.9 g/dl, 6%--between 9.0-9.9 g/dl and less then 1% of the infants had a level of hemoglobin below 9.0 g/dl. An association was found between the rate of anemia and ethnicity as Arabs showed higher rates of anemia than Druze and between the rate of anemia and the type of settlement. The low rates of anemia was found among children from the higher socio-economic level. The Bedouin settlements showed the highest rate of anemia. In addition to a significant association also was detected between anemia and the number of children in the family (Shehab S, et. al, 2001)

2.3.4 Diagnosis of iron deficiency anemia

The biochemical indicators are methods used to detect the sub clinical or marginal deficiencies or imbalances in the individuals. Also it could be used to enhance or support dietary, anthropometric, or other kinds of data related to nutritional status

Biochemical indicators could measured directly through nutrients metabolites in blood or urine (e.g. serum Vitamins A, B12 level). It could measure the hemoglobin response to iron supplements. Hemoglobin (Hb) is considered the biochemical indicator for anemia determination (Shah, 1981), (Miller.R, 2006)
As stated in Miller (2006) Mainly, doctors don't diagnose anemia until they run blood tests as part of a routine physical examination. A complete blood count (CBC) may indicate that there are fewer red blood cells than normal. Other diagnostic tests may include:

Blood smear examination: Blood is smeared on a glass slide for microscopic examination of RBCs, which can sometimes indicate the cause of the anemia.

Iron tests: These include total serum iron and ferritin tests, which can help to determine whether anemia is due to iron deficiency.

Hemoglobin electrophoresis: Used to identify various abnormal hemoglobin's in the blood and to diagnose sickle cell anemia, the thalassemias, and other inherited forms of anemia.

Bone marrow aspiration and biopsy: This test can help determine whether cell production is happening normally in the bone marrow. It's the only way to diagnose Aplastic anemia definitively and is also used if a disease affecting the bone marrow (such as leukemia) is a suspected cause of the anemia.

Reticulocyte count: A measure of young RBCs, this helps to determine if production of red blood cells is at normal levels.

In addition to running these tests, doctor may ask about a family history of anemia and child's symptoms and medications. This may lead the doctor to perform other tests to look for specific diseases that might be causing the anemia

The American Academy of Pediatrics recommends at least once measuring for hemoglobin and hematocrit during each of the following periods: Infancy (between 6-9 months) early childhood (1-5 years), late childhood (5-12 years)and adolescence (14-20) as a routine screening (American Family Physician, 1995).
Anemia could be diagnosed by analyzing the hemoglobin concentration in the blood or by measuring the proportion of red blood cells in the whole blood (hematocrit).

According to the hemoglobin level anemia is classified into mild, moderate and severe based on the criteria developed by the World health Organization (De Mayer et al 1989) severe anemia is a hemoglobin concentration less than 7.0g/dl , whereas moderate anemia hemoglobin concentration would be 7.0-9.9 g/dl and in mild anemia the hemoglobin concentration would be 10.0-11.9 g/dl (10-10.9 g/dl for pregnant and under 3 years aged children).

Blood tests are done to diagnose iron deficiency anemia and distinguish it from other types of anemia. The laboratory tests that are performed to look for iron deficiency anemia include Low hematocrit and hemoglobin (red blood cell measures) ,small red blood cells, low serum ferritin (serum iron level, high iron binding capacity (TIBC) in the blood and blood in stool (visible or microscopic) To detect iron deficiency in children and infants, the use of age-specific reference standards must be employed. There are marked developmental changes in normal values for Hb, Ht, MCV, MCH and TS. Moderately severe iron deficient anemia is easily recognized in children by a low MCV, reduced SF, SI, an increased TIBC, EP and RDW (Oski 1993). The diagnosis of milder forms of iron deficiency is more difficult, as values for iron deficient and iron sufficient persons overlap considerably.

Table (4) Hemoglobin (Hb) and hematocrit (Hct) levels according to WHO/UNICEF/UNU (1997), adopted from WHO (1996)

Age group	**Critical level**	
	Hematocrit %	**Hemoglobin g/dl**
6months - 5year	11.0	33
5-11 years	11.5	34
12-13 years	12.0	36
Men	13.0	39
Women/ Non pregnant	12.0	36
Pregnant women	11.0	33

Anemia considered severe when hemoglobin concentration equal 7g/dl and life threatening very severe when Hb reached 4.0 g/dl.

Severity of anemia could be classified according to red cell morphology and by path physiologic mechanism. The classification that based on MCV size and coloration by Hb (MCHC, mean corpuscular hemoglobin concentration) is called Morphological classifications. While the classification that depends on the size of the red cell anemia could be normocytic if the size of the RBC is normal (MCV 80-100 fL), macrocytic if the size is above normal (MCV> 100fL), or microcytic if the size is below normal (MCV<80fL). And according to the coloration by hemoglobin content can be normal (normocytic) or hypo chromic with low content of hemoglobin. (Robert et al, 1998)

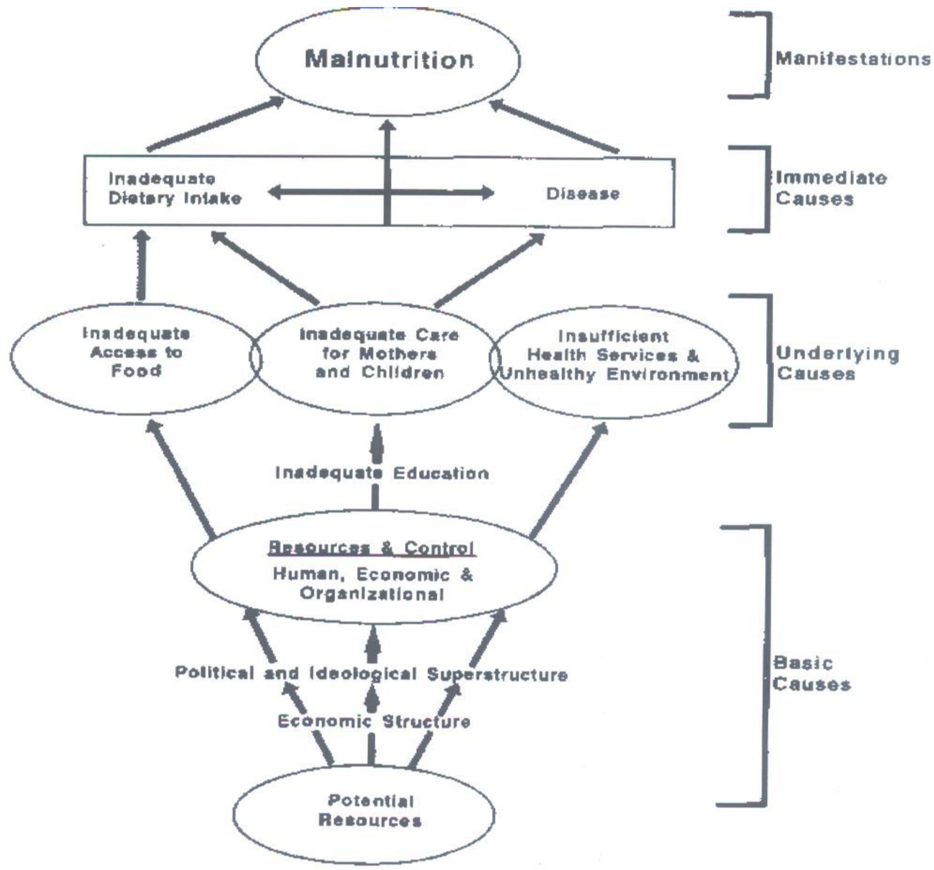
Serum ferritin measurement:

Serum ferritin is the most useful test in the diagnosis of iron deficiency. It reflects iron stores accurately in healthy people; a level below normal is diagnostic of iron deficiency. In an anemic patient a normal level is less useful, as many diseases such as malignancy, liver disease and inflammatory diseases cause a rise in ferritin independent of iron stores. In such patients a low level can be considered to be diagnostic of iron deficiency and the diagnosis is virtually excluded if the level is above normal. In patients with intermediate ferritin levels and anemia the gold standard for the assessment of storage iron is marrow aspiration and Prussian blue staining.

2.4 Framework for analysis

2.4.1 Determinants of nutritional situation

The primary determinants of malnutrition as conceptualized by many authors relates to unsatisfactory food intake, severe and repeated infections or combination of both. Malnutrition is the result of a complex interaction of factors involving such diverse elements as household access to food, child and maternal care, safe water and sanitation, and access to basic health services as stated in the American Academy of Family Physicians (2003; UNICEF,1998) . Malnutrition conceptual framework given by UNICEF(1998) is widely analytical tool clarifying the causal factors and their interactions at three main levels: immediate, underlying and basic causes .



Source : UNICEF 1998

Below is a summary of the known factors and their effects.

Food-health- care

These factors are considered the main three pillars of nutritional security (UNICEF, 1998). The interaction between the immediate and underlying factors includes the household food insecurity, inadequate maternal and child care, unhealthy environment and poor health services could affect the dietary intake negatively and contributes to the spread of infections.

The household food security affected directly by the financial , social and physical access. Presence of several types of food at the market level doesn't mean that food is reachable by every one and there is no food access problem.

The level of caring practices between the individual providing the care and the recipient one is determines by many factors and particularly the use and control of resources related factors.

Human resources are the most crucial one that influenced by the level of education, presence of skills and motivations in addition to knowledge and experience. Presence of the economic resource is also important and could play a role in supporting the food access at the individual and community levels (UNICEF,1998).

Education

A lack of access to good education and correct information is also a cause of malnutrition. The information strategies and accessible education programs could enhance the aware ness, skills and behaviors needed to control and prevent malnutrition. Investments in basic education by governments affected by malnutrition effects the brain development and the intellectual performance. Iron deficiency anemia threaten millions of children, and could be considered one of the countries barriers to educational systems improvement (UNICEF,1998). Parents educational level have its influence over all family members; education could help mothers to take accepted decision among household, and have a better access to household resources(ACC/SCN,1990; Rizkallah,1991) cited at Al- Rai (2005). Female illiteracy increased the risk for stunting, mothers who were illiterate were more likely to have stunted children(Shah. et.al,2003)

Political situation

War and other catastrophic conditions are responsible for only a tiny part of the worldwide malnutrition crisis. But such emergencies, like the ongoing crises in the Great Lakes region of Central Africa and in the Democratic People's Republic of Korea, often result in the worst forms of malnutrition. Meeting food requirements in these situations is essential, but so is protecting people from illness and ensuring that young children and other vulnerable groups receive good care.

Socioeconomic situation

Malnutrition has long been recognized as a consequence of poverty. Despite the dramatic gains in reducing child malnutrition, the absolute number of malnourished children worldwide has grown. Individuals income variations , coupled with reductions in social protection, could effects on the nutritional well-being of children as in the industrialized countries.

Discrimination and violence against women are major causes of malnutrition. As women are the main care providers of nourishment during the crucial periods of children's development. Their caring practices affect children's nutritional well-being, particularly when women and girls face discrimination in education and employment. Poor household income and overcrowding are important risk factors for stunting(Shah. et.al,2003). Income growth could improve the food demand and nutritional outcomes(Alderman, et. al,2000). Discrimination and violence against women are major causes of malnutrition (UNICEF,1999)

childhood illnesses

Malnutrition is a consequence of disease and inadequate dietary intake, children have high mortality risk as a result of a common childhood disease than those who are adequately nourished. The malnutrition in early periods of life including the period of fetal growth is strongly linked with the later life development stages. The most critically vulnerable groups are developing fetuses, children up to the age of three and women before and during pregnancy and while they are breastfeeding. Malnourished children, are not protected from frequent illness and do not receive the adequate care especially in developing countries due to the limited resources and lack of health services. Malnourished children are more prone to illnesses and malnutrition is also commonly the result of illness that affects child growth and development. In parts of Africa where malaria is common, about one third of child malnutrition is caused by malaria. The disease also has dangerous nutritional consequences for pregnant women. In addition, pregnant women are more susceptible to malaria, and children born to mothers with malaria run a greater chance of being born under weight and anemic.

Maternal and child nutrition

Physical potential is shaped during the period from the conception, as child's organs and tissues, blood, brain and bones are formed. In the first 18 months of life human development proceeds rapidly, the nutritional status of pregnant and breastfeeding mothers and young children are important for a child's later development. Growth during the fetal stage depends on how well nourished a woman was before pregnancy, as well as how much weight she gains while she is pregnant. Birth weight will double in the first four months of life. And fulfilling the women’s food, health and care needs could be considered a struggle for many women in the developing world. (UNICEF,1998). Feeding pattern, family income, mother with anemia and drinking clean water were factors associated with children's anemia (Zeng LX, 2004). Children good nutrition could be clearly appear in their physical body built. They seems taller, stronger, healthier than their malnourished peers. Societies that meet women's and children's nutritional needs also lift their capacities for greater social and economic progress.

As stated in UNICEF (1998) the United Kingdom and some of Western European countries, half of the economic growth achieved between 1790 and 1980 was attributed to better nutrition and improved health and sanitation conditions. Nutrition could be protected even in countries with high poverty rate as it occurred in parts of Brazil, the percentage of underweight children decreased from 17 % in 1973 to under 6% in 1996.

Ensuring good nutrition is a matter of international law, every government in the world recognizes the right of all children to the highest attainable standard of health, including the right to good nutrition and its three vital components: food, health and care. Nutritional disorders in mothers, especially iodine deficiency, could produce varying degrees of mental retardation in her infant. About 60 per cent of women of childbearing age in South Asia where half of all children are underweight are themselves underweight. In South-East Asia, the proportion of underweight women is 45 per cent; it is 20 per cent in sub-Saharan Africa.(UNICEF,1998)

Low birth weight and child health

Low-birth weight babies, defined as weighing less than 2.5 kilograms, are at greater risk of dying than infants of average weight. If they survive, they will have more episodes of illness, their cognitive development may be impaired and they are also more likely to become malnourished. The effects of malnutrition cross generations. Malnourished and underweight mothers are likely to deliver small infants at birth. Low birth-weight and low body mass index of mothers were the strong predictors of stunting, whereas low birth-weight and iron deficiency were the strong predictors of anemia(Mamiro PS. et.al,2005)

Low-birth weight babies have IQs that average 5 points below those of healthy children. And children who were not breastfed have IQs that are 8 points lower than breastfed children.

Mothers are facing more difficulties in feeding low birth weight babies, and it could be the reason that clarify why the low birth weight babies at a higher risk to develop malnutrition. Currently about 24 million low-birth weight babies are born every year, about 17 per cent of all live births, mainly in developing countries.

Multi-gestational pregnancy and anemia

It is definitely known that twins pregnancy creates a heavy load on pregnant iron stocks. A study was conducted in Tunisia by Ben Miled (1989) among term newborns, aims to compare the risk of anemia among twins. The study results showed 3 and 6 months hemoglobin level and mean corpuscular hemoglobin are significantly lower in twins. Early preventive iron supplementation is essential to decrease the risk of anemia in twins (Ben Miled S, et.al,1989)

Child age, sex and nutritional disorders

Under nutrition showed higher risk among children under three years. The prevalence of anemia in children 6-23 months old was twice as high among children aged 24-59 months, 61.8% vs. 31%. The decreasing trend with age was significant. Anemia prevalence was similar in boys and girls (Mahgoub, S. et.al,2006). Anemia and iron deficiency increased strongly with age,(Seigel EH. et.al,2006). The prevalence of anemia among children was relatively high in 6-18 months age, and declining when children grew older(Zeng LX, 2004)

2.4.2 Consequences of malnutrition

Malnutrition is related to more than half of all child deaths worldwide. Its effects extend to the millions of survivors who are left crippled, chronically vulnerable to illness and intellectually disabled. Malnutrition is a real crisis and called the silent emergency. Its persistence has profound and frightening implications for children, society and the future of humankind. Of the annual preventable 12 million deaths among children below five years of age in developing countries over 6 million, (55%) are directly or indirectly attributed to malnutrition. (UNICEF, 1998). Nearly 2.2 million children die from diarrhea caused dehydration that is often aggravated by malnutrition Many children suffer from multiple types of malnutrition and numbers tend to overlap. At global level, about 226 million children are stunted. This type of nutritional disorder is associated with a long-term reduction in dietary intake, most often closely related to repeated episodes of illness and poor-quality diets.(UNICEF, 1998). About 67 million children are estimated to be wasted, below the weight they should be for their height, as a result of reduced dietary intake, illness, or both. Nearly 183 million children weigh less than they should for their age (the same source).

The effect of malnutrition on human performance, health and survival have been the subject of many extensive researches for several decades. It considered as an underlying factor in many diseases in both children and adults. Malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, physical work capacity and consequently impacts on human performance. Malnutrition is a consequence of disease and inadequate dietary intake, more elements social, political, economic, cultural are involved beyond the physiological situation. Even mild vitamin A deficiency impairs the immune system, reducing children's resistance to diarrhea, which kills 2.2 million children a year Malnourished children, unlike their well-nourished peers, not only have lifetime disabilities and weakened immune systems, but they also lack the capacity for learning in comparing to their well-nourished peers. (UNICEF,1998) Children who are severely underweight found to be two to eight times more liable to die within the following year compared to children of normal weight for their age. Malnutrition varies in its forms and each might contribute to the other, such as the protein-energy malnutrition, the micronutrients deficiencies such as iodine, iron and vitamin A. The World Health Organization (1995) and the UNICEF (1998).

2.4.3 Causes of Anemia

Iron deficiency anemia (IDA) is a decrease in the red blood cells numbers due to insufficient iron intake. Iron is an essential component of hemoglobin synthesis. Lack of iron in the children's diet could lead to iron deficiency anemia. Children requires approximately 2.0 mg iron/day and if they did not receive their daily requirements of iron, anemia could be developed (scrimshaw,1991). The most common causes of IDA in general are due to lack of iron intake, blood loss, poor absorption of iron due to presence of inhibitors such as Tannin in the tea, phytate, calcium and phosphates Tea drinkers showed higher anemia prevalence (Disler et al ., 1975; Rossand et al., 1979; Galan et al., 1985; Razagui et al. , 1991). In the first

6 months of age, iron stores are dependent on what has occurred in pregnancy. Due to the possible low stores of iron during pregnancy, low birth weight or premature infants are particularly vulnerable. During the following six to twelve months iron deficiency can be brought on by poor feeding practices. At this age prolonged exclusive breast feeding, delayed introduction of foods, lack of meat in the diet or over dependence on caws milk may bring on anemia. The prevalence of iron deficiency anemia has declined over the past decades but, infants with low birth weight, or fed whole caws milk during the first year of life, and those from low socioeconomic status still at risk to have anemia (Soh P, 2004) . In addition , there is a number of the types of anemia with different causes as the following .

Iron deficiency anemia (IDA) is the most common type of anemia. Occurs when there is insufficient iron in the body.

Megaloplastic (or vitaminB-12deficiency) anemia. Lack of folic acid or vitamin B-12 in the body could lead to this type of anemia.

Megaloplastic (or vitaminB-12deficiency) anemia. Lack of folic acid or vitamin B-12 in the body could lead to this type of anemia.

Inherited blood disease. Family history due to genetic causes could lead to a higher risk to have the disease. Sickle cell anemia is one type of inherited blood disease.

Aplastic anemia. This rare problem happens when the body is unable to synthesis enough red blood cells. For further types of anemia details see literature appendix (2)

Signs and symptoms of Anemia

Anemia sings and symptoms are depending on the cause and the severity of anemia,. It might developed gradually without notable signs and symptoms. Anemia mainly associated with pale skin color (pallor), Irritability, Weakness, Shortness of breath, Sore tongue, Spoon-shaped brittle nails, unusual food cravings (called pica), headache and decreased pinkness of the lips in addition to Blue-tinged or very pale sclera (whites of eyes), recurrent infections, Decreased attention

Span, and could be asymptomatic in case of mild anemia (Miller.R,2006)

2.4.4 Consequences of Anemia

Anemia has an important health, welfare, social and economical consequences. These includes reduced work capacity, increased mortality risk in complicated cases, particularly during the prenatal period**.**

It considered as a major cause for malnutrition, leads to loss of appetite, which reflect negatively on the general health of the children and cause malnutrition**.** The deficiency may result in impaired cognitive development, lower IQ. Some times, the effect of nutritional deficiencies could be irreversible. Women and children are the most vulnerable group to have anemia (IDA). It considered a major contributing factor of post partum maternal mortality (WHO,1991), (Miller.R,2006)

At the mother child health level

Three quarters of the children who die worldwide of causes related to malnutrition are described as mildly to moderately malnourished with no signs of problems. More than 2 billion people, mainly women and children, are iron deficient, and the World Health Organization (WHO) estimates that 51 per cent of children under the age of four in developing countries are anemic. (WHO,2002). Anemia as a malnourishment form has been identified as a contributing factor, if not a principal cause, in 20 to 23 per cent of all post-partum maternal deaths in Africa and Asia (UNICEF,1998)

Anemia is a factor affect the pregnancy and childbirth, the estimates to its complications that it kill 585,000 women annually; folate deficiency in mothers at risk can cause birth defects in infants, such as spina bifida. Iron deficiency anemia can delay psychomotor development and impair cognitive development, lowering IQ by about 9 points especially in infancy and early childhood. Anemic pre-school children have been found to have difficulty in maintaining attention and discriminating between visual stimuli. Poor school achievement among primary school and adolescent children has also been linked to iron deficiency. Limited mental as well as physical potential of malnourished children could affect the way they will face the future. They will become adults with lower physical and intellectual abilities. Iron-deficient children under the age of two years show problems with coordination and balance and appear more withdrawn and hesitant. Decrease child's intellectual ability to interact with and learn from the environment.

At the socio economic level

Anemia is ignored in most majority population countries despite, it is one of the most prevalent public health problems which has serious consequences for national development. Iron deficiency causes at least 50% of all anemia, and a million annual deaths; three-quarters of these deaths occur in Africa and South-East Asia. At the global level (IDA) is classified in the "top ten" risk factors that contribute to burden of disease as stated by UNICEF report (1998). A study estimates the economic costs of IDA at 4.05% of gross domestic product (GDP)—US$2.32 per capita in lost productivity and US$14.46 per capita in lost cognitive function. About $50 billion in GDP is lost annually world wide in low-Estimates of Economic Losses from Iron Deficiency Anemia (Cognitive & Productive) (Horton and Ross,2003)

It could lower the levels of productivity and higher levels of chronic illness and disability, often in societies with little economic capacity for even minimal therapeutic and rehabilitative services. Malnutrition often linked to disability and illness which increased the costs and expenses at the family level. Especially in poor and limited social and health services as in the developing countries. In 1990 alone, The worldwide loss of social productivity caused by four over lapping types of malnutrition, nutritional stunting and wasting, iodine deficiency disorders and de efficiencies of iron and vitamin A amounted to almost 46 million years of productive, disability-free life.

Vitamin and mineral deficiencies are estimated to cost some countries the equivalent of more than 5 per cent of their gross national product in lost lives, disability and productivity. Bangladesh and India forfeited a total of $18 billion in 1995. Malnourished children's low resistance to illness, decreased the effectiveness of the available resources and decreased the access to the other basic health services and sanitation. (UNICEF,1998)

2.4.5 Prevention and management of anemia

■**Diet**, Child's diet is the most important approach to prevent and treat mild iron deficiency.

Miller. R(2006) mentioned Good choices for diet include iron fortified grains and cereals, red meat, egg yolks, leafy green vegetables. Too much milk drinking could worsening anemia status as it cause iron loss through intestinal walls, and decrease the appetite for solid foods. For picky eaters, vitamins supplementation that includes iron may be needed. Hem iron is better absorbed than Nonheme iron.

The amount of iron varies according to the type of food as iron dietary sources are divided into:

Best sources: breast milk, formula with iron, iron fortified cereals, liver, prune juice

Good sources: eggs, meat, fish, chicken turkey, soybeans, peanut butter, dried beans, lentils, molasses, peas

Other sources: tuna, apricots, raisins, kale, prunes, greens .

■**Iron and Breast milk:** Many literatures mentioned that, iron content of breast milk is often low, but it is adequate to prevent iron deficiency anemia for at least the first 6months of life, and iron deficiency does occur if the same amount of iron received from food other than breast milk as the breast milk iron considered highly absorbed in comparison to iron from other sources (Stekel A, 1984), (Miller. R, 2006),(American Family Physicians, 1995). Morning milk contains less iron than evening milk during the single feeding, the fore milk has a lower iron concentration than the hind milk, the range being from 0.3 to 1.0 Mg/ml, it also varies between women, even in the individual woman during the lactating period, the day and the nursing period. For further information see (literature appendix 4).

Chapter Four

Results for the survey carried out on children 6-24 months at Yatta (Stage one)

4.1 Introduction

In total 1565 child in the age group 6-24 months were tested through a health services project provided by Ard El Atfal (AEA) jointly with Tdh Italy in Yatta area, which targeted all Yatta children in this age group. In this chapter, the basic characteristics of the study population are described. The results of the nutritional status assessment for the children; assessed by anthropometric measurements including weight, height, and head circumference are presented, and also their blood test results for measuring their hemoglobin level are shown. The findings of the structured questionnaire, filled for each child in the sample to collect data about his nutritional status and socioeconomic factors are shown. Data was collected during field visits and routine work at Yatta clinic facilitated through the health team of Ard El Atfal clinic (AEA /local NGO) with the participation of the researcher, as he was a member of its staff.

4.2 Data analysis

4.2.1 Description of the first stage

The study population consisted of 1565child aged 6-24 months from Yatta town, 734 females (46.9%) and 831males (53.1%). Based on the nutritional and anemia status, children were classified into two groups, 512 healthy children (not anemic, not malnourished), and 1053 unhealthy (anemic, or malnourished children or both). Characteristics of the children and their mothers are presented below.

Socioeconomic conditions

Family working members: About 34.2% (536) of the total study subjects were considered social cases according to the project social cases criteria, most of these social families have income less than 600 NIS (social families criteria mentioned at definitions Appendix). In total 44.4% of the families have none of its members working, 51.6% (802) of the total families have one member working for income, and 3.5% (54) have two workers. Farther more the fathers represented 53.4% (835) of the workers in the families and the rest of the fathers 46.6% (730) were not.

Familial and house conditions**:** From the total tested families, only 1.9 % (30) were refugee and the rest were non refugee. About77.9% (1219) of the total sample children were living in nuclear families and the rest 22% (345) were living in extended families.

Based on the criteria used for house condition classification (Appendix…..) only 57.2% (895) of the children lived in a healthy house and the rest 34.3% (536) were living in unhealthy home conditions. Out of the tested children, about 43.5% (681) were living in families composed of six members or less and the rest 56.5 % (884) were living in family consisting of seven members or more. From the total group 29% (455/1565) families had three children or more of which their ages were less than five years, while the rest of families 71% (1110) had only one or two children below five years old. On the other hand about 60.3% (943) had 1-5 children aged 5-15 years.

Maternal characteristics

Mothers Age

Mother’s age ranged between 16-48 years. About 42.6% of the total children mother's aged less than 26 years old, and the rest (57.2%) age was between 26-48 years. The following table (6) showed the distribution of mother ages

Mother age group	Frequency	%
Below 20 years	97	6.2
20-25	570	36.4
26-30	443	28.2
31-35	256	16.4
36-40	160	10.4
Above 40	39	2.4
Total	1565	100

Chi-sq goodness of fit = 824.323 P ≤ 0.000

Mother's education:

Of all children's mothers, about 88.8 % (1392) had any type of school education whether primary or secondary and only 6.5% of the total mothers had a collage or university education. Mothers that received no school education at all represented 11.1% (172)

From the total of 984 (62.8%) mothers who had education of preparatory to primary school level, about (68.1%) 671 had anemic children.

Children's characteristics:

Age

As stated before, the population consisted of 1565child aging 6-24months. About 46.9% (734) of the sample were females and 53.1% (831) were males. The age distribution for the total sample was as the following:

- 6-11 months were 1095 children representing 70% of the sample
- 12-17 months were 313 children representing 20% of the sample
- 18-23 months were 157 children representing 10% of the sample

The study was divided into two stages according to the child's nutritional status, a healthy group (Not anemic, not malnourished) consisting of 512 child and an unhealthy group (anemic, malnourished, or both) consisting of 1053 child. The age distribution of the children in each group presented in table (2) showed a significant relation (chi =72.386, P<0.0001) between age and being unhealthy age. The percentage of unhealthy among the all children in the group (1565)decreased from (75.4) in the age 6-11 to (19) in the age group 12-17 (OR= 1.47) and to (5.6) in the age group 18-24 (OR=4.5). Males represented 57.4% (456) from the total unhealthy group (794) that aged 6-11 months. The age group 6-11 months was represented the highest percentage (75.4) among the unhealthy children as showed in table (2).

Table (7) showed the distribution of the children according to the health status by age

Age group	**Healthy children**	**%**	**Unhealthy children**	**%**	**Total**	**OR**
6-11 months	301/512	58.8	794	75.4	1095	**1**
12-17 months	112	21.9	201	19	313	**1.47**
18-23 months	99	19.3	58	5.6	157	**4.5**
Total	512	100	1053	100	1565	

Mantel Haugel chi- square for = 72.386 (df=1), P < 0.0001

Child sex

As stated before the study children were 1565 child divided by gender into 734 females (46.9%) and 831 males (53.1%)

Table (8) The distribution of the sample according to the age groups of children by gender

Age group	**Males**	**%**	**Females**	**%**	**Total**	**%**	**OR**
6-11 months	602	72.4 %	493	67.2 %	1095	70	
12-17 months	159	19.2	154	21	313	20	**6.2**
18-23 months	70	8.4	87	11.9	157	10	**0.66**
Total	831	100	734	100	1565	100	

Chi- square =83.71 (df=2)P<0.001

Males were represented 52.3% among the unhealthy group children (malnourished or anemic) while females were representing 47.7%. The Odds ratio) was higher in males (53.1) in comparison to the Odds ratio in females (46.9) as showed in

Table (9). The distribution of the sample according to gender by nutritional status

Age group	**Healthy children**	**%**	**Unhealthy children**	**%**	**Total**	**OR**
Males	184	56.1%	637	52.3%	821	

Females	144	43.9	581	47.7	725	1.17
Total	328	100	1218	100	1546	

Chi- square = 1.497 (df=1) P=.221 ***OR=1.17***

Gestational age at birth

Out of the total children, about 96.3% (1014) were born as a full term pregnancy results (>37 weeks), while 3.7 % (39) were born before the 36 weeks of pregnancy (premature).

A total of 214 child representing a percentage of 20.3 from the total (1050) malnourished or anemic children in the age group 6-24 months were born with a low birth weight (<2.5 k.g). (Regarding this variable, data was available for cases only)

4.2.2 Nutritional status analysis and malnutrition prevalence

About 53.8% of the total cases were not malnourished; while 46.2 % were malnourished classified as follows: 38.2% of the total cases have first-degree malnutrition, 7.5% have second degree, and 0.6%have third degree according to the classifications of. Gomez and waterloo graph that was used by AEA. When the Z score was used for the classification of malnutrition problems (-2SD), it showed that about (328 child) 21.2% of the total children were malnourished. The three types of malnutrition were distributed as the following: Stunting was 15.8% (245) from the total children. Wasting (Wt-Ht) was (52) 3.4% and underweight (lightness: weight- age) was (165) 10.7 % from the total children in the study (1565).

Children's diet

Out of the total 1565children, about 32.1% ate ten meals per day, while 25.3% ate eight meals. For the description of the feeding pattern for children, data was available for cases only (malnourished or anemic children). Regarding the type of meals for these cases 3.5 % were breast fed only, while, 0.9% had breast feeding + bottle milk, 58.8% had breast feeding + soft, 1.1% had bottle milk only, 17.9% had bottle milk & soft, 8.8% had breast feeding +bottle milk & soft and the rest 8.9% depended on family food.

Malnutrition and diet

With regard to the malnourished children in the age group 6-12 months, 52.6% had received soft food and or other source of nutrition (breast milk and or artificial milk) as showed in the following table:

Table (10) Nutritional status distribution by nutrition type for children aged 6-12m

Feeding type	**Total Malnourished children (6-12m)**	%	**Total Not malnourished (6-12m)**	%	**OR**
BF only or Breast and fluid	7	4.0	27	4.4	
BF + bottle milk	2	1.1	8	1.3	0.964
BF + soft	92	52.6	423	68.8	0.839
Bottle milk only	6	3.4	5	0.8	4.629
Bottle milk + soft	37	21.1	88	14.3	1.622
BF + bottle + soft	29	16.6	56	9.1	1.997
Family food	2	1.1	8	1.3	0.964
Total	175	100.0	615	100.0	

Chi-sq= 23.87 p<0.001

Even in the age group 13-24 months, malnutrition prevalence was the highest (66.1)

among the group of children who were receiving soft food and or other source of nutrition

whether breast milk and or artificial milk as shown in the following table:

Table (11)Nutritional status distribution by nutrition type for children aged 13-24 m

Feeding type	Total malnourished aged 13-24 month	%	Total Not malnourished aged 13-24 month	%
BF + soft	26	36.1	77	42.5
Bottle milk + soft	18	25.0	44	24.3
BF + bottle + soft	4	5.6	3	1.7
Family food	24	33.3	57	31.5
Total	72	100.0	181	100.0

Chi-sq= 23.89 p<0.001

Table (12) Nutritional disorders distribution by nutrition type for children 6-12 month

Feeding type	Healthy (not malnourished)	Malnourished	OR
BF only	27	9	
BF + bottle milk	8	2	1.33
BF + soft	423	120	1.18

Bottle milk only	5	13	1.13
Bottle milk + soft	88	62	0.47
BF + bottle + soft	56	39	0.48
Family food	8	3	0.89
Total	615	248	

Chi- square =47.6 , P<0

For children in the age group 6-12 months, nutritional disorders (wasting, stunting and

underweight) were prevalent (89.1%) among those receiving soft food and other source

of nutrition (breast milk and or artificial milk) as showed in table (13)

Table (13) Nutritional disorders distribution by nutrition type for children 6-12 month

Feeding type	**Healthy (not malnourished)**	**Malnourished wasting**	**Malnourished Stunting**	**Malnourished Under weigh**
BF only	27	3	5	1
BF + soft	423	39	67	14
Bottle milk only	5	6	6	1
Bottle milk + soft	88	27	25	10
BF + bottle + soft	64	15	24	2
Family food	8	1	1	1
Total	615	91	128	29

Even in the age group 13-24 months, the tree types of malnutrition still the highest among

those receiving soft food and other source of nutrition

(Breast milk and or artificial milk) as shown in the following table:

Table (14)Nutritional disorders distribution by nutrition type for children 13-24 m

Feeding type	**Healthy (not malnourished)**	**Malnourished wasting**	**Malnourished Stunting**	**Malnourished Under weigh**
BF + soft	77	15	22	3
Bottle milk + soft	44	10	12	2
BF + bottle + soft	3	3	3	1
Family food	57	11	17	6
Total	181	39	37	12

From the above six tables it was clear that the most common type of feeding provided to

the children in the age group 6-24 months was breast feeding and soft food

Table (15)Nutritional disorders distribution by nutrition type for children 13-24 m

Feeding type	**Healthy (not malnourished)**	**Malnourished wasting**	OR
BF + soft	10	40	
Bottle milk + soft	44	24	7.33
BF + bottle + soft	3	7	1.71
Family food	57	34	6.71
Total	181	88	

Chi- square =30.98 , P<0.001

4.2.3 Anemia

A total of 1037 child representing a prevalence of 66.4 % from the total sample were found anemic. There distribution by degree of anemia was as following:

- Mild anemia: 607 children representing a prevalence of 38.9 in the total sample (1565)
- Moderate anemia: 429 children representing a prevalence of 27.5 in the total sample
- Severe anemia: One child representing a prevalence of 0.1 in the total sample.

Factors associated with anemia

In the previous section, I have presented the general situation and characteristics of the children and their mothers with regard to each variable tested. In this section I am presenting only the significant relations between anemia and the other independent variables. For more detailed information about the measure of significant relationships between anemia and the other variables (See Appendix table 1)

Significant relationships

To find out which of the factors of age, sex and birth type were associated with anemia, this dependant variable (anemia) was cross- tabulated with these variable. Following is the summary of the results:

<u>Anemia and age</u>

Age group and anemia : When age was categorized into groups, the age group of 6-11 had the highest prevalence of 71.4 (779) among the anemic group(1037) followed by 12-17 months as the second age group affected by anemia and had a prevalence of 63.8 (200) (OR=0.711).

Table (16) showed anemia prevalence among age groups

	Child age in age groups						Total	%
	6-11	%	12-17	%	18-23	%		
Anemic	779	71.4	200	63.9	58	36.9	1037	66.4
Not anemic	313	28.6	113	36.1	99	63.1	525	33.6
Total	1092	100	313	100	157	100	1562	100
OR			**0.711**		**0.235**			

($x^{2= 73.860}$, P= .000).

Based on the above table, a significant relation ship was detected between anemia and children age groups.

Also a significant positive relationship was detected between hemoglobin level and age group division. Correlation r = 0.19 P value of .000 for Chi-square of 75.296 as shown in

Table (17) Anemia degrees distribution by age groups

Anemia degree	Child age in age groups						
	6-11	%	**12-17**	%	**18-23**	%	Total
Not Anemic	313	28.6	113	36.1	99	63	525
Mild	451	41.3	117	37.4	39	24.8	607
Moderate + (1 case severe)	328	30.1	83	26.5	19	12.2	430
Total	1092	100	313	100	157	100	1562

(X^2= 75.296, P=. 000)

Anemia and sex

The total sample 1565 consists of 734 (46.9%) females and the rest (53.1%) were males children. When the total anemic cases (1037) were divided by gender it showed that, A total of 586 children representing a percentage of 56.5% from the total anemic children were males. A significant relation ship between child sex and anemia was detected had a P value of .000 for chi- square of 14.089 Table (11) showed anemia distribution by gender

Table (18) showed anemia distribution by gender

Anemia status	Child sex				Total
	Male	%	Female	%	
Anemic	586	70.6	451	61.6	1037
Not anemic	244	29.4	281	38.4	525
Total	830	100	732	100	1562

(X^2 = 14.089, P=.000) OR=1.5

Anemia cases were classified (mild, moderate and severe) by gender. Moderate anemia was found to be higher in males representing a prevalence of 24.9 (259) in comparing to females prevalence of moderate anemia 16.3 (170). A significant relationship between the degrees of anemia and the child sex was detected which had a P value of .000 for a chi square of 19.639

Table (19)showed anemia degrees distribution by gender

Anemia status	**Males**	**Females**	**Total**	**OR**
Not Anemic	244	281	525	Reference
Mild	327	280	607	1.35
Moderate and severe	259	171	430	1.74
Total	830	732	1562	

(x^2 of 19.639, P=.000) person's r= 0.11

Anemia and birth type

Anemia was classified in accordance to child birth type as a single or part of a twin baby, A significant relation ship was detected between anemia and the variable, which had a P value of .048 for a x^2 of 7.809 . Anemia prevalence was 93.1% (27) among the 29 part of twin babies.

Anemia and family social situation

Out of total 1565 families about 533 families were classified as a social cases. These cases represented the children who lived in poor socioeconomic situations. The child anemia status was affected by the social situation of the family that the he lived in. A significant relation ship between anemia and being a child living in poor socioeconomic condition (social cases) was detected which had a P value of .005 for $x^{2=}$ 8.070 and anemia prevalence among the social cases children was 71.1 (379).

Anemia and mother education

A significant relation ship between mother education level and anemia was detected OR= 0.62 (x^2 = 8.750 , P=.010) From the total anemic children, about 46.1% (478) child their mothers years education ranged between 0-6 years. The highest percent of not anemic children was found among those for mothers with collage or university education.

Anemia and other not significant relations

Anemia relationship was tested also with the variables of stunting, wasting, underweight and child feeding. None of these variables showed a significant relationship with anemia. Below is a summary information about the none significant relationships with anemia. Table (20) summaries the variables and their chi squares test significance results.

Variable	Chi Square Value	P – value	OR
Stunting and anemia	$x^{2 = 2.311}$	P=. 139	0.79
Wasting and anemia	$x^{2= 2.597}$	P= .107	0.59

Underweight and anemia	$x^{2=}$2.79	P=.095	0.74
Child feeding and anemia	$x^{2=10.835}$	P=.685	-

Anemia and underweight

A non significant relationship between underweight (wt-age)and anemia was detected. OR =0.74 ($x^{2=}$ 2.79 P=.095).The prevalence rate of underweight among anemic children was 88.5 %. From total anemic (1027, about 88.5 % of children were under weighted

Anemia and wasting

Chi- Square test showed a presence of relation between wasting (Wt-Ht)and anemia but not statically significant one. Wasting prevalence rate represented 96.1 (987/1027) among anemic children.

Anemia and child feeding

Despite, the absence of a significant relationship between the type of food the child received and anemia, different types of foods showed different anemia rates. For all children in the study, anemia prevalence rate was 98.9% (610/617) among children fed by breast feeding and soft food. From total 617 children who were breast fed and fed on soft food as daily feeding pattern about 98.9% (610) were anemic, while anemia prevalence was 99.5% (186) among total 187 children were fed bottle milk (artificial cows milk) and soft food.. From total children who were fed by exclusive breast feeding (35), about 97.1 (34) were anemic

The sample 1565 child was distributed according to the feeding pattern as the following:

Table (21) Anemic status distribution by nutrition type for children aged 6-12m

Feeding type	**Total anemic aged 6-12month**	**%**	**Total Not anemic aged 6-12 month**	**%**

BF only	33	4.3	1	8.3
BF + soft	510	65.5	6	50.0
Bottle milk only	10	1.3	1	8.3
Bottle milk + soft	123	15.7	1	8.3
BF + bottle + soft	103	13.2	3	25.1
Total	779	100	12	100

Chi-sq)= 8.2 p>0.05 p=0.315

Based on the above table, the highest percentage of anemic children in the age group 6-12 months was (92) among those receiving soft food and other sources of nutrition (breast milk and or artificial milk).

Even in the age group 13-24 months, anemia prevalence still the highest (65.9) among those receiving soft food and other sources of nutrition (breast milk and or artificial milk) as shown in table (22).

Table (22) Anemic status distribution by nutrition type for children aged 13-24 m (above one year)

Feeding type	**Total anemic aged 13-24 month**	**%**	**Total Not anemic aged 13-24 month**	**%**
BF + soft	100	38.8	1	100
Bottle milk + soft	64	24.8	0	0
BF + bottle + soft	10	3.9	0	0
Family food	84	32.6	0	0
Total	258	100	1	100

Chi-sq)= 1.57 p>0.05 p=0.905

4.2.4 Factors associated with Malnutrition

The nutritional disorders wasting, stunting and underweight were tested with several variables. Some of the tested variables showed a significant relationship with the nutritional disorders and others showed none significant relationship. In this section , I will present the variables that showed significant relationships with each nutritional disorder separately. For further information about the measures of associations with these significant variables, see a summary significant table annex no.....

Birth type of the children was significantly associated with all malnourishment indicators, stunting and underweight (wt-age). Below is a summary of the significant relationships between malnutrition disorders and the other variables

Stunting

Stunting relationships were tested with the following variables, showed a significant relationships.

■*Stunting by mother education:* A significant relationship was detected between stunting and mother's level of education with P value of .070 and chi square 3.3

■*Stunting by social situation:* A total of 100 stunted child representing a percentage of 19 from total social cases children (527) and these represented a stunting prevalence rate of 19 % among the social cases children whereas stunting prevalence was 14.2 % (145) among children living in better social situations (not social cases 1019). A significant relationship was detected between being a social case and stunting ($x^{2=}$5.866, P= .015).

■A significant relationship was detected between home status and stunting ($x^{2=8.9}$, P= .003) OR= 1.54

■Stunting by refugee type**:** A significant relation between being refugee child and stunting was detected (x^{2}= 4.586, P=. 032) OR= 0.43 Stunting rate among 30 refugee children was 30% (9) comparing to 15.6% (236) stunting rate among 1515 non refugee children.

■*Stunting and feeding type*: A significant relationship between the type of food that the child received as a daily feeding and stunting was detected, with P value of .008 for x^{2} of 20.477 The prevalence of stunting among 617 children were fed by breast feeding and soft food as daily feeding pattern was 14.5 (89) where as it was 19.9 (37) among the total children (187) which were fed bottle milk (artificial cows milk) and soft food. The least stunting percent was among children who were fed by exclusive breast milk 14.3% among all stunted children.

■Stunting and birth type: A significant relationship between birth type (born type) and stunting was detected, this relationship had a P value of .003 for a x^2 of 8.687 was observed. The prevalence of stunting in a single child was 16.9 (171) where as in part of twins it was 37 (11) (OR=3.01.)

■***Stunting* and child sex**: A significant relation ship between child stunting and sex was detected (x^{2}=5.55, P=.021). Stunting among males was higher than females Odds ratio (OR) =0.72 (95% CI= 0.54 – 0.94)

Table (23) showed stunted children distribution by gender

Stunting (Height – Age	**Child sex**				Total
	Male	%	Female	%	
Height –age >= -2SD	674	82.1	627	86.4	1301
Height –age < -2SD	147	17.9	98	13.6	245
Total	821	100	725	100	1546

Wasting

■*Wasting by feeding type*: A significant relationship was detected between wasting (wt-Ht) and the type of food that the child received as daily feeding. This relation had P value of .017 and chi square of 10.078 From total 615 children were fed by breast feeding and soft food as daily feeding pattern about 2.8 % (17) were wasted where as from total 186 children were fed bottle milk (artificial cows milk) and soft food, about 6.5%(12) were wasted

■*Wasting by birth type*: A significant relationship was detected between wasting (wt-Ht) and the birth type. This relation had P value of .000 and chi square of 13.255 OR= 0.87

Under weight

■*Underweight by child feeding type*: Child feeding, and under weight (wt-age) also showed a significant relation with P value of .000 and chi square of (39.042). From total 615 children were fed by breast feeding and soft food about 8.8% (54) were underweighted while from total children were fed bottle milk (artificial cows milk) and soft food (186), about 19.9%(37) were underweighted. The least underweight percent was among children who were fed by exclusive breast milk 8.6 % among all underweighted children

■ Under weight (wt-age)and birth type: The OR was 3.9 as its prevalence among total single born children was 11.8 (120) where as in part of twins it was 34.5 (10). A significant relationship between the born type and underweight was detected had a P value of .000 and chi square of 13.255

■ Underweight by home status: showed a significant relation with P value of .000 for a chi square of 12.8 The prevalence rate of underweight among 528 children were living in an unhealthy home status was 15% whereas underweight prevalence rate was 8.8 % (78 child) among 887 children were living in better homes situations (healthy houses Appendix).

■ Underweight by the number of workers in the family: The prevalence of underweight(wt-age) among 685 children had no working members in their families was 12.1% (83) Comparing to 15.6% (123) among 789 children having one member working in their families and for 54 families having two members working only 9.3% (5) children were under weighted. Under weight was not found among any children were living in the families having three working members.

Nutritional disorders and other non significant relationships

Nutritional disorders relationships were tested with twenty variables. None of these variables showed a significant relationship. For detailed information see appendix table (…..). Despite the non significant relationship between the variables which were showed in the appendix table , cross tabulation showed the following:

Birth type and nutritional disorders

From total single born children about 3.9% (40) child were wasted, while wasting was 3.4% (1) among part of twin born children

Social situation and nutritional disorder

Underweight prevalence rate among social cases children was 12.7 % which was higher than the non social children who had prevalence of (9.6%). From total 527 children living in poor social conditions (social cases), about 12.7% (67) were underweighted children while underweight was 9.6% (98) among children living in better social conditions (not social cases 1019).

Mother education and nutritional disorder

■Mother education and wasting (Wt-Ht): For total mothers who received no type of school education (171), about 5.3% (9) child were wasted, while from 515 mothers receiving primary school education, about 4.1% (21) child were wasted, and from total 98 mothers receiving collage or university education about 2% (2) children were wasted

■Mother education and underweight (wt-age): From total mothers not receiving any school education (171), about 18.7% (32) child were under weighted, while from 515 mothers receiving primary school education, about 11.8% (61) child were under weighted, and from total 98 mothers receiving collage or university education about 3.1% (3) children were under weighted.

Number of workers in the family and nutritional indicators

■Number of workers in the family and stunting: Among the total of 685 children having no one working in their family, about16.8% (15) children was stunted and from 789 children having one member working in their families, about 15.6% (123) child were stunted. Only 9.3% (5) stunted children from total 54 children having 2 members working in their families.

Stunted was not found among any child living in a family having three working members.

■Number of workers in the family and wasting (Wt-Ht) From total 685 child having no body working in their family, about 3.8% (26) child were wasted and from 789 children having one member working in their families, about 3.2% (25) child were wasted, while only 1.9% (1) wasted children from total 54 children having 2 members working in their families. Wasting was not found among children in families having three working members.

4.2.5 Children follow up pattern

From a total of children that were diagnosed as anemic or malnourished by AEA team; follow-up data was available for 1053 child. These children follow-up has attributed to a total of 4400 visits which were distributed as a following:

Health center visits: The mothers brought their children to the health center for various reasons, whether for medical counseling issues or receiving the next dose of iron treatment. These has contributed to a total of 3169 visits with an average of 3 visits per child

Home visits: When the mothers did not arrive on the regular time to receive the next dose of iron for their children while there was a medical need for the child attendance, field health workers did those home visits These has contributed to a total of 1231 (27.9%) of the total visits.

4.2.6 Discharge analyses findings

Children admitted for treatment (anemic, malnourished or both) were discharged when they finished their iron course treatment or when became well according to the project protocol. Data collected on the discharge of cases showed the following:

The average length of stay in the program for all discharged was 17 weeks(4months), with an average weight gain of 400 g per month

The average length of stay in the program for only anemic cases was 14 weeks with an average weight gain of 325g per month.

The average length of stay in the program for only malnourished cases was 23 weeks with an average weight gain of 620g per month.

Nutritional problems recurrence in the families

When mothers were asked about whether they have another child that had previously received treatment in AEA (previous file opened) for anemia or malnutrition other than the current child 79.4% (837) reported such recurrence in the family.

4.3 Children below 6 months of age

(The 2nd Stage results)

4.3.1 Introduction

In this chapter, the basic characteristics of the second study population are described, together, with the nutritional status of the currently non-pregnant women (15-49 years) and their children under 6 months of age in Yatta area. The nutritional status for children was described by anthropometric measurements including weight, height, and head circumference also their blood was tested for Hb and serum ferritin. The relationship of malnutrition and anemia with certain variables including demographic, socioeconomic, and women's health related factors were assessed. For mothers the nutritional status was assessed by measuring their hemoglobin and serum ferritin levels. In total 200 women and their children were examined.

4.3.2 Description of the 2nd Study population

4.3.3 Description of the mother’s variables:

Mothers Age

The average age of mothers in the sample was 28 years ranging from 16-46. Of these mothers 6.2 % mothers were currently below 20 years of age. 70.8% were below 30 at the time of the interview.

The following table (24) showed the distribution of mother ages

Mother age group	**Frequency**	**%**
Below 20 years	97	6.2
20-25	570	36.4
26-30	443	28.2
31-35	256	16.4
36-40	160	10.4
Above 40	39	2.4
Total	1565	100

Chi-sq (5 d.f)= 824.32 p<0.001

Age of Mothers at marriage

The average age of mothers at marriage was 18 (14-37). About 6.5% (13/200) of the mothers were 14 years old at marriage and 16.5% (33) were 16 years old. In total 46% (92/200) were below 18 (data not showed) and 72.5% were below 20 at marriage. The most frequent age of marriage for mothers was 16-17 years, as (65) 32.5% of all mothers got married at this age.

Table (25) represents the distribution of mothers age at marriage

Mother age of marriage	**NO of mothers**	**%**
14-19	145	72.5
20-25	44	22

26-30	7	3.5
31-35	2	1
36-40	2	1
Total	200	100

Chi-sq. (4 d.f)=379.15   p<0.001

Age of Fathers at marriage

Out of the total fathers in this study population, about 102 fathers representing a percentage of 51 were married at the age of 20 to 25 years old. The average age of fathers at marriage was 23 (14-75). About 3.5 % (7 of the fathers) were 16 years old or less when they got married and 19.5% (39) were 18 or less years old. While (69) 34.5% of the fathers got married between the age 18-20years. In total 29% (58) fathers were below 20 and 79.5% (159) were 25 or less at marriage (data not shown).

Table (26) represents the distribution of fathers age at marriage

Father age of marriage	NO of fathers	%
14-19	57	28.5
20-25	102	51
26-30	27	13.5
31-35	7	3.5
36-40	1	0.5
41-45	2	1
>45	4	2
Total	200	100

Chi-sq. (6 d.f)=246.6   p<0.001

Education

Educational level of mothers

Table (27) shows the distribution of the mothers years of educational level. The average number of years for mothers education was 5.54 (0-16). About 11.5 %(23) of the mothers did not receive any school education, whereas 36% (72) had only elementary school education. Out of the 200 mothers only 0.5% (1) had collage education. And 2.0% (4) had university education.

Table(27) Shows the distribution of mothers years of education

Mothers years of education	**No of mothers**	**%**
0	23	11.5
1-6	72	36
7-12	100	50
13-18	5	2.5
Total	200	100

Chi-sq. (3 d.f)=114.76   p<0.001

Educational level of fathers

The average years of fathers education was 5 (range 0-18). About 7 %(14) of the fathers did not receive any school education and 36 %(72) had only elementary school education. Out of the total 200 fathers, only 2.5% (5) had received a collage education and 4% (8) had received university education. (data not shown).

Table(28) Shows the distribution of fathers years of education

Fathers years of education	No of Fathers	%
0	14	7
1-6	72	36
7-12	98	49
13-18 (Post school education)	16	8
Total	200	100

Chi-sq. (3 d.f)=104.8   p<0.001

Family size

The average family size was 7.87 members. Of the 200 families 17.5% (35) composed of 1-4 members, 55.5% (111) composed of 5-9 while the remaining 27% (54) of the families composed of 10 members or more. The majority (66%) of the participating mothers had families of size 4 -9 members. Concerning the family type in which the children lived in, about 24% (48) were extended families while the rest 76% (152) were nuclear families.

Marriage and first pregnancy

About 10.5% (21) of the mothers got pregnant after the first year of marriage and 89.5% (179) of the mothers got pregnant during their first year of marriage. From those who got pregnant in the first year 12.5% (25) got pregnant directly after marriage

Mothers Ante natal care

Of the total tested mothers 23.5% (47) didn't receive any antenatal care or blood testing during their last pregnancy. 50.2% (101) had their blood tested at least once for hemoglobin and 20% (40) had a hemoglobin level below 11 mg/dl during their last pregnancy. Concerning iron supplementation during pregnancy 26% (52) didn't take any iron supplementation during the last pregnancy while 74% (148) received some iron supplementation and of these 103 (69.5%) took 2 Boxes (3000 mg). A total of 60 mothers representing a percentage of 82.2 from total anemic mothers received 0-2 iron supplementation Boxes during their last pregnancy. The commercial name for the iron supplementation used was “JEFEROL-R tablets “ . Each tablets contains: Dried ferrous sulfate equivalent to 50 mg. elemental iron Folic Acid 0.4mg.

Table (29) present the amount of iron received by mothers during their last pregnancy and their anemic status.

No Of Iron tablets Boxes	No of mothers	%	Number of anemic mothers	%
0-2	149	74.5	60	82.2
2.1-4	42	21	8	11
4.1-6	7	3.5	5	6.8
6 Boxes and more	2	1	0	0.0
Total	200	100	73	100

A total of 108 children representing a percentage of 74.5 from total anemic children in the second blood test (6-7m) their mothers were receiving 0-2 iron supplementation Boxes (0-3000mg) during their last pregnancy. Table (30) showed mothers iron consumption during last pregnancy by child anemia at the age of 6-7 months

No Of Iron tablets Boxes …..mg	No of mothers	Number of anemic children (6-7m)	%
0-2	149	108	74.5
2.1-4	42	30	20.7
4.1-6	7	6	4.1
6 Boxes and more	2	1	0.7

Total	200	145	100

Pregnancy and delivery: The average number of pregnancies to the interviewed mothers was 5.19 . A total of 80 mothers representing 40% of the total (200) had 6 pregnancies and more.

Table(31) presents the distribution of the number of pregnancies for the interviewed mothers

No Of Pregnancies	No of mothers	%
0-5	120	60
6-10	62	31
11 & more	18	9
Total	200	100

The average number of deliveries was 4.33 , About 31% (62) mothers were delivered 6 children or more. Concerning the location of birth, In total 99% (198) of the mothers had given birth in a hospital and 11.5% (23) had a history of cesarean section (C/S) while 46.5% (93) were aborted once or more. When mothers were asked about the usage of contraceptive device 64% (128) stated that they have never used contra captive device during their life.

Mothers eating habits

Mother's diet

Mothers were asked about the frequency of different types of food consumption (number of times per week), the mean for the frequency for each type of food consumption was calculated. As shown below in table (……) the most frequent types of food consumed by mothers were bread (19.4 times per week), rice (2.9), tomato, egg and legumes. Concerning hem iron consumption, about 20.5% (41 mothers) ate chicken at least once a month, 24.5 %(49) ate it at least once a week, 20% (40) mothers ate it once a month and 14.5 %(29) ate chicken once every two weeks.

Table (32) shows the mean for mother's weekly consumption of different types of food.

Fish	**Liver**	**Fresh meat**	**Frozen meat**	**Fresh juice**	**Fresh fruit**	**Chicken**	**Milk + its products**	**Green vegetables**	**Legumes/ beans**	**Egg**	**Tomato**	**Rice**	**Bread**
0.1	0.2	0.2	0.4	0.6	1.1	1.2	1.3	1.6	1.9	2.0	2.4	2.9	19.4

Drinking tea As shown in table (29) about 94.5% (189) of the mothers were frequent tea drinkers, and 52.5% of the mothers were drinking more than five cups per day. From these 52.5% twenty three mothers 11.5% had consumed 11 cups or more. A total of 38 mothers representing a percentage of 52% of the anemic mothers were drinking 6 cups of tea and more daily. The amount of tea cups consumed by mothers per day was distributed in table (32)

Consumed cups of tea /day	Number of mothers	%	Number of anemic mothers	%
0	11	5.5	4	5.5
1-5	84	42	31	42.4
6-10	82	41	30	41.1

11-15	17	8.5	7	9.6
16 and more	6	3	1	1.4
Total	200	100	73	100

4.3.4 Socioeconomic characteristics

Current income

A total of 126 fathers representing a percentage of 63 from the total sample were working whether regular or irregular working hours. All the 200 participating mothers reported their family income. The household monthly income ranged between no income, representing 25.5 % (51) of the families who depend on relatives, and 4000 NIS, which was the case for 1% from all study sample families. About 27% of the mothers reported an income of 1000 NIS. While10% reported an income of 500 NIS or less represents 10% of the entire study sample.

Table (33) shows the current income distribution Table (33) shows the current income distribution

Level of income (by NIS)	Number of families	%
0 - 500	85	42.5
600 - 1000	67	33.5
1100 - 1500	27	13.5
1600 - 2000	16	8
2100 - 4000	5	2.5
Total	200	100

Chi- square =118.1 (df=4)P<0.001

House situation

The majority (97%) of the families owned their houses while the rest (3%) lived in rented houses. House rooms' number ranged from 1 – 6 room. About 52% of houses were 1-2 room, 30.5% were three rooms, 11% four rooms and only 3.5% were more than four rooms

Presence of a disabled member

About 10% (20) of the mothers reported the presence of a disabled member in the family. Only 4.5% from those handicapped were receiving follow up care services as mothers reported.

Smoking

About 54.5% from the children's fathers were smokers while 45.5% were non smokers. About 21.5% were smoking one cigarette box daily while 10.5 % of smokers were smoking two cigarette box daily.

4.3.5 Description of the study children

Total sample children were 200; about 46% (92) of them were males while 53.5% (107/200) were females.

Birth weight

The average weight of the children aged 3-4 months at the time of testing was 5687gm with average height of 59.8cm. At birth about 8% of these children had low weight (2500 g or less) the remaining 91% had a normal birth weight and there were no twins among the sample subjects.

Child Feeding Pattern

Children showed differences in the feeding pattern they received. Breast feeding group represented 92.5% of these (185/200) were exclusive breast feeders representing 62% (124/200) from the entire study sample. About 46 %(92) of the mothers always used two breasts during the same feeding while 42.5 %(85) always used only one breasts and 8 %(16) were in between both previous pattern. Bottle milk (Cows milk) feeders represented 6.5% (13/200).

4.3.6 Nutritional and Anemia status

Anemia among mothers

The anemia status of mothers was assessed by hemoglobin and serum ferritin testing. Mothers were considered anemic if their hemoglobin level was below 12g/dl (Hb<12g/ dL) thus, Mother's hemoglobin level ranged from 8.2 - 14.7 g/dl with average of 12.1 g/dl. Concerning mothers anemia, it was found that about 36.5 % of all the tested mothers (73 mothers) were anemic while 14.5 % (29) had hemoglobin level below 11 g/dl and

Table (34) shows the Hb distribution pattern in mothers.

Hemoglobin level	Number of mothers	%
Hb 7-9.9 mg/dl	6	3
Hb 10-10.9 mg/dl	23	11.5
11 – 11.9 mg/dl	44	22
Hb 12-12.9 mg/dl	74	37
Hb 13 -13.9 mg/dl	47	23.5
14 -14.9 mg/dl	6	3
Total	200	100

Chi- square =106.66 (df=5)P<0.001

Mother's ferritin levels

Mother's ferritin level was considered low when its level was below 12mcg/ 100ml. At the time of enrolment about 32.5% of the tested mothers had a low ferritin level.

And the mean for their ferritin was 21.17 ng/ml

Anemia among infants

Anemia and age

Anemia status was determined according to the hemoglobin level distribution depending on the WHO criteria (Hb cut off value below 11 g/dl). Based on this criteria about 66.5 %(133) of the children had a hemoglobin level below 11 g /dl. The mean children hemoglobin at the age 3-4 months was 10.56g/dl and range 7.8 – 13.1 g/dl. When children reached the age 6-7 months, about 72.5% (145) of the them had a hemoglobin level below 11 g /dl. with average of 10.42g/dl and range 6.9-12.3 g/dl. Even when more conservative criteria (Hb < 10.5 g/dl) was adopted 45% of the babies were found as anemic (CI= 38% - 52%). The mean child Hb at both ages whether 3-4 months or 6-7 months was below 11 g/dl (10.49/dl). The Hb average at the age of 3-4 months was 10.56g/dl and decreased to 10.42 when child reached the age 6-7 months. Also for the Hb range it was decreasing from 7.8-13.1 g/dl at the age of 3-4 months to 6.9-12.3g/dl when children reached the age of 6-7 months.

Table (35) presents the distribution of the 200 children anemic status by age

Age	Anemic		Not anemic	
	N	%	N	%
3-4 months	133	66.5	67	33.5
6-7months	145	72.5	55	27.5

Based on the above table, anemia prevalence increased from 66.5 at the age 3-4 months to 72.5 when children reached the age of 3-4 months. Table (36) showed the distribution of Hb level in the first and the second blood test for the same children

Hemoglobin level	***First CBC at 3-4m***		***Second CBC at 6-7m***	
	Number of children	***%***	Number of children	%
7 - 9.9 mg/dl (moderate)	50	25	64	32.0
10 - 10.9 mg/dl (mild)	83	41.5	81	40.5
11 – 11.9 mg/dl	52	26	47	23.5
12 - 12.9 mg/dl	14	7	8	4.0
13 - 13.9 mg/dl	1	0.5	0	0.0
Total	200	100	200	100

Based on the above table the severity of anemia (moderate anemia) increased from 25% at the age of 3-4 months to 32% when children reached the age of 6-7 months. The anemic cases with hemoglobin below 7g/dl were included in the moderate cases.

Anemia and child sex :

A total of 133 child representing (66.5%) from the total sample were anemic at the age of 3-4 months. When it was classified by sex, no large differences were detected between both sexes. The prevalence of anemia among males was 67.7% (63) while it was 65.5% (70) among females at the age of 3-4 months. *Table (37)* presents the distribution of the 200 children according to anemia status by gender (3-4 months)

Hemoglobin division	Male		Female		Total	
	N	%	N	%	N	%
Anemic	63	67.7	70	65.4	133	66.5
Not Anemic	30	32.3	37	34.6	67	33.5
Total	93	100	107	100	200	100

When severity of anemia was considered a significant difference appeared by sex as anemia was more severe in females (27.1% moderate cases) than in males (22.6%moderate cases) at the age of 3-4 months. Table (38) showed the distribution of Hb level for children at the age 3-4 months divided by gender

Hemoglobin level	***Male***		***Female***		***First HB***	
	Number of children	***%***	Number of children	%	Total children	%

Hb 7-9.9 mg/dl	21	22.6	29	27.1	50	25
Hb 10-10.9 mg/dl	42	45.2	41	38.3	83	41.5
11 – 11.9 mg/dl	25	26.9	27	25.2	52	26
Hb 12-12.9 mg/dl	5	5.4	9	8.4	14	7
Hb 13 -13.9 mg/dl	0	0	1	0.9	1	0.5
Total	93	100	107	100	200	100

Moderate anemia decreased in females from 27.1% at the age of 3-4 months to 23.4% s they reached 6-7 months of age. While in males it increased from 22.6% at the age of 3-4 months to 41.9% when children reached the age of 6-7 months.

Table (39) showed the distribution of the hemoglobin level for the same children when they reached the age 6-7 months divided by gender

Hemoglobin level	***Male***		***Female***	
	Number of children	***%***	Number of children	%
Hb 7-9.9 mg/dl	39	41.9	25	23.4
Hb 10-10.9 mg/dl	32	34.4	49	45.8
11 – 11.9 mg/dl	18	19.4	29	27.4
Hb 12-12.9 mg/dl	4	4.3	4	3.4
Hb 13 -13.9 mg/dl	0	0	0	0
Total	93	100	107	100

4.3.6 The main changes in the two blood tests results

Analysis of the two blood tests showed that hemoglobin distribution in children at the age of six months of age is not increasing than it was at the age of 3-4 months.

Table (40) showed the complete blood count measurements at both blood tests (200 children)

Blood test	Mean at 3-4 months of age	Mean at 6-7 months of age
Hb	10.56	10.41
Hct	32.56	32.51
Mcv	83	76.37
Ferritin	96.92	------

Based on table(40) it was clear that the mean corpuscular volume (MCV) and the hemoglobin level decreased when the children reached the age 6-7 months.

The results of the measurements for the second hemoglobin test were found lower than in the first hemoglobin test among fifty percent of the study population. Whereas 43.5% of the second measurements were Increased.

Anemia incidence and prevalence

Analysis for the same child hemoglobin in both blood tests showed changes in the level of hemoglobin regardless the anemia status as the following: About 12 children (6%) their hemoglobin at the age 3-4 months remained the same as their hemoglobin at the age of 6-7 months. Decreased incidence was 50.5% (101) of the children as their hemoglobin at the age of 3-4 months was higher than their second hemoglobin at the age of 6-7 months. Recovery rate was 43% (87) of the children as their second hemoglobin at the age of 6-7 months was higher than their first hemoglobin at the age of 3-4 months.

Table (41) showed the changes occurred regarding hemoglobin measurement regardless anemia status at both blood tests for the same child (200 children*)*

Hemoglobin situation in first and second tests per child	**Total number of children**	**%**
First Hemoglobin = Second hemoglobin	12	6 %
First Hemoglobin > Second hemoglobin (decreased incidence)	101	50.5%
First Hemoglobin < Second hemoglobin (increased or recovery)	87	43 %
Total	200	100

When looking to the changes in the children’s hemoglobin at the two blood tests that produced or removed anemia, it was noticed that a total of 107 children representing 53.5% were anemic at the first and the second blood tests enrollment. Only 13% had their hemoglobin increased by age 6-7m and became not anemic (recovered). Whereas the not anemic children at the first and second blood test were 29 child representing 14.5% of the total group.

Table(42) showed the changes occurred regarding anemia classification at both blood tests (Hemoglobin cut of 11 mg/dl*)*

Hemoglobin situation	**Total number of children**	**%**
Anemic at the first blood test and remain anemic at the second blood test	107	53.5 %
Normal at the first blood test and became anemic at the second blood test (incidence)	38	19 %
Anemic at the first blood test and became normal at the second blood test (recovery rate)	26	13 %

Normal at the first blood test and remain normal at the second blood test	29	14.5%

Table (43) showed a significant relationship was detected between child first and second hemoglobin

	Second Hemoglobin		**Total**
	Anemic	**Not anemic**	
First Hb Anemic	73,8%	47.3%	66.5%
First Hb Not anemic	26.2%	52.7%	33.5%
Total	100%	100%	100%

Chi- square of 12.6 , P=0.001

4.3.7 Hemoglobin below six months significant relationships

When the child hemoglobin was tested with the other variables in the second group of the study (<6m study). It showed the following significant relations:

A significant relationship between child hemoglobin at the age of 3-4 months and child hemoglobin levels at the age of 6-7 months of age. This relation had a P value=0.001 for a Chi square of 12.6

A significant relationship between child hemoglobin at the age of 3-4 months and child birth weight was detected. This relation had a F- test value=4.02 for a P value=.019

A significant relationship between child hemoglobin at the age of 3-4 months and the type of food he received was detected. This relation had a F- test value=3.88 for a P va

4.3.8 Ferritin Significant relationships

Infants ferritin level considered low when<20mcg/100ml. About 7% of the total tested children had low ferritin levels. Mothers were also tested for their hemoglobin and ferritin levels. Mother's ferritin level was considered low when its level was below 12mcg/100ml. About 32.5% of the total tested mothers had low ferritin levels.

Ferritin relationship was tested with several variables collected in this study, some of these variables showed a significant relationship with ferritin and will be presented in this section while others showed non significant relationships and were summarized in table

(44) Appendix. Two cutoff points were considered for ferritin in ferritin testing with the other variables.

Main findings for child ferritin cutoff value 20mcg/100ml

Mother ferritin and child ferritin: A significant difference between mother ferritin and child ferritin was detected (Person correlation value =0.93, p=.007 < 0.05)

Mother ferritin and mother hemoglobin: A significant difference between mother ferritin and mother hemoglobin was detected T- test showed P=.00

Child sex and ferritin: A significant relationship between child ferritin level and child sex was detected (F value =11.089, p=.001 < 0.05)

Child ferritin and child hemoglobin at the age of 6-7 months. A significant relationship between child ferritin level and child hemoglobin at both cutoff values of ferritin. for the age of 6-7 months the significant relationship was detected had a P value = 1.420 OR= 1.420 Also a significant relationship was detected between child's ferritin level whether it is less or more than 20and children's anemia at the age of six months as significant =.009"chi-sequare test

A significant relationship between anemic mothers and mothers ferretin level cut point 12as significant=.00"chi-sequare test**.**

Table (44) showed a significant relation ships between the following variables considering child ferritin cut off value 20 mcg/ 100 ml for ferritin variable analysis:

No	Variable	Chi – square Or Pearson value	F- test	P- value	OR
1	Mother ferritin and child ferritin	Person correlation value =0.93		p= 0.007	
2	Child ferritin and child sex	---------------	F value =11.089	p=.001	
3	Mother ferritin and mother hemoglobin	29.346		.000	5.499
4	Child ferritin <20 and child Hb at 6-7 months age	5.710 (R= .169)		.012	1.420

<u>Significant relationships (ferritin cutoff value 30)</u>

Ferritin variable at cutoff point 30mcg/100ml was cross tabulated with the other variables it showed the following:

Mother Hemoglobin and Mother ferritin ($x^{2\,==}$ 8.78, P= 0.003)

From total 155 mothers there ferritin less than 30 about (41.9%) 65 mothers were anemic and (58.1%) 90 mothers were not anemic.

Child ferritin less than 30 and child hemoglobin at the age 6-7months ($x^{2\;=\;8.90}$, P= .001) From total 21 child their ferritin less than 30 about 21 child (100%) were anemic.

Child ferritin less than 30 and type of refugee ($x^{2\,==\,10.22}$, P= .030)

From total 21 child their ferritin less than 30 about (9.5%) 2 children were refugee while from total 179 children their ferritin 30 and above about (99.4%) 178 child were non refugee.

Child ferritin less than 30 and home status ($x^{2\,==\,4.27}$, P= .057)

From total 21 child their ferritin less than 30 about (57%) 12 children were living in healthy home status, while from total 179 child their ferritin 30 and above about (77.6%) 139 child were living in healthy home status.

Child ferritin and child sex ($x^{2 == 8.31}$, P= .005)

From total 21 child their ferritin less than 30 (76%) 16 were males while from total 179 their ferritin 30 or above (43%) 77 were males**.**

Table (45) summarized the significant relationships for child ferritin level 30 mcg/ 100ml with the other variables

.

Variable	Chi – square	P- value	OR
Mother Hemoglobin and Mother ferritin	$x^{2 =}$ 8.78,	P= 0.003	3.34
Child ferritin less than 30 and child hemoglobin at the age 6-7months	$x^{2\ = 8.90}$	P= .003	1.44
Child ferritin less than 30 and type of refugee	$x^{2 = 10.22}$	P= .001	18.7
Child ferritin less than 30 and home status	$x^{2 =\ 4.27}$	P= .039	0.384
Child ferritin and child sex	$x^{2 == 8.31}$	P= .004	4.24

The ferritin was also tested with the variables in the study (group two) showed a non significant relationships whether when ferritin cutoff 20 or 30 adopted. For more detailed information about the no significant relations see table (25) Appendix.

Multivariate analysis

For the first stage (6-24 m) child hemoglobin

Child hemoglobin in the first phase and the regression analysis results

We have tested the effect of the variables summed together to fined out their effect on the hemoglobin level (for child Hb 6-24 m) and to confirm the association of the bi variate analysis results with the variables. This was done by regression analysis (model 36 appendix).

in which we included the variables of birth type, home status, mother situation, no of member more than 15 years, child sex, child age, refugee type, mother education, current age of mother, number of children less than 5, father work, feeding type, number of children (5-15) year, child weight, family type, is it social, no of workers, child height and number of family members . Our model below showed a Correlation Coefficient of 0.187 (P= .000) for all the variables together with the hemoglobin level which indicate that these variables can explain the variability of Hb by .35 square (the value of R square) such a model had a significant level of P= .049 for

F – test =1.603

The details of the model are shown in table (36 appendix) . It confirm the significance of the bivariate analysis for child hemoglobin with child sex and child birth type. It add a new significant relations with no of family members, number of children less than 5 years, no of children (5-15) and number of members more than 15 years.

Child hemoglobin in the second phase at the age of six months

We have tested the effect of the variables summed together to fined out their effect on the hemoglobin level (at the age of 6 months) and to confirm the association of the bi variate analysis results with the variables. This was done by regression analysis in the following model in which we included the variables of ferritin for the mother, mcv, anemic type, feeding type, child birth weight, average meals per day, iron received by mothers during pregnancy, head circumference, ferritin for the child, child sex, gestational age, age of the child, hemoglobin on admission and child weight. Our model shown below showed a Correlation Coefficient of .550 (P= .000) for all the variables together with the hemoglobin level which indicate that these variables can explain the variability of Hb by .30 square (the value of R square) such a model had a significant level of P= .000 for

F – test = 5.312

The details of the model are shown in table (34 appendix) . It confirm the significance of the bivariate analysis for child ferritin at the age of 3-4 months. It add a new significant relations with child sex, birth weight, twins and feeding type.

Mother hemoglobin in the second phase and the regression analysis results

We have tested the effect of the variables summed together to fined out their effect on the hemoglobin level (of the mothers) and to confirm the association of the bi variate analysis results with the variables. This was done by regression analysis in the following model in which we included the variables of ferritin for the mother, mcv, hct, iron received by mothers during pregnancy, age of the mother , education, marriage age, no of abortions, no of pregnancies and no of deliveries. Our model shown below showed a Correlation Coefficient of .914 (P= .000) for all the variables together with the hemoglobin level which indicate that these variables can explain the variability of Hb by .835 square (the value of R square) such a model had a significant level of P= .000 for

F – test = 78.746

The details of the model are shown in table (35 appendix) . It confirm the significance of the bivariate analysis for mother ferritin. It add a new significant relations with mother HCT, MCV and the current age of the mother.

5.4 Summary of Results

5.4.1 Stage One results summary

Analysis for 1565 child aged 6-24 months (first sample) showed that about 66.4% (n=1037) were anemic (Hb cut value 11g/dl). The nutritional status analysis for the children showed, 15.8% were stunted(≥ -2 SD), 3.4 % were wasted(Wt-Ht, ≥ -2SD) and 10.7 % were underweighted (Wt-Age ≥-2 SD). Analysis indicated a significant relationship between child nutritional disorders and the following variables: Stunting was significantly related with child sex ($x^{2=5.55,\ P=.021}$) OR= 0.72 (95% CI = 0.54-0.94), child age in age groups ($x^{2=\ 10.95,\ P=\ .001),}$ home status ($x^{2=8.87,\ P=.003}$) OR= 1.54(95% CI =1.15-2.053), refugee status ($x^{2=4.58,\ P=.032}$) OR= 0.43(95% CI =0.19-0.95), child feeding type ($x^{2=20.4\ \ P=.008}$), family social situation ($x^{2=5.86,\ P=.019}$) OR= .708(95% CI =.53-.93), born type (single or part of twins) ($x^{2=8.68,\ P=.010}$) OR= 3.013(95% CI =1.39-6.49) and mother education ($x^{2=3.3\ ,\ P=.070}$). While wasting (Wt-Ht) was significantly related with child feeding type ($x^{2=10.078,\ P=.000}$) and twins. Regarding under weight (Wt-Age), it was significantly related with (twins)birth type ($x^{2=13.225,\ P=.000}$), child feeding type ($x^{2=39.042,\ P=.000}$), home status ($x^{2=12.8,\ P=.000\ \ OR=\ 1.83}$) and number of workers in the family($x^{2=4.00,\ P=.045}$)

Analysis showed that about 66.4% (1037) of the total children aged 6-24 months were anemic. A significant relationship was found between anemia and the following variables:

Being a child living in poor socioeconomic condition (x^2 = 8.070, P=.005). Child age ($x^{2=73.860,\ P=.000}$), child age in age groups ($x^{2=75.296,\ P=.000}$), child sex ($x^{2=14.089,\ P=.000}$), born type ($x^{2=7.809,\ P=.048}$) and mother education level (x^2 =8.750, P=.010).

Not significant relation ships were found in the following variables in the first sample: Nutritional disorders (wasting, stunting or underweight) were not statically significant related with family type (nuclear or extended), mother situation (widow, separated, divorced or live with husband)., number of working members in the family (only was significant with underweight). Wasting or underweight were not statically significant related with mother education, being refugee child.

Wasting was not statically significant related with born type, family social situation and or family home status. Regarding anemia, analysis showed that: there is no significant relationship between anemia and wasting, stunting or underweight. In addition to that, there was no significant relationship between anemia and the child feeding type.

5.4.2 Stage Two results summary

The analysis for 200 infants child aged less than 6 months (second sample) showed that about 66.5 % (133) were anemic at the age 3-4 months with mean hemoglobin level 10.56 g/dl ranged from 7.8-13.1g/dl. Anemia prevalence was increased among these children when they reached when they reached the age of 6-7 months, as it reached 72.5% (145) with mean hemoglobin level 10.42g/dl ranging from 6.9-12.3g/dl. About 36.5% of children's mothers were anemic (Hb cut value < 12g/dl) , with mean hemoglobin level 12.1 g/dl ranging from 8.2-14.7g/dl. Out of the total 200 mothers, 32.5% had low ferritin level(ferritin <12mcg/100ml) with a mean of 21.17mcg/100ml. Infants were also tested for their ferritin levels at the age of 3-4 months and showed 7% low ferritin levels (ferritin<20mcg/100ml). The mean infant ferritin level was 97.52mcg/100ml). About 45% of these infants were anemic when Hb cut value <10.5g/dl was used.

Both hemoglobin tests for the 200 infants at the age of 3-4months and when they reached the age of 6-7months, were strongly correlated ($x^{2=}$12.6, P=0.001<0.05). The child hemoglobin at the age 3-4months was correlated with both child birth weight (F value= 4.02, P=.019) and the type of feeding he received (F value = 3.88, P=.005). A positive correlation between mother ferritin and child ferritin was found (Pearson correlation coefficient = 0.93, P=.007), <u>Also child ferritin was significantly related with child sex and type of family</u>. (F value= 11.089, P=.001) , (F value = 0.03, P=.865) respectively. A significant relationship was detected between mother ferritin and mother hemoglobin ($x^{2=29.346,\ P=\ .000}$). Child ferritin at 3-4 months of age was related to the hemoglobin level when the child reached 6-7 months($x^{2=5.710,}$ P= .012 OR=1.420 CI 95% (1.294-1.558).

When cut off value for ferritin was increased to 30mcg/dl it provided additional support for the significant relationship between child ferritin and sex ($x^{2=8.31,\ P=\ .005}$), child first and second hemoglobin. It also showed a new significant relation ships with:

1- The refugee status ($x^{2=\ 10.22,\ P=.030}$)

2- The family home status ($x^{2=\ 4.27,\ P=.057}$)

3- Child ferritin at 3-4 months of age was related to the ferritin level when the child reached

6- 7 months($x^{2=8.90,}$ P= .001)

<u>**Not significant relation ships**</u> were detected between mother hemoglobin and child hemoglobin neither when he was 3-4 months nor when he

reached 6-7 months. Child ferritin level was also checked for its relationship with mother education, number of rooms in the household, refugee status, mother age, number of family members, source of income, current income and home status and nor of them showed a significant relationship. There was also no significant relation between child hemoglobin at the age 3-4 months and the following factors: child sex, mother education, number of rooms in the household, being refugee, mother age, number of family members, home status of the family, source of income, current income, family type and number of meals received per day.

The hemoglobin level at the age 3-4 months did not show differences with sex indicating abs cense of significant relationship. There was no significant relation between child hemoglobin at the age 3-4 months and feeding pattern whether using one or two breasts in the same feeding meal, duration of each breast feeding, and the number of breast feeding meals provided to the child per day. Also the number of bottle meals (artificial cow's milk) received per day by the child was not significantly related to the child hemoglobin.

When the child hemoglobin level at 3-4 months detected for possible relationship with the mother variables as the place of delivery, number of pregnancies, number of abortions, number of tea cups consumed by mothers per day, mother work, amount of iron supplements received by mothers during pregnancy, no significant relationships were found. Also no significant relationship was found between child hemoglobin at 3-4 months and family social situation such as: father work, number of workers in the family, living in poor family social conditions and number of educated people in the family.

CHAPTER TWO

LITRETURE REVIEW

2.1 Introduction

Nutritional disorders are more prevalent in the developing countries due to the food access problems. About one- sixth (800 million) of the developing countries are suffering from food access difficulties despite the presence of food for every one at the global level. (FAO, 1999). The most vulnerable population to food access difficulties are mainly distributed in South Asia, they reached about nearly 280 million, in East Asia with about 240 million and in Sub-Saharan Africa 180 million, and the rest are distributed in Latin America, Middle East, and North Africa (FAO,1999). (as sited in Al- Rai,2005).

Malnutrition rates have been falling over the last two decades in most regions of the developing world. The exception was in sub-Saharan Africa, where malnutrition rates increased during the early 1990s, following the regional economic decline in the late 1980s. (UNICEF,1998) and (FAO, 1999). High growth rates, large populations and economic decline are important factors affecting the food consumptions pattern negatively. Such conditions will disturb the availability and regularity of food at the market level and prevent the individuals from meeting their daily food requirements (FAO,1999) and UNICEF report (1998)

The population size and the growth rates are crucial factors affecting, the consumption and availability of food for the individuals as the case in the developing countries (WHO, 1995; Anderson, 1999). In developing countries it is estimated that more than 5 million deaths under five years of age occurs due to under nutrition (University of London, 2003). And researchers estimates that over 13 million children, and a ratio of more than one in every four under the age of 12, have a difficult time getting the food they need. In the United States over 20 per cent of children live in poverty, more than double the rate of most other industrialized countries(UNICEF,1998). In the United Kingdom, children and adults in poor families face health risks linked to diet, a recent study cited high rates of anemia in children and adults, and premature and low-weight births. In the Russian Federation, the prevalence of stunting among children under two years of age increased from 9 per cent in 1992 to 15 per cent in 1994. In the Central Asian republics and Kazakhstan, 60 per cent of pregnant women and young children were anemic(the same source)

2.2 Contextualization

2.2.1 Nutritional Problems in Arab Countries

Malnutrition have been studied in many Arab countries. In Oman, Musaiger (1993) reported that poor dietary habits, inadequate nutrients intake, infection and poor environmental situation are the factors contributing to the nutritional problems founded among children in the southern part of the country. According to the multi assessment surveys he carried out during 1988-1991, the prevalence of wasting was ranged from between 3.2% to 4.5% among children 2-4 years and it diminished at the age of five. On the other hand stunting was more prevalent among preschool age children and it increased from 18.2% at the age of two to 25.5% when the chilled reached the age of five. The prevalence of anemia was56% among the children aged 2-5years. The highest anemia prevalence was present at the age of 2 years as it represented 77% and decreased to 22% at the age of five years (Musaiger et al,1993)

In Al-Kuwait, a cross-sectional study was conducted among school and kindergarten student aging 6-59 months and their mothers by Amine and Al Awadi (1996). The study showed similar wasting prevalence among males10.1% and females 10.9% while stunting was biased towards males, 11.5% in comparison to 9.9% in females. Obesity was prevalent among females, it was 18.4 % while 16.1% in males. The prevalence of anemia was higher among males 32.9% than females 25.8%. According to the study results the students growth rate in general was close to the international standards which attributed to the high per capita income that affected food habits and dietary food intake.

Another study was conducted in Al-Bahrain among children aged 1-2 years by Al Bahrain Research Center (2003), showed 45% anemia prevalence with sex and age differences. Anemia was more prevalent in females than males, and the highest rate was recorded in the second year aged children which represent 43% from total anemic group. Mothers educational differences were noticed among children as university educated mothers had lower prevalence of anemic children while for illiterate mothers the prevalence was higher (36% vs 50%). Also working mothers children had a higher prevalence of anemia among their children (39%) in comparison to non-working mother's (47%) (Mussaiqer Abdel Rahman/ Al Bahrain research center, 2003).

Nutritional studies conducted in Jordan, Egypt, Syria, Lebanon and Iraq indicated the existence of nutritional problems in the region among children less than five years of age as in the table (3): Malnutrition prevalence in Palestine and its neighboring countries

Country	**Palestine**	**Jordan**	**Lebanon**	**Egypt**	**Syria**
Moderate and severe underweight	8.3%	5%	3%	12%	13%
Moderate and severe wasting	7.8%	2%	3%	6%	9%
Moderate and severe stunting	11.7%	8%	12%	25%	21%

(MOH-HIS, Palestinian Health care system, Health status in Palestine 2002, July 203).

A study conducted in 1999 among infants and children below three years of age with different samples in four countries and showed different anemia prevalence, the highest anemia prevalence was found in Gaza children 74.9% compared to 49.7% anemia prevalence among the West Bank children, 35.9% in Jordan Lebanon showed 29.6% While the lowest anemia prevalence, was 28% among the children in Syria (Madi,2001). Another study was carried out in Palestine among group of children aged 0-5 years in Ein Dyuk village, showed 59% anemia prevalence in addition to 44% malnourished prevalence higher in females (51%) than in males 34**%** (UPMRC, 1988).

2.2.2 Nutritional status in Palestine

Al- Aqsa Intifada started in September 2000. The Israeli attacks activities affected the Palestinian population living situation, the socio economic and nutritional household status in Gaza strip and West bank. World bank estimates that more than 30% of the Palestinians in the West Bank and the Gaza Strip are dependent on food donations from the World Food Program, the ICRC or other NGOs. According to USAID analysis, about 50% of all Palestinians require external food assistance to meet their minimum daily caloric intake (World Bank, 2002). Several studies conducted among Palestinian children and women showed different rates of malnutrition. With the rates in females higher than that in males due to social discrimination. A study was conducted by Giacamon (1996) among Palestinian children in Zbeidat, showed that severe malnutrition prevalence was 7%, while moderate malnutrition prevalence was 20% and mild malnutrition was 25.1% among the studied children.

Growth parameters for children aged 5-10 years measured in 164 males and 87 females in the West Bank, showed that children from high socioeconomic groups weighed more and were taller than children in the medium and low groups despite no significant differences found in the blood values of the children from different socioeconomic groups in the same study (In Isaacs, 1988). According to a report presented by Yip et all, (1990) on the nutritional status of the Palestinian children and women in the child bearing age in the UNRWA fields, The prevalence of wasting was 1.8 in both West Bank and Gaza. The prevalence of underweight in the West Bank was 3.9% and 4.5% in Gaza. Anemia prevalence (Hb <11mg%) among Gaza children was 70.3% and was higher than the West Bank children (57.8%). Women in the third trimester had 11.4 mg % mean hemoglobin concentration in the West Bank compared to 10.8 mg% in Gaza. Another study was carried out among two groups of pregnant women from different age groups attending UNRWA health centers showed high anemia prevalence 73% and 76%. Early marriage, short intervals between pregnancies, low socioeconomic status, malnutrition were found to be associated with anemia.

The main cause of anemia according to the study was nutritional (Hmaid. S,1987). Malnutrition prevalence was 35.9% among surveyed children with significant differences between sexes (higher in females). Weaning age children had higher prevalence of malnutrition than the rest of the surveyed children in the sample. The prevalence of anemia among the children in the study was 25% (Hb<11mg %) and the lowest hemoglobin level was found to be among children aged 6-23 months . Children who were fed slowly on breast milk had the lowest anemia incidence(Abdel nour, 1991).Another   study by Jabra (1984) was carried out among children drawn from UNRWA antenatal clinic registers, showed that half of surveyed children were anemic (Hb<11mg %). Wasting prevalence was2.5% in Gaza and 1.8 % in West Bank while the prevalence of stunting was 20.4% in Gaza and 15.1% in the West Bank (% below 2 SD). The study also showed high anemia prevalence (50%) among pregnant and lactating women. Rizkallah (1991) found that the prevalence of wasting and stunting among primary School children in refugee camps in the West Bank to be 18.8 % and 32% consequently. Family wealth had an effect on the wasting and stunting prevalence but no effect on the children' anemia status, anemia was higher among females than males. Poor family children had higher wasting prevalence (42.5%) compared to wasting prevalence among all the study children (18.8 %). The prevalence of wasting and stunting was not affected by the frequency of the eating. Mothers awareness and children wasting prevalence were significantly correlated according to the study findings.

A comparison made by Tulchinsky, (1994) between three cohorts of children aged up to 15 months, among five government clinics in Gaza city. It concluded that marked improvement was noticed in growth pattern in general with better growth pattern among high socio economic categories infants. No differences between males and females were found. Contradicting to these results by Kumar (1995) another survey conducted in Gaza strip among 1500 children (705males and 795females) showed that there was no significant differences between both sexes, while geographical differences were noticed. She also found that South Gaza children suffered from malnutrition more than the other areas and the over all underweight prevalence was 15.1% with a wasting prevalence of 5.7% while the stunting prevalence was 14.2%. The study emphasized the need for continuous monitoring and children nutritional status surveillance system (Kumar,1995). Another study conducted among children in the age group 0-18 months at five government clinics in Gaza strip showed no gender differences, while socioeconomic condition affected the anthropometric status of the children (Schoenbaum et al, 1995).

Malnutrition is considered a potential problem in the case of economic deterioration. Comprehensive national food and nutrition policy should be developed in such conditions and the nutritional capacity should be strengthened within MOH as well dietary related diseases prevention and anemia control programs should be established. Watson (1996) reported that malnutrition is a potential problem when the economic deterioration occurs and establishing nutrition information system within the MOH, is essential to compact the dietary related diseases and anemia. The highest anemia prevalence was found in the children below two years old among the surveyed 6-35 months. Palestinian refugee children registered at UNRWA health centers in north Jordan, showed anemia prevalence 29.6%, with no significant association between child hemoglobin level and weaning age, sex, family size and mother education while a statistically significant association was found between the child hemoglobin level and age, weight, family income and mother Hb level during pregnancy (Bashir,1996). Another survey of UNRWA clinic antenatal records emphasized the need for more attention should be directed towards dietary habits and the routine iron supplementation for all pregnant should be considered when severe anemia became prevalent (Pappagallo,1996).

Maternal illiteracy, weaning practices, lack of breast feeding, recurrent diarrhea and stunting were factors associated with anemia. The study recommended that breast feeding, weaning practices promotions as well as food fortification with iron were highly needed to for

Palestinian children under 3 years of age and their mothers in West Bank, Gaza, Jordan, Lebanon and Syria refugee camps (Hassan et al, 1997). Anemia was more common in the younger age groups and more prevalent in males than females (Shubair et al,2000). Two studies about the Palestinian children and women nutritional health status were carried out in 2002 by the Johns Hopkins and Al Quds University and the second one was conducted by the Palestinian Central Bureau of statistics (PCBS,2002). Despite the differences, both studies agreed that rates of stunting were higher than rates of wasting and underweight, and stunting in Gaza strip was more prevalent than in the West Bank

Table (1) showed the nutritional problems distribution among the Palestinian children

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Malnutrition indicators	**PCBS Study 2002**			**John Hopkins Study2002**		
Region	**Palestine**	**WB**	**GS**	**Palestine**	**WB**	**GS**
Under weight	3.5	4	2.6	8.3%	8.3	11.9
Wasting	2.5	2.9	2	7.8%	4.3	13.3
Stunting	9	8	10.5	11.7%	7.5	17.5

Source : PCBS 2002

The Nutritional Survey conducted by the Palestinian Bureau of Statistics (2002) jointly with the (Birzeit University / Johns Hopkins University) showed that 37.9 % of children aged 6-59 months were anemic with hemoglobin levels lower than 11gm/dl. Anemia was found to be at its highest prevalence (53.4%) among children 12-23 months old (cut off point 11gm/dl), followed by 42.2% for the age 6-11 months old (cut off point of 10.5gm/dl). In the Gaza strip children aging 12-59 months had a higher prevalence than the West Bank children as it was (38.7% Gaza strip compare to 33.5% in the WB). The highest prevalence was observed in the refugee camps children; the prevalence was 40.1% in the compared to 34.0% in the rural areas and 34.2% in urban settings.

Johns Hopkins and Al Quds university study 2002 revealed that the global acute malnutrition (moderate to severe acute malnutrition rate) was 7.8% in Palestine (13.3% in Gaza strip and 4.3% in West Bank) and the prevalence of acute malnutrition in the Gaza strip was (13.3%) was considered a humanitarian emergency according to WHO classification (10-14.9) and a severe public health problem. The global chronic malnutrition prevalence was 11.7% in Palestine (17.5% in Gaza strip and 7.9% in West Bank). The prevalence of global acute and chronic malnutrition was higher among refugees than non-refugee (9.6% among refugee and 8.8% among non-refugee) where chronic malnutrition was 15.1% among refugees and 10.6

among non refugees. The prevalence of anemia was 43.9% in Palestine (44.1% in Gaza strip and 43.7% in West Bank). While the results of PCBS revealed the following: The prevalence of stunting (height for age) was 9% while prevalence of wasting (weight for height) was 2.5%. The prevalence of underweight (weight for age) was 3.5%.

Table (2) Anemia prevalence's among children and women in Palestine

Anemia	**PCBS Study 2002**			**John Hopkins Study2002**		
Region	**Palestine %**	**WB**	**GS**	**Palestine %**	**WB**	**GS**
Children 6-59 months	38	35.5	41.6	43.8	43.7	44.1
Women 15-49 years	33.2	31.4	36.5	48.6	43.8	52.8

Source : MOH-HIS, Palestinian Health care system, Health status in Palestine 2002, July 203 .

The Nutritional problems were varied between macro and micro nutrient deficiencies as the Johns Hopkins study revealed (2002). The study showed that the presented protein and micronutrient intake was different from the Recommended Dietary Allowances (RDA). Results showed energy intake deficiency among Palestinian children was 62.2% (64.3%in GS and 60.2% in WB) while Protein intake deficiency was 10% (9.8 in GS and 10.2 in WB). And Iron intake deficiency was 78.1 %(77.6% in GS and 78.7 in WB). On the other hands women in Palestine also suffering from nutritional deficiencies. The energy intake deficiency among Palestinian women was 63.3 %(66.8in GS and 61.5 in WB), Protein intake deficiency was 26.6 %(22.8 in GS and 28.6 in WB) while Iron intake deficiency was 73.5 %(71.5% in GS and 74.6 in WB) (MOH-HIS, 2002, 2003). The most important growth parameter in children affected by the deficiency was stunting rate. Its rate increased between the years 1996 and 2002 mainly in the rural areas and in the Gaza Strip. The problem of anemia is still prevalent in Palestine and increasing in its rate among women and younger children (Palestinian

Authority, 2005) (PCBS, 2002)

2.3 Conceptualization

2.3.1 Malnutrition and anemia

Malnutrition is a term covers different deficiency state ranging from deficiencies of specific micronutrients, like minerals and vitamins and limited to protein and calorie malnutrition. Malnutrition or under nutrition could also be defined as the physical state resulting from inadequate food intake for long periods of time. In the case of malnutrition the body is lacking the raw materials from food for long periods of time, physiological and physical changes occur. Both unbalanced and inadequate diets could lead to malnutrition as stated in Abdeen,2002 and (UNICEF,1998). Some of the malnourished people appear healthy, as in the case with anemia (lack of iron). They may look overweight as in obesity; or underweight as in starvation. Children who are mildly underweight are twice as likely to die as the better nourished children. In the moderate to severe underweight children, the risk of death increases between five and eight times. Underweight increased the risk of mortality from infectious diseases. Researchers estimated 53% of child deaths a year attributable to underweight (UNICEF,1998; London School of Hygiene & Tropical Medicine, 2003). Behavioral abnormalities could be associated with severely malnourished children. They are more apathetic and less active and explorative of their environment (Grantham-McGregor et al. 1997)

2.3.2 Nutritional status assessment

Assessment Methods

To identify the individual needs, control the nutritional related disease, and help in further planning specially for policy makers assessment methods are widely used. Nutritional intake and nutritional assessment are the two possible methods that are used to assess the adequacy or deficiency of food intake among individuals or population groups. The nutritional status can be assessed by any of the four types of activities often called the **ABCD** approach referring to:

- **A**nthropometrics (the study of human body measurements on a comparative bases)
- **B**iochemical tests such as Hb, MCV, serum ferritin etc
- **C**linical observations
- **D**ietary and personal histories

There is no one single parameter that could alone measure the individual nutritional status directly, or determine the problems or the actual needs. Each part of this approach is important and should be considered.

Anthropometric measurements

The science that deals with body measurements called anthropometry, such as size, weight, and proportions. Growth charts and other clinical standards also could be used to monitor the child's growth. Anthropometry defined as “the measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degree of nutrition” (Jelliffe, 1966). It considered as the most practical field technique and the most common one used for the quantitative assessment of the nutritional status (WHO Working Group,1986). The usage of the nutritional anthropometry usage as stated by Gibson (1990) are the following: simple, safe, non invasive, precise and accurate if standardized techniques are used. Requiring non expensive equipment, portable, could be made or purchased locally and even unskilled personnel can perform measurement procedures.

The information could be generated on past nutritional history, and could be used to quantify the degree of malnutrition or over nutrition. It could also be used to evaluate and monitor the nutritional changes over time for large representative sample sizes. In nutrition emergency situations the techniques could be adopted as a screening method to identify risk groups (Gibson, 1990).On the other hand the inability to distinguish the effect of specific nutrient deficiencies like zinc and Iron is considered one of the disadvantages of the nutritional anthropometric methods use. Further more, these methods are unable to pinpoint the main cause of under nutrition. In addition weight can vary over a short period of time and a child can lose up to 20% of his/ her weight in a few weeks in emergency situations as stated in the above same source.

Tow types of anthropometric are used:

1. Stature: standing height, or recumbent length which is used in children up to 2 years.

2. Weight: which reflects long and current term status.

The nutritional status assessment measures that used in children according to their age and sex are Weight for age, which is influenced by height, represents longer term status. On the other hand, Weight for height, reflects the current nutrition status and body composition.(Cogill, 2003).

Child hood nutritional status assessment

Anthropometric indicators are using data on children's age, height and weight. It could be used also to assess the impact of programs intervention (FAO, 2001). Three key anthropometric measures are calculated based on a combination from age, height and weight data. These are weight-*for-height, (wasting) height-for-age (stunting) and weight-for-age.*

Weight for height (wasting): This index measures body mass in relation to body length. And generally associated with failure to gain weight or severe weight loss (thinness or wasted). Two indicators can measure this issue, Low weight for height or weight for age. If children weight for height two standard deviation below the median are too thin for their height, or wasted, if three standard deviation below the median they considered severely wasted and called acute malnourished. Wasting represents food shortage in the period immediately before survey, and it represents recent episodes of illness or acute food shortages.

Weight for age: It is an index of both heights for age and weight for height. If weight for age two-standard deviation below median child considered under weight for his age and severely under weight if his measures are three standard deviations below the median. A child may be under weight for his age, because he is stunted, because he is wasted, or because he is both stunted wasted.

Height for age (stunting**):** This index provides an indicator of linear growth retardation. Children with height for age, two standard deviations below the median considered short for there age or stunted and if their height or age three standard deviation below the median they are considered severely stunted. This situation mainly associated with poor over all economic conditions and repeated exposure to adverse condition. Due to the prolonged period of inadequate nutrition intake or recurrent or chronic illness. It doesn't vary appreciably with the season of data collection. This indicator is the most consistently correlated with children's mental development, in addition to delay neuron-sensory, IQ and school achievement in older children. Stunting is extremely prevalent in third word countries, reaching 60% in some areas. It found to be associated with children development. Many investigators have attempted to control for socio-economic conditions when studying the association between stunting and mental development in school-aged children. Nutritional supplementation given to stunted children for 2 years showed improvement in psychomotor development. While poor development found in stunted children due to poor nutrition (Grantham- McGregor et al,1996).

Classification of malnutrition

1- Acute malnutrition:

It is generally associated with failure to gain weight or a loss of weight (thinness or wasting). Two indicators can measure this issue, Low weight for height or weight for age. Children whose weight for height or weight for age below three standard deviations from the median of the reference population are considered acute malnourished.

2- Chronic malnutrition:

It is low height for age where height falls below one standard deviation from the median of the reference population (shortness or stunting). This situation is mainly associated with poor over all economic conditions and repeated exposure to adverse condition.

Iron deficiency anemia

Anemia: is a condition, which is characterized by a decrease in the concentration of hemoglobin in the blood and decrease in the blood cell volume lower than the established WHO cutoff figures ranges from Severe anemia when hemoglobin concentration was less than 7.0 g/dl, moderate anemia when hemoglobin concentration was 7.0 – 9.9 g/dl and mild anemia when hemoglobin concentration 10.0 – 11.9 g/dl (10 – 10.9 g/dl for pregnant and children under age three). In our study we considered the definition of mild anemia as (10 – 10.9 g/dl) (De Maeyer et al, 1989).

Anemia is one of the most widespread public health problems in the world. More than 2 billion people are affected by Iron deficiency anemia world wide. Its prevalence is highest among children and women in the childbearing age, particularly pregnant and lactating women.(WHO,1991; Denission et al,1995). Iron deficiency in children leads to behavioral disturbances and developmental delay. In pregnant women, it increases the risk for a preterm delivery and delivering a low-birth weight baby. (WHO, UNICEF, 1997) In the majority population countries the problem consequences extends to the welfare, social and economic status of the population. The deficiency may result in impaired cognitive development, reduced work capacity and, in complicated cases, increased the risk of mortality, particularly during the prenatal period.

There is also evidence that anemia may result in reduced growth and increased morbidity. It considered as a major cause for malnutrition, leads to loss of appetite, poor dietary intake which reflect negatively on the general health of the children and end up with malnutrition (Miller. 2006;UNICEF, 1998) There is a need to understand the under lying causes of anemia in the first years of life , particularly the first two years of age. Few studies were found to illustrate the factors that influence children's nutritional status at this age. Most of the nutritional studies among children were investigated children between the age of 3-5 years

Palestinian Bureau of statistics (2002) conducted a survey jointly with (Birzeit University / Johns Hopkins University) showed that 37.9 % of children aged 6-59 months were anemic, with hemoglobin levels lower than 11gm/dl. Anemia was found to be at its highest prevalence (53.4%) among children 12-23 months old (cut off point 11gm/dl), followed by 42.2% for the age 6-11 months old (cut off point of 10.5gm/dl). In the Gaza strip children had a higher prevalence than the West bank children as it was (38.7% GS compare to 33.5% WB). The highest prevalence observed in refugee camps children (PCBS, 2002).

Micro nutrient deficiencies affect one third of the world populations (WHO, UNICEF, 1999). Anemia (IDA) is one of the most widespread micronutrient deficiency among the public health problems in the world. Anemia defined as a state of red blood cells quality and quantity reduction below the normal level (De Mayer and Adiels –Tegman, 1985). It could be also defined as a state that the hemoglobin concentration fallen below two standard deviations below the median for a healthy population of the same age, sex, and stage of pregnancy

(WHO/UNICEF/UNU 1997).It considered as an endemic problem for all classes of the population (WHO, 1991). More than 2 billion people are affected by Iron deficiency anemia world wide, the most common vulnerable groups to this deficiency are infants, children at pre-school age and pregnant and lactating women. In general, females are more vulnerable to anemia than males due to inadequate intakes of iron in their diet in addition to the social discriminations (Dennison et al, 1995).

Generally, men do not became anemic unless there is blood loose history (UNRWA,1999). Blood loosing could be pathological, as in the case of intestinal helminthes, infectious or physiological as in menstruation, pregnancy and delivery consequences (Scrimshaw, 1991). The consequences of the problem in the developing countries extend to the welfare, social and economic status of the population. It increases the poor pregnancy out come including prematurely, low birth weight and maternal mortality. Some studies showed the relation ship between anemia and number of pregnancies, as the prevalence of anemia in pregnancy doubled after the 3rd pregnancy (Bangkok,1972). There is also some evidence showing that anemia may result in impaired cognitive development and child growth reduction. Anemia is a final out come of a multi risk factors interaction. The most common risk factors are dietary factors. Iron, folate and vitamin B12 are examples for micro nutrient deficiency anemia.

Genetic hemoglobinpathies, race, geographical factors are also considered as anemia contributing factors (WHO/UNICEF/UNU,1997) smoking, sex, age, chronic bleeding, infections (malaria) and pregnancy status were found to be associated with the problem. The factors associated with the bioavailability of iron in the diet accounts for the majority of causes of anemia (INACG, 1979, 1989, De Mayer et al, 1989 Hercbergard Galan, 1992;Yip, 1994). Iron bioavailability is low in populations consuming high amounts of legumes and cereals due to phytate and tannin inhibitors(FAO/WHO, 1988). Anemia is defined as a condition, characterized by a decrease in the concentration of hemoglobin in the blood and a decrease in the blood cell volume, lower than the established cutoff value which ranges from110 g/l for pregnant women and children 6 months – 5 years of age, to 120 g/l for non pregnant women and to 130 g/l for men (WHO/UNICEF/UNU,1997) (WHO/ UNICEF,1999). Hemoglobin is an iron-containing protein in red blood cells that carries the oxygen from the lungs to cells throughout the body

Anemia occurs when the healthy red blood cells (RBCs) becomes low. As RBCs contains hemoglobin, which carries oxygen to the body’s tissues. Untreated anemia can lead to several complications in the body including fatigue, apathy, impairment of growth and development and decreased resistance to infection (American Family Physician, 1995).

A study was conducted among infants in Akko sub-district to investigate the association between anemia and socio-demographic variables. The finding showed that 30.8% of these infants had a hemoglobin level below 11 g/dl, 24% had a hemoglobin level between 10.0-10.9 g/dl, 6%--between 9.0-9.9 g/dl and less then 1% of the infants had a level of hemoglobin below 9.0 g/dl. An association was found between the rate of anemia and ethnicity as Arabs showed higher rates of anemia than Druze and between the rate of anemia and the type of settlement. The low rates of anemia was found among children from the higher socio-economic level. The Bedouin settlements showed the highest rate of anemia. In addition to a significant association also was detected between anemia and the number of children in the family (Shehab S, et. al, 2001)

2.3.4 Diagnosis of iron deficiency anemia

The biochemical indicators are methods used to detect the sub clinical or marginal deficiencies or imbalances in the individuals. Also it could be used to enhance or support dietary, anthropometric, or other kinds of data related to nutritional status Biochemical indicators could measured directly through nutrients metabolites in blood or urine (e.g. serum Vitamins A, B12 level). It could measure the hemoglobin response to iron supplements. Hemoglobin (Hb) is considered the biochemical indicator for anemia determination (Shah, 1981), (Miller.R, 2006)

As stated in Miller (2006) Mainly, doctors don't diagnose anemia until they run blood tests as part of a routine physical examination. A complete blood count (CBC) may indicate that there are fewer red blood cells than normal. Other diagnostic tests may include:

Blood smear examination: Blood is smeared on a glass slide for microscopic examination of RBCs, which can sometimes indicate the cause of the anemia.

Iron tests: These include total serum iron and ferritin tests, which can help to determine whether anemia is due to iron deficiency.

Hemoglobin electrophoresis: Used to identify various abnormal hemoglobin’s in the blood and to diagnose sickle cell anemia, the thalassemias, and other inherited forms of anemia.

Bone marrow aspiration and biopsy: This test can help determine whether cell production is happening normally in the bone marrow. It's the only way to diagnose

Aplastic anemia definitively and is also used if a disease affecting the bone marrow (such as leukemia) is a suspected cause of the anemia.

Reticulocyte count: A measure of young RBCs, this helps to determine if production of red blood cells is at normal levels.

In addition to running these tests, doctor may ask about a family history of anemia and child's symptoms and medications. This may lead the doctor to perform other tests to look for specific diseases that might be causing the anemia

The American Academy of Pediatrics recommends at least once measuring for hemoglobin and hematocrit during each of the following periods: Infancy (between 6-9 months) early childhood (1-5 years), late childhood (5-12 years)and adolescence (14-20) as a routine screening (American Family Physician, 1995).

Anemia could be diagnosed by analyzing the hemoglobin concentration in the blood or by measuring the proportion of red blood cells in the whole blood (hematocrit). According to the hemoglobin level anemia is classified into mild, moderate and severe based on the criteria developed by the World health Organization (De Mayer et al 1989) severe anemia is a hemoglobin concentration less than 7.0g/dl , whereas moderate anemia hemoglobin concentration would be 7.0-9.9 g/dl and in mild anemia the hemoglobin concentration would be 10.0-11.9 g/dl (10-10.9 g/dl for pregnant and under 3 years aged children).

Blood tests are done to diagnose iron deficiency anemia and distinguish it from other types of anemia. The laboratory tests that are performed to look for iron deficiency anemia include Low hematocrit and hemoglobin (red blood cell measures) ,small red blood cells, low serum ferritin (serum iron level, high iron binding capacity (TIBC) in the blood and blood in stool (visible or microscopic) To detect iron deficiency in children and infants, the use of age-specific reference standards must be employed. There are marked developmental changes in normal values for Hb, Ht, MCV, MCH and TS. Moderately severe iron deficient anemia is easily recognized in children by a low MCV, reduced SF, SI, an increased TIBC, EP and RDW (Oski 1993). The diagnosis of milder forms of iron deficiency is more difficult, as values for iron deficient and iron sufficient persons overlap considerably.

Table (4) Hemoglobin (Hb) and hematocrit (Hct) levels according to WHO/UNICEF/UNU (1997), adopted from WHO (1996)

Age group	**Critical level**	
	Hematocrit %	**Hemoglobin g/dl**
6months - 5year	11.0	33
5-11 years	11.5	34
12-13 years	12.0	36
Men	13.0	39
Women/ Non pregnant	12.0	36
Pregnant women	11.0	33

Anemia considered severe when hemoglobin concentration equal 7g/dl and life threatening very severe when Hb reached 4.0 g/dl.

Severity of anemia could be classified according to red cell morphology and by path physiologic mechanism. The classification that based on MCV size and coloration by Hb (MCHC, mean corpuscular hemoglobin concentration) is called Morphological classifications. While the classification that depends on the size of the red cell anemia could be normocytic if the size of the RBC is normal (MCV 80-100 fL), macrocytic if the size is above normal (MCV> 100fL), or microcytic if the size is below normal (MCV<80fL). And according to the coloration by hemoglobin content can be normal (normocytic) or hypo chromic with low content of hemoglobin. (Robert et al, 1998)

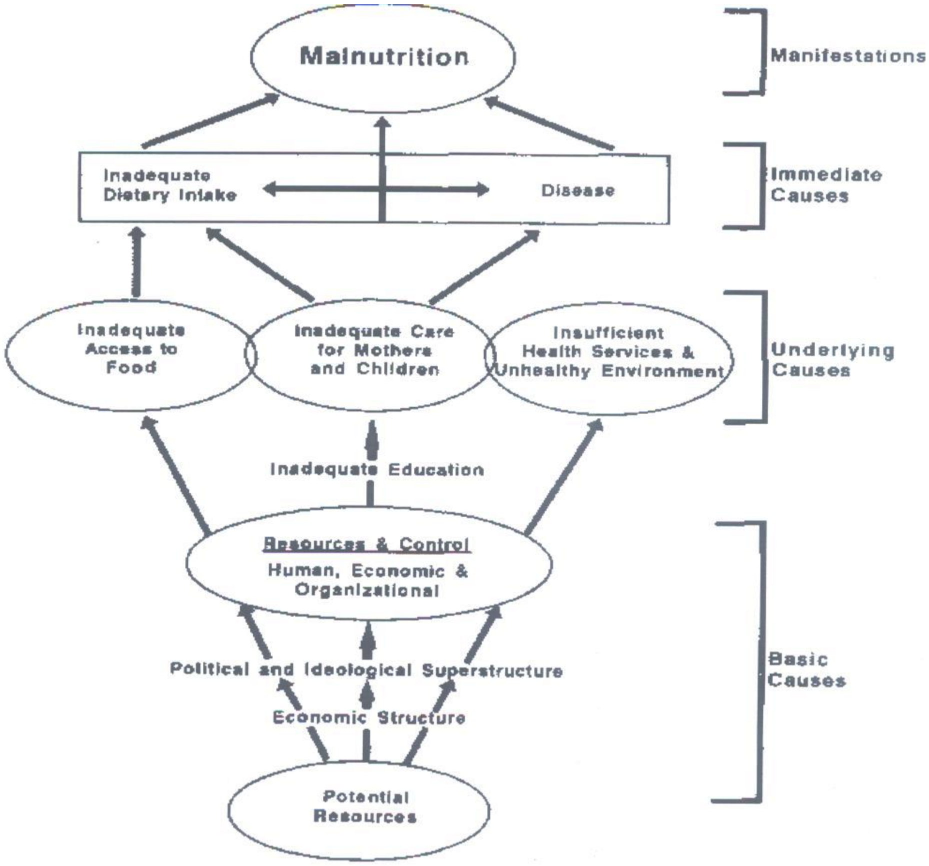
Serum ferritin measurement:

Serum ferritin is the most useful test in the diagnosis of iron deficiency. It reflects iron stores accurately in healthy people; a level below normal is diagnostic of iron deficiency. In an anemic patient a normal level is less useful, as many diseases such as malignancy, liver disease and inflammatory diseases cause a rise in ferritin independent of iron stores. In such patients a low level can be considered to be diagnostic of iron deficiency and the diagnosis is virtually excluded if the level is above normal. In patients with intermediate ferritin levels and anemia the gold standard for the assessment of storage iron is marrow aspiration and Prussian blue staining.

2.4 Framework for analysis

2.4.1 Determinants of nutritional situation

The primary determinants of malnutrition as conceptualized by many authors relates to unsatisfactory food intake, severe and repeated infections or combination of both. Malnutrition is the result of a complex interaction of factors involving such diverse elements as household access to food, child and maternal care, safe water and sanitation, and access to basic health services as stated in the American Academy of Family Physicians (2003; UNICEF,1998) . Malnutrition conceptual framework given by UNICEF(1998) is widely analytical tool clarifying the causal factors and their interactions at three main levels: immediate, underlying and basic causes .



Source : UNICEF 1998

Below is a summary of the known factors and their effects.

Food-health- care

These factors are considered the main three pillars of nutritional security (UNICEF, 1998). The interaction between the immediate and underlying factors includes the household food insecurity, inadequate maternal and child care, unhealthy environment and poor health services could affect the dietary intake negatively and contributes to the spread of infections.

The household food security affected directly by the financial , social and physical access. Presence of several types of food at the market level doesn't mean that food is reachable by every one and there is no food access problem.

The level of caring practices between the individual providing the care and the recipient one is determines by many factors and particularly the use and control of resources related factors.

Human resources are the most crucial one that influenced by the level of education, presence of skills and motivations in addition to knowledge and experience. Presence of the economic resource is also important and could play a role in supporting the food access at the individual and community levels (UNICEF,1998).

Education

A lack of access to good education and correct information is also a cause of malnutrition. The information strategies and accessible education programs could enhance the aware ness, skills and behaviors needed to control and prevent malnutrition. Investments in basic education by governments affected by malnutrition effects the brain development and the intellectual performance. Iron deficiency anemia threaten millions of children, and could be considered one of the countries barriers to educational systems improvement (UNICEF,1998). Parents educational level have its influence over all family members; education could help mothers to take accepted decision among household, and have a better access to household resources(ACC/SCN,1990; Rizkallah,1991) cited at Al- Rai (2005). Female illiteracy increased the risk for stunting, mothers who were illiterate were more likely to have stunted children(Shah. et.al,2003)

Political situation

War and other catastrophic conditions are responsible for only a tiny part of the worldwide malnutrition crisis. But such emergencies, like the ongoing crises in the Great Lakes region of Central Africa and in the Democratic People's Republic of Korea, often result in the worst forms of malnutrition. Meeting food requirements in these situations is essential, but so is protecting people from illness and ensuring that young children and other vulnerable groups receive good care.

Socioeconomic situation

Malnutrition has long been recognized as a consequence of poverty. Despite the dramatic gains in reducing child malnutrition, the absolute number of malnourished children worldwide has grown. Individuals income variations , coupled with reductions in social protection, could effects on the nutritional well-being of children as in the industrialized countries. Discrimination and violence against women are major causes of malnutrition. As women are the main care providers of nourishment during the crucial periods of children's development. Their caring practices affect children's nutritional well-being, particularly when women and girls face discrimination in education and employment. Poor household income and overcrowding are important risk factors for stunting(Shah. et.al,2003). Income growth could improve the food demand and nutritional outcomes(Alderman, et. al,2000). Discrimination and violence against women are major causes of malnutrition (UNICEF,1999)

childhood illnesses

Malnutrition is a consequence of disease and inadequate dietary intake, children have high mortality risk as a result of a common childhood disease than those who are adequately nourished. The malnutrition in early periods of life including the period of fetal growth is strongly linked with the later life development stages. The most critically vulnerable groups are developing fetuses, children up to the age of three and women before and during pregnancy and while they are breastfeeding. Malnourished children, are not protected from frequent illness and do not receive the adequate care especially in developing countries due to the limited resources and lack of health services. Malnourished children are more prone to illnesses and malnutrition is also commonly the result of illness that affects child growth and development. In parts of Africa where malaria is common, about one third of child malnutrition is caused by malaria. The disease also has dangerous nutritional consequences for pregnant women. In addition, pregnant women are more susceptible to malaria, and children born to mothers with malaria run a greater chance of being born under weight and anemic.

Maternal and child nutrition

Physical potential is shaped during the period from the conception, as child's organs and tissues, blood, brain and bones are formed. In the first 18 months of life human development proceeds rapidly, the nutritional status of pregnant and breastfeeding mothers and young children are important for a child's later development. Growth during the fetal stage depends on how well nourished a woman was before pregnancy, as well as how much weight she gains while she is pregnant. Birth weight will double in the first four months of life. And fulfilling the women's food, health and care needs could be considered a struggle for many women in the developing world. (UNICEF,1998). Feeding pattern, family income, mother with anemia and drinking clean water were factors associated with children's anemia (Zeng LX, 2004). Children good nutrition could be clearly appear in their physical body built. They seems taller, stronger, healthier than their malnourished peers. Societies that meet women's and children's nutritional needs also lift their capacities for greater social and economic progress.

As stated in UNICEF (1998) the United Kingdom and some of Western European countries, half of the economic growth achieved between 1790 and 1980 was attributed to better nutrition and improved health and sanitation conditions. Nutrition could be protected even in countries with high poverty rate as it occurred in parts of Brazil, the percentage of underweight children decreased from 17 % in 1973 to under 6% in 1996.

Ensuring good nutrition is a matter of international law, every government in the world recognizes the right of all children to the highest attainable standard of health, including the right to good nutrition and its three vital components: food, health and care. Nutritional disorders in mothers, especially iodine deficiency, could produce varying degrees of mental retardation in her infant. About 60 per cent of women of childbearing age in South Asia where half of all children are underweight are themselves underweight. In South-East Asia, the proportion of underweight women is 45 per cent; it is 20 per cent in sub-Saharan Africa.(UNICEF,1998)

Low birth weight and child health

Low-birth weight babies, defined as weighing less than 2.5 kilograms, are at greater risk of dying than infants of average weight. If they survive, they will have more episodes of illness, their cognitive development may be impaired and they are also more likely to become malnourished. The effects of malnutrition cross generations. Malnourished and underweight mothers are likely to deliver small infants at birth. Low birth-weight and low body mass index of mothers were the strong predictors of stunting, whereas low birth-weight and iron deficiency were the strong predictors of anemia(Mamiro PS. et.al,2005)

Low-birth weight babies have IQs that average 5 points below those of healthy children. And children who were not breastfed have IQs that are 8 points lower than breastfed children. Mothers are facing more difficulties in feeding low birth weight babies, and it could be the reason that clarify why the low birth weight babies at a higher risk to develop malnutrition. Currently about 24 million low-birth weight babies are born every year, about 17 per cent of all live births, mainly in developing countries.

Multi-gestational pregnancy and anemia

It is definitely known that twins pregnancy creates a heavy load on pregnant iron stocks. A study was conducted in Tunisia by Ben Miled (1989) among term newborns, aims to compare the risk of anemia among twins. The study results showed 3 and 6 months hemoglobin level and mean corpuscular hemoglobin are significantly lower in twins. Early preventive iron supplementation is essential to decrease the risk of anemia in twins (Ben Miled S, et.al,1989)

Child age, sex and nutritional disorders

Under nutrition showed higher risk among children under three years. The prevalence of anemia in children 6-23 months old was twice as high among children aged 24-59 months, 61.8% vs. 31%. The decreasing trend with age was significant. Anemia prevalence was similar in boys and girls (Mahgoub, S. et.al,2006). Anemia and iron deficiency increased strongly with age,(Seigel EH. et.al,2006). The prevalence of anemia among children was relatively high in 6-18 months age, and declining when children grew older(Zeng LX, 2004)

2.4.2 Consequences of malnutrition

Malnutrition is related to more than half of all child deaths worldwide. Its effects extend to the millions of survivors who are left crippled, chronically vulnerable to illness and intellectually disabled. Malnutrition is a real crisis and called the silent emergency. Its persistence has profound and frightening implications for children, society and the future of humankind. Of the annual preventable 12 million deaths among children below five years of age in developing countries over 6 million, (55%) are directly or indirectly attributed to malnutrition. (UNICEF, 1998). Nearly 2.2 million children die from diarrhea caused dehydration that is often aggravated by malnutrition Many children suffer from multiple types of malnutrition and numbers tend to overlap. At global level, about 226 million children are stunted. This type of nutritional disorder is associated with a long-term reduction in dietary intake, most often closely related to repeated episodes of illness and poor-quality diets.(UNICEF, 1998). About 67 million children are estimated to be wasted, below the weight they should be for their height, as a result of reduced dietary intake, illness, or both. Nearly 183 million children weigh less than they should for their age (the same source).

The effect of malnutrition on human performance, health and survival have been the subject of many extensive researches for several decades. It considered as an underlying factor in many diseases in both children and adults. Malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, physical work capacity and consequently impacts on human performance. Malnutrition is a consequence of disease and inadequate dietary intake, more elements social, political, economic, cultural are involved beyond the physiological situation. Even mild vitamin A deficiency impairs the immune system, reducing children's resistance to diarrhea, which kills 2.2 million children a year Malnourished children, unlike their well-nourished peers, not only have lifetime disabilities and weakened immune systems, but they also lack the capacity for learning in comparing to their well-nourished peers. (UNICEF,1998) Children who are severely underweight found to be two to eight times more liable to die within the following year compared to children of normal weight for their age. Malnutrition varies in its forms and each might contribute to the other, such as the protein-energy malnutrition, the micronutrients deficiencies such as iodine, iron and vitamin A. The World Health Organization (1995) and the UNICEF (1998).

2.4.3 Causes of Anemia

Iron deficiency anemia (IDA) is a decrease in the red blood cells numbers due to insufficient iron intake. Iron is an essential component of hemoglobin synthesis. Lack of iron in the children's diet could lead to iron deficiency anemia. Children requires approximately 2.0 mg iron/day and if they did not receive their daily requirements of iron, anemia could be developed (scrimshaw,1991). The most common causes of IDA in general are due to lack of iron intake, blood loss, poor absorption of iron due to presence of inhibitors such as Tannin in the tea, phytate, calcium and phosphates Tea drinkers showed higher anemia prevalence (Disler et al ., 1975; Rossand et al., 1979; Galan et al., 1985; Razagui et al. , 1991). In the first 6 months of age, iron stores are dependent on what has occurred in pregnancy. Due to the possible low stores of iron during pregnancy, low birth weight or premature infants are particularly vulnerable. During the following six to twelve months iron deficiency can be brought on by poor feeding practices. At this age prolonged exclusive breast feeding, delayed introduction of foods, lack of meat in the diet or over dependence on caws milk may bring on anemia. The prevalence of iron deficiency anemia has declined over the past decades but, infants with low birth weight, or fed whole caws milk during the first year of life, and those from low socioeconomic status still at risk to have anemia (Soh P, 2004) . In addition , there is a number of the types of anemia with different causes as the following .

Iron deficiency anemia (IDA) is the most common type of anemia. Occurs when there is insufficient iron in the body.

Megaloplastic (or vitaminB-12deficiency) anemia. Lack of folic acid or vitamin B-12 in the body could lead to this type of anemia.

Megaloplastic (or vitaminB-12deficiency) anemia. Lack of folic acid or vitamin B-12 in the body could lead to this type of anemia.

Inherited blood disease. Family history due to genetic causes could lead to a higher risk to have the disease. Sickle cell anemia is one type of inherited blood disease.

Aplastic anemia. This rare problem happens when the body is unable to synthesis enough red blood cells. For further types of anemia details see literature appendix (2)

Signs and symptoms of Anemia

Anemia sings and symptoms are depending on the cause and the severity of anemia,. It might developed gradually without notable signs and symptoms. Anemia mainly associated with pale skin color (pallor), Irritability, Weakness, Shortness of breath, Sore tongue, Spoon-shaped brittle nails, unusual food cravings (called pica), headache and decreased pinkness of the lips in addition to Blue-tinged or very pale sclera (whites of eyes), recurrent infections, Decreased attention

Span, and could be asymptomatic in case of mild anemia (Miller.R,2006)

2.4.4 Consequences of Anemia

Anemia has an important health, welfare, social and economical consequences. These includes reduced work capacity, increased mortality risk in complicated cases, particularly during the prenatal period**.**

It considered as a major cause for malnutrition, leads to loss of appetite, which reflect negatively on the general health of the children and cause malnutrition**.** The deficiency may result in impaired cognitive development, lower IQ. Some times, the effect of nutritional deficiencies could be irreversible. Women and children are the most vulnerable group to have anemia (IDA). It considered a major contributing factor of post partum maternal mortality (WHO,1991), (Miller.R,2006)

At the mother child health level

Three quarters of the children who die worldwide of causes related to malnutrition are described as mildly to moderately malnourished with no signs of problems. More than 2 billion people, mainly women and children, are iron deficient, and the World Health Organization (WHO) estimates that 51 per cent of children under the age of four in developing countries are anemic. (WHO,2002). Anemia as a malnourishment form has been identified as a contributing factor, if not a principal cause, in 20 to 23 per cent of all post-partum maternal deaths in Africa and Asia (UNICEF,1998)

Anemia is a factor affect the pregnancy and childbirth, the estimates to its complications that it kill 585,000 women annually; folate deficiency in mothers at risk can cause birth defects in infants, such as spina bifida. Iron deficiency anemia can delay psychomotor development and impair cognitive development, lowering IQ by about 9 points especially in infancy and early childhood. Anemic pre-school children have been found to have difficulty in maintaining attention and discriminating between visual stimuli. Poor school achievement among primary school and adolescent children has also been linked to iron deficiency. Limited mental as well as physical potential of malnourished children could affect the way they will face the future. They will become adults with lower physical and intellectual abilities. Iron-deficient children under the age of two years show problems with coordination and balance and appear more withdrawn and hesitant. Decrease child's intellectual ability to interact with and learn from the environment.

At the socio economic level

Anemia is ignored in most majority population countries despite, it is one of the most prevalent public health problems which has serious consequences for national development. Iron deficiency causes at least 50% of all anemia, and a million annual deaths; three-quarters of these deaths occur in Africa and South-East Asia. At the global level (IDA) is classified in the "top ten" risk factors that contribute to burden of disease as stated by UNICEF report (1998). A study estimates the economic costs of IDA at 4.05% of gross domestic product (GDP)—US$2.32 per capita in lost productivity and US$14.46 per capita in lost cognitive function. About $50 billion in GDP is lost annually world wide in low-Estimates of Economic Losses from Iron Deficiency Anemia (Cognitive & Productive) (Horton and Ross,2003)

It could lower the levels of productivity and higher levels of chronic illness and disability, often in societies with little economic capacity for even minimal therapeutic and rehabilitative services. Malnutrition often linked to disability and illness which increased the costs and expenses at the family level. Especially in poor and limited social and health services as in the developing countries. In 1990 alone, The worldwide loss of social productivity caused by four over lapping types of malnutrition, nutritional stunting and wasting, iodine deficiency disorders and de efficiencies of iron and vitamin A amounted to almost 46 million years of productive, disability-free life.

Vitamin and mineral deficiencies are estimated to cost some countries the equivalent of more than 5 per cent of their gross national product in lost lives, disability and productivity. Bangladesh and India forfeited a total of $18 billion in 1995. Malnourished children's low resistance to illness, decreased the effectiveness of the available resources and decreased the access to the other basic health services and sanitation. (UNICEF,1998)

2.4.5 Prevention and management of anemia

■**Diet**, Child's diet is the most important approach to prevent and treat mild iron deficiency.

Miller. R(2006) mentioned Good choices for diet include iron fortified grains and cereals, red meat, egg yolks, leafy green vegetables. Too much milk drinking could worsening anemia status as it cause iron loss through intestinal walls, and decrease the appetite for solid foods. For picky eaters, vitamins supplementation that includes iron may be needed. Hem iron is better absorbed than Nonheme iron.

The amount of iron varies according to the type of food as iron dietary sources are divided into:

Best sources: breast milk, formula with iron, iron fortified cereals, liver, prune juice

Good sources: eggs, meat, fish, chicken turkey, soybeans, peanut butter, dried beans, lentils, molasses, peas

Other sources: tuna, apricots, raisins, kale, prunes, greens .

■**Iron and Breast milk:** Many literatures mentioned that, iron content of breast milk is often low, but it is adequate to prevent iron deficiency anemia for at least the first 6months of life, and iron deficiency does occur if the same amount of iron received from food other than breast milk as the breast milk iron considered highly absorbed in comparison to iron from other sources (Stekel A, 1984), (Miller. R, 2006),(American Family Physicians, 1995). Morning milk contains less iron than evening milk during the single feeding, the fore milk has a lower iron concentration than the hind milk, the range being from 0.3 to 1.0 Mg/ml, it also varies between women, even in the individual woman during the lactating period, the day and the nursing period. For further information see (literature appendix 4).

CONCLUSION

The risk of malnutrition and its outcomes such as wasting, stunting and underweight differs among infants and young children.. Local studies found that children under five years are at a high risk to develop nutritional disorders, particularly stunting. In this study, Yatta children had a high prevalence of nutritional problems (anemia, stunting, wasting and underweight) than other children as showed by the local Palestinian studies. The differences in this study may have been influenced by the demographic and socioeconomic factors that the sample subjects were living.

The recurrence of nutritional problems in the family children studied was high. This might relate to the deep rooted nutritional problem in the area because of the socioeconomic conditions or lack nutritional awareness issues. According to the WHO classifications for the public health problems, anemia could be classified a severe to moderate public health problem in Yatta area.   It considered the problem severe if it is above 40 % in women and young children, and moderate public health problem if between 20-39.9 %.

Stunting is a problem as described in the literature and appears to be increasing. Stunting was higher among the children receiving soft diet and bottle milk (non breast milk) than those receiving soft diet and breast milk.. Stunting was 50% among children received bottle milk only as daily feeding and the least percent was among the stunted children who received breast feeding only. The negative outcomes on children underline the need for further studies to address its causes among the children under the 2years.

Children under the age of six months are at risk to develop anemia early. Anemia prevalence among children under six months was increasing by age and not decreasing. Infants iron stores are affected by their mothers iron stores status. Studies clarifying the relationship between mothers and child anemia were limited at the national level. Further studies required at a national level to clarify the problem and to generalize the findings.

Children's feeding pattern, could be considered also a risk factor that might increase the nutritional disorders. This was clear from the significant association that showed between child feeding type and all types of malnutrition discussed in this study. The type of food provided to children as daily meals was associated with anemia in children under six months and the three types of nutritional disorder(wasting, stunting and under weight)in the children aged 6-24months.Most of the available studies were among children under five. Nutritional status studies for children below two years of age were limited, particularly the first six months of life.

The first year of life could hold more than risk factor for the infant to develop iron deficiency anemia. WHO and UNICEF recommended exclusive breast feeding up to the first six months of life and weaning started in this age, complementary feeding still a question required further attention and further studies are recommended to clarify the situation. The hind milk contains higher amount of iron than the fore milk, the child could have higher amount of iron from the night breast feeding compared to the day breast milk iron (Stekle, 1984). According to our analysis we found that exclusive breast feeding was given to 124 children(62%), from those breast fed infants 46% (92) of the children were always fed by both breasts during the same feeding and only 42.5% were fed by one breast in each feed.

About 22% of the second group mothers (45/200) mentioned that they have warms and anemia represented 15.5% from these mothers. Presence of worms could be considered as a problem in the area required further attention through organized dew arming programs and activities.

Recommendations

1. The study findings indicate the necessity for an intervention program at a national level to reduce the high rate of anemia among children, particularly, those below 2 years of age. Policy and programs should be designed and implemented at the national level to reduce the dramatic differences in nutritional status with special emphases on the rural areas.
2. Anemia under six months is a problem that requires further efforts in the primary and secondary preventive measures through government and nongovernmental MCHN cervices.
3. Screening for iron deficiency anemia in children started at the 9 months, and even the preventive iron supplementation provision, such policy required revision based on further studies to meet the local needs of children living in crises or risk situation. Suggested starting iron screening at six months.
4. Preventive iron supplementation for children in areas at high risk to develop anemia could started before the age of six months (based on a further studies).
5. There is still limited information available on the feeding patterns and the types of food provided for children in the first 2 years of life particularly the first six months and its consequences on children nutritional status (anemia and malnutrition). Further studies are recommended in these areas. Special programs concerning health education and awareness components regarding breast feeding and complementary feeding issues at a national issues could be established.
6. More comprehensive studies should be followed to better understand the children feeding patterns, complementary feeding and breast feeding practices especially for children in the first 2 years of life.
7. Local studies about ferritin situation in young children and pregnant mothers were limited, there is limited information on the nutritional status and dietary habits among young pregnant women and their birth outcomes, further studies are also recommended.

الملخص

يعتبر سوء التغذية و حتى يومنا هذا من الأمراض الشائعة في فلسطين و خصوصا بين الامهات و الأطفال في السنوات الأولى من العمر. ويعرف بأنه حالة من عدم التوازن في الجسم اما بسبب الزيادة أو النقصان في تناول المواد الغذائية الضرورية مما يؤدي إلى نقص في بعض العناصر الغذائية الدقيقة في الجسم كالحديد أو البروتين. يعتبر فقر الدم الناتج عن نقص الحديد من أكثر أمراض سوء التغذية شيوعا، حيث يعرف بانه انخفاض في نسبة الهيموجلوبين (خضاب الدم) Hb < 11mg / dl

تشير الدراسة الى وجود هذه المشاكل الصحية(فقر الدم و سوء التغذية)بشكل مرتفع في بلدة يطا.

ظهرت هذه النتائج من خلال الدراسة التي اجريت على أطفال يطا من خلال دراسة مجموعتين من الأطفال، المجموعة الاولى قامت بدراسة 1565 طفل من الفئة العمرية 6 – 24 شهر و هم جميع الأطفال الذين فحصوا في مشروع مكافحة فقر الدم للعام 2005في جمعية ارض الأطفال.

تم مراجعة ودراسة ملفات هؤلاء الاطفال و فحوصات الدم التي اجريت لهم مع دراسة المعلومات التي جمعت عن الاطفال و عائلاتهم و مدى تأثيرها على نسب سوء التغذية و فقر الدم لديهم.

المجموعة الثانية للدراسة تمت على مرحلتين من العمر للاطفال الذين تقل اعمارهم عن ستة اشهر.
تم جمع المعلومات عن هؤلاء الاطفال و اجراء فحوصات دم لهم و لامهاتهم (Ferritin , CBC&S) على عمر3– 4 أشهر , أعيد فحص الأطفال على عمر 6 شهور لمعرفة مدى اصابتهم بفقر الدم (الانيميا)
تهدف هذه الدراسة الى الكشف عن مشاكل الوضع الغذائي للاطفال في منطقة يطا وتحديد نسبة فقر الدم لديهم اضافة الى دراسة الانيميا عند الاطفال في سن مبكر (ما قبل الشهر السادس). قد توفر هذه الدراسة معلومات تفيد في تحسين الخدمات المقدمة للاطفال في الاشهر الاولى من العمر ، خصوصا و أن هناك نقص في الدراسات و المعلومات عن وضع الاطفال في فلسطين لهذه الفئة العمرية و خاصة بما يتعلق بالأنيميا.

إن الدراسات التي اجريت في فلسطين حول هذا الموضوع تشير إلى انتشار هذه المشكلة الصحية و تزايد في نسبة الاصابة بمرض فقر الدم و سوء التغذية مما يتطلب العمل على الحد من هذه المشاكل الصحية و التخطيط لها على مستوى وطني .

أهم النتائج التي أشارت إليها الدراسة كانت كما يلي:

المجموعة الأولى (6–24 شهر)

نسبة فقر الدم كانت 66.4% أظهر التحليل وجود علاقة بين فقر الدم و كلا من : العمر, المجموعات العمرية, ولادة التوأم, تعليم الأم , الوضع الاجتماعي للأسرة .
سوء التغذية الناتج عن تراجع الطول للعمر (التقزم) 15.8 %

نسبة النحافة 3.4 %

نقص الوزن 10.7%

المجموعة الثانية (الأطفال الذين تقل أعمارهم عن 6 أشهر)

نسبة فقر الدم لدى الاطفال على عمر 3–4 شهور كانت 45%(Hb<10.5) و 66.5% اذا ما اعتمد (Hb <11g\dl). و عند تكرار فحص الدم لهؤلاء الاطفال على عمر 6 – 7 شهور ظهرت النتائج ارتفاع في نسبة فقر الدم الى 72.5 %(Hb <11g\dl)

نسبة فقر الدم لدى الأمهات كانت 36.5%مع متوسط هيموجلوبين بين 12.1% حيث أن النسبة كانت تتراوح بين 8.2 – 14.7 dl.

أظهر التحليل وجود علاقة بين الإصابة بفقر الدم على عمر 3–4 شهور و الإصابة به على عمر 6–7 شهور. فقر الدم كان مرتبط ب وزن الطفل على عمر الولادة و نوع الأطعمة التي يتناولها الطفل.

كانت نسبة الأمهات ذوات مخزون الحديد المنخفض 32.5%Ferritin<12 mcg/100ml

هناك ارتباط بين مخزون الحديد في الكبد عند الأمهات و مخزون الحديد عند أطفالهن.

هناك ارتباط بين مخزون الحديد في الكبد عند الأطفال و كلا من : جنس المولود ونوع الأطعمة التي كان يتناولها.

هناك فروق ما بين نسبة الإصابة بفقر الدم عند الذكور و الإناث فقد كانت النسبة أعلى عند الذكور.

لقد أظهرت هذه الدراسة حجم المشكلة التغذوية و نسبة فقر الدم لدى الأطفال في منطقة يطا مع الإشارة إلى بعض العوامل التي تؤثر في زيادة نسبة فقر الدم و سوء التغذية.

تم التحليل للفرتين بناءا على تبني حدين فاصلين (2 cutoff values for ferritin were adopted (Ferritin > 20 mcg/100ml and 30 mcg/100 ml) وبناءا على ذلك كانت النتائج مختلفة.

لوحظ من خلال الدراسة أن الأطفال في الأشهر الاولى (اقل من 6 شهور) هم عرضة للإصابة بفقر الدم مما يتطلب اتخاذ الإجراءات الوقائية اللازمة على عمر مبكر .

منطقة يطا من المناطق الفلسطينية ذات تجمع سكاني كبير و هناك حاجة ماسة إلى العمل بشكل مخطط ومدروس على مستوى وطني لمكافحة فقر الدم و سوء التغذية.

Tables for the first group (6-24 months)
Significant relationships measures of significance

Table (1) Summarizes the significant relation ships between anemia and the other variables in addition to their measures of relationship for a significant association

Table (2) showed the significant relationships between anemia and variables

Variable	Chi Square	P – value	(OR)
Anemia and children age groups.	73.860	P= .000	(12-17m) 0.711 (18-23m) 0.235
Anemia degrees and children age groups.	75.296	P=. 000	
Anemia and sex	14.089	P= .000	1.5
Anemia degree and sex	19.639	P= .000	-
Anemia and birth type	7.809	P=.048	6.8
Anemia and social cases	8.070	P=.005	1.4
Mother education and anemia	8.750	P=.010	0.62
Anemia and malnutrition(wasting or stunting or underweight)	4.31	P=.038	1.33

Table (3) summarized the significant variables with malnutrition problems

No	Variable	Chi Square Value	P - value	r	OR
1-	Stunting and sex	$X^{2=5.55}$	P=.021	0.06	0.72
2-	Stunting and home status	$X^{2=8.9}$	P= .003	0.08	1.54
3-	Stunting and Birth type	X^2 = 8.687	P=.003	0.091	3.01
4	Stunting and mother education	$X^{2= 3.3}$	P=.070	0.05	
5	Stunting and social case	$X^{2=}$5.866	P= .015	0.06	0.71
6	Stunting and feeding type	$X^{2=20.477}$	P=.008	0.08	
7-	Stunting and refugee child	$X^{2= 4.586}$	P=. 032	0.05	0.43
8-	Wasting and feeding type	$X^{2=}$10.078	P=.017	0.07	-
9-	Wasting and birth type	13.255	.000	0.004	0.87
10-	Underweight and feeding type	$X^{2=}$39.042	P= .000	0.11	
11-	Underweight and birth type	$x^{2=}$13.255	P=.000	0.11	3.92
12-	Underweight (wt-age) and home status	$x^{2=12.8}$	P= .000	0.1	1.83
13-	Feeding type and malnutrition(wasting+ stunting+ underweight)	$x^{2=}$24.765	P=.001	0.11	-
14-	Family workers numbers & underweight	$X^{2= 4.00}$	P=.045	0.051	-

Table (4) summaries the none significance variables and their chi- squares tests of significance results.

Variable	Chi Square Value	P – value	R	OR
Born type and wasting	$x^{2=.018}$	P= .892	0.04	0.87
Wasting and social case	$x^{2=. 950}$	P=. 330	0.025	0.76
Underweight & social case	$x^{2=3.493}$	P = .062	0.025	0.77
Family type and wasting	$x^{2=.950}$	P= .330	0.029	1.1
Family type and Stunting (Ht-age)	$x^{2= .549}$	P=. 583	0.015	1.13

Family type and underweight	x^{2}= 0.417	P= 0.519	0.016	
Mother situation and wasting	x^{2}= .386	P=. 551	0.015	
Mother situation and under weight	x^{2}=. 823	P=. 916	0.003	
Mother situation and stunting	x^{2}=. 949	P= .588	0.014	
Mother education and wasting (Wt-Ht)	X^{2}= 2.6	P=.106	0.04	
Mother education and underweight (wt-age)	X^{2}= 2.9	P=0.09	0.046	
Family number of workers and stunting	X^{2} =2.2	P= .477	0.038	
Family workers numbers and wasting	X^{2}=1.0	P=0.320	0.025	
Father work and wasting (wt-Ht):	x^{2}= 1.084	P = .298	0.026	1.34
Father work and stunting	x^{2}= 1.074	P=. 300	0.026	1.16
Father work and underweight	x^{2}=2.128	P=. 145	0.037	1.27
Home status and wasting	x^{2} = .762	P=. 909	0.014	1.17
Refugee type and wasting (wt-Ht)	x^{2} =1.066	P =..302	0.026	1.04
Refugee type and underweight (wt-age)	x^{2} =2.786	P=. 095	0.042	0.47

Summary for the non significant relation ship for group one and group two

Group one none significant relationships Were found in the following variables in the first group 96-24m): Nutritional disorders (wasting, stunting or underweight) were not statically significant related with family type (nuclear or extended), mother situation (widow, separated, divorced or live with husband). number of working members in the family (only was significant with underweight). Wasting or underweight were not statically significant related with mother education, being refugee child. Wasting was not statically significant related with birth type, family social situation and or family home status. Regarding anemia, analysis showed that: there is no significant relationship between anemia and wasting, stunting or underweight. In addition to that, there was no significant relationship between anemia and the child feeding type.

Group two none significant relation ships were detected between mother hemoglobin and child hemoglobin neither when he was 3-4 months nor when he reached 6-7 months. Child ferritin level was also checked for its relationship with mother education, number of rooms in the household, refugee status, mother age, number of family members, source of income, current income and home status and nor of them showed a significant relationship. There was also no significant relation between child hemoglobin at the age 3-4 months and the following factors: child sex, mother education, number of rooms in the household, being refugee, mother age, number of family members, home status of the family, source of income, current income, family type and number of meals received per day. The hemoglobin level at the age 3-4 months did not show differences with sex indicating abs cense of significant relationship. There was no significant relation between child hemoglobin at the age 3-4 months and feeding pattern whether using one or two breasts in the same feeding meal, duration of each breast feeding, and the number of breast feeding meals provided to the child per day. Also the number of bottle meals (artificial cow's milk) received per day by the child was not significantly related to the child hemoglobin.

When the child hemoglobin level at 3-4 months detected for possible relationship with the mother variables as the place of delivery, number of pregnancies, number of abortions, number of tea cups consumed by mothers per day, mother work, amount of iron supplements received by mothers during pregnancy, no significant relationships were found. Also no significant relationship was found between child hemoglobin at 3-4 months and family social situation such as: father work, number of workers in the family, living in poor family social conditions and number of educated people in the family.

Table (4)AEA project

Ard El Atfal (AEA) is a Palestinian primary health care institution proposed an emergency intervention in Yatta area aiming at enhancing the health, nutritional status of Yatta children reducing the prevalence of the anemia among them by 30%. Handling different aspects of nutritional status of children below 24 month of age in Yatta town. The study will focus on the analysis of the data collected through the project phases. The project phases are the following

Identification phase

- Targeted children names and addresses list were taken from the ministry of interior.
- Health worker team visited the families and referred the targeted children to the lab & clinic; Questioner was filled for the family, including basic information on the socioeconomic and health conditions of the child and family.

Referral and Screening phase

- Children in the identified age group were referred to the lab and clinic
- A full CBC test was taken for all the referred children during the project period.
- The mean total Hemoglobin were used as indicators for the classification of anemia degree. WHO Standards will be taken into consideration when we will analyze the data.

- Anthropometrical measurements will be done to identify the malnourished cases were identified.

Treatment and prevention phase

- Preventive and curative Iron supplementation were provided to the needed children according to the WHO protocols.
- Preventive dose (2 - 3 mg/kg / day)
- Low birth weight dose (2 - 2.5 mg/ kg / day)
- Curative dose for children in the age group 6 24 months according to the degree of anemia as Mild anemia (3 mg /kg/day), Moderate anemia (5 – 6 mg/ kg /day) and Severe anemia cases are referred to hospital
- Vitamins supplementation as needed.
- Quality food supplementation (food parcels) were provided to the social cases
- Health awareness campaign to raise the awareness of the importance of dietary issues in child health, include individual and group counseling among children’s mothers

HEALTHY HOUSE AND SOCIAL SITIOATION ASSESSMENT METHODS

The health workers had visited the houses and filled the questionnaire for each family having children aged 6-24 months in Yatta area. Assessment based on the healthy house and social criteria designed by AEA. Some of the variables in the criteria were adopted based on the literatures and the others were collected from similar instruments used in previous national studies such as PCBS studies 2002 . The researcher participated in the 6-24 months questionnaire forming as he was one of Ard El Atfal management staff member

Table (5)Healthy house criteria

- Location

The health worker assessment for the healthy house will consider several issues related to house location that might affect its healthy situation such as, the house is located in a crowded, unclean area surrounded by animals, stones factory, dusty area, far from health services, close to environmental source of pollution…ect.

■ Household size and distance, not crowded, not small house, kitchen not considered one of the household rooms, house hold size suitable to the number of the family members.

■ Ventilation

Adequate ventilation to the house is available, adequate sunrays pass through, accepted level of humidity in the house.

■ Number of resident members in the house are adequate in comparing to the number of the house rooms number (4 members / room)

■ Suitable sewage system and water source, the household water source, adequate, clean, away from pollutant source…..ect.

■ Building and structure of the house suitable, no wholes or cracks in the building, well designed and safe structure.

■ Household hygiene level, clean house, availability of services necessary for food preparing, clean kitchen, adequate lighting and space…ect.

■ Household surrounding environment

Table (6)Social cases criteria

■ The father in the family is unemployed or not working at the time of the interview or having chronic disease prevent him from working.

■ If employed household and the family had more than two members studying in the university or had three to five children less than15 years, or had persons over 60 years.

■ Presence of handicapped or chronic ill member in the family that required extra expenses

■ Family income is not enough in compared to the number of the household members, or family income 600 NIS or less

■Absence of supportive source of income for the family such as land, car, trade,….ect

Second group tables of none significance relationships

Not significant Relationships

Analysis showed no significant differences between the mean of hemoglobin for both sex at the age of 3-4 months. T-test showed mean for females hemoglobin was 10.57g/dl while the mean hemoglobin for males at the same age was 10.56g/dl

Table (25)showed no significant relation ships between the following variables:

Variable	**F – test or Chi – square**	**P- value**
Mother hemoglobin and Child hemoglobin at the age 3-4 months	x^2 =2.9	p= .061
Mother hemoglobin and child hemoglobin at the 6-7 months age	x^2 =0.40	p= 0.31
Child sex and hemoglobin level at the age 3-4 months.	F value =0.009	p=0.92
Child hemoglobin at 3-4 months and mother education	F value =0.542	p=.556
Child ferritin and mother education	F value =1.597	p= .177
Child Hb at 3-4 months age and the household room's number.	F value =0.793	p> 0.05
Child ferritin and number of rooms in the house hold	F value =0.983	p= .429
Child hemoglobin at the age 3-4 months and Being refugee	F value =2.3	p= .131
Child ferritin and Being refugee	F value =3.2	p= .074
Child Hb at the age of 3-4 months and mother age	F value =0.992	p > 0.05
Child ferritin at the age of 3-4 months and mother age	F value =1.2	p > 0.05
Child Hb at 3-4 months age & number of family member	F value =0.7	p=.778
Child ferritin and number of family member	F value =1.22	p=.778
Child Hb at the age 3-4 months and type of family	F value =0.33	p= .940
Child Hb at 3-4 months age and family home status	F value =0.17	P > 0.05
Child ferritin and home status of the family	F value =0.33	p=.717
Child Hb at the age 3-4 months and source of income	F value =0.39	p=.940

Child ferritin and source of income	F value =0.87	p= .901
Child Hb at the age 3-4 months and current income	F value =1.17	p= .266
Child ferritin and current income	F value =0.64	p= .917
Child Hb at 3-4 months & number of meals received/ day	F value =0.51	p= .914

Table (26) showed Not significant relationships for the second group

Variable	F – test	P- value
Child Hb at 3-4 months and the duration of breast feeding	F value =0.68	p= .727
Child Hb at 3-4 month & the usage of the two breasts in the same meal	F value =1.78	p=0.171
Child hemoglobin at 3-4 months age and the number of bottle feeding meals he received/ day	F value =1.59	p= .131
Child hemoglobin at 3-4 months age and place of delivery	F value =1.77	p=.173
Child Hb at 3-4 months and the number of pregnancies	F value =0.66	p= .556
Child Hb at 3-4 months age and the number of abortions	F value =0.86	p= .543
Child Hb at 3-4 m & family educated members number	F value =0.63	p= .774
Child Hb at 3-4 months and the number of iron box given to the mother during pregnancy	F value =0.79	p=.575
Child hemoglobin at 3-4 months age and the number of tea cups consumed by the mother / day	F value =0.82	p=.825
Child hemoglobin and mother works	F value =0.02	p= .856
Child hemoglobin at 3-4 months and being social case	F value =0.52	p= .471
Child hemoglobin at 3-4 months age and father work	F value =0.46	p=.838
Child Hb at 3-4 months & workers number in the family	F value =0.45	p=.566
Child Hb at the age of 3-4 months and mother age	Fvalue =0.992	p=.322
Child ferritin and mother age	F value =1.2	p= .239
Child ferritin and mother education	Fvalue =1.597	p=.177

When the cut value for ferritin level increased to 30 mcg/100ml it showed the following no Significant Relationships as showed in table (27)

Variable	**Chi- square**	**P- value**
Mother ferritin and child Hb at 6-7 months	x^2 =.811	0.450
Mother ferritin and child Hb 3-4 months	x^2 =.477	0.480
Mother ferritin < 30 and refugee type	x^2 =.884	1.000
Mother ferritin <30 and child sex	x^2 =2.796	0.126
Mother ferritin < 30 and child feeding type	x^2 =10.114	0.893
Mother ferritin and family social case	x^2 =.042	0.847
Child ferritin<30 & child Hb at 3-4 months	x^2 =.989	.464
Child ferritin < 30 and mother hemoglobin	x^2 =.102	0.815
Child ferritin < 30 and type of family	x^2 =.316	0.788
Child ferritin and feeding type	x^2 =9.119	0 .139
Child ferritin and family social case	x^2 =.759	0.429
Mother ferritin and family type	x^2 =2.270	0.166
Child ferritin and type of family	F value= 0.0	p= .865

استبيان

رقم الاستمارة .... تاريخ تعبئة الاستمارة : / /2005

ساعة البدء بأخذ الاستمارة : .... ساعة الانتهاء من الاستمارة:.......................

معلومات عن الطفل المبحوث

1- الاسم الرباعي :...

2- العمر .... تاريخ الميلاد : / /

3- الجنس : 1- ذكر 2- أنثى

4- حالة الولادة : 1- مفرد 2- توأم 3- توأم ثلاثي

5- أسابيع الحمل :   1- اقل من 37اسبوع   2- من 37-42 أسبوع   3- أكثر من 42 أسبوع

6- هل تناول الطفل الحديد المقوي :   1- نعم   2- لا

1. في حالة نعم يرجى تفصيلات الحديد
2. على أي عمر أعطي الطفل حديد الوقاية .... شهر
3. عدد علب شراب الحديد .... علبة

في حالة أعطي حديد (Drops) عدد العلب .... اسمه ونوعه............................

7- تغذية الطفل : 1- رضاعة طبيعية فقط   2- رضاعة صناعية فقط

3- رضاعة طبيعية ووجبات نظيفة   4- رضاعة طبيعية وصناعية

5 - حليب صناعي + وجبات خفيفة

8- إذا أعطي الطفل حليب صناعي على أي عمر ادخل الحليب الصناعي

....

اسم الحليب الصناعي الذي يعطي للطفل

....

9- تفصيلات عدد الوجبات اليومي : الرضاعة الطبيعية .... الرضاعة الصناعية ....

10-هل عاني الطفل من اسهالات خلال الأسبوعين الماضيين ؟ نعم لا

إذا كان نعم حدد نوع المرض : ....

11- أين تمت الولادة الطفل : 1- البيت 2- المستشفى 3-مراكز التوليد 4- غير ذلك حدد

12-كيف كانت الولادة :1- طبيعية 2-قيصرية 3- استعمال أدوات ميكانيكية 4-غير ذلك حدد

13-ما هو ترتيب طفلك الحالي بين أخواته

البكر الثاني الثالثة الرابع الخامس فأكثر

14-هل يعاني الطفل من الأمراض التالية

1-تشوهات خلقية 2- إمراض قلب 3- ربو (أزمة)

4- اسهالات 5-إمراض كلى 6- إمراض في الدم

7- إمراض أخرى حدد

معلومات عن الأم المبحوثة

15- اسم الأم الرباعي (حسب الهوية

)..

16- العمر الحالي :.. تاريخ ميلادها : / /

17-عمر الزواج

للام:...

18- عمر الزواج للأب

:...

19- كم كانت المدة بالسنوات بين الزواج والحمل الأول

:..

20-عدد الأحمال

:...

21-الولادات :...

22-الإسقاطات :...

23- تعليم الأم : 1- أميه 2- تقرا وتكتب 3- ابتدائي

4 -إعدادي 5- ثانوي 6- جامعي

24- مجموع عدد السنوات الدراسية للام : ....

25- هل تعمل الأم باجر خارج البيت : 1- نعم 2-لا

26- هل تستعمل الأم حبوب منع الحمل : 1- نعم 2- لا

27- هل تستعمل لولب لمنع الحمل : 1- نعم 2- لا

28- هل استعملت حبوب مقوي (حديد) إثناء حملها للطفل الحالي : 1- نعم

2-لا

29- هل استعملت أدوية أخرى ؟ 1- نعم 2- لا

حدد...............

30-هل لديك الدورة الشهرية الآن ؟ 1- نعم 2-لا

31- هل الفترة ما بين دورتك الشهرية والدورة التي تليها تكون ما بين (25-35) يوم

1- نعم 2-لا 3- ليس

لها نمط

32- كم معدل أيام الدورة لديك ؟

1 - اقل من 3 أيام 2- بين (3-8) أيام 3- أكثر من

8 أيام

33- حسب رأيك هل كمية الدم في الدورة لديك : 1- طبيعية 2- قليلة 3-

كثيرة

34- هل أنت حاملا الآن : 1 - نعم 2-لا

35- كم مرة تتناولين الأطعمة التالية خلال الأسبوع ؟

اللحمة الطازجة .... اللحوم

المجمدة:..

الأسماك :...الكبده

:..

الدجاج:..الحليب ومشتقاته

:..

البيض :...الخبز

:...

الأرز:..الفواكه الطازجة

:...

العصير الطازج :..................................البندوره

:..

البقوليات (عدس ،حمص ،فول ،فاصوليا بيضاء

)...

العصير الطازج:..

36- هل تتناول الأم الشاي : 1- نعم 2- لا

في حالة نعم حدد عدد الكاسات في اليوم ....

37- هل تتناول الشاي :1- مع الوجبة 2- بعد الوجبة

3- بين الوجبات

38- هل تناولت الأم أقراص الحديد أثناء الحمل (للطفل المدروس) 1- نعم 2-

لا

في حالة نعم عدد علب الحديد التي تناولتها .... اسم الحديد

....

39- هل تم فحص دم أثناء الحمل ؟ 1- نعم 2-لا

عدد مرات فحص الدم أثناء الحمل ....

كم كانت نسبة الهيموجلوبين HP.....................................

40- هل تعاني من إصابة بالديدان : 1- نعم 2-لا

في حالة الإجابة نعم نوع الديدان

1- الديدان البيضاء الشعرية 2- الإسكارس (دودة طويلة) 3- نوع آخر 4-

لا تعرف

متى أصبت بالديدان

41- هل تناولت علاج الديدان :1- نعم 2-لا

ما هو العلاج

:...

....

42- هل أصيب أفراد آخرين في الآسرة بالديدان : 1- نعم 2-لا

في حالة الإجابة نعم حدد النوع

1 -الديدان البيضاء الشعرية

2 -الإسكارس(دودة طويلة)

3 -نوع آخر

4 -لا تعرف

متى أصيب بالديدان

....

....

هل تناولت علاج الديدان : 1- نعم 2-لا 3- ما هو العلاج

....

<u>معلومات حول الزوج (للمبحوثة)</u>

43- نوع العمل :

1- لا يعمل 2- يعمل 3- في حالة يعمل ما هي طبيعة عمله الحالي

....

في حالة عاطل عن العمل ما هي طبيعة عمله السابق

....

44- ما هو مجموع الدخل الشهري للأسرة

1- اقل من 500 شيكل 2- 500-1000 شيكل

3- 1000-1500شيكل 4- اكثر من ذلك

45--ما هو مستوى تعليم الأب : 1- ابتدائي 2- إعداي 3- ثانوي

4- جامعي 5- غير متعلم

46- الأب يدخن : نعم لا

في حالة الإجابة بنم عدد علب السجاير في اليوم

....

47- هل تمتلك الأسرة : 1- قطعة ارض 2- سيارة 3- أغنام أو مواشي

48- في حالة نعم هل هي مستغلة لإدرار الدخل : 1- نعم 2- لا

حدد.............

معلومات عن الأسرة والسكن

49- نوع الأسرة : 1- نووية 2- ممتدة

50-- حالة الأسرة :1 لاجئ 2- غير لاجئ

51- عدد الأفراد الكلي .... عدد الزوجات في الأسرة

....

52- توزع أفراد الأسرة حسب الفئات العمرية

1- اقل من خمس سنوات 2- من 5-15 سنة 3- أكثر من 15

سنة

53- عدد غرف المنزل الذي يسكنون فيه ....

54- عدد الأبناء الذين يتعلمون في مدرسة أو معهد ....

55- هل يوجد أطفال معاقين في الأسرة ؟ 1- نعم 2-لا

في حالة نعم عدد المعاقين ....

56- هل يتابع المعاق في مركز صحي معين ؟ نعم لا

57- عدد أفراد الأسرة الذين يعلمون باجر

....

58- كم عدد أفراد الآسرة الذين يعلمون ولكنهم الآن عاطلين عن العمل

....

59- ما هو مصدر مياه الشرب

1- خط رئيسي (بلدية) 2- مياه الأمطار (الآبار جمع)

3- شراء تنكان 4- مصادر أخرى

60- هل تابعت الأسرة سابقا في جمعية ارض الأطفال : نعم لا

61- هل تتابع الأسرة في جمعية ارض الأطفال حاليا : نعم لا

في حالة نعم المتابعة للطفل يعاني من : 1- فقر الدم 2- سوء التغذية 3- غير ذلك /حددي

62- هل تلقت محاضرات تثقيف صحي من قبل عاملين ارض الأطفال : نعم لا

حدد الموضوع : ....

عدد المحاضرات التي تلقتها :...

__Stage two questionnaire__

Date :   /   /2005   Family code : ……..   Child's code :…………

Child's name (four names) ………………………   study Code……………

1- Date of Birth :   / /   Age (in months) : ………..

2- Sex : (1) Male   (2) Female

3- Born : 1- Single   2- part of twin   3- triple or more

4- Birth weight ………….. gr ( ) unknown

5- Gestational Age : 1- Full term (9m)   2-rremature (less than 9m)

If premature did he /she received preventive iron : (1)yes   (2) No . if yes number of iron bottle received ………………..

6- type of feeding :

1) B.F only 2) BF +bottle milk 3) BF +soft

4) BF +fluid

5)Bottle milk only 6) bottle milk +soft 7) BF +bottle +soft

8)family food

7- current average number of meals per day : ………………….

8- Weight : …………….. gm

9- Height : ……………… cm

10- Head circumference : …….cm

11- Dose the child suffer form any of the following diseases

1- R.T .I disease 2- U.T,I disease 3- Dermatological disease

4- Endocrine disease 5- D. disease 6- congenital abnormalities

7-Ophthalmic diseases 8- other accompanying 9- no accompanying disease

10- Cardiac disease if other specifies

……………………………………………

LAB TERST ON FIRST VISIT

12- RBC : ………….. 13-WBC: ……….. 14- PLT:……………

15- HB ……..gr/dl 16- Hematocrit : ……… 17- MCV ……fl

18- Ferritin:………….

19- Type of Anemia :

1-Mild IDA 2- Moderate IDA 3- Sever IDA

4- other anemia 5- not anemic 6- Not classified

20- If Malnourished :
1- I degree 2-IIdegree 3- III degree 4-not malnourished
21- Treatment given for IDA mal and Accompanying illnesses:
1- Iron drops 2- Iron syrup 3- Vit A&D 4- antibiotics
5- Bronchodilators 6- Antipyretic 7- if Others , specify……………………

LAB TEST ON SECOND VIST (AT 6 MONTHS)

22- RBC : ………….. 13-WBC: ……….. 14- PLT:…………….
25- HB ……..gr/dl 16- Hematocrit : ……… 17- MCV ……fl

MOTHER INFORMATION

1- mother age : ……….. year 2- age of marriage : ………. Year
3- Gravid : ……….. 4- Para:……….. 5- Abortion ……….

6- mother education :
1- elementary 2- secondary 3- institute /University 4- not educated
7- mother social status :
1- living with husband 2-Divorced 3- married /separated
4- married live with her family 5- widow 6- died
8- Drinking tea :1- yes 2- No if yes number of cubs /day………………
9- Adding Vit to food containing iron :
1- Rarely 2- always 3-not regularly 4- no 5- Dose not know

10-how often did the mother eat the following foods per week ?
Eggs………. Milk diary …………. Fresh meat …………….. frozen mean …………... liver …………chicken ………….. Legumes ……………….green vegetables …………
Tomato ………fresh fruit /juice ……………Rice ………….Bread …………………..

11- During this child (studied child) : 1- mother hemoglobin was....…… 2- not checked

12-Did the mother receive iron supplementation during this pregnancy ?
1- yes 2- no
If yes number of iron boxes taken : 1- (1Box) (2Box) (3Box) (4None)

13- Space between this child and the previous one ……………….months
14- Mother complains from worms : 1- yes 2- No
If yes : types of worms :
1- pine worms 2- Hock worms 3- others 4- she doesn't know
15- Other family member complains from worms :
1- Currently 2-Previously 3- None
If yes : types of worms :
1- pine worms 2- Hock worms 3- others 4- she doesn't know

<u>FAMILY SOCIO ECONOMIC DATA</u>

1- Family type : (1) extended (2) nuclear (2) N◦ of wives :…………
3-N ◦ of family members …………….
4- Their age groups : less than 5 year …… from 5-15 y ……… more than 15 y ………
5- is the father currently working ? 1- yes 2- no
6- type of father work (current / previous work) :
1- worker 2- government employee 3- private work

4- agriculture work 5-Driver 6- Other
7- number of working members in the family :
1- one 2- two 3- three 4- more than 3 5- none
8- Refugee status : 1- Refugee 2- non refugee
9- Family has malnourished or anemic child registered previously in AED projects :
1- yes 2- No

Literature review appendix

Appendix (1) Anemia pathophysiology

The main three body mechanisms that produce anemia includes, excessive destruction of red blood cells, blood loss and inadequate production of red blood cells.

Anemia due to blood loss (post hemorrhagic anemia), due to prolonged or massive bleeding that leads to red blood cells loss such as injury, surgery or a problem in the blood's clotting ability. Slower, long term blood loose as in intestinal bleeding from inflammatory bowel disease can also lead to anemia. On the other hand the increased destruction of the red cells (hemolytic anemia) in which premature destruction of red blood cells present. Another kind of anemia could occur due RBC production reduction which includes the micro nutrients anemia or the A plastic one.

Micronutrient anemia such as:

- Iron – deficiency anemia is the most common micronutrient anemia in which there is decrease in red blood cells production due to the shortage of iron.
- Folic acid deficiency: The red blood cells production decreased due to the shortage of folic acid in the diet.
- Pernicious anemia: due to in adequate absorption of vitamin B12.

A plastic anemia: The red blood cells production decreased due to bone marrow function reduction due to a viral infection, or exposure to a certain toxic chemicals, radiation or medication. Full blood count and blood film will usually suggest the diagnosis. The red cells distribution width "RDW" is a useful parameter in differentiating iron deficiency from thalassemia minor by providing a measure of variation in red cells size. The RDW in thalassemia minor is usually normal as the population of cells are relatively uniform, whereas in iron deficiency the value is usually >14.5% (Cook et al 1992b).

(Appendix 2) Types of anemia

There are many types of anemia, all with different causes

- **Iron deficiency anemia (IDA)** is the most common type of anemia. Occurs when there is insufficient iron in the body. Iron is essential for hemoglobin synthesis. Blood lose for various reasons might lead to anemia such as in case of heavy periods, ulcers, colon polyps, or colon cancer. A diet In adequate iron in the diet, Pregnancy, particularly the multi gestational one could also lead to IDA if there's not enough iron for the mother and fetus. Ground beef, clams, spinach, lentils, baked potato with skin, sunflower seeds, and cashews are good source of dietary iron (Adelkan DA, 1998).
- **Megaloplastic (or vitaminB-12deficiency) anemia.** Lack of folic acid or vitamin B-12 in the body could lead to this type of anemia. These vitamins could help the body to keep healthy blood and nervous system. This type of anemia, the body synthesis red blood

cells unable to deliver oxygen. Folic acid supplements (pills) can treat this type of anemia. You can also get folic acid in beans and legumes; citrus fruits and juices; wheat bran and other whole grains; dark green leafy vegetables; and poultry, pork, shellfish, and liver. Sometimes, with this disease, your health care provider may not realize you're not getting enough B-12. This usually happens to someone with pernicious anemia,(a type of autoimmune disease). B-12 deficiency may also be more common in people with other autoimmune problems such as Crohn's disease. B-12 shortage could cause numbness in the legs and feet, walking problems, memory loss, and visual problems. The treatment depends on the cause. But some times required B-12 shots to be given or taking special B-12 pills.

- **Underlying diseases.** Certain diseases could affect the body's ability to synthesis red blood cells. As the case of kidney diseases, mainly those getting dialysis (takes out wastes from your blood if the kidneys can't), Those patients are at a higher risk to develop anemia. Their kidneys can't create enough hormones to make blood cells, and iron is lost in dialysis.
- **Inherited blood disease.** Family history due to genetic causes could lead to a higher risk to have the disease. Sickle cell anemia is one type of inherited blood disease. sickle cells are hard and have a curved edge instead of having normal red blood cells that move through blood vessels easily,. These cells cannot squeeze through small blood vessels and block the organs from getting blood. The rapid destruction and delayed compensation to the blood cells causes the anemia.

Another inherited blood disease is thalassemia. It happens when the body is missing certain genes or when variant (different from normal) genes are passed down from parents that affect the hemoglobin synthesis in the body.

- **Aplastic anemia.** This rare problem happens when the body is unable to synthesis enough red blood cells. Since this affects the white blood cells too, It increases the risk for infections and unpreventable bleeding due to one of the following situation:
    - cancer treatments (radiation or chemotherapy)
    - exposure to toxic chemicals (like those used in some insecticides, paint, and household cleaners)
    - some drugs (like those that treat rheumatoid arthritis)
    - autoimmune diseases (like lupus)
    - viral infection that affects bone marrow o bone marrow diseases

The treatment depends on how serious the anemia is. It can be treated with blood transfusions, medicines, or a bone marrow transplant.

Serum iron studies

literatures mentioned that earlier studies employed only one biochemical indicator such as Hb, hematocrit or transferrin saturation (TS), as a measure of iron status. The use of single indicators of iron status can be misleading when assessing iron deficiency because of the overlap between normal and abnormal values of the indicators and there is no single indicator monitors the entire spectrum of iron status (

Miller. R, 2006),(Cook et al, 1976). Different types of studies are used to measure the amount of iron in the blood, and the ability of the body to use it; ferritin, serum iron, and total iron binding capacity are the most common three blood tests are usually ordered as part of screening program to diagnose before they become serious. And help to find out the cause of anemia, diagnose some forms of autoimmune disease or cancers and catch the genetic problems such as hemochromatosis.

Table (5) The key laboratory measurements summarized by Cook et al (1992b)

Laboratory measurements of iron	Iron deficiency range	Iron excess range
Hemoglobin	<13.0g/l men <12.0g/l women	
Mean cell volume (MCV) Red cells distribution width(RDW)	< 80 fl >16%	
Erythrocyte protoporphyrin	>70 ug/dl RBC	
Serum iron TIBC Transferrin saturation	<600ug/l >400ug/l <16%	>1800ug/l >60%
Serum ferritin Serum transferring receptor	<12ug/l >8.5mg/l	>300ug/l

More recent nutritional surveys have employed a battery of iron measurements to increase their sensitivity and specificity. For example in the NHANES II impaired iron status was defined using multiple criteria. The presence of two or more abnormal values for iron status was considered indicative of impaired iron status, acknowledging that these indicators could also be affected by inflammation (ESWG, 1985). The two models used were the MCV and the ferritin model. The MCV model employed MCV, TS and EP as indicators whereas the ferritin model used SF, TS and EP (SF was only available for a sub sample of the NHANES II population).

Some differences between the two models can be expected, as the ferritin model can detect an earlier change in iron status, whereas the MCV model indicates a later change after significantly impaired erythropoietin. A diagnosis of iron deficiency based on SF<16 ug/l alone, implies that not only are iron stores absent but that an IDE is already present. The most suitable ages to test for anemia is at one year of age, between 2 and 3 years, at about 5 years in the preschool child and in adolescence." Dallman et al (1980)"

(literature Appendix 3)Screening for iron deficiency

Often only one or two parameters are used for iron deficiency screening as cost and convenience are important factors to be considered. The sensitivity and specificity are of great importance when using just one or two parameters, four laboratory measures which have been identified as suitable for single use or in combination (Cook et al, 1992a) include:

- Single measures as: Hemoglobin, Serum ferritin, Erythrocyte protoporphyrin, Serum transferrin receptor
- Combination measures as: Serum ferritin and hemoglobin, Erythrocyte protoporphyrin and hemoglobin, Serum receptor and hemoglobin, Serum ferritin and serum receptor.

Hemoglobin remains a key screening measure as it can detect the most severe stage of iron deficiency associated with the majority of clinical symptoms. By combining hemoglobin measurement with serum ferritin, its sensitivity and specificity are greatly improved. If both are normal, iron deficiency is excluded; if both are low, iron deficiency anemia is diagnosed (American Family Physician, 1995). If SF is low but Hb normal, then the individual may have depleted iron stores or mild iron deficient erythropoietin. Hb and EP can be used when cost is a constraint or an immediate result is needed. Hb and serum receptor can detect iron deficiency anemia and tissue iron deficiency. SF and serum receptor can provide a quantitative measure of body iron over a broad range of iron status (Miller.R, 2006). Serum ferritin indicates the level of iron storage and the serum receptor indicating the degree of tissue iron deficiency. Both indicators require only a few micro liters of blood that can be readily obtained by capillary sampling (Cook et al 1993).

(literature Appendix 4) Prevention and management of anemia

■**Diet**, Child's diet is the most important approach to prevent and treat mild iron deficiency.

Miller. R(2006) mentioned Good choices for diet include iron fortified grains and cereals, red meat, egg yolks, leafy green vegetables.

Too much milk drinking could worsening anemia status, as drinking more than 32oz. per day can cause iron loss through intestinal walls, and decrease the appetite for solid foods. For picky eaters, vitamins supplementation that includes iron may be needed. Hem iron is better absorbed than Nonheme iron. The percentage absorption of Nonheme iron from a meal containing only meat is 20% to 30% as compared to 2 to 3 % in vegetable foods or diary products. Hem iron provided nearly one-third of the daily iron requirement. The quantity of animal tissue in a given meal is probably the single most important determinant of iron availability except for milk intake (Stekel, 1984), (Miller, 2006). The amount of iron varies according to the type of food as iron dietary sources are divided into:

Best sources: breast milk, formula with iron, iron fortified cereals, liver, prune juice

Good sources: eggs, meat, fish, chicken turkey, soybeans, peanut butter, dried beans, lentils, molasses, peas

Other sources: tuna, apricots, raisins, kale, prunes, greens

If the diet is deficient in iron or a child’s anemia is still severe oral therapy is essential. Milk and antacids may interfere with absorption of iron and should not be taken at the same time as iron supplements. Vitamin C (ascorbic acid) can increase absorption and is essential in the production of hemoglobin (Citrus fruit or juice with an iron -rich food such as, orange juice). A after 2 months of iron therapy, the hemoglobin should return to normal but iron supplements should be continued for another 6 to 12 months. The therapy will replenish the body's iron stores, contained mostly in the bone marrow. It is important to rechecks child's blood counts about one month after he has started treatment to make sure it is working and the anemia is resolving **(**Stekel A, 1984).

■**Iron and Breast milk:** Many literatures mentioned that, iron content of breast milk is often low, but it is adequate to prevent iron deficiency anemia for at least the first 6months of life, and iron deficiency does occur if the same amount of iron received from food other than breast milk as the breast milk iron considered highly absorbed in comparison to iron from other sources (Stekel A, 1984), (Miller. R, 2006),(American Family Physicians, 1995). Morning milk contains less iron than evening milk during the single feeding, the fore milk has a lower iron concentration than the hind milk, the range being from 0.3 to 1.0 Mg/ml, it also varies between women, even in the individual woman during the lactating period, the day and the nursing period. All these factors also affect the breast milk iron utilization. Iron amount in breast milk varies within a range of 0.2 to 0.7 Mg/ml with Co lustrum values of 0.5 to 0.7mg/ml (Stekel A, 1984) (Miller. R, 2006)

It is not known if dietary iron or the iron status of the mother has any effect on the concentration of iron in breast milk. The available data do not indicate a correlation between maternal dietary iron intake or iron status and breast – milk iron. The casein content of cow's milk is 8 to 10 times higher than that of breast milk. Lactoferrin is one of the major components among the proteins in breast milk and its higher concentrations have been reported in colostrums. Lactoferrin can inhibit the growth of Escherichia coli, Candida alb cans, streptococcus mutans, vibrio cholera) (Stekel A, 1984) (Miller. R, 2006) There is a difference in iron nutrition concentration between breast fed and artificially fed infants. Investigators found that iron absorption is 49% from breast milk, 10% from cow's milk and 7 to 9% from supplemented formula. These results are explained by a difference in digestive capacity. Cow's milk is very high in casein, almost 10 times higher than human milk and casein in the stomach of an infant can form hard curds that can pass through the gastrointestinal tract without complete digestion. Whether direct or in directly, the high calcium content in infant formula affect iron bioavailability. It is known that iron absorption is increased by low PH. The stomach content will be more acidic in breast – fed infants than in artificial (cow's milk fed) infants as cow's milk has a higher buffering capacity compared to human milk making it favoring iron absorption from breast milk. It is known that human milk is high in concentration of a peptide similar to epidermal growth factor (EGF), the peptide hormone decrease Gut acid secretion and stimulate growth proliferation of intestinal mucosal cell, which enhance iron absorption. Iron in Breast milk has very high bioavailability and therefore term breast fed infants do not need iron supplementation for the first 6 month of life (Stekel A, 1984).

■ Iron fortified cereals and formula. These products could provide the body with enough iron and recommended for children during the weaning periods. And the period of solid food introduction (American Family Physicians, 1995)

The treatment of anemia mainly depends on its underlying causes, anemia caused by infection will improve when the infection passes or treated. Treatment of severe or chronic forms of anemia may include blood transfusion, removal of the spleen or treatment with medications to cover the infection or stimulate the bone marrow to produce more blood cells. For the mild to moderate cases iron supplement introduced as syrup or iron drops, depends on the hemoglobin level, the child's age and weight (Miller.R,2006).

supplements could be stopped and fortified infant formula started up to the age of twelve months (Miller.R,2006). Cow's milk should be avoided before the age of one year. If the infant is term and formula-fed: Iron-fortified formula could be used until the age of 12 months. There is no need to use iron -fortified cereal if the iron -fortified infant formula used the same above source and (Stekel A, 1984). For preterm Infants after being discharge from hospital care: Iron supplementations starts mg/kg/day, fortified formula no later than age 1 month and continue up to the age of 12 months. The same source and There is no need to use additional iron if the preterm infants (weight>1kg) and fed by iron-fortified formula. Iron -fortified infant cereals and meat could be started after about age 4 months, in addition to ascorbic acid-rich foods with meals to improve iron absorption. (Miller.R,2006)

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List of abbreviations

1 **Hb……………………………………Hemoglobin level**

2 **MCV…………………………………Mean corpuscular volume**

3 **MCH…………………………………Mean corpuscular hemoglobin**

4 **CBC………………………………….Cell blood count**

5 **SF…………………………………….Serum ferritin**

6 **M / F…………………………………Male / Female**

7 **LBW…………………………………Low birth weight**

8 **Wt……………………………………Weight**

9 **Ht……………………………………Height**

10 **AEA …………………………………Ard El Atfal**

11 **UNRWA…………………………… United National Relief and Work Agency for Palestinian refugee**

12 **PCBS……………………..Palestinian Central Bureau of Statistics**

13 **WHO……………………….………World Health Organization**

14 **SD……………………………......Standard deviation**

15 **NCHS………………………………National Center for Health Statistics**

16 **IUCD…………………………………Intra Uterine Contra captive Device**

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