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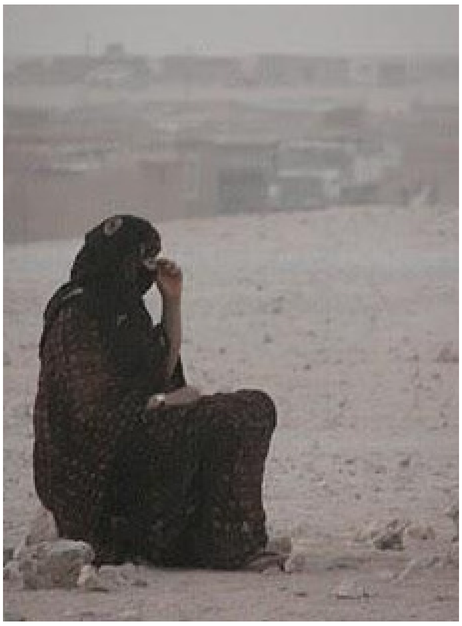
Challenges with Iron Deficiency Anemia among Women of Reproductive Age in Saharawi Refugee Camps, Tindouf, Algeria



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Abstract

Objective:

This study was carried out to assess the prevalence of iron deficiency anemia (IDA), and identify the possible causes of the problem from the public health and nutrition point of view. The target group used is women of reproductive age (15-49 years), both non-pregnant and pregnant women in the Saharawi refugee camps, in Tindouf, Algeria.

Methods:

Study participants consisted of 707 (90%) non-pregnant women and 63 (8%) pregnant women, living in four different refugee camps (EI Aiune, Aswerd, Smara and Dakla) near Tindouf in Algeria. Nutritional iron status was assessed using the haemoglobin (Hb) cut-off value by WHO. In addition, questionnaires, anthropometric measurements (weight, height and MUAC) were executed to calculate the possible causes of anemia.

Results:

The prevalence of IDA, as estimated by Hb, was 54% (n=369) with a mean±SD on Hb) was 11.3±2.4 g/dl in non-pregnant women, and was 66% (n=39) with a mean±SD on Hb was 9.9±2.5 g/dl in pregnant women. The highest prevalence of IDA (60%) was found in Dakla (n=104) among non-pregnant women of reproductive age, which had a mean±SD on Hb was 10.9±2.4g/dl. The lowest (44%) was found in Smara (n=76), which had a mean±SD on Hb was 11.7±2.4 g/dl. Differences on levels of Hb in non-pregnant women were statistical significantly high between Smara and Dakla (p=0.00). The prevalence of most serious IDA was found in Dakla (n=17) among pregnant women, which an average had Hb of 9.14±2.49 g/dl.

The prevalence of IDA among non-pregnant women were found in the four age groups; less than 20 years of age, 20-29 years of age, 30-39 years of age and 40-49 years of age, which was 40%, 59%, 57% and 45% respectively. There were significant differences ($p<0.05$) on levels of Hb among non-pregnant women between "less than 20 years of age" (mean±SD, 11.9±2.2 g/dl) and "30-39 years of age" (11.0±2.5 g/dl), and between 30-39 years of age (11.0±2.5 g/dl) and 40-49 years (11.6±2.7 g/dl). The prevalence of IDA among pregnant women found in the age groups 30-39 years, 20-29 years and 40-49 years of age were 70%, 66% and 50%, respectively. There were 35%, 48%, 14% and 8% of women of reproductive age who had children in age groups, less than 2 years, 2-4 years, 5-9 years, and more than 10 years of age, respectively; and they had Hb, 10.8±2.2, 11.0±2.6, 11.4±2.6 and 12.3±2.8 g/dl, respectively. There were significant differences on levels of Hb between the women who had children less than 2 years and more than 10 years of age ($p=0.00$), and between women who had children between 2-4 years and more than 10 years of age ($p=0.01$).

By self-reported data, the prevalence of diarrhea, pneumonia, cardiac disease, diabetes and celiac diseases was 74%, 50%, 33%, 6% and 4%, respectively, in the women of reproductive age (both non-pregnant women and pregnant women). The women who with diabetes (12.3±2.3 g/dl) and pneumonia (11.4±2.5 g/dl) had a higher mean of Hb than those without diabetes (11.1±2.5 g/dl) and pneumonia (11.0±2.5 g/dl); and there was a significant differences between them, respectively ($p<0.05$).

According to food intake (24 hour recall) of various groups, there were significant differences ($p<0.05$) between EI Aiune[1] and either Awserd, Smara or Dakla; between Awserd[2] and either Smara or Dakla; and between Smara and Dakla. The median of food consumption by the DDS groups (1-11) within 24 hours in EI Aiune, Smara and Dakla, and Awserd was 5, 6 and 7, respectively. There were significant differences on

[1] EI Aiune either...or: between EI Aiune and Awserd, between EI Aiune and Smara, and between EI Aiune and Dakla.

[2] Awserd ether...or: between Awserd and Smara, and between Awserd and Smara.

the medians of food consumption using the DDS groups, within 24 hours between EI Aiune and either Awserd, Smara or Dakla; between Awserd and either Smara or Dakla.

The mean±SD on BMI among non-pregnant women in severe-, moderate-, mild IDA and normal level of Hb were 23.0±4.9, 24.9±5.1, 24.7±5.2 and 26.3±5.5 kg/m^2, respectively. There were significant differences ($p<0.05$) on BMI between severe[3] and either moderate IDA, mild IDA or normal level of Hb; between moderate IDA and normal level of Hb; and between mild IDA and normal level of Hb.

In total, the prevalence of women who got Plumpy nut, WSB and iron supplements was 2%, 36% and 8%, respectively. There was a lower mean on Hb on these who got WSB compared to those who did not (10.7±2.5 and 11.3±2.5 g/dl respectively, p=0.01).

Conclusion:

According to the results high prevalence of IDA appears to be an important public health problem among women of reproductive age. In conclusion, effective actions such as consumption of various food groups, supply of high-quality iron fortified food, and supply of oral ferrous aimed at the prevention and treatment of iron deficiency is strongly recommended in the Saharawi refugee camps, Tindouf, Algeria.

[3] Severe either...or: between severe and moderate, between severe and mild, and between severe and normal.

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List of Acronyms

AECI	Agencia Española de Cooperacion International
ANOVA	Analysis of Variance
AUC	Akershus University College
BMI	Body Mass Index
CBS	Corn Soya Blend
CDC	Centre for Disease Control and Prevention (USA)
CRS	Saharawi Red Crescent Society
DALY	Disability Adjusted Life Years
DDS=IDDS	Dietary Diversity Score = Individual Dietary Diversity Score
DHS	Demographic Health Surveys
DMT	Divalent metal transporter
ECHO	European Commission Humanitarian Office
ENA	Emergency Nutrition Assessment
FAO	Food and Agriculture Organization of the United Nations
Hb	Haemoglobin
HCP	Heme Carrier Protein
HKI	Helen Keller International
IDA	Iron Deficiency Anemia
IPHN	Institute of Public Nutrition
JAM	Joint Assessment Mission
LSD	Least Significant Difference Test
LBW	Low Birth Weight
MCV	Mean Corpuscular Volume
MDM	Médicos del Mundo
MoH	Ministry of Health
MUAC	Mid-upper arm circumference
NaFeEDTA	Sodium Ferric Ethylenediaminetetraacetic Acid
NCA	Norwegian Church Aid
NGO	Non Governmental Organisation
PNSS	Programme Niño Sano
PPS	Probability Proportional to Size
RBCs	Red Blood Cells
RC	Reticulocyte Count
SADR	Saharawi Arab Democratic Republic
SMART	Standardized Monitoring and Assessment of Relief and Transitions
SPSS	Statistical Package of Social Sciences
SD	Standard Deviation
TIBC	Total iron-binding capacity
UK	United Kingdom
UN	United Nations
UNU	United Nations University

UNICEF	United Nations Children's Fund
UNHCR	United Nations High Commissioner for Refugees
USA	United States America
WFP	World Food Programme
WHO	World Health Organization
WSB	Wheat Soya Blend

1.0 Introduction

Anemia is one of the most common and intractable nutritional problems in the world today (WHO, 2004). WHO (World Health Organization) & CDC (Center for Disease Control and Prevention) (2004) estimate that some two billion people are anemic defined as hemoglobin concentrations those are below recommended thresholds. The main causes of anemia are: dietary iron deficiency; infectious diseases such as malaria, hookworm infections and schistosomiasis; deficiencies of other key micronutrients including folate, vitamin B12 and vitamin A; or inherited conditions that affect red blood cells (RBCs), such as thalassaemia (WHO & CDC, 2004). Anemia during pregnancy is associated with multiple adverse outcomes for both mother and infant, including an increased risk of hemorrhage, sepsis, maternal mortality, perinatal mortality, and low birth weight (LBW) (WHO, UNICEF & UNU, 2001; Nacher et al., 2002; Yazdani et al., 2004).

Iron deficiency, and specifically IDA, is still considered as the most severe and important nutritional deficiency worldwide (WHO & CDC, 2004; Denic & Agarwal, 2007). WHO and World Bank have ranked iron deficiency anemia as the third leading cause of disability-adjusted life years (DALYs) lost for women of reproductive age (Yip & Ramakrishnan, 2002). A common cause of iron deficiency in low-income countries is that women, who require about twice as much iron as men, consume only half as much. They often eat less liver, meat, fish and fruit, the best sources of available iron (WHO, UNICEF & UNU, 2001).

Refugees are a highly vulnerable population group that has been suffering from nutrition deficiency disease. The United Nations High Commissioner for Refugees (UNHCR) and Non Governmental Organization (NGO) has been providing basic humanitarian assistance (health care, shelter, water and education for Saharawi refugee camps since 1975, which World Food Programme (WFP) has been providing food assistance since 1986 in Tindouf, Algeria (UNHCR & WFP, 2002). UNHCR conducted nutritional survey clearly shows anemia is common amongst the women and children in the Saharawi refugee camps, Algeria (UNHCR & WFP, 2002). Figure 1 shows that the prevalence of total anemia among women of reproductive age in 1997, 2001, 2002 and 2005 was 62%, 48%, 48% and 66%, respectively , in Saharawi refugee camps, Tindouf (Ferrari, 2006). Therefore, we can conclude from the beginning of 2002 that the prevalence of total anemia and severe anemia among the women of reproductive age showed a rising trend in the Saharawi refugee camps, Algeria. Even though they receive humanitarian aid from different organizations, the prevalence of anemia is still serious among women of reproductive age in the Saharawi refugee camps. WHO, the United Nations Children's Found (UNICEF) & the United Nations University (UNU) (2001), they strongly recommended preventive iron- and folic acid-supplementation in the areas where the prevalence of anemia among women of reproductive age is severe over 40%.

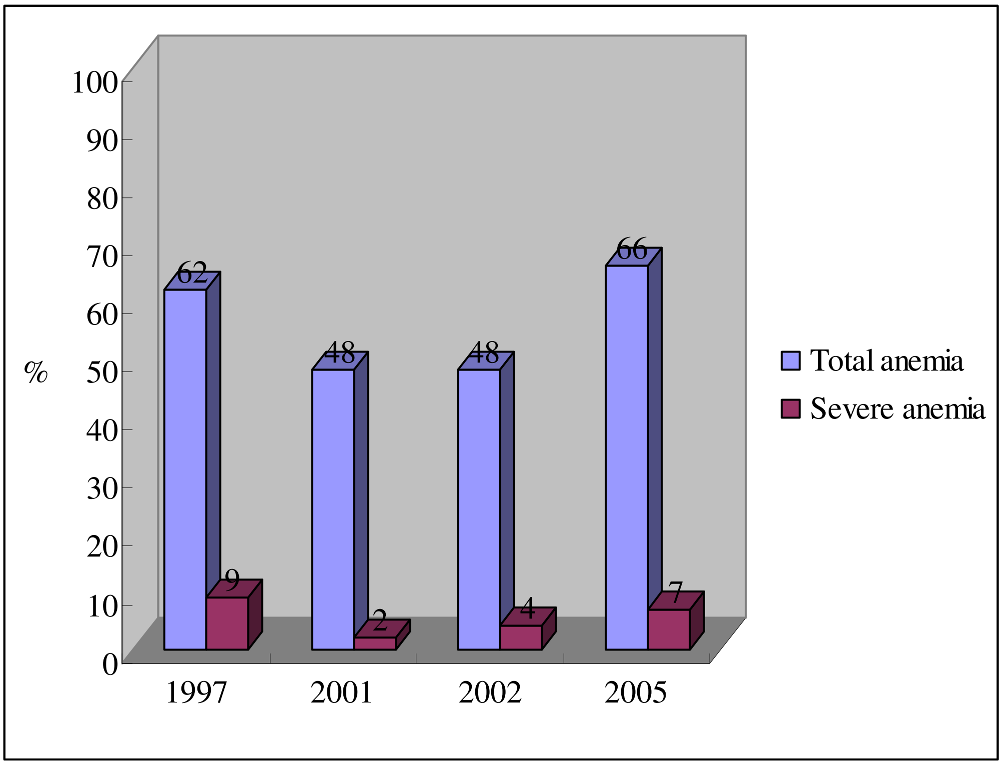

Figure 1 Trend of anemia among women of reproductive age (15-49 years) in the Saharawi refugee camps, Algeria (1997 – 2005) (Ferrari, 2006).

A number of studies (Agrawal et al., 2006; HKI & IPHN, 2006) have demonstrated that the prevalence of anemia was higher among women of reproductive age (both non-pregnant women and pregnant women) in non-industrialized countries than industrialized countries. The strategic plan of UNHCR (2008 – 2010) shows the extent of anemia falls within the definition of a severe public health problem (> 40%) among women of reproductive age in several refugee camps such as Ethiopia, Mozambique, Algeria, Kenya and Sudan East. Several countries reported that availability of food fortification (wheat flour with iron and folic acid), milk sugar and salt with iron to build long term iron stores remains the key to reduce anemia (Agarwal et al., 2006, Menon et al., 2007). A study in rural China reported that a combination of iron, folic acid, retinol, and riboflavin more effective than iron plus folic acid alone (Ma et al., 2008). A number studies indicates that dietary bioavailability improvements, in the form of meat (e.g., Hurrell et al, 2006), sodium iron ethylenediaminetetraacetic acid (NaFeEDTA) fortified fish sauce (e.g., Thuy et al., 2003, 2005) and ascorbic acid (e.g., Hurrell et al., 2004; Teucher et al., 2004) promote the absorption of non-hame iron, therefore reducing prevalence of iron deficiency anemia. Newer strategies have been developed by UNHCR that preventing and treating anemia among refugee and other persons of concern to UNHCR is a priority (UNHCR, 2008 – 2010).

1.1 Background

Profile – Saharawi Refugee Camps

The Western Sahara is the last African colony. It was occupied in 1975 by Morocco, despite the protests of the UN and the resistance of the independence Saharawi movement, the Polisario Front (MER, 2004). In the region of Tindouf are four large refugee camps for Sharawi refugees from Western Sahara: Ei Aiune, Awserd, Smara and Dakla. The headquarters of Polisario Front, with the government in exile of the Saharawi Arab Democratic Republic (SADR), are headquartered in Rabuni, a camp dedicated to administration (AI, 2004).

The Tindouf area with 165.000 people is located in the hammada, a vast desert plain of the Sahara Desert. Summer temperatures are often above 50 degrees centigrade. Frequent sand storms disrupt normal life. There is little or no vegetation, so basic life can not be sustained in this environment (MER, 2004).

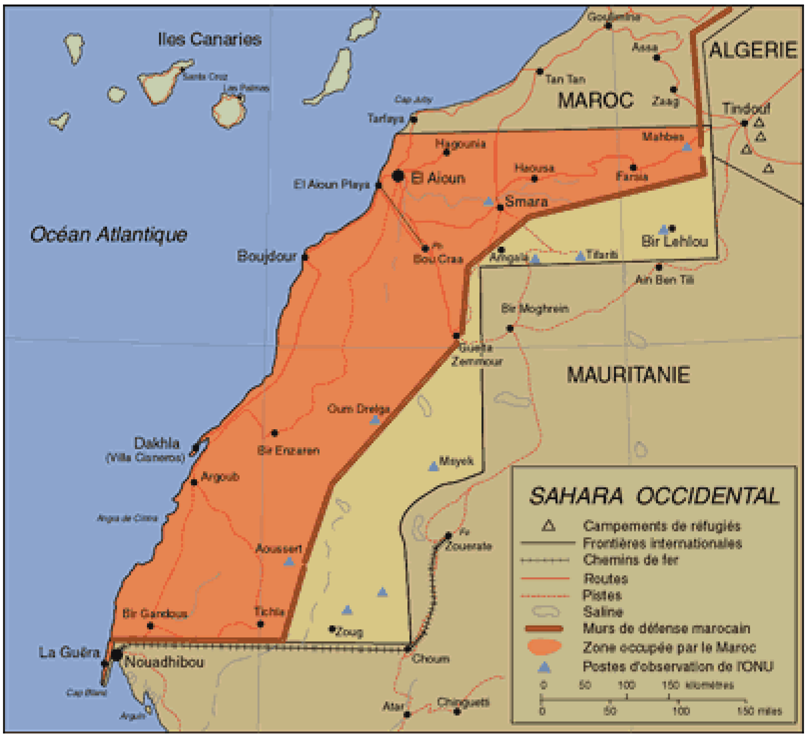

Figure 2 The location of the Saharawi refugee camps, in Tindouf, Algeria.
http://www.sahara-occidental.com/pages/informer/point_col/framecolsup.htm

The refugee camps in Tindouf Province, Algeria, run by the Polisario Front, are wholly reliant on foreign aid that brought in food and clothing by car and plane. The World Food Programme (WFP) and UNHCR have been providing the basic food needs the refugees since 1986. The major food donors include donations targeted via WFP, NGO and direct donations from European Community Humanitarian Office (ECHO) to the Saharawi refugee camps (UNHCR, UNICEF, WFP & WHO, 2002).

2.0 Aims of the study

The main objective of this study was to analyse the prevalence of IDA and identify the possible causes of the problem from a health and nutrition point of view, among women of reproductive age (15-49 years, both non-pregnant women and pregnant women) in the Saharawi refugee camps, Tindouf, Algeria.

2.1 Specific Objectives

Specific objectives of the study are:

- To analyse the prevalence of IDA (moderate and severe) amongst non-pregnant women of reproductive age in the difference between camps.
- To analyse the prevalence of IDA (moderate and severe) amongst pregnant women of reproductive age in the difference between camps.
- To identify underlying causes of IDA related to
  - a) age
  - b) disease
  - c) hygiene
  - d) food intake
  - e) nutritional status
  - f) supplementation
- To suggest recommendations to treat IDA among women of reproductive age (15-49 years, both non-pregnant women and pregnant women) in the Saharawi refugee camps.
- To suggest recommendations to prevent IDA among women of reproductive age (15-49 years, both non-pregnant women and pregnant women) in the Saharawi refugee camps.

3.0 Theoretical background

3.1 Anemia

Erythrocyte is size-measured as mean corpuscular volume (MCV). Haemoglobin concentration is reduced as a consequence of significant iron deficiency (Lewis et al., 2001; Balducci, et al., 2007). Anemia is the decreased ability of the RBCs to provide adequate oxygen to body tissues. It may be due to a decreased number of RBCs, a decreased amount of substance in RBCs, which transports oxygen (haemoglobin), or a decreased volume of RBCs (Balducci, et al., 2007; Bridges & Pearson, 2008).

Measurements of hemoglobin, serum ferritin, serum iron, and transferring (total iron-binding capacity, TIBC) capacitate iron status to be characterized in detail of anemia (Dallman et al., 1992). Anemia is defined that in clinical terms anemia is an insufficient mass of RBCs circulating in the blood; in public health terms anemia is defined as a hemoglobin concentration below the thresholds given by WHO, UNICEF & UNU (2001). Iron deficiency anemia is a decrease in the number of red cells in the blood caused by too little iron. WHO criteria for the diagnosis of anemia have used among women (15-49 years) in the Saharawi refugee camps (see Table 1), very severe anemia is defined as haemoglobin 4 g/dl (WHO, UNICEF & UNU, 2001).

Table 1 Cut-off points for hemoglobin values for diagnosis of anemia by WHO (WHO, UNICEF & UNU, 2001).

Women (15-49 years)	**Categories of anemia (Hb g/dl)**			
	Total	Mild	Moderate	Severe
Non-pregnant	Hb<12	Hb 11	Hb 8.0	Hb<8.0
Pregnant	Hb<11	Hb 10	Hb 7.0	Hb<7.0

The prevalence of anemia in a population as measured by low haemoglobin concentration, or low hematocrit is by far the several well-established methods using indicator for detecting iron deficiency (WHO, UNICEF & UNU, 2001; Semba, et al., 2008).

Iron deficiency is the leading cause of anemia; although most anemias are due to iron deficiency, the role of other causes (such as folate and vitamin B12 deficiency or anemia of chronic inflammation) should be distinguished (WHO & CDC, 2004; Balducci, et al., 2007; Kraemer & Zimmermann, 2007).

3.2 Metabolism of iron

Iron is a metal of capital importance in most living organisms. A well-balanced diet contains sufficient iron to meet body requirements. A human body requires iron for the synthesis of the oxygen transport proteins, haemoglobin and myoflobin, and other iron-dependent enzymes that participate in electron oxidation-reduction reaction (Gibney et al., 2007; Mann & Truswell, 2007). The total amount of iron present in the body varies with body weight, gender and long-term nutrition. It is also affected by the condition of health, growth and pregnancy. The total body iron averages approximately 3.8 g in men and 2.3 g in women (Gibney et al., 2007). Approximately 75% is in the haemoglobin of red blood cells and about 25% is present in body stores in the liver (Mann & Truswell, 2007; Geissler et al., 2005).

3.2.1 Iron absorption

Iron is mainly absorbed in the duodenum and upper jejunum (Geissler et al., 2005; Mann & Truswell, 2007). There are two types iron in the food; haem iron are combined with haemoglobin and myoglobin in animal origin foods such as meat, poultry and fish (haem, 40%), and non-haem iron are combined from of iron salts and iron in other proteins such as ferritin, which is present in both foods of plant origin (non-hame, 100%) and foods of animal origin (non-haem, 60%) (Gibney et al., 2009; Nes et al., 2006).

Several investigations has shown two transporters appear to mediate the entry of most if not all dietary iron into mucosal cells; one transfers intact haem molecules derived from hemoglobin or myoglobin in meal (haem carrier protein, HCP 1) (Shayeghi et al., 2005); the other (divalent metal transporter, DMT 1) transfers all other iron that is rendered soluble in the gastric juice and remains in solution in the small intestine (non-haem iron) (Gunshin et al., 1997; Anderson & Frazer, 2005).

3.2.2 Iron bioavailability

In plant foods, iron exists in the less bioavailable non-heme form (Hurrell, 1997). Compared with absorption of haem- and non-haem iron is less influenced by the iron status of individuals, therefore the bioavailability of food iron is strongly influenced by enhancers and inhibitors in the diet (WHO, UNICEF & UNU, 2001; Geissler & Powers, 2005).Iron absorption can change from 1% to 40%, relying on the mix of enhancers and inhibitors in the meal. As thus, the sufficiency - i.e. bioavailability - of iron in common diets can be meliorated by varying meal patterns to improve enhancers, lower inhibitors, or both (WHO, UNICEF & UNU, 2001).

Enhancing of iron absorption

Factors promoting iron absorption was summarized in table 2. These (ascorbic acid, citric acid, lactic acid, fructose and peptider from protein sources) enhance the solubility of the iron, facilitating absorption (Geissler & Powers, 2005; Barasi, 2007). The absorption of non-haem iron can be improved when a source of haem iron is consumed in the same meal (Gibney et al., 2007; Mann & Truswell, 2007). The previous studies results show that the most important enhances of non-haem iron absorption are ascorbic acid (vitamin C) (Hurrell et al., 2004; Teucher et al., 2004; Geissler & Powers, 2005), meat (Hurrell et al, 2006; Tetens et al., 2007) and fish (Thuy et al., 2003; Thuy et al., 2005; Geissler & Powers, 2005). There are several foods such as amla, guava and citrus fruits, which promotes iron absorption from plant foods (Gibney et al., 2007). Evidence also exists that the promotion of iron absorption of vitamin C mainly from fruits, juices, potatoes and some other tubers, and other vegetables such as green leaves, cauliflower, and cabbage (WHO, UNICEF & UNU, 2001).

Inhibiting of iron absorption

Factors inhibiting iron absorption was also summarized in table 2. These (phytate, polyphenols, oxalate, phosphates, calcium and zink) either bind with iron, making it less soluble, or compete for binding sites (Geissler & Powers, 2005; Barasi, 2007). Phytates, polyphenols, oxalate and phosphate block iron absorption such as in whole cereal grains; tea, coffe, nuts; spinach and egg yolk; respectively (Geissler & Powers, 2005; Barasi, 2007). Iron-binding phenolic compounds (tannins) present in black, green and herbal tea are not at risk of iron owing to any kind of tea drinking for healthy adults (Mennen et al., 2007). Dairy products rich in calcium such as milk or cheese can inhibit iron absorption (Gibney et al., 2007). Calcium, particularly from milk and milk products inhibits iron absorption, while a milk glycoprotein, lactoferrin prensent in breast milk is a better source of iron than either cow's milk or non-fortified milk substitutes (WHO, UNICEF & UNU, 2001; Geissler & Powers, 2005; Gibney et al., 2007).

Table 2 Main factors affecting the bioavailability of dietary iron (Geissler & Powers, 2005; Barasi, 2007).

Factors promoting absorption	Factors inhibiting absorption
Ascorbic acid (vitamin C)	Phytate (in whole cereal grains)
Citric acid	Polyphenols (in tea, coffee and nuts)
Lactic acid	Oxalate (in tea, spinach)
Fructose	Phosphates (in egg yolk)
Peptides from protein sources,	Calcium[a]
especially meat, fish and poultry	Zink

a. Calcium inhibits both haem and non-haem iron absorption. All other factors affect only non-haem iron.

3.2.3 Iron storage and losses

Iron storage

Iron is stored as ferritin or hemosiderin, which is found primarily in the liver, spleen, reticuloendothelial cells and bone marrow (Gibney et al., 2007). In the liver, iron is stored mainly in parenchymal cells or hepatocytes, while in the bone marrow and spleen iron is stored in reticuloendothelial cells (Gibney et al, 2007; Semba & Ramakrishnan, 2008). The stored iron is chiefly a reservoir of iron to supply cellular needs for haemoglobin production (Semba & Ramakrishnan, 2008). In men, about one-third of the total body iron is storage iron, but in women only about one-eighth is storage iron (Gibney et al., 2007).

Iron losses

Iron losses occurred in normal individuals mainly in faces (0.6 mg/day), bile and desquamated mucosal cells, and in minute quantities of blood. Other ways of iron loss include desquamated skin and sweat (0.2-0.3 mg/day), urine (<0.1 mg/day) (Gibney et al., 2007; Semba & Ramakrishnan, 2008). Men require about 1 mg (range 0.5-2.0 mg/dag) iron daily each day, and this is sufficient to balance the daily losses from desquamation of epithelia (Gibney et al., 2007). Greater iron utilization via growth in childhood, greater iron loss with minor hemorrhages, menstruation (0.4-0.5 mg/day) in women, and greater need for iron in pregnancy will increase 1.3-1.4 mg of absorbed dietary iron (Gibney et al., 2007; Semba & Ramakrishnan, 2008). Iron supplied in the diet is balanced by iron losses and requirements for growth, pregnancy and lactation (Mann & Truswell, 2007).

3.3 Causes of iron deficiency

Iron deficiency is the most common known from of nutritional deficiency (WHO, UNICEF & UNU, 2001). Iron-deficiency anemia, often caused by insufficient iron intake such as special diets low[4] and special diets high[5] in dietary iron; poor absorption of iron by the body; and almost invariably reflects chronic bleeding such as excessive menstrual bleeding, non-menstrual bleeding, bleeding from gastrointestinal tract and blood loss from reproductive system (Bridges & Pearson, 2008; Semba & Ramakrishnan, 2008).

Recent studies (Loukas et al., 2005; Pasricha et al., 2008) indicate that the high prevalence of iron deficiency in the developing world where hookworm infestation, causing owing to blood loss. In some low-income countries, malaria was an important factor related to maternal mortality in pregnancy (Brabin, 1983; Brabin et al., 2001). However, it is now apparent that the poor bioavailability of iron in largely unprocessed cereal-based diets is the major cause of iron deficiency in the developing countries (WHO, UNICEF & UNU, 2001; Semba & Ramakrishnan, 2008).

3.4 Symptoms and consequence of iron deficiency

The value of fall in hemoglobin may bind to symptoms (Gibney et al., 2007). Symptoms of iron deficiency include fatigue, weakness, pallor, dyspnoea on

[4] Special diets low: Low consumption of meat.
[5] Special diets high: High consumption of phytates.

exertion and palpitations (Mason, 2007). Although, symptoms of iron deficiency can occur even before the condition has progressed to IDA; therefore this is why it is important to screen haemoglobin for too little iron among high risk groups (Gibney et al., 2007).

The impact of non-haematological includes damage in work capacity, intellectual performance, neurological function and impaired immune function and, in children, psychomotor disturbances (Mason, 2007; Mann & Truswell, 2007). Symptoms of gastrointestinal tract are painful atrophy of the mucosa membrane covering the tongue (see Figure 3), the oesophagus and the stomach; and brittle, grooved fingernails and spoon-shaped nails (Mason, 2007; Mann & Truswell, 2007; Bridges & Pearson, 2008). People with severe, long-standing iron deficiency and folate deficiency have a same symptom (Bridges & Pearson, 2008). Specifically, prevalence of IDA among pregnant women increases perinatal risks for mothers and neonates, meanwhile increases overall infant mortality (WHO, UNICEF, UNU, 2001; Nacher et al., 2002; Yazdani et al., 2004).

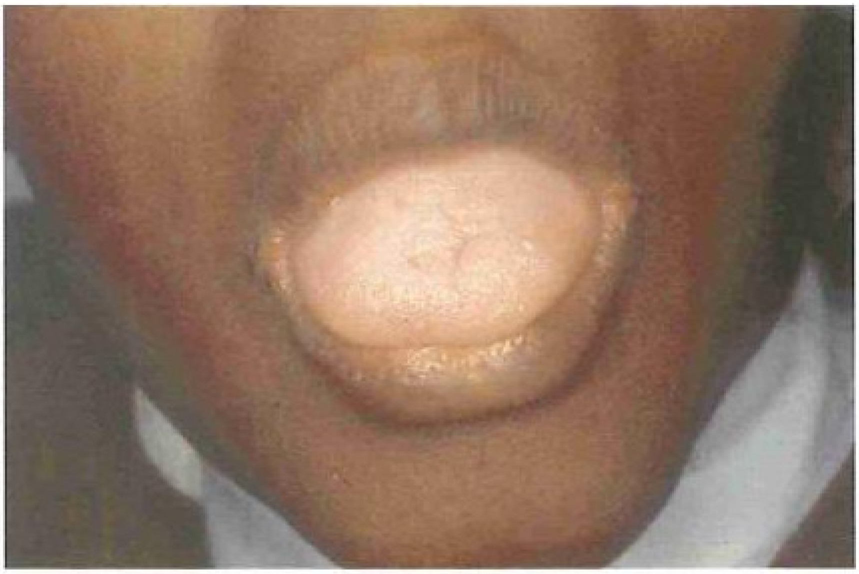

Figure 3 Atrophic glossitis and angular stomatitis due to iron deficiency (Bridges & Pearson, 2008, p. 101).

3.5 Iron overload

Iron overload has been associated with damage of the liver and other organs of people with primary or secondary increased iron overload which can lead to hereditary hemochromatosis (Mann & Truswell, 2007). Hereditary hemochromatosis is an autosomal recessive disorder, and a study has found a homozygote frequency of 100-500 per 100,000 in North America and Europea (Semba & Ramakrishnan, 2008). People of northern European decent are most likely to have the gene mutation that causes iron overload which can lead to hemochromatosis, but in developing countries, incidence of hemochromatosis is lower than northern European (Semba & Ramakrishnan, 2008). The other non-genetic causes may occur such as complications from other blood disorders, chronic transfusion therapy, chronic hepatitis, and excessive iron intake (Mann & Truswell, 2007). The prevalence of severe hereditary anemia such as thalassemia major is more usual because of repeated transfusion in Asia and Africa (Semba & Ramakrishan, 2008). Iron-overload related disease in hereditary hemochromatosis commonly develops in men, but not in women (Allen et al., 2008).

Symptoms or early symptoms of iron overload or hemochromatosis include fatigue, weakness, abdominal pain, vomiting, liver cirrhosis, liver cancer, heart failure, arthritis and endocrine disease (Mann & Truswell, 2007). The preferred treatment for reducing iron levels in hemochromatosis patients is called therapeutic phlebotomy[6] (Mann & Truswell, 2007; Semba & Ramakrishnan, 2008).

3.6 Folate deficiency

Folate (Vitamin B9) plays an important role in the synthesis and methylation of

[6] Phlebotomy: is simply the removing of blood from the body.

nucleotides that interpose in cell multiplication and tissue growth (Allen et al., 2006). Nutritional deficiency of folate is common in people consuming a limited diet. This can be exacerbated by malabsorption conditions, including celiac disease and tropical sprue. Pregnant women are at risk for folate deficiency because pregnancy significantly increases the folate requirement, especially during periods of rapid fetal growth (i.e in the second and third trimester) (McPartlin et al., 1993; Mann & Truswell, 2007). During lactation, losses of folate in milk also increase the folate requirement. Folate is present in high concentrations in legumes (bean salad), leafy green vegetables (e.g., spring greens and broccoli), some fruits (orange), yeast and liver (Mann & Truswell, 2007; Allen et al., 2006). Some staples, such as white rice and unfortified corn, are low in folate (Allen et al., 2006). In fact, a number of investigations to prove that giving folate with iron is any better at preventing anemia than providing iron alone (Atukorala et al, 1994; Haiden et al., 2006).

3.7 Strategies to prevent and treat iron-deficiency anemia

The basic principles on the prevention of IDA can be manipulatet of the diet (Gibney et al., 2007; Mann & Truswell, 2007). Strategies of prevention by WHO, include the agriculture, health, commerce, industry, education and communication sectors should be working together to reducing of IDA (WHO, UNICEF & UNU, 2001). However, the widespread organizations and sectors should be working in tightness with communities and local NGO. Further strategies for the prevention and treatment of anemia among women which suggested to reduce poverty, promote the consumption of a diversified diet, improve health services and sanitation, and promote better care and feeding practices (WHO, UNICEF & UNU, 2001). The strategies of UNHCR (2008-2010), the control and reduction of anemia's prevalence indicates the priority refugee populations which have been identified and located in camps, Algeria; while focusing on anemia, will also aim to improve the general dietary intake of micronutrients and reduce micronutrient malnutrition as a whole. The UNICEF has been working on various approaches for improving the micronutrient content of food aid (WHO & UNICEF, 2007).

3.7.1 Iron supplementation

Primary prevention and treatment of iron deficiency among women of reproductive age includes adequate dietary iron intake and iron supplementation (WHO, UNICEF & UNU, 2001). WHO, UNICEF & UNU (2001) indicate that pregnant women with adequate iron reserves, iron supplements provided during pregnancy will be more efficient at improving the iron status of the mother and of the fetus.

WHO, UNICEF & UNU (2001) recommends iron supplementation tighter with folic acid. The high physiological requirement for iron in pregnancy is difficult to meet with most diets. Therefore, all pregnant women should routinely receive universal supplementation that should be given 60 mg iron and 400 µg folic acid daily during the second half of pregnancy to control IDA (see Table 3). In settings where the prevalence of anemia is high (>40%), an additional 3 months of treatment during the postpartum period is recommended by WHO, UNICEF & UNU (2001). For non-pregnant women, in areas where the prevalence of anemia in women of reproductive age is severe (over 40%), preventive iron supplementation of 60 mg/day iron with 400µg folic acid for 3 months should be reasoned (see Table 3) (WHO, UNICEF & UNU, 2001). Although, the amounts of iron supplementation recommended treating of IDA for adults is 120 mg/day iron for 3 months (WHO, UNICEF & UNU, 2001).

Table 3 Dosage schedules for the use of iron supplementation to prevent and treat IDA by WHO, UNICEF & UNU (2001).

Prevalence of anemia in pregnancy	**Dose**	**Duration**
Universal supplementation	Iron:60mg/day Folic acid:400μg/day	As soon as possible after pregnancy starts…
Women of reproductive age (non-pregnant women)	**Dose**	**Duration**
Above 40%	Iron:60mg/day Folic acid:400μg/day	3 months

Notes:

- Supplementation of iron and folic acid as soon as possible after pregnancy starts – no later than the third month – and continuing for the rest of pregnancy.
- The amounts of iron supply recommended to treat IDA for adult is 120 mg/day iron for 3 months.

Although routine iron and folic acid supplementation has been used in many countries, but the prevalence of maternal anemia often remains high, suggesting that the effectiveness of such a program is not high. Efforts to improve the effectiveness of the program include insuring the supply and distribution and communication to primary health care workers and women on the benefits of supplementation (Semba & Ramakrishan, 2008). Under supervised conditions, weekly iron supplementation is an effective option for prevention of anemia in women of reproductive age and in turn prevent severe anemia during a subsequent pregnancy (Cavalli-Sforza et al., 2005). WHO, UNICEF & UNU (2001) indicates that iron supplementation programmers should be carefully assessed, and their efficiency and effectiveness should be monitored, to improve critical aspects of the system.

3.7.2 Iron fortification

Fortification of foods with iron has been a commonly used strategy to combat iron deficiency throughout the world (WHO, UNICEF & UNU, 2001; Gibney et al., 2007). The dietary habits of the population are an important consideration in selecting a food for fortification. Based on a number of reports, food items successfully used iron fortification include wheat flour, curry powder, soy sauces, salt and fish sauce, and milk powder (Mannar & Gallego, 2002; Thuy et al., 2003). Ferrous sulfate and elemental iron powders have traditionally been used to fortify wheat and other cereal flours, and Wheat-Soy Blend (WSB) is traditionally used for children and women of iron supply (WHO, UNICEF, UNU, 2001). A study found that WSB with Sprinkles (12.5 mg iron and other key micronutrients) can reduce of anemia among children from 9 to 24 months in rural Haiti (Menon et al., 2007). The NaFeEDTA, known as iron-EDTA, is a potentially valuable fortification that has hitherto had limited use; and compared to other fortificants, it is better absorbed and not sensitive to many food iron inhibitors (WHO, UNICEF & UNU, 2001). NaFeEDTA-fortified fish sauce has been successfully used to reduce the prevalence of IDA among women in rural Vietnam (Thuy et al., 2003; Thuy et al., 2005).

4.0 Materials and Methods

Methodology can properly refer to the theoretical analysis of the methods appropriate to a field of study or to the body of methods and principles particular to a branch of knowledge (Hellevik, 2002). In quantitative study, the aim is to determine the relationship between one thing (an independent variable) and another (a dependent or outcome variable) in a population. Quantitative research designs are either descriptive (subjects usually measured once) or experimental (subjects measured before and after a treatment). A descriptive study establishes only associations between variables. An experiment establishes causality (Creswell, 1994, 2009).

This thesis is focus on analysis of data that were collected from others. Even though, I was not participating in data collection, but I will explain the process of data collection in this section. This information is taken from a report written about the survey (MoH-Saharawi, WFP, MdM, NCA & AUC, 2008). The data collection was done by interview through household and women questionnaires, anthropometric measurements and measurement of haemoglobin among women of reproductive age, in March 2008.

4.1 Stakeholders and implementation process

The design and implementation of the survey was lead by Médicos del Mundo (MdM) on behalf of the Saharawi Ministry of Health (MoH) with the technical assistance of Norwegian Church Aid (NCA), Akershus University College (AUC) and WFP. The survey was funded by Agencia Española de Cooperacion International (AECI). The Saharawi Red Crescent Society (CRS) and UNHCR provided technical assistance during the data collection and with the analysis of the results.

4.2 Study design

This was a randomly cross sectional survey using quantitative data collection methodologies. Twelve enumerators were trained in all aspects of the survey instruments and received basic nutrition training. They were divided into three teams with four people per team. International staff from MDM, NCA, Niño Sano and WFP supervised the data collection. In addition, staff from UNHCR and CRS observed the data collection.

4.2.1 Study participants

The study was conducted between 9th of March and 2nd of April 2008 near Tindouf, in the Algeria desert. The total population was 150.000 refugees, 125.000 of these characterizes as vulnerable, living in 4 refugee camps. The target survey groups were pregnant women and non-pregnant women of reproductive age (15-49 years).

Table 4 Population groups and procedures in the Saharawi refugee camps, March 2008.

Population groups	**Procedures**
Non-pregnant women (15-49 years)	Questionnaire, weight, height and haemoglobin measurement
Pregnant women (15-49 years)	Questionnaire, weight, height, MUAC and haemoglobin measurement

4.2.2 Sample size

The calculation of the sample size was based on the expected outcomes using the Emergency Nutrition Assessment (ENA) for Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology version 1.

According to the survey 2002 the calculations was done with an estimated 18% of the population of 150.000 being women of reproductive age (15-49 years) (UNHCR, UNICEF, WFP & WHO, 2002). Using previous numbers of people it was found that the number of people per camp was more or less the same. It was therefore decided that in order to be able to differentiate between the four camps the sample size was multiplied by four. In addition a +5% refusal rate was included. Table 5 shows the sample size calculation.

Table 5 Calculation of sample size in the women of reproductive age (15-49 years)

Women of reproductive age	**Anemia**
Prevalence in previous surveys (%)	66.4
Assumed current prevalence (%)	66
Precision desired	+/- 10
Design effect (the actual design effect)	1.8
Sample size	155
To be able to differentiate/each camp*4	620
Including refusal rate of 5%	651

Table 5, it stands that 651 women of the reproductive age (15-49 years) was needed in order to have a representative sample. Previous surveys had indicated that there were two women of the reproductive age (15-49 years) in each household. This meant that 326 households were needed to get the required number of women of the reproductive age.

4.2.3 Sampling

Since there were no lists of inhabitants in each Daira[7] available a cluster sampling approach was used. The Dairas were used as sections for allocation of clusters by using a Probability Proportional to Size (PPS) methodology. Since it was assumed

[7] Each of the four camps is divided into 6-8 administrative units called Daira

that each camp has more or less the same population sized, the camps were divided into 48 clusters using the computer programme SMART, having an equal number of clusters in each camp.

Each Daira had a health dispensary which was situated approximately at the centre. This was used as a point of spinning a pen to identify a random direction. An approximately line was followed to the end of the Daira, and the pen was spun again to identify another random direction. The first house in this direction was chosen randomly by selecting a number between one and 20 from a list. The next house on the right on the line was the house that was visited next. This continued till information from sufficient women was collected. If all houses along the line had been included and there was still a need for more women of reproductive age to be included, the pen was spun again and a new direction was followed. The selection of households was done by the supervising staff, representatives from Ministry of Health (both at national and local level) and nurses from the health centre in the Daira. During data collection the next household was always identified by the survey supervisor.

The definition of household was discussed extensively with Ministry of Health and the team members. As a conclusion a household were defined as people who routinely cook, eat and share the same ration. All eligible individuals (women of reproductive age) within the household were interviewed and measured. In case of refusals or if people were absent they were not replaced in the sampling plan. If a dwelling was empty, neighbours or the accompanying nurse were asked if it was likely that the residents would return. Provided that the household members would return before the team left the cluster the same day, the household was revisited, if not the household was skipped. Eligible women missing from a household were noted and if possible the household was revisited. In the cases where this was not possible the women were reported as missing.

4.2.4 Training of the teams

The selection of households, the survey and the training for the survey was overseen by a nutrition consultant from NCA/AUC, a nutritionist from MDM, a nurse from Niño Sano and a senior nutritionist from NCA/AUC, in collaboration with the Saharawi Ministry of Health. All survey team members were Saharawi refugee staffs who were fluent in Spanish and Hasania. The staffs were selected by the Saharawi Ministry of Health and followed an extensive training schedule for two weeks. The training included basic nutrition, survey objective, survey methodology on collection of anthropometry, dietary intake, mortality data, food security data, anaemia using Haemocue and identification of oedema. At the end of the two weeks of training the team members undertook an exam covering the questionnaires. This helped the survey supervisors to identify who would be most suitable for each responsibility within the team, and who would be the most suitable team leaders.

Following the theoretical training, four days of practical training, both in the national hospital and the field, was done. The training included testing of the questionnaire, familiarization with the equipments and practical experience for the teams were carried out. During the practical training constructive feedback was given to the team members.

4. 3 Data collection

Interviewers administered the modular questionnaire, and the anthropometric measurements to analyze the prevalence and causes of anemia amongst women of reproductive age (15-49 years) in each household. On average, it took about one hour to complete the questionnaires and the anthropometric measurements in each household. This obviously depended on the size of the household.

4.3.1 Household questionnaires

All questionnaires used were developed in close collaboration between MDM, NCA, Niño Sano, WFP, Red Crescent Society and MoH. The questionnaires used were also based on questionnaires used in previous surveys in the camps and internationally recognized tools. They were then modified to best reflect the situation in the camps in collaboration with the team members. The food security questionnaire was based on the questionnaire used by WFP in other countries and the dietary questionnaires were based on the questionnaire used in Demographic Health surveys (DHS surveys) and WFP surveys. The dietary questionnaire contained information of 24 hour recall. The questionnaires developed to assess health seeking behaviours in women were based on international recognized questionnaires and questionnaires used in other surveys performed in the camps.

4.3.2 Food consumption and dietary diversity at individual level

In order to capture the individual dietary diversity score (IDDS or DDS) questions about both the women's individual food intake was performed by asking about the food intake in the last 24 hours. The food items were grouped in 14 groups. The food groups used were 1. Cereals and food made from grain (including wheat, rice, barley, gofio, bread, muffins, biscuits, spaghetti, couscous), 2. Dairy products (milk; powder milk, Candia, yoghurt and cheese), 3. Local goat and camel milk, 4. Vitamin A rich vegetables (carrots and pumpkin), 5. Other vegetables (potato, onion, tomato, peppers, beetroot), 6. Fruits (oranges, lemons, dates, banana, apple, juice and marmalade), 7. Lentils, beans, peas and nuts, 8. Canned fish (tuna, sardine, mackerel), 9. Meat (camel, goat, chicken, beef), 10. Liver, 11. Egg, 12. Tea, coffee, sugar, candy, chocolate, soft drinks, 13. Fortified foods, 14. Oils and fat. A Dietary Diversity Score is an index of how many food groups a person has eaten.

Dietary Diversity Score, measured by the number of food groups eaten by an individual in the last 24 hours, is a good proxy of the nutrient (mainly micronutrient) adequacy of the diet of an individual. The way to interpret the DDS results is currently not standardized. There is no standard list of foods or food groups, and no cut-off point, upon which the international community agrees for a broad use in all contexts. However, a huge research work is currently ongoing[8].

In this survey it was used the last 24 hours intake when calculating the DDS and the further analysis of the data. DDS for 24 hours was calculated by taken how many times a food item was eaten during 24 hours.

4.4 Anthropometric survey

The most widely anthropometric measurements of body size are those of stature (height or length) and body weight (Gibson, 1996). Weight was determined using an electronic digital scale (UNISCALE) measuring to the nearest 0.1 kg. Because of low temperature and cultural background were women weighed with some clothes. The weight of the clothes was estimated and withdrawn from the number that the scale was showing. These conditions were met, weight measurements and determination of weight increments was interpreted with confidence. Height of women of reproductive age was measured by using a Height Board.

Body mass index (BMI) (weight/height^2, kg/m^2) is considered to be the most suitable, objective anthropometric indicator of nutritional status of the adult. It was chosen because this anthropometric indicator, derived from measures of weight and height of individuals of both sexes, is consistently and highly correlated with body weight (or energy stores within the body) and is relatively independent of the height of the adult (Gibson, 2005).

[8] SCN Task Force on Assessment, Monitoring and Evaluation. (March 2008). Fact sheets on Food and Nutrition Security Indicators/Measures: Dietary Diversity (DD)

While a BMI under 18.5 kg/m^2 is considered as the cut-off for the diagnosis of chronic undernutrition in adults, a series of cut-offs are provided to delineate the degrees of severity of undernutrition (James et al., 1988; Ferro-Luzzi et al., 1992; Health Canada, 2003). The BMI classification system for adults used by WHO (2000a) (see Table 6).

Table 6 WHO classification of overweight in adults according to BMI (WHO, 2000a).

Classification	BMI (kg/m^2)	Risk of comorbidities
Underweight	< 18.50	Low (but risk of other clinical problems is increased)
Normal range	18.50-24.99	Average
Overweight	=> 25.00	Increased
Pre-obese	25.00-29.99	Moderate
Obese	>30.00	Severe

Mid–upper-arm circumference (MUAC) is a composite measure of muscle, fat, and bone. It has been used as an alternative index of malnutrition in rapid nutritional surveys when weight and stature measurements were not feasible (WHO, 1995). Wasting was defined as MUAC < 22 cm according to the value recommended in pregnant women for the screening of malnutrition (James et al., 1994). The MUAC was taken by using a UNICEF MUAC tape to the nearest mm.

4.5 Measurement of haemoglobin

The measurement of haemoglobin in the women of reproductive age (15-49 years) was done in the household using a photometer (Haemocue B-haemoglobin Photometer). Haemoglobin concentration was estimated from a finger prick sample of blood, by using the Hemocue system. This system has been used in field surveys for estimating haemoglobin in capillary blood and gives results comparable to estimates obtained by sophisticated laboratory methods in present study. Anemia was evaluated as a categorical variable of haemoglobin by WHO (see Table 1).

4.6 Statistical analysis

The data were exported to Statistical Package of Social Sciences (SPSS) and Microsoft Office Excel. All data were analysed by statistical program SPSS, version16.0 for Windows (SPSS Inc., 2008). The data were manually input SPSS, and this was done a frequency analysis and analysis of variables. Continuous variables with normal distribution were summarized using mean, standard deviation (SD) and median with a range. Frequencies and percentages were calculated for all the categorical variables such as haemoglobin levels, women age and BMI categories for both pregnant women and non-pregnant women in present study.

There are two kinds of variables, namely dependent and independent. Dependent variables means at some data depend on each other. Independent data is data, which is not dependent on other data. Statistical comparison between the results for women of the childbearing age was carried out with a parametric method (Independent Samples T-test, One-way ANOVA [9] Test and LSD [10]) and nonparametric method (Kruskal-Wallis [11] test and Mann-Whitney U test). Probability values below 0.05 were considered significant (Kinnear & Gray, 2009).

[9] ANOVA: Analysis of Variance.

[10] LSD: Least Significant Difference tests should only be carried out if the initial One-way ANOVA is significant, $p<0.05$.

[11] The Kruskal Wallis test can be applied in the one factor ANOVA case. It is a non-parametric test for the situation where the ANOVA normality assumptions may not apply.

4.6.1 Frequency tables

The frequencies procedure provides statistical and graphical displays that are useful for many types of variables. These help to arrange the distinct values in ascending or to descending order or order the category by their frequency. The advantages of this method are that it counts percentage, mean, median, mode, sum, standard deviation, variance, range, and minimum and maximum values. Frequency tables are also a method that was used for analyzing field data. This method was especially useful for description of background information in present study such as married status, education, pregnant, know writing and reading, alive and dead children, haemoglobin, age, camps, disease, food groups, DDS, water tanks, BMI, MUAC, WSB, get plumpy nut and take iron.

4.6.2 Independent-Samples T Test

The t-test is used to compare the values of the means from two samples and test whether it is likely that the samples are from populations having different mean values. The independent samples t-test is used to test the hypothesis that the difference between the means of two samples is equal to H_0[12] (this hypothesis is therefore called the null hypothesis); and the difference between the means of two sample is not equal to H_1[13] (this hypothesis is called the alternative hypothesis (Ringdal, 2007).

4.6.3 Analysis of variance

Analysis of variance is a collection of statistical models, and their associated procedures, in which the observed variance is partitioned into components due to different explanatory variables. In its simplest form ANOVA gives a statistical test of whether the means of several groups are all equal, and therefore generalizes

[12] H0: The means of the two groups are not significantly different.
[13] H1: The means of the two groups are significantly different.

t-test to more than two groups (Rogerson, 2006; Ringdal, 2007).

The One-way ANOVA is used to test for differences among two or more independent groups (Rogerson, 2006). Levene's test for homogeneity of variances is typically used to confirm homoscedasticity. As before, if the significance of Levene's test is greater than 0.05, we can assume that the assumption of equal variances has been met. As such we would need to select an alternative statistical (the One-way ANOVA test), followed by LSD test with multiple comparisons (Connolly, 2007; Kinnear & Gray, 2008). The LSD devoloped by Fisher, was to explore all possible pair-wise comparisons of means comprising a factor using the equivalent of multiple t-tests (Kinnear & Gray, 2009).

4.6.4 The Kruskal-Wallis Test

The nonparametric test for two or more categories is the Kruskal-Wallis test. The Kruskal-Wallis test does not assume a normal population, unlike the analogous one-way analysis of variance. However, the test does assume an identically-shaped and scaled distribution for each group, except for any difference in medians (Rogerson, 2006). As before, if the significance of Levene's test is 0.05 or less, we have to conclude that the assumption of equal variances has not been met. As such we would need to select an alternative statistical (the Kruskal-Wallis test) (Connolly, 2007). The Kruskal-Wallis test, as the results from the probability value of less than 0.05 could be interpreted as significant differences between the groups (Rogerson, 2006; Connolly, 2007).

4.6.5 The Mann-Whitney U test

The Mann-Whitney U test is a nonparametric test for assessing whether two independent samples of observations come from the same distribution. It is one of the best-known nonparametric significance tests, such as the median, that resistant to outliers and skewness (Rogerson, 2006; Connolly, 2007). The Mann-Whitney U test was applied in this study, asymptotic p-values (2-tailed) below 0.05 were considered significant.

4.7 Ethical clearance

Research projects had been approved by Saharawi Ministry of Health and CRS. All the data collection and data entry was carried out in Algeria, March 2008, so it was no need to send an application to the Norwegian research authorities.

5.0 Results

5.1 Background information

The Survey included 215 households from four camps, a total there were 796 women of reproductive age (15 – 49 years). Table 7 shows that those 14% of the women of reproductive age did not get married, but those 79% got married. In the target group, the women from 15 to 45 years, most of them (71%) know writing and reading. About education, 24% of the women had never education, 24% had less than 6th grade, 29% had education of secondary school, and only 3% had higher education.

In total, 81% of the women of reproductive age had children and 19% had no children. About death of children, those were 35% of the women of reproductive who had dead of children. In non-pregnant women, they had an average of BMI was 25, 3 kg/m^2, with a range between 12,7 and 45,7 kg/m^2. In pregnant women, those were 11% who had a value of MUAC less than 25 cm, and 60% had a value of MUAC over 25 cm.

Table 7 Description of information of background among the women of reproductive age in the Saharawi refugee camps, Algeria, March 2008.

Women	**Total in (n=796)**
Houshold	Total in (n=215)
Age, mean (min – max)	32 (15-49)
Marital status, % (n)	
Not married	14 (108)
Married	79 (627)
Divorced	6 (47)
Widow	1 (10)
Know write, % (n)	
Yes	71 (559)
No	29 (233)
Know read, % (n)	
Yes	71 (562)
No	29 (230)
Education, % (n)	
None	24 (187)
Less than 6th grade	24 (187)
Up to 6th grade (Primary school)	7 (59)
7th to 9th grade (Secondary school)	29 (233)
10th to 12th grade (High school/Vocational studies)	13 (103)
Higher education	3 (23)
Pregnant, % (n)	
Yes	8 (63)
No	90 (707)
Don't know	2 (16)
Children alive, % (n)	
No children	19 (149)
Have children	81 (648)
Children dead, % (n)	
No dead children	65 (517)
Have had dead children	35 (280)
BMI in non-pregnant women, mean (min – max)	25,3 (12,7 – 45,7)
MUAC in pregnant women	
MUAC < 25, % (n), (mean, min – max)	11 (7), (22,3, 21 – 24)
MUAC > 25, % (n)	60 (38)

5.2 Target population

The study population consists of total 786 women of reproductive age who were non-pregnant and pregnant women (range from 15 to 49 years), with 90% (n=707) non-pregnant and 8% (n=63) pregnant. With 2% (n=16) did not know if they were pregnant or not (see Table 7).

Table 8 presents a short general description of results among the women of reproductive age (15-49 years), in the Saharawi camps, Algeria. Furthermore, the following results will specifically be introduced in this study.

Table 8 Description of results of target population, the women of reproductive age (15-49 years) in the Saharawi refugee camps, Algeria, March 2008.

Results among women			**Hb**	
	n	**%**	**Mean±SD**	**Range**
Non-pregnant women	707	90	-	-
Camp categories (total)	685	100	11.3±2.4	4.0-18.2
EI Aiune	165	24	11.3±2.3	4.1-18.2
Aswerd	175	26	11.2±2.6	4.2-15.9
Smara	172	25	11.7[a]±2.4	4.0-16.4
Dakla	173	25	10.9[a]±2.4	4.4-15.5
Age categories (total)	683	100	11.3±2.4	4.0-18.2
Less than 20 years	45	7	11.9[b]±2.2	5.0-15.8
20-29 years	249	36	11.2±2.2	4.2-15.8
30-39 years	225	33	11.0[b,c]±2.5	4.0-16.1
40-49 years	164	24	11.6[c]±2.7	4.4-18.2
Pregnant women	63	8	-	-
Camp categories (total)	59	100	9.9±2.5	5.7-15.0
EI Aiune	11	18	10.3±1.9	7.2-13.6
Aswerd	14	24	10.0±3.1	5.7-15.0
Smara	17	29	10.2±2.4	6.3-14.0
Dakla	17	29	9.1±2.5	5.7-13.3
Age categories (total)	59	100	9.9±2.5	5.7-15.0
20-29 years	32	54	9.5±2.5	5.7-13.3
30-39 years	23	39	9.9±2.3	6.3-14.4
40-49 years	4	7	12.1±2.6	9.7-15.0
Children's age categories in women (total)	637	100	11.0±2.5	4.0-18.2
Children < 2 years	225	35	10.8[d]±2.2	4.1-15.3
2-4 years	275	43	11.0[e]±2.6	4.0-16.1
5-9 years	85	14	11.4±2.6	4.2-18.2
Children> 10 years	52	8	12.3[d, e]±2.8	5.5-16.4

a) LSD test: A significant difference on Hb between Smara and Dakla, p=0.03.

b) One-way ANOVA test: A significant difference on Hb between less than 20 years and 30-39 years in the non-pregnant women, p=0.03.

c) One-way ANOVA test: A significant difference on Hb between 30-39 years and 40-49 years in the non-pregnant women, p=0.01.

d) LSD test: A significant difference on Hb between women who had children less than 2 years and women who had children more than10 years, p=0.00.

e) LSD test: A significant difference on Hb between women who had children between 2-4 years and women who had children more than 10 years, p=0.01.

5.3 Analysis prevalence of iron deficiency

The measurement of the haemoglobin concentration in the blood of the women of reproductive age (15-49 years) showed that there was a high prevalence of anemia among both non-pregnant women and pregnant women in the four camps; EI Aiune, Aswerd, Smara and Dakla.

5.3.1 Iron deficiency anemia in the non-pregnant women

Among the 685 non-pregnant women between 15 and 49 years measured on haemoglobin, 54% (n=369) was iron deficiency (Hb<=11.9). The prevalence rates were 11%, 28% and 15% for severe, moderate and mild anemia in the non-pregnant women, respectively (see Table 9). Figure 4 reveals that the mean (±SD) of haemoglobin concentration among the total non-pregnant women was 11.3±2.4 g/dl, with a range 4.0 – 18.2 g/dl in the Saharawi refugee camps.

Table 9 Prevalence of anemia among non-pregnant women (15-49 years) divided by haemoglobin categories, in the Saharawi refugee camps, Algeria, March 2008.

Anemia in non-pregnant women	**n**	**%**
Severe anemia Hb < 8 g/dl	72	11
Moderate anemia Hb 8-10.9 g/dl	194	28
Mild anemia Hb 11-11.9 g/dl	103	15
Total	369	54

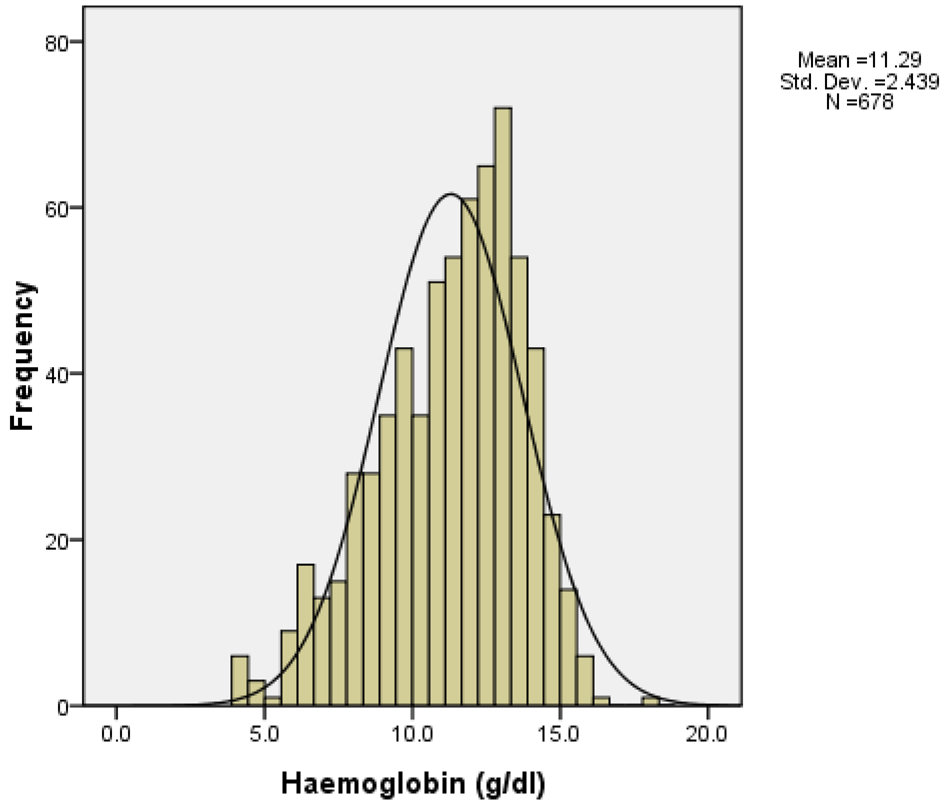

Figure 4 Distribution of haemoglobin concentrations among non-pregnant women (15 - 45 years) in the Saharawi refugee camps, Algeria, March 2008.

Iron deficiency anemia in different camps

Iron deficiency was relatively common in all four refugee camps. The prevalence of anemia (Hb<=11.9) among non-pregnant women were 60% (n=104), 56% (n=98), 55% (n=91) and 44% (n=76) for camp in Dakla, Aswerd, EI Aiune and Smara, respectively. The highest prevalence of anemia was found in Dakla, 60% (n=104) of non-pregnant women had IDA, while in Smara, 44% (n=76) had IDA (See Figure 5).

In Smara, the non-pregnant women had a significant higher haemoglobin level (mean±SD, 11.7±2.4 g/dl) than in the other camps ; while in Dakla, the non-pregnant women had a significant lower haemoglobin level (mean±SD, 10.9±2.4 g/dl) (See table 8). In Dakla, 32% had moderate IDA and 13% had severe

IDA among non-pregnant women (n=173) (see Figure 5). The figure 6 showed that the significant difference between Smara and Dakla on the haemoglobin level among non-pregnant women, P=0.00 (see Table 8 a.).

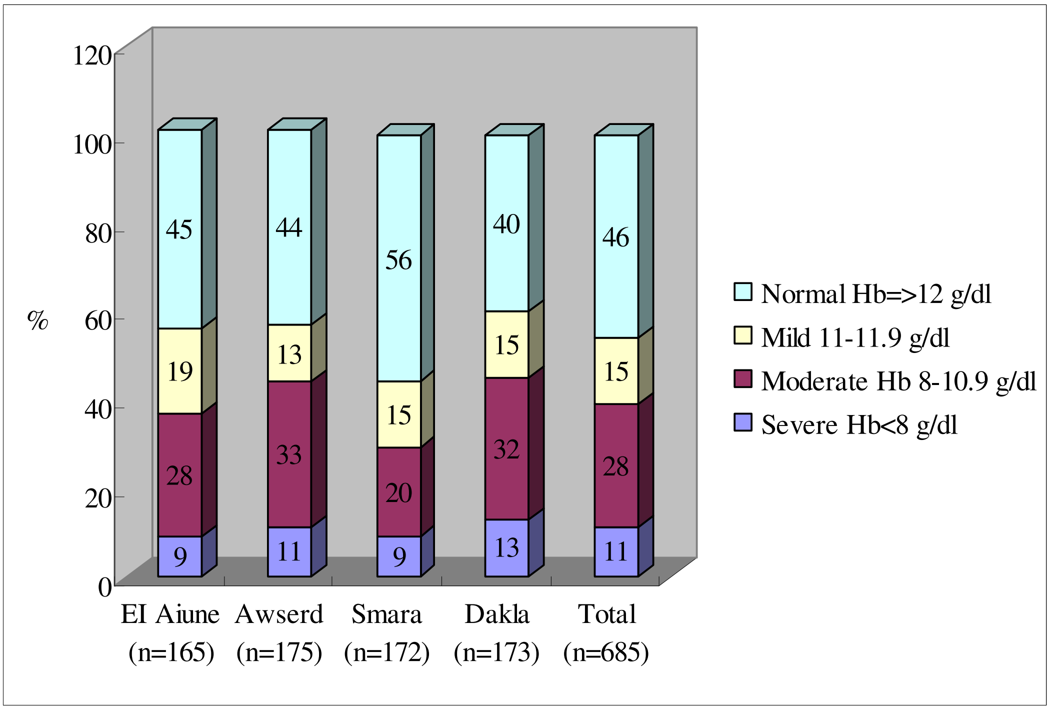

Figure 5 Prevalence of anemia among non-pregnant women (15-49 years) divided by camps, in the Saharawi refugee camps, Algeria, March 2008.

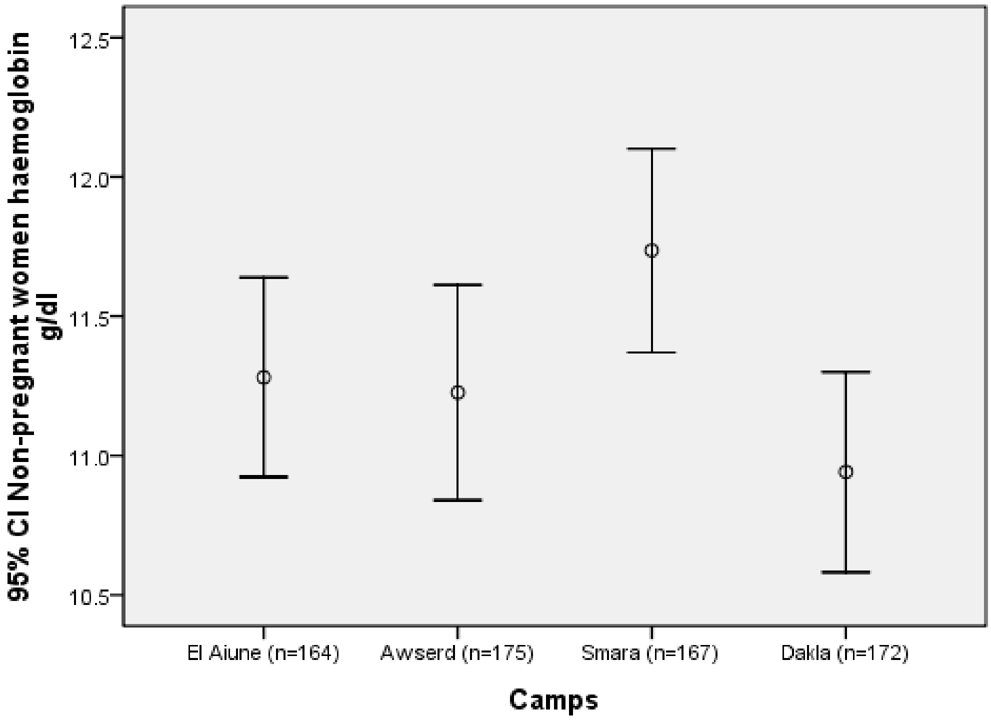

Figure 6 Effect of the camps on the level of haemoglobin among non-pregnant women, in the Saharawi refugee camps, Algeria, March 2008.

5.3.2 Iron deficiency anemia in the pregnant women

Among the total 59 pregnant women between 15 and 49 measured haemoglobin, 66% (n=39) were iron deficiency (Hb<=10.9). The prevalence rates were 15%, 36% and 15% for severe, moderate and mild IDA in pregnant women, respectively (see Table 10). The figure 7 reveals that the mean (±SD) of haemoglobin concentration in total pregnant women was 9.9±2.5 g/dl in the Saharawi refugee camps.

Table 10 Prevalence of anemia among pregnant women (15-49 years) divided by haemoglobin categories, in the Saharawi refugee camps, Algeria, March 2008.

Anemia in pregnant women	**n**	**%**
Severe anemia Hb < 7 g/dl	9	15
Moderate anemia Hb 7-9.9 g/dl	21	36
Mild anemia Hb 10-10.9 g/dl	9	15
Total	39	66

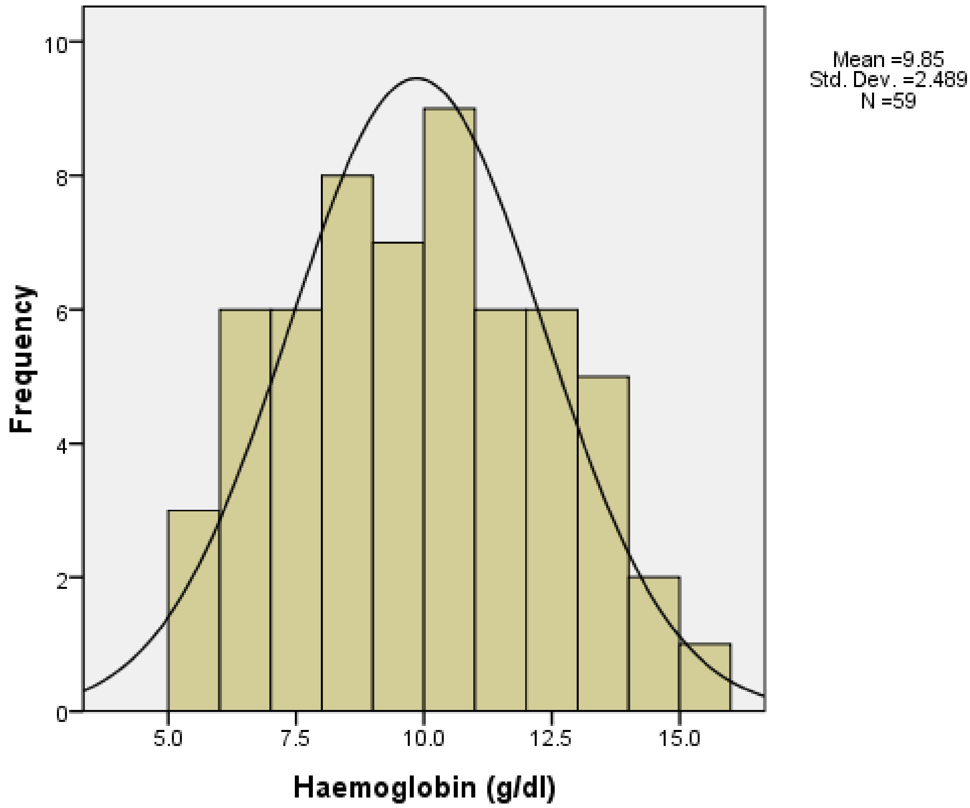

Figure 7 Distribution of haemoglobin concentrations among pregnant women (15 - 45 years), in the Saharawi refugee camps, Algeria, March 2008.

The prevalence of anemia (Hb<=10.9) among pregnant women were 77% (n=17), 64% (n=14), 64% (n=11) and 60% (n=17) for camp in Dakla, Aswerd, EI Aiune and Smara, respectively (see Figure 8). The highest prevalence of anemia was found in Dakla, 77% of pregnant women had IDA, while in Smara, with 60% had

IDA

In EI Aiune, the pregnant women had a higher haemoglobin level (mean±SD, 10.3±1.9 g/dl), while the pregnant women in Dakla had a lower haemoglobin level (mean±SD, 9.1±2.5 g/dl) (see Table 8). There were no significant difference between each camp on the haemoglobin level among pregnant women, p=0.57.

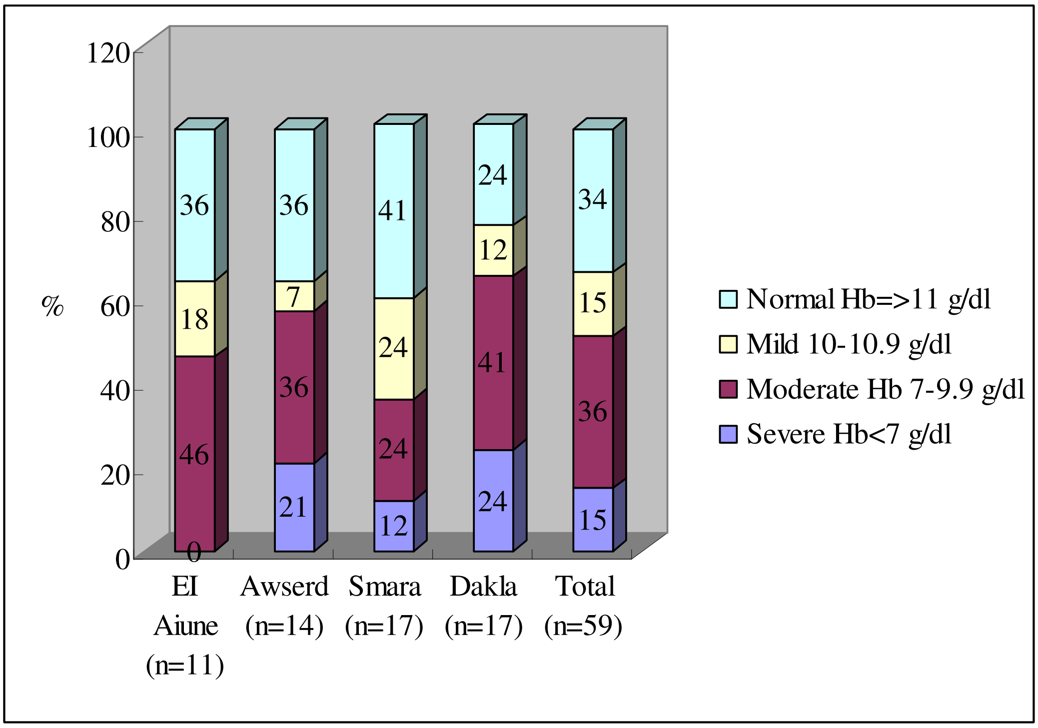

Figure 8 Prevalence of anemia among pregnant women (15-49 years) divided by camps, in the Saharawi refugee camps, Algeria, March 2008.

5.4 Possible causes of anemia among women

The prevalence of anemia was increased among the women of reproductive age with many possible causes. Iron deficiency is the most common cause of anemia. Although, iron deficiency is generally the most common cause of anemia, there are other nutritional, genetic, and environmental causes as well. In this section, based on the possible causes linked to IDA among women of reproductive age was analyzed in the Saharawi refugee camps, such as age, disease, food intake, malnutrition and supplementation.

5.4.1 Age groups in the non-pregnant women

The non-pregnant women were categorized according to the age group, as follows in the age group less than 20 years (n=45), 20-29 years (n=249), 30-39 years (n=225) and 40-49 years (n=164) (see Table 8). The figure 9 shows that the prevalence of IDA is divided into the four age groups; which were 42%, 59%, 57% and 45%, respectively in less than 20 years old, 20-29 years, 30-39 years and 40-49 years of age. A high prevalence of IDA in 20-29 years and 30-39 years of age; which had a mean (±SD) on the level of haemoglobin was 11.2 g/dl (±2.2) in the age group 20-29 years, and which had a lower mean (±SD) on the level of haemoglobin was 11.0 g/dl (±2.5) in the age group 30 to 39 years (see Table 8). Prevalence of severe and moderate anemia was the most serious is that 12% and 32% in 30-39 years of age (see Figure 9).

There were significant differences between the age group less than 20 years and 30-39 years of age; between 30-39 years and between 40-49 years of age on the levels of haemoglobin among non-pregnant women, $p<0.05$ (see Table 8 b,c; and Figure 10).

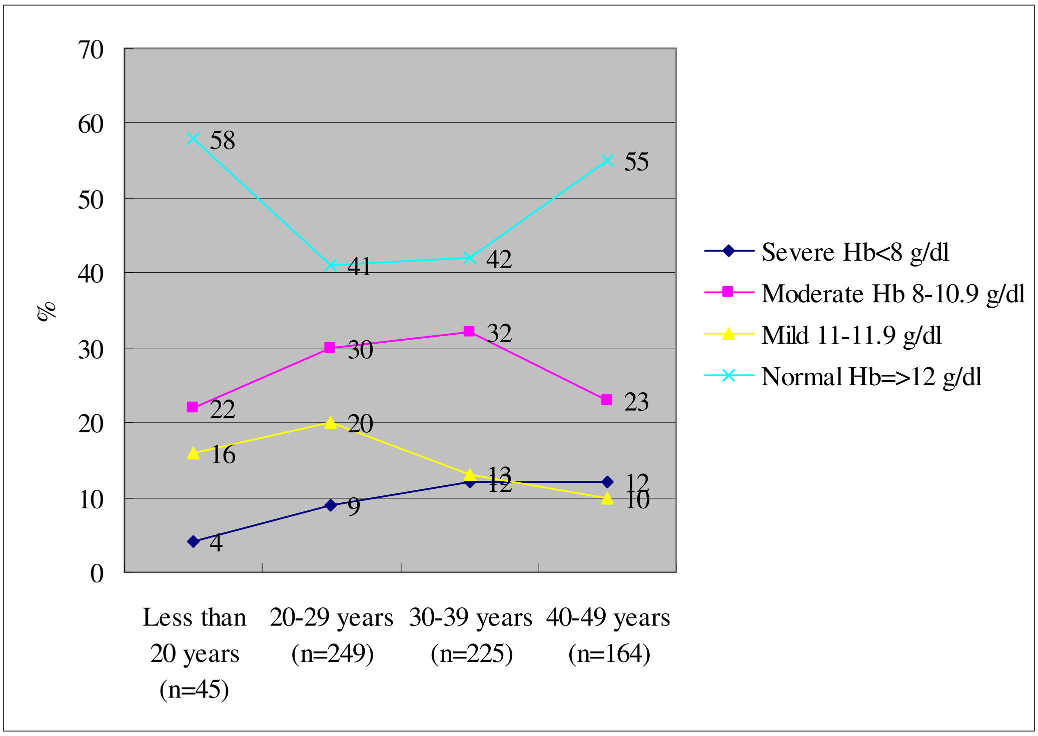

Figure 9 Trends in prevalence of anemia by age groups among non-pregnant women (15-49 years), in the Saharawi refugee camps, Algeria, March 2008.

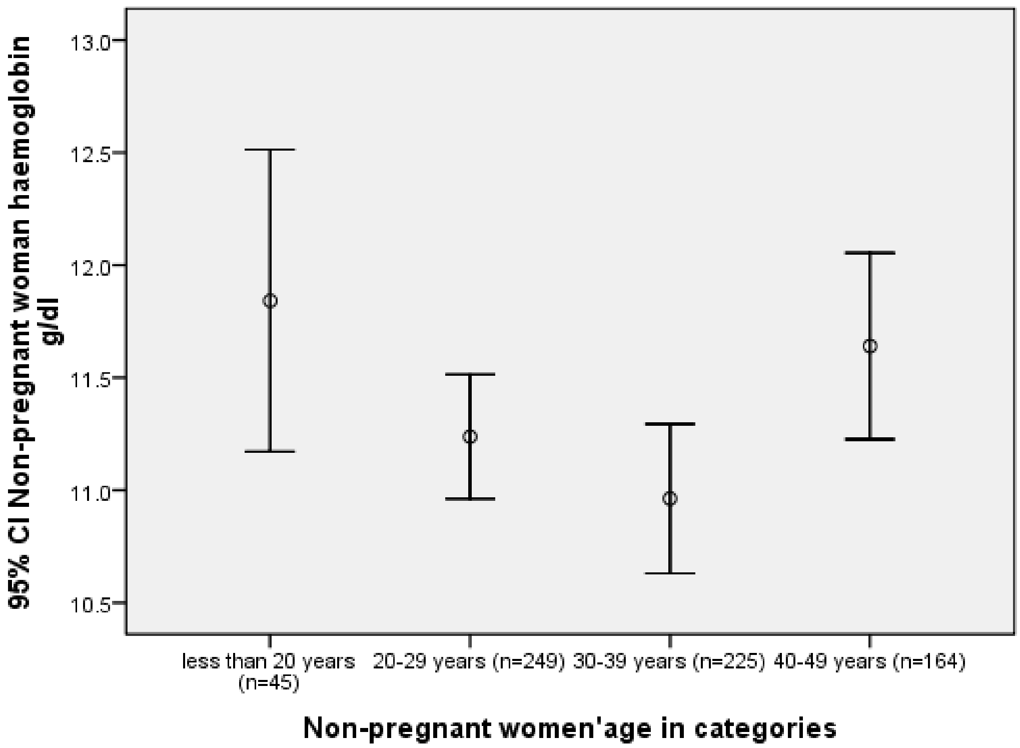

Figure 10 Effect of non-pregnant women's age categories on the levels of haemoglonbin, in the Saharawi refugee, Algeria, March 2008.

Figure 11 shows that 78% of the women of reproductive age had children less than 5 years of age in the Saharawi refugee camps; those were 35% who had children less than 2 years of age with an average of haemoglobin was 10.8 g/d, 43% who had children between 2-4 years with an average of haemoglobin was 11.0 g/dl. In addition, which 14% of the women had children between 5-9 years with an average of haemoglobin was 11.4 g/dl, which 8% of the women had children more than 10 years with a higher average of haemoglobin was 12.3 g/dl. There were significant differences between the women who had children less than 2 years and the women who had children more than 10 years on the levels of haemoglobin, p<0.00; and between the women who had children between 2-4 years and the women who had children more than 10 years on the levels of haemoglobin, p<0.01 (see Table 7 d, e; and Figure 12).

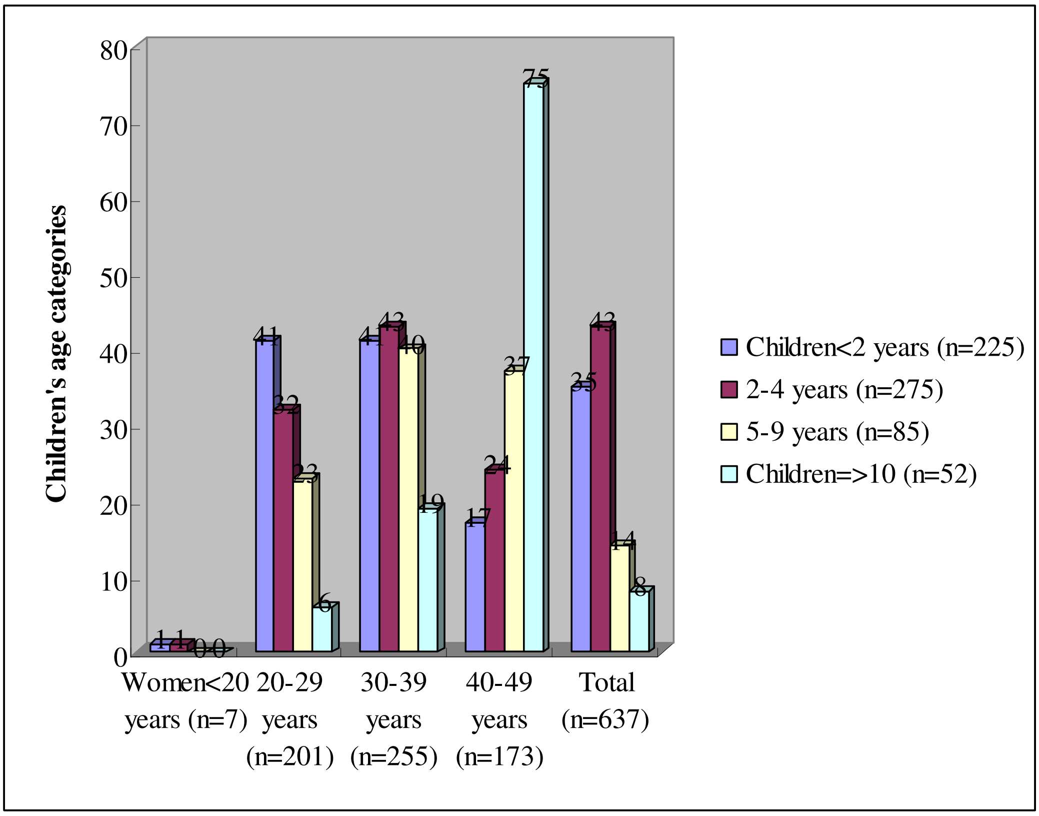

Figure 11 Categories of children's age divided by the women's age categories in the Saharawi refugee camps, March 2008.

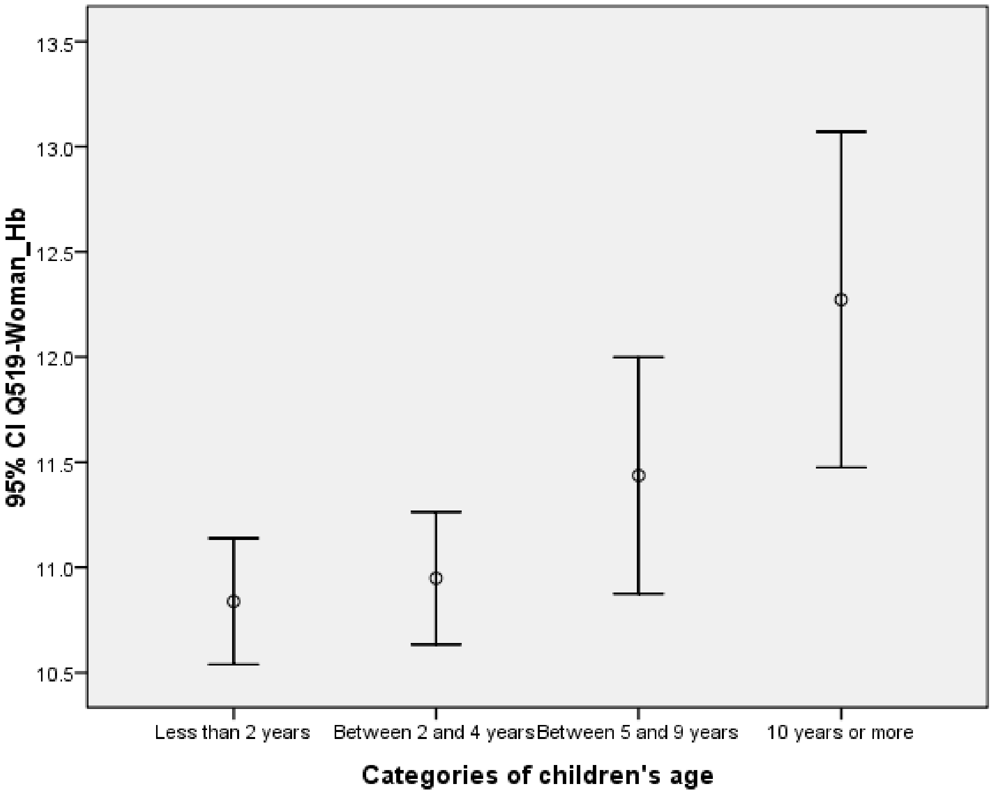

Figure 12 Effect of the categories of children's age on the level of haemoglobin among women of reproductive age in the Saharawi refugee camps, Algeria, March 2008.

5.4.2 Age groups in the pregnant women

The pregnant women were categorized in three age group, as follow 20-29 years (n=32), 30-39 years (n=23) and 40-49 years (n=4) (see Figure 13). Figure 13 shows that the prevalence of IDA among pregnant women in the age group 30-39 years, 20-29 years and 40-49 years is 70%, 66% and 50% respectively. Prevalence of severe and moderate anemia was the most serious is that 19% and 34% in 20-29 years of age.

The overall mean±SD of haemoglobin levels was 9.9 g/dl ± 2.5 g/dl in the pregnant women. Table 8 shows that the mean±SD of haemoglobin levels were low (9.5±2.53 g/dl; 9,9 ± 2.3; respectively) in the age groups from 20 to 29 years and

30 to 39 years. There were no significant differences on haemoglobin levels of pregnant women between the women's age in categories, p>0.05.

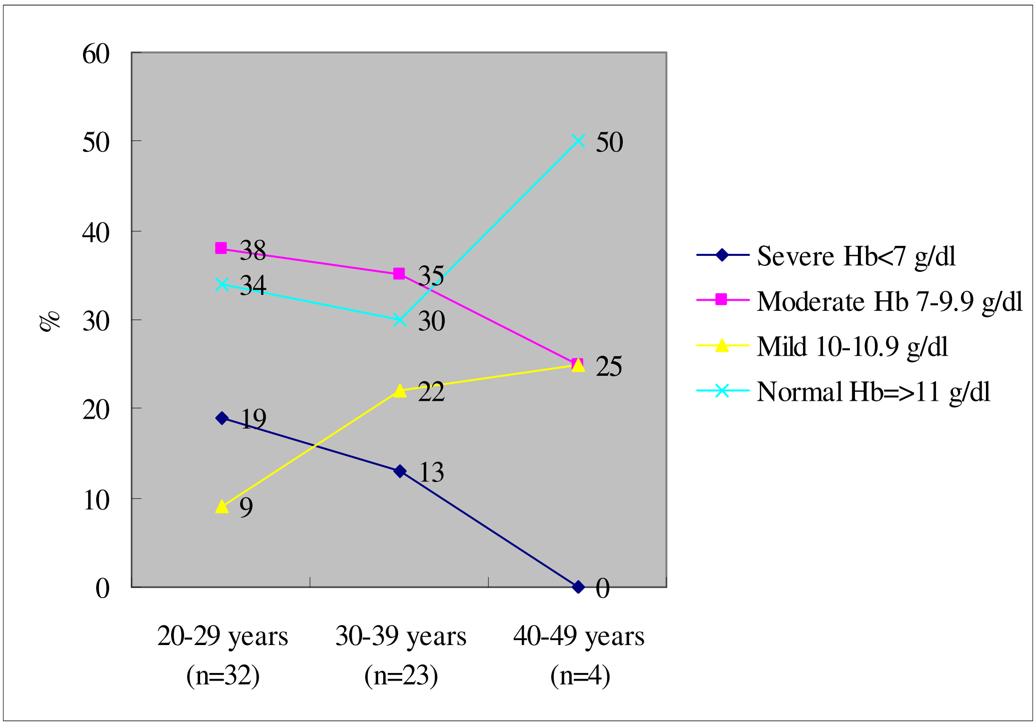

Figure 13 Trends of anemia among pregnant women divided by age, in the Saharawi refugee camps, Algeria, March 2008.

5.4.3 Disease

Figure 14 shows the prevalence of self reported on different diseases in pregnant women and non-pregnant women together. Figure 14 shows that the disease with the highest prevalence was diarrhoea (74%); approximately 50% suffered from pneumonia and 33% suffered from cardiac diseases, where the lowest prevalence of disease was diabetes and celiac disease (6% and 4%, respectively). There were no significant differences on self reported different diseases between the camps in the women of reproductive age, p>0.05.

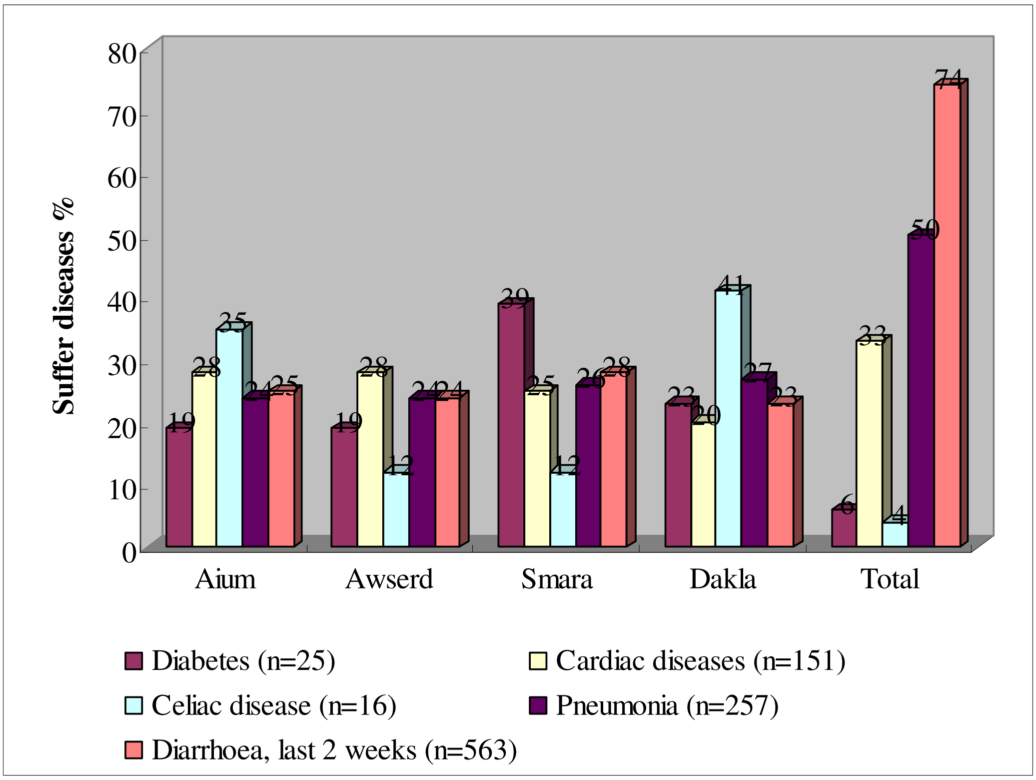

Figure 14 The prevalence of different diseases among women of reproductive age (15-49 years) on self report divided by camps, in the Saharawi refugee camps, March 2008.

Table 11 presents the women who suffered from diabetes had a significant higher mean of the level of haemoglobin (12.3 g/dl) than those who was not suffering from diabetes (11.1 g/dl). It also presents women who suffered from pneumonia; the levels of haemoglobin (11.4 g/dl) were higher than the women did not suffer pneumonia (11.0 g/dl). There were significant differences on levels of haemoglobin between the women who suffered from diabetes and pneumonia, and the women who did not suffering from diabetes and pneumonia, $p<0.05$ (see Table 11). In addition, there was no statistical significant difference on level of haemoglobin between suffering from other diseases and those who did not suffer the disease, such as cardiac diseases, celiac disease and diarrhoea, $p>0.05$ (see Table 11).

Table 11 Effect of different diseases on haemoglobin levels among women (15-49 years) in the Saharawi refugee camps, March 2008.

Disease		n	Haemoglobin g/dl (Mean±SD)	P-values
Diabetes	yes	25	12.3±2.3	P=0.02*
	no	390	11.1±2.5	
Cardiac diseases	yes	151	11.2±2.7	P=0.88
	no	314	11.1±2.5	
Celiac disease	yes	16	11.2±2.6	P=1.00
	no	392	11.2±2.5	
Pneumonia	yes	257	11.4±2.5	P=0.04*
	no	252	11.0±2.5	
Diarrhea (last 2 week)	yes	563	11.1±2.6	P=0.85
	no	195	11.2±2.5	

* T-test $p<0.05$: significant differences on levels of haemoglobin between women with diabetes and without diabetes; and between women with pneumonia and without pneumonia.

5.4.4 Food Intake

Dietary diversity, defined by the number of food groups eaten by an individual is a good proxy indicator of the quality of the diet. Both pregnant women and non-pregnant women were asked about the food intake in the last 24 hours. DDS is an index of how many food groups a person has eaten.

Table 12 summarizes the percentage of women who were reported to have eaten from the food groups in the last 24 hours. The table 12 shows food groups such as cereals, other vegetable, lentils, and oils and fats and tea coffee had a maximum of consumption, on the contrary, liver and eggs were consumed in relatively small amount. From the below table we can find that women in the EI Aiune seem to have a lower percentage of consumption from most of the food groups. Table 12 also indicated that there was a significant difference in food intake between the each camp among women (15-49 years) as follows between EI Aiune and either Awserd, Smara or Dakla; between Awserd and either Smara or Dakla; and beween Smara and Dakla, $p<0.05$.

Table 12 Percent of women (15-49years) reported intake (24 hour recall) of various food groups in the Saharawi refugee camps, Algeria, March 2008.

Food Groups	**Total (n=786) %**	**Aiune[14] (n=197) %**	**Awserd (n=191) %**	**Smara (n=206) %**	**Dakla (n=192) %**
1.Cereals and food made from grain	96*	$98^{a.b.c}$	100	100	100
2.Dairy products	43*	$30^{a.b.c}$	43^{d}	56^{f}	42
3.Local goat and camel milk	60	58	59	58	64
4.Vitamin A rich vegetables	78*	$33^{a.b.c}$	94	93	90
5.Other vegetables	96*	$84^{a.b.c}$	99	100	100
6.Other fruits	59*	$42^{a.b.c}$	$84^{d.e}$	59	53
7.Lentils, beans, peas and nuts	92*	$83^{a.b.c}$	93	96	94
8.Canned fish	17*	$5^{a.b.c}$	$13^{d.e}$	22	30
9.Meal	33*	$23^{a.b.c}$	35	37	26
10.Liver	1	1	3	1	1
11.Egg	2*	$4^{b.c}$	3^{e}	1	0
12.Tea,coffee, sugar, candy, choloade, coca, fanta etc	93*	90^{b}	90^{d}	97	95
13.Oils and fat	97*	94^{b}	97	99	97
14.Fortified food	57*	55^{a}	$67^{d.e}$	56	49

*Significant difference Mann-Whitney Test $p<0.05$, **a=** between EI Aiune and Awserd, **b=**between EI Aiune and Smara, **c=**between EI Aiune and Dakla, **d=**between Awserd and Smara, **e=**between Aswerd and Dakla, **f=**between Smara and Dakla

Table 13 divides the DDS into three groups (low-, medium- and high DDS). It revealed that the DDS mean (±SD) of women was 5.6 (±1.40) with a range of 1 to 11 groups meaning that 45% women had ate from less than 5 food group, 29% had ate from 6 food groups and 26% had ate from 7 or more food groups (see Table 13).

[14] Aiune = EI Aiune

Table 13 DDS of women (15-49 years) based on 24 hours of intake interview by divided into three groups (low-, medium- and high DDS), in the Saharawi refugee camps, Algeria, March 2008..

Dietary Diversity Score	**Women (15-49 years)**	
	n	**%**
Low DDS	352	45
Medium DDS	224	29
High DDS	207	26
Total	783	100

Figure 15 also summarize the data on food consumption within 24 hours. They were divided by three categories of DDS. Food intake of the women with low score had a very basic diet, as it most was cereals, lentils, oil, tea and other vegetables such as potato and onion. Food intake of the women in the medium categories of DDS had the same basic food groups as those in the low categories of DDS, but also often consumed food groups such as local milk and vitamin A rich vegetables (carrot). Variety of food products were consumed by the majority of women in the high-DDS group. The liver and the number of eggs consumed significantly less than other types of food in all three DDS group (see Figure 15).

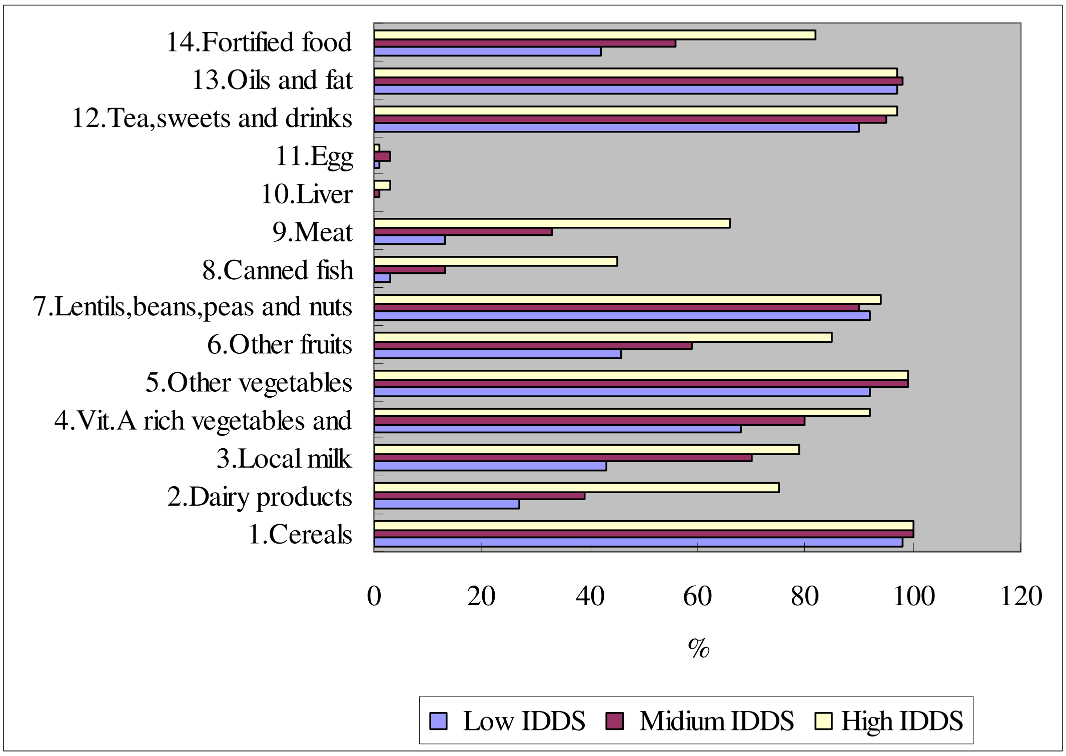

Figure 15 Percent of women consumed each food group as a function of the categories of DDS in the Saharawi refugee camps, Algeria, March 2008.

Table 14 reveals that the consumers in the low DDS group were made up by mostly women in EI Aiune, those in the highest group of DDS were women in Smara and Dakla with 40% and 33% respectively. Women in EI Aiune, the median of food consumption in the DDS groups were 5 with a range 1-11, where consumption was the lowest (see Table 15). Relatively, women in Awserd, the median of food consumption in the DDS groups were 7 with a range 2-8, where consumption was the highest (see Table 15). Women in Smara and Dakla, the median of food consumption in the DDS groups were the same that was 6 with a range 3-9 (see Table 15). There were high significant differences on the consumption of food in the DDS groups among women between the camps, as follows EI Aiune and Awserd, EI Aiune and Smara, EI Aiune and Dakla, Awserd and Smara, and Awserd and Dakla (see Table 15 and Figure 16).

Table 14 Percent of DDS (low-, medium- and high groups) in the women (15-49 years) divided by camps in the Saharawi refugee camps, Algeria, March 2008.

	Camps				
DDS	EI Aiune (n=194)	Awserd (n=191)	Smara (n=206)	Dakla (n=192)	Total (783)
	%	%	%	%	%
Low DDS	58	52	36	35	45
Medium DDS	27	33	24	32	29
High DDS	15	15	40	33	26

Table 15 Women's median of food consumption in the DDS groups (1-11) within 24 hours divided by camps in the Saharawi refugee camps, Algeria, March 2008.

Camps	**n**	**Median of DDS**	**Range**
EI Aiune	194	5[a.b.c.]	1 -11
Awserd	191	7[a.d.e]	2 – 8
Smara	206	6[b.d]	3 – 9
Dakla	192	6[c.e]	3 – 9
Total	783	6	1 – 11

Mann-Whitney Test: **a=**significant differences between EI Aiune and Awserd, p=0.02; **b=**significant differences between EI Aiune and Smara, p=0.00; **c=**significant difference between EI Aiune and Dakla, p=0.00; **d=**significant difference between Awserd and Smara, p=0.00; **e=**significant difference between Awserd and Dakla, p=0.00.

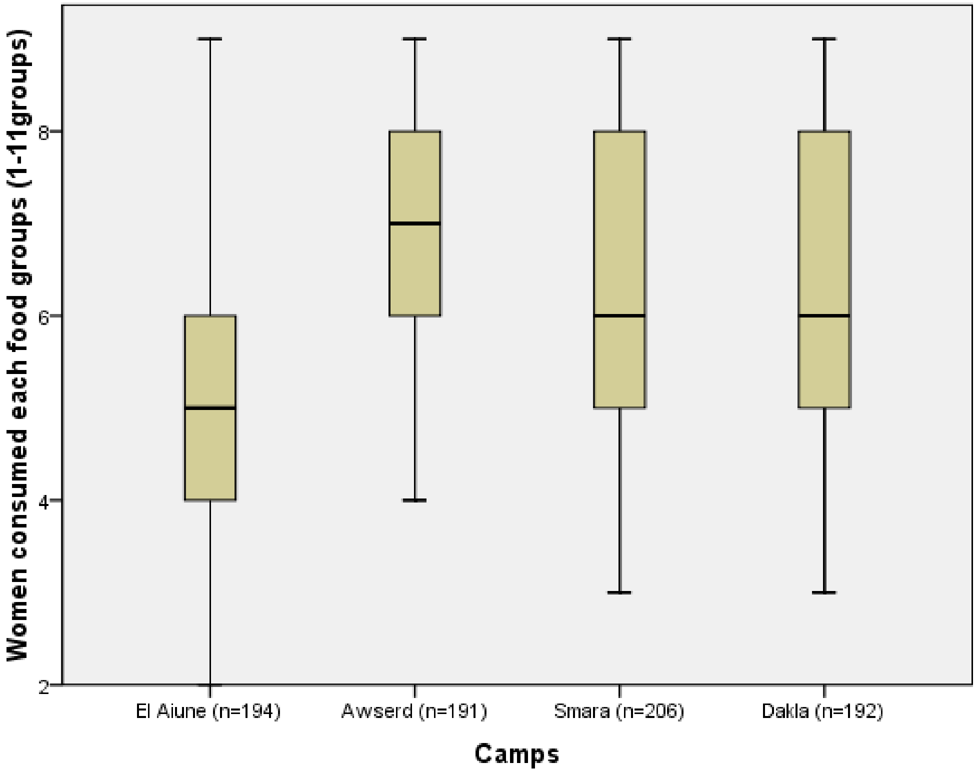

Figure 16 Effect of women's median of food consumption in DDS groups (1-11) by 24 hours intake interview divided by camps, in the Saharawi refugee camps, Algeria, March 2008.

5.4.5 Hygiene

In the women's questionnaire, there is no reference to hygiene-related question. With regard to the frequency of water tank cleaning were asked where the questionnaire in the household. In the household survey questionnaires, a total of 183 households answered the question on the frequency of cleaning the water tank. Figure 17 shows that 55% of households cleaned water tank once a month and 5% of households had never before cleaned the water tank. About 10% of the households cleaned water tank once a week, once a year, less than once a year and other, respectively.

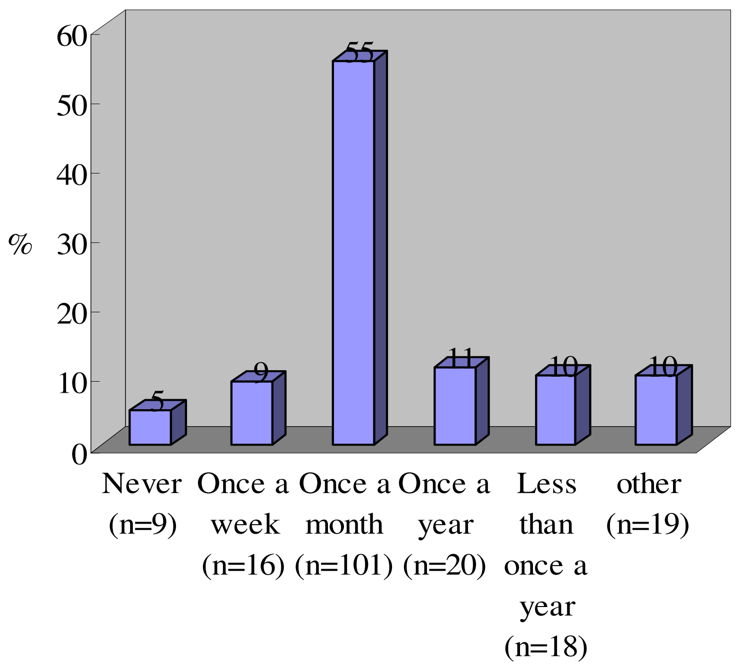

Figure 17 The frequency of cleaning the water tank among women from questionnaire of household in the Saharawi refugee camps, Algeria, March 2008.

5.4.6 Nutritional status

Anthropological measurements are applied on the analysis of malnutrition in present study, for the non-pregnant women had weight and height measurements, for the pregnant women had MUAC measurements.

BMI among non-pregnant women

In the non-pregnant women, BMI average was 25.3 kg/m². Figure 18 shows that 9% were underweight (BMI<18.5 kg/m²), 42% were normal range (BMI 18.5-24.99 kg/m²), 26% were overweight (BMI 25-29.99 kg/m²) and 19% were obese (BMI>30 kg/m²) (see also Table).

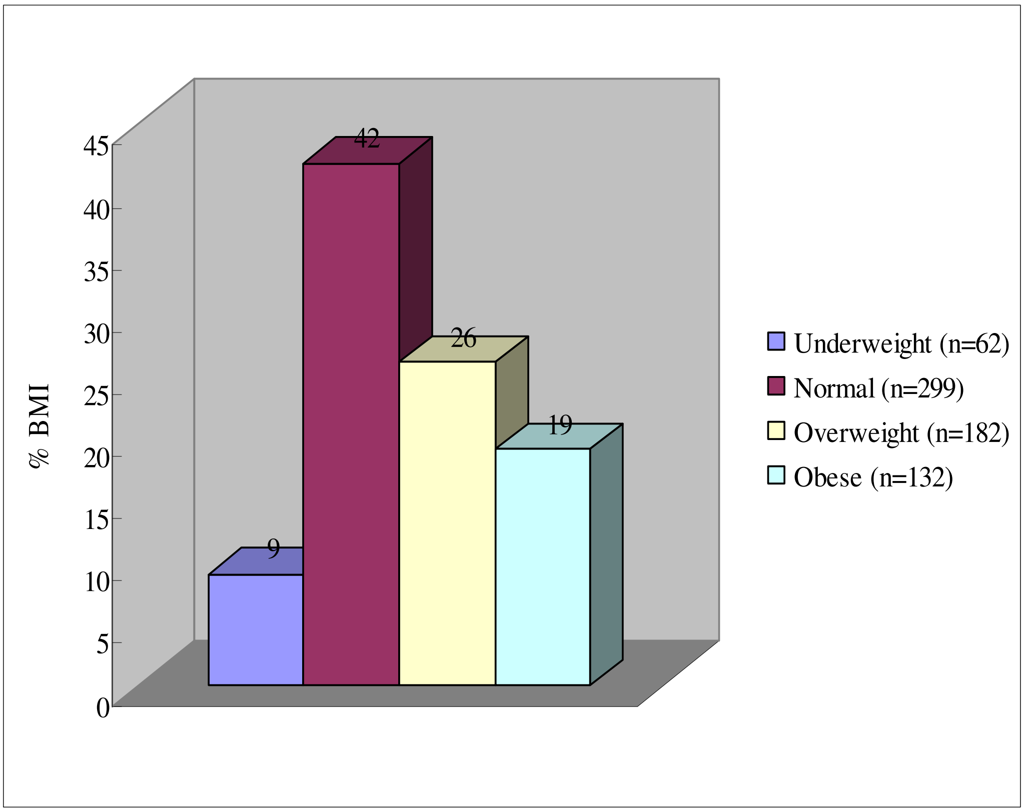

Figure 18 Percent of BMI among non-pregnant women (15-49 years) divided by categories in the Saharawi refugee camps, Algeria, March 2008.

The mean±SD of BMI (kg/m²) in non-pregnant women were divided into severe-, moderate-, mild IDA and normal range, it was 23.0±4.9, 24.9±5.1, 24.7±5.2 and 26.3±5.5, respectively (see Table 16). Non-pregnant women with severe anemia, BMI were the lowest (23.0 kg/m^2); on the contrary, non-pregnant women without anemia, BMI were the highest (26.3 kg/m^2) (see Table 16). There were significant difference on BMI between categories of haemoglobin, as follows between severe and moderate, severe and mild, severe and normal, moderate and normal, and between mild and normal (see Figure 19).

Table 16 The mean of BMI among non-pregnant women divided by haemoglobin categories in the Saharawi refugee camps, Algeria, March 2008.

Haemoglobin categories	n	BMI (kg/m²) Mean±SD	Range
Severe Hb<8 g/dl	69	23.0[a.b.c]±4.9	12.9 – 36.2
Moderate Hb 8-10.9 g/dl	189	24.9[d]±5.1	12.7 – 42.1
Mild Hb 11-11.9 g/dl	98	24.7[e]±5.2	16.3 – 40.3
Normal Hb=>12 g/dl	310	26.3±5.5	15.1 – 45.7
Total	666	25.3±5.4	12.7 – 45.7

One-way ANOVA p=0.00, LSD test:

a. significant difference between severe <8 g/dl and moderate 8-10.9 g/dl, p=0.01

b. significant difference between severe <8 g/dl and mild 11-11.9 g/dl, p=0.04

c. significant difference between severe <8 g7dl and normal =>12 g/dl, p=0.00

d. significant difference between moderate 8-10.9 g/dl and normal =>12 g/dl, p=0.00

e. significant difference between mild 11-11.9 g/dl and normal =>12 g/dl, p=0.01

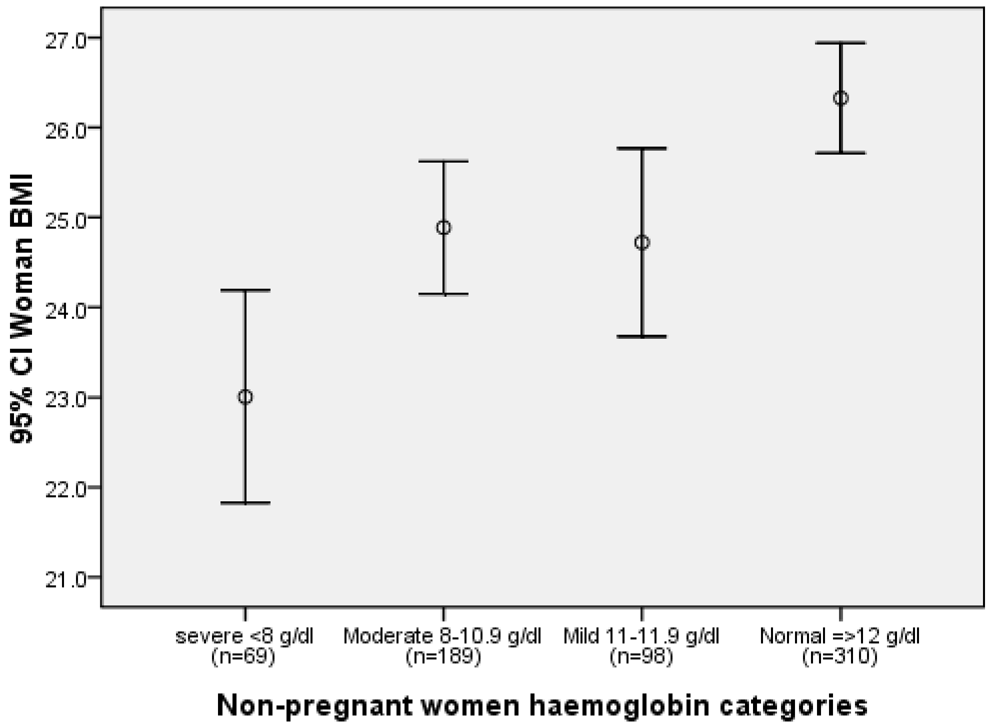

Figure 19 Effect of non-pregnant women's (15-49 years) haemoglobin categories on BMI in the Saharawi camps, Algeria, March 2008.

MUAC among pregnant women

MUAC is the most useful measurement for identifying pregnant women with increased risk of LBW. MUAC is relatively stable throughout pregnancy and independent of gestational age and can therefore be used in all stages of pregnancy. The measurement is simple and no other information is required. A more appropriate cut-off point for selection of women at risk during emergencies might therefore be closer to 21 cm. In pregnant women, a total 71% measured MUAC, 11% was cut-off point range from 21 to 24 cm and 60% was cut-off point range over 25 cm (see Table 7). In pregnant women, who was not found anybody MUAC cut-off point is less than 21 cm.

5.4.7 Supplementation

A variety of food and supply of iron has a practical meaning for the prevention and treatment of IDA in the women of reproductive age. Figure 20 shows the 2%, 36% and 8% of women of reproductive age got plumpy nut, WSB, and supply of iron, respectively, in the Saharawi refugee camps.

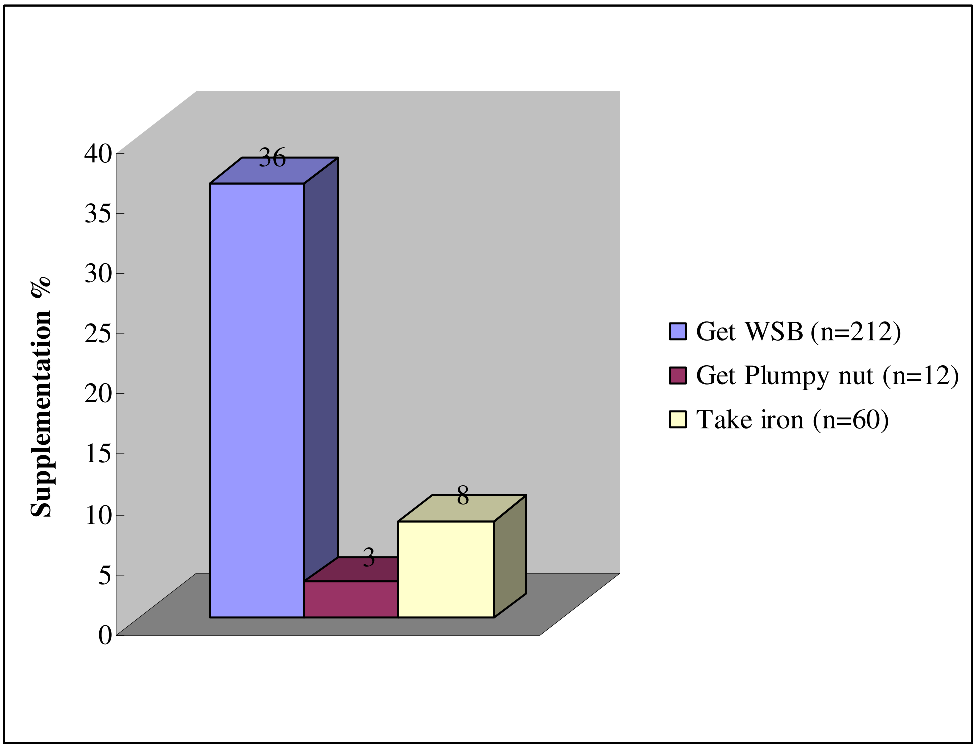

Figure 20 Percent of supplementation among women (15-49 years) in the Saharawi refugee camps. Algeria, March 2008.

Table 17 presents that the women got WSB had a lower mean (±SD) of haemoglobin 10.74 g/dl (±2.48) than women did not get WSB, with a higher mean (±SD) of haemoglobin 11.30 g/dl (±2.53). There was no significant difference between women that got Plumpy nut and women that did not get Plumpy nut; and between women that took iron and women that did not take iron (see Table 17). There was significant difference on haemoglobin between women that got WSB and women that did not get WSB in the Saharawi refugee camps (see Table 17).

Table 17 Effect of supplementation on haemoglonbin levels among women (15-49 years) in the Saharawi refugee camps, Algeria, March 2008.

Supplementation		**n**	**Haemoglobin g/dl mean±SD**	**p-values**
Get WBS	yes	212	10.7±2.5	p=0.01*
	no	383	11.3±2.5	
Get plumpy nut	yes	12	10.6±2.5	p=0.43
	no	494	11.2±2.5	
Take iron	yes	60	10.9±2.7	p=0.45
	no	730	11.2±2.5	

*T-test: significant differences on haemoglobin between women who got WBS and women who did not get WBS, $p<0.05$.

6.0 Discussion

This study was planned to assess the prevalence and identify the causes of IDA, and give the possible recommendations on how to prevent and treat IDA among women of reproductive age (15-49 years), in the Saharawi refugee camps, Algeria. There are three aspects of this study these will be addressed in the discussion. The first aspect involves the prevalence of IDA among non-pregnant women; the second aspect involves the prevalence of IDA among pregnant women; and finally, deals with the possible causes of IDA age such as age, disease and hygiene, food intake, malnutrition and supplementation in women of reproductive age.

6.1 Prevalence of IDA among women of reproductive age

In this study, the results indicated a high prevalence of IDA among the non-pregnant women and pregnant women (54% and 66%, respectively). WHO, UNICEF & UNU (2001) estimated that 42% of all women and 52% of pregnant women in developing countries are anemic, with half having IDA. In the most industrialized countries, the prevalence of anemia among pregnant women is around 20% which is therefore considered reasonable to classify these populations as having a medium prevalence of anemia, since prevalence up to 5% may not necessarily be regarded as abnormal in any population (WHO, UNICEF & UNU 2001).

In the United Kingdom (UK), 18% of women between 16 and 64 years old, and 21% of female between 11 and 18 years of age, are iron deficient (Heath & Fairweather-Tait, 2002). In Denmark, 0% of pregnant women with on iron supplementation have IDA, and 18% of pregnant women without iron supplementation (Hercberg et al., 2001). In the United States America (USA), 9 –

11% of non-pregnant women aged between 16 and 49 years old are iron deficient, and 2–5% of non-pregnant women have IDA, with more than double higher frequency in poorer, less educated, and minority (Scholl, 2005). Comparing with the other countries at regional-level, the prevalence of anemia among non-pregnant women and pregnant women in UK, Denmark and USA, the prevalence of IDA among non-pregnant women and pregnant women in this study is a serious public health problem in the Saharawi refugee camps.

Most studies on the prevalence of anemia in areas of high incidence of anemia shows a high occurrence particularly in pregnant women (Crawley, 2004; Brabin et al., 2001). A study in India has been reported a much higher prevalence of anemia (84%) in pregnant women than that found in this study, but the prevalence of severe anemia (9.2%) was lower (Agrawal et al., 2006). Another study reported the prevalence of anemia to be lower than what was found in this study, for both non-pregnant women (46%) and pregnant women (39%) in Bangladesh (HKI & IPHN, 2006). Comparing with the prevalence of anemia among non-pregnant women and pregnant women in the countries (India and Bangladesh) where anemia is a serious, the high prevalence of anemia is still a cause for concern in public health problem among non-pregnant women and pregnant women in the Saharawi refugee camps.

Two studies have been carried out in the Saharawi refugee camps; which reported that 66% of women of reproductive age were anemic in 2005 (UNHCR, WHO & INRAN, 2005), 46% of non-pregnant women and 64% of pregnant women were anemic in 2007 (NCA & AUC, 2008). Comparing with data of prevalence of anemia in 2005 and 2007, the prevalence of anemia in this study was high among women of reproductive age in the Saharawi refugee camps. This study indicated that the prevalence of IDA among the non-pregnant women was highest in Dakla and lowest in Smara. Furthermore, severe anemia was the most serious epidemic among both non-pregnant women and pregnant women in Dakla. In the non-pregnant women, the levels of Hb in Dakla were significantly lower than in Smara. Among pregnant women, the prevalence of IDA was also highest in Dakla.

In short, this study confirmed the results of previous studies (UNHCR, WHO & INRAN, 2005; NCA & NUC); that the prevalence of IDA was an important public health and nutrition problem in the four camps. According to the results of prevalence of IDA, there is a strong reason to worry about the target population, especially in Dakla.

6.2 Possible causes of IDA among women of reproductive age

Many causes could lead to IDA among women of reproductive age in the Saharawi refugee camps. The identifying of the cause of IDA is an important and a fundamental step in the prevention and treatment of anemia. For demarcation reason, in this study IDA among women of reproductive age was identified by six possible causes; age, disease and hygiene, food intake, malnutrition and supplementation. The ensuing discussions are based on the results of this study that try to discuss the possible causes associated with IDA in women of reproductive age (15-49 years).

6.2.1 Age

In this study, the non-pregnant women's age (15-49 years) were categorized into four different groups[15]. The prevalence of IDA in the different groups showed that IDA as a serious health problem exists in 20-29 years and 30-39 years. In contrast, moderate IDA and severe IDA were the most serious in the age group 30- 39 years.

[15] Non-pregnant women age categories: less than 20 years, 20-29 years, 30-39 years and 40-49 years.

The lowest prevalence of IDA was found in the age group of less than 20 years old, especially moderate and severe IDA. This could be explained by a greater blood loss during childbirth, but those in the age group of less than 20 years old have never had childbirth. Therefore this is the reason why the incidence of anemia is lower in the age group of less than 20 years than in other age groups. Many studies reported the loss of iron through bleeding of menstruation; therefore, that is why the non-pregnant women of reproductive age need to increase iron intake (0.4-0.5 mg/kg/dag) (Gibney et al., 2007; Semba & Ramakrishnan, 2008). The average on the level of Hb among non-pregnant women was lowest in the age group of 30-39 year old. Furthermore, comparing with other age groups, there were significant differences on the levels of Hb in the age group between 20-29 years and 30-39 years, and between 30-39 years and 40-49 years. A recent study in Pemba Island, Zanzibar, and Tanzania, gave findings which provide evidence of a previously-suspected link between maternal anemia and greater blood loss at childbirth and postpartum (Kavle et al., 2008). Therefore based on greater blood loss at childbirth and postpartum is found in women of reproductive age, we can believe that the non-pregnant women in the age group of 30-39 years had the highest prevalence of IDA in the Saharawi refugee camps.

This study did not find the pregnant women aged less than 20 years; therefore the age of pregnant women was divided into three categories; 20-29 years, 30-39 years, and 40-49 years. The prevalence of anemia was highest in the age group of 20-29 years, followed by the age group of 30-39 years among pregnant women; but by using statistic tests, the results did not find that the age categories had an impact on the levels of Hb among pregnant women in this study. Bharati et al. (2008) reported that the different categories of age have no impact on anemia among pregnant women in India. Therefore, we confirm Bharati et al (2008) that the different categories of age among pregnant women have no effect on IDA.

The study found that the women of reproductive age who had children aged less than 5 years had significantly lower Hb than women who had children aged more than 10 years. In particular, the average of Hb was lowest in women who had children less than 2 years old, and then followed by between 2 and 4 years old. The Institute of Medicine (IOM, 1990) reported that the postpartum period is conventionally thought to be the time of lowest iron deficiency risk because iron status is expected to dramatically improve after delivery. Bothvell & Charlton (1981) reported that maternal iron requirements radically decline with the birth of the infant, whose iron needs take precedence over the mother's. Iron losses are significantly reduced by post partum amenorrhea and a relatively small amount of iron is lost though breast milk (IMO, 2001). Many early studies have shown iron status recovering and a concomitant low prevalence of postpartum anemia in samples of mid- to high socioeconomic status (Svanberg et al., 1975; Taylor et al., 1982; Milman et al. 1991; Eskeland et al., 1997). Further, investigations of ethnically diverse low- income populations in USA, Bodnar et al. (2001) & Bodnar et al. (2002) reported that postpartum iron deficiency and anemia are far more common than previously thought; signaling that poor postpartum iron status is a public health problem that warrants greater attention. This study confirms previous studies that the prevalence of IDA in postpartum women (from 0 to 24 months) is the most serious public health problem in the low-income population. The women in Saharawi refugee camps are typical low-income population, rely on WFP and several NGO to provide the basis for food aid. According to our finding in the Saharawi refugee camps, a daily protocol of iron supplementation is recommended for treatment and prevention in the priority target group, "women who had the children aged less than 2 years". In brief, selective supplementation and screening programs which yields the most desirable cost-benefit ratio should be implemented with alternative programs among women of postpartum period (from 0 to 24 months) in the Saharawi; for example universal supplementation and screening.

6.2.2 Disease and hygiene

Earlier, WHO (2000b) reported anemia is often the result of combination of parasitic infections (hookworms [16], schistosomiasis [17] or malaria [18]) among refugees dependent on the food aid (WHO, 2000b). The above-mentioned diseases were not asked on the questionnaire that was used under data collection among women of reproductive age in the Saharawi refugee camps. These refugee camps are located in a very dry desert region, water is provided through closed pipes and water containers, therefore there is no anopheles[19]. As a result, the incidence of these diseases (hookworms, schistosomiasis or malaria) is relatively low. Because of these reasons, the above-mentioned diseases have not been asked on the questionnaire. In this study a questionnaire was used to ask the women of reproductive age about a history of suffering from different diseases such as diarrhoea, pneumonia, cardiac disease, diabetes and celiac disease. In total, non-pregnant women and pregnant women who had diarrhoea (last 2 weeks), pneumonia, cardiac diseases, diabetes and celiac disease was 74%, 50%, 33%, 6% and 4%, respectively. The information about the history of suffering from any of these diseases was self-reported [20] on questionnaire among women of reproductive age in this study.

According to the prevalence of suffering from different diseases that was

[16] Hookworms: a disease caused by an infestation of hookworms, often resulting in severe anemia.
[17] Schistosomiasis: another term for bilharzia, is a parasitic disease caused by several species of fluke of the genus schistosoma. This disease is most commonly found in Asia, Africa, and South America, especially in areas where the water contains numerous freshwater snails, which may carry the parasite.
[18] Malaria: is caused by a parasite called Plasmodium, which is transmitted via the bites of infected mosquitoes in many tropical and subtropical regions. In the human body, the parasites multiply in the liver, and then infect red blood cells.
[19] Anopheles: a mosquito of a genus which is particularly common in warmer countries and includes the mosquitoes that transmit the malarial parasite to humans.
[20] Self-reported: the information was only based on what the women reported themselves that is not confirmed.

mentioned above; it seems that the prevalence of diarrhea and pneumonia was higher (more than 50%) than that of other diseases. Diarrhoeal diseases poses a major health problem in most of the refugee camps of the world (WHO, 2005). Nearly 90% of diarrhoeal diseases have been attributed to unsafe or inadequate water supplies and poor sanitary (WHO, 2004) conditions affecting a large part of the world's population (Hughes & Koplan, 2005). These diseases are usually associated with overcrowded settlements, poor access to clean water and good sanitation, and a change in diet (Tomczyk et al., 2004; Masangwi, et al., 2009). These can be used to understand why diarrhea is highly prevalent among women of reproductive in the Saharawi refugee camps. diarrhoea in these camps could be explained by the following two causes: the first cause could be poor access to personal hygiene and good sanitation; and the other cause could be a change in diet. In the four camps, they were now forced to rely on foodstuffs handed out by relief agencies, rather than the locally grown food products which they were familiar with. WFP does not always provide the refugees with the food they are used to eating (change in diet). However, for ill or malnourished individuals, diarrhoea can lead to severe dehydration and can become life-threatening. Although the burden of pneumonia has decreased dramatically in developed countries during the past century, lung infections are still a leading cause of mortality and morbidity globally (Mizgerd, 2006). Pneumonia is caused by a number of infections agents, including viruses, bacteria and fungi; and can be prevented by immunization, adequate nutrition and by addressing environmental factor (Boschi-Pinto et al., 2008). In this study, half of women of reproductive age suffered from pneumonia in the four camps. Could this be caused by infection of bacteria and viruses or lacking of nutrition? There is a need for further studies to explain the prevalence of pneumonia among women in the four camps. Two studies reported that the population in North Africa with an elevated prevalence of celiac disease (5.6%), which is the highest known in the world today, is the

Saharawi people, who are of Arab and Berber origin, who have a high degree of consanguinity, and who live as refugees in Algeria (Sahara Desert) (Catassi et al., 1999 & Lionetti et al., 1999). This study showed that 4% of women of reproductive age suffer from celiac disease, which is a high prevalence of celiac disease in the world. This elevated prevalence may be explained by genetic factors (Xu et al., 2002); and by environmental factors, because in the last few decades dietary habits were changed in the Saharawi refugee camps (Rätsch & Catassi, 2001).

Comparing women who suffered from the different diseases with those who did not among women of reproductive age; it was found that women with diabetes and pneumonia had a higher average on the level of Hb than women without those two diseases in the Saharawi refugee camps. Mokdad et al. (2003) indicated that a population which has a high BMI has an increased risk of getting diabetes. This study found that the increasing of BMI promotes an increase in the levels of Hb among women between 15 and 49 years old. High BMI is usually a result of consuming lots of fods, including iron-rich foods, foods which increase the absorption of iron, which can result in high Hb. As a result, we can infer that the non-pregnant women have a higher BMI have consumed lots of foods including those rich in iron or increase iron absorption, therefore resulting in the increasing levels of Hb amongst them. In this study, there were only a few women with diabetes, this is not enough to prove that diabetes have an effect on Hb. Can diabetes lead to increased Hb among women of reproductive age? I could not find any evidence to determine this. This is a very interesting field of research in public health and nutrition in the future time.

People with sickle cell anemia[21] are at an increased risk of getting pneumococcal pneumonia, and this is caused by sickle cells blocking the small blood vessels of the lungs. This blockage is complicated by accompanying problems such as infection and pooling of blood in the lungs, so the pneumococcal infection may be fulminant in people with sickly cell anemia (Pearson et al., 1969). Clinically, it is known that infection can lead to increased Hb, and could be the reason explaining why the women with pneumonia had a higher mean of Hb than the women without pneumonia in the four camps. But I did not find the evidence to prove it. Therefore, additional researches are needed to prove exactly what the relationship between pneumonia and IDA is.

In this study, more than half of the households cleaned their water tank once a month. The questions about hygiene (such as hand-washing and organic foods-washing) were not asked on the questionnaire for women between 15 and 49 years old. Kajiya et al. (2006) strongly suggested that we wash or heat organic foods well after purchase. On self-reported disease, most of women suffered from diarrhoea in the last 2 weeks, and this might be related to the impact of hygienic habits. We all know that diarrhoea can spread through contaminated food or drinking water, or from person-to-person due to bad hygiene. When left untreated, severe fluid loss from diarrhoea can cause and lead to death (Murray & Lopez, 1997). Therefore, diarrhoea associated with hygiene among women of reproductive age in the Saharawi refugee camps should be reflected in further health research and strategies by the major donors such as WFP.

[21] Sickly cell anemia (disease): A genetic blood disease due to the presence of an abnormal form of hemoglobin, namely hemoglobin S. Hemoglobin is the molecule in red blood cells that transports oxygen from the lungs to the farthest reaches of the body.

6.2.3 Food intake

According to the intake of various food groups (from 24 hour recall) summaries; the food groups such as cereal, vegetable, lentils, fats, tea and coffee have been consumed by the absolute majority of women; food groups such as dairy products, other fruits and meat have consumed by fewer; and food groups such as liver and egg have been consumed by the absolute minority. Many studies reported that meat, liver, fish and fruit have a good effect on anemia among women of reproductive age (Hurrell et al., 2004; Thuy et al., 2005; Tetens et al., 2007); therefore, increasing of food intake in different categories is an important tool in the prevention and treatment of anemia in the Saharawi refugee camps.

Enhancing of iron absorption

In the camp, EI Aiune, it was found that both non-pregnant women and pregnant women seem to have a lower percentage of consumption on the most of the food groups, but they have a higher level of Hb than those in Aswerd and Dakla. Comparing the mean on the levels of Hb among women of reproductive age in the four camps; the non-pregnant women in Smara had a higher level on Hb than the other three camps. Similarly, the pregnant women in Smara also had a higher level of Hb than the pregnant women in Aswerd and Dakla. The following discussions on food intake among women of reproductive age in the Saharawi refugee camps are based on these results.

In Smara, compared to other camps, the majority of women of reproductive (15-49 years) consumed lots of vegetables, fruits, dairy products and canned fish, especially meat. In addition, in Smara, the women who consumed the high DDS groups were much higher (40% of women ate from 7 or more food groups) with than in the other camps. A number of researchers reported that ascorbic acid is an important factor to enhance iron absorption effect in anemia (Teucher et al., 2004;

Geissler & Powers, 2005).

The two main measures available for improving dietary iron bioavailability are reductions of the factors inhibiting iron absorption or/and increasing the number of factors with enhancing effects on iron absorption. Several studies, where done, which found out that ascorbic acid, meat and fish promotes absorption of non-haem iron in areas with high prevalence of IDA (Teucher et al., 2004; Hurrell et al., 2006; Tetens et al. 2007). Teucher et al. (2004) reported that ascorbic acid, with its reducing and chelating properties, is the most efficient enhancer of iron absorption when its stability in the food vehicle is ensured.

Promoting local food production (including livestock and poultry) and use of locally available ingredients rich in ascorbic acid (vitamin C), can be sustainable ways of accomplishing the dietary modification needed to improve the iron bioavailability of iron in developing countries. A common cause of IDA in the Saharawi refugee camps is that women eat less liver, meat and fish (canned fish), which are the best sources of iron available. Because of environmental and geographical factors, the agricultural and horticultural techniques in the Saharawi refugee camps can not be developed. When it comes to food, most of them rely on food assistance from various organizations; therefore, the quality of the food supply is essential on the prevention and treatment of IDA among women of reproductive age in the Saharawi camps. The existing organizations need to come up with new strategies of adequately supplying for the women of reproductive age in the Saharawi refugee camps with foods rich in iron such as meat, liver, canned fish, fruits, juices, potatoes and some other tubers, and other vegetables (green leaves, cauliflower, and cabbage).

Inhibiting of iron absorption

The food groups such as cereal, food made from grains, tea and coffee were commonly consumed among women (15-49 years) in AI Aiune, Aswerd, Smara and Dakla. This type of diet provides low amounts of bioavilable iron because of the high content of iron-absorption inhibititors such as phytate and polyphenols (Hurrell et al., 1999; Geissler & Powers, 2005). Many studies reported that tea inhibits non-haem iron absorption to a considerable extent (Disler et al., 1975; Hurrell et al., 1999). But Mennen et al. (2007) reported that no relation between black, green or herbal tea and iron depletion in a general apparently healthy adult population. In this study, the women (15-49 years) of the Saharawi refugee camps consumed tea often, but this did not have effect on iron status. But we still recommend that the women separate tea drinking from mealtime (one or two hours later), then the tea would not inhibit iron absorption because most of the food would have left the stomach. Whether the tea has considerable effects on iron absorption is an interesting future research.

Geissler & Powers (2005) pointed out that the inhibition of absorption of non-haem iron is caused phytates, which are found especially in cereal products. A study reported that wheat is a highly consumed cereal crop, on a worldwide scale; it contributes approximately 30% of the total cereal production, making it a major source of minerals for many people (McKevith, 2004). Another study in rural Malawi, reported that a community-based method to remove dietary phytates has been used, which resulted in an improved iron status (Manary et al., 2002). Cereals and grains containing phytates could hinder the absorption of iron, the cereals and food made from grain were consumed by the absolute majority of women of reproductive age in the Saharawi refugee camps. As a result, we suggest the reduction of the consumption of foods with phytates and the increasement of iron fortification on the major staple foods such as wheat flour or corn flour.

6.2.4 Nutritional status

Anthropometric measurements of height and weight (BMI=weight/height^2) were used to assess anemia among non-pregnant women, and MUAC was used for pregnant women in this study. MUAC had been measured on some of the pregnant women, but did not find any as underweight (MUAC<21 cm). In this study, the non-pregnant women had a total average of BMI of 25.3 kg/m^2, and 9% of them were underweight (BMI<18.5 kg/m^2) in the four camps. For non-pregnant women, imbalanced BMI (body mass index) is just one of the many factors of developing chronic diseases. Normal BMI from 18.5 to 25 (in kg/m^2), if a person's BMI increases over 25 kg/m^2 means overweight and obesity, while increasing the risk of many diseases such as non insulin-dependent diabetes, dyslipidaemia, hypertension, coronary heart disease and gallstones (WHO & FAO, 2003; Lean, 2006). In contrast, if a person's BMI decreases below 18, it means that malnutrition, while also increasing the risk of some diseases such as nutritional marasmus, Kwashiorkor and tuberculosis (WHO & FAO, 2003).

This study also showed that the non-pregnant women with severe IDA (Hb<8 g/dl) had a normal average BMI was 23.0 kg/m^2. In addition, the non-pregnant women with IDA (mild-, moderate-, severe IDA) had a normal BMI between 23.0 and 24.7 kg/m^2. Bodnar et al. (2004) reported that high pre-pregnancy BMI increases the risk of postpartum anemia. Can we assume the opposite to be true? Does that mean that we can assume that if non-pregnant women have a low or normal BMI (like in this study group) are at a lower risk of postpartum anemia? I could not find any study to prove this. There is a need for more studies which investigate the relationship between BMI and anemia among non-pregnant women of reproductive age in the Saharawi refugee camps.

6.2.5 Supplementation

The women of reproductive age (15-49 years) who got Plumpy nut, took iron and wheat soy blend from the dispensary were 2%, 8% and 36% respectively. One can see that a very small number of women received Plumpy nut[22] and iron supplementation. The prevalence of IDA in the women of reproductive age (both non-pregnant women and pregnant women) was lower in Smara than the other camps (discussed under the subheading, enhancing of iron absorption under "food intake"). Interestingly, comparing women who got WSB with those who did not; the women who got WSB had a lower mean on the level of Hb than women those who did not get WSB, in the four camps. This can maybe be explained by the following two hypothesis; at the time of measuring Hb, (1) the desired effects of WSB had not yet taken place, (2) the WSB supplied could also have not been enough or was of poor quality.

In the Saharawi refugee camps, high-quality, fortified foods were unavailable or unaffordable for those who need them and traditional iron supplementation program face challenges with compliance and supply. There is a need for new strategies in dealing with these challenges. In resent years, some researchers proposed that micronutrient deficiencies should be addressed directly via high quality supplements and fortifications (Ruel et al., 2004; Moench-Pfanner et al, 2005). Phuy et al. (2003), (2005) reported that the regular consumption of iron-fortified (NaFeEDTA) fish sauce significantly reduced the prevalence of IDA in women of reproductive age in Vietnam. Fortifying of fish sauce with iron by using a water-soluble, highly bioavailable compound (NaFeEDTA) is a promising strategy for combating IDA in Vietnam (Phuy et al., 2003; Phuy et al., 2005).

[22] Plumpy nut was ment for children, therefore the women of reproductive age were not supposed to have it.

Food fortification will continue to be an important tool, not only to treat or prevent specific nutritional deficiencies (such as iron, iodine, zinc, vitamins, calcium and minerals), but also to promote a general state of well-being in different populations, and possibly to prevent certain chronic diseases. The identification and development of fortifying agents that will guarantee product quality and high bioavailability are technological and scientific challenges. Some options for the future are the microencapsulation of nutrients, the use of nutrient bioavailability stimulants (addition of ascorbic or other organic acids to promote iron absorption), and the elimination of inhibitors of mineral absorption in the intestine (e.g., phytates).

For women (15-49 years) in the Saharawi refugee camps at risk of certain deficiencies (i.e., the pregnant women and non-pregnant women), the objectives for adding nutritional to food could be: to maintain the nutritional quality of foods, keeping nutrient levels adequate, to correct or prevent specific iron deficiencies; to increase the added nutritional value of a product (commercial view); and to provide certain technological functions in food processing.

Fortified blended foods must meet certain criteria in terms of micronutrient fortification such as vitamin A, thiamine (B1), riboflavin (B2), niacin, folic acid, vitamins C and B12, iron, calcium and zinc (UNHCR, UNICEF, WFP & WHO, 2003). The fortification of WSB is particularly important in iron, folic acid and vitamin A for women of the reproductive age (both non-pregnant women and pregnant women) in the Saharawi refugee camps. The Saharawi refugees living in the western desert region, have difficulties in getting fresh fish. Only a small amount of canned fish could be obtained, but this is obviously not enough to counteract the serious prevalence of anemia in the Saharawi refugee camps. Therefore, introducing iron-fortified (NaFeEDTA) fish sauce as a way of increasing iron intake, can be applied to prevent and treat IDA among the women of the reproductive age in the Saharawi refugee camps. In brief, supplementation through the fortification of micronutrients is a traditional and successful application to achieve the prevention and treatment of IDA in the developing countries.

Iron supplementation to prevention of IDA is important to differentiate between supplementation that aims at preventing anemia by correcting IDA before IDA is manifest, and therapeutic supplementation, which aims at correcting established IDA (Viteri, 1995). The WHO, UNICEF & UNU (2001) recommended that iron and folic acid preventive supplementation should be implemented when prevalence of anemia in women of reproductive age (both non-pregnant women and pregnant women) is severe (> 40%). In this study, the prevalence of IDA among women of reproductive age is over 40% in Saharawi refugee camps; based on this result, we propose that the adequacy of the iron intake by diet and supplement are important strategies to reduce the anemia among Saharawi refugee women in reproductive age (15 – 49 years) (WHO, UNICEF & UNU, 2001).

7.0 Recommendations

In this section, some strategies will be recommended for prevention and treatment of IDA among women of reproductive age (both non-pregnant women and pregnant women) in the Saharawi refugee camps. Four approaches to correcting nutritional IDA for target groups are recommended, alone or in combination with each other: firstly, dietary modification and diversification value and iron bioavailability; secondly, supplementation (the provision of micronutritional, usually in higher doses, without food); thirdly, food-based interventions (fortification, the addition of micronutrients to processed foods); and finally, nutritional education.

7.1 Dietary modification and diversification

Dietary modification and diversification is a more sustainable long-term, economically-feasible and culturally acceptable strategy that can be used to alleviate several micronutrient deficiencies simultaneously, but has significant practical limitations. It is difficult to change dietary preferences and foods such as meat and fish that are rich sources of highly bioavailable iron, because they are lacking. Therefore, humanitarian assistance at a level of public nutrition promotion to increase the supply of various foods is essential.

For instance, food aid as an emergency, the quality- and quantity of food donations is an important aspect; for example meat contain iron that effect the haemoglobin directly, while fruits, juice and vegetables containing vitamin C that help the absorption of iron from other foods, including fish (canned fish and fish sauce), this helps on the absorption of iron. Also eating a diet that includes a variety of nutritious foods from each of the four major food groups each day: for example, plenty of fruits containing rich vitamin C (especially citrus), and green leafy and yellow vegetables (spinach and broccoli); plenty of legumes, nuts, seeds and cereals, preferably wholegrain; lean meat, poultry, liver, fish and other seafood or alternatives.

7.2 Iron supplementation

The oral ferrous sulfate is the most widely used iron preparation throughout the world. The UNHCR (2008 – 2010) strategic plan for refugees recommends that the implementation of a targeted treatment of moderate and severe anemia which, in addition to a full medical assessment and appropriate drug treatment, may also involve the use of a range of therapeutic nutrition products such as tablets.

1) A daily protocol of iron supplementation is recommended to prevention and treatment of IDA in the priority target groups among the non-pregnant women. The efficacy of once- or twice-weekly iron (60 mg) supplementation in non-pregnant women in the Saharawi refugee camps could be implemented.
2) For non-pregnant women, preventive iron supplementation of 60 mg/day iron with 400 µg folic acid for 3 months should be considered. For pregnant women, the daily supplementation of 60 mg iron and 400µg folic acid to women during pregnancy and the first 3 months postpartum is recommended. While for pregnant women with mild to moderate IDA treatment with oral ferrous iron of 100 mg/day between meals is recommended the initial therapeutic option in the first and second trimester.
3) The recommendation for treatment of severe IDA in women of reproductive age (15-49 years) is a daily high-dose of oral iron (120 mg) and folic acid (400 µg) for 3 months. In the pregnant women with mild to moderate IDA, treatment with oral ferrous iron of 100 mg/day between meals is the initial therapeutic option in the first and second trimester. The international

recommendation for treatment of severe anemia in pregnant women is a daily high-dose of oral iron (120 mg) and folic acid (400 μg) for 3 months; after completing 3 months of therapeutic supplementation, pregnant women should continue preventive supplementation regimen.

4) Provision of iron supplementation and folic acid on camp-based infrastructures, mostly during pregnancy, but also before pregnancy.
5) Monitoring and evaluation systems should be implemented to determine if the intended outcomes are being achieved.

7.3 Food-based intervention (Fortification)

1) Implementation of iron fortification is recommended. Iron fortification activity is a recommended as part of anemia prevention programs, it is been applied on a large scale to prevent anemia, in other areas of the world. One approach is to fortify a basic food such as cereals and food made from grain, which are foods consumed in substantial quantities by the most women (15-49 years).
2) The quality of fortification in the blended foods is essential for the prevention and treatment of IDA among women of reproductive age (both non-pregnant women and pregnant women) in the Saharawi refugee camps. For instance blended foods CBS and WBS can be fortification using both iron, folic acid and vitamin A instead of just one of ether them.
3) Both dried and liquid milk and milk products should be fortified with iron where IDA is prevalent. For instance, an iron and vitamin C-fortified milk formula fed daily to Chilean infants starting from 3 months until 15 months of age virtually eliminated IDA (Walter et al., 1990). In addition, Argentina has successfully fortified liquid milk with iron using ferrous sulfate microencapsulated with phospholipids with no deleterious effects on the shelf life or sensory properties of milk.

4) The iron-EDTA has been extensively used as a stabilizer in some industrialized countries, so has fish sauce, curry powder and sugar.

7.4 Nutrition education

Nutritional education should be imparted through lectures, audiovisual aids and demonstrations for several months among women of reproductive age in Saharawi refugee camps. However, with the increasing development of products on nutrition for the prevention and treatment different form of IDA, there is a need for a continued education and guidance in the future.

8.0 Conclusions

This study focus on the analysis of the prevalence of IDA and its possible causes from public health and nutrition point of view, and recommends several strategies for prevention and treatment of IDA among women of reproductive age (both non-pregnant women and pregnant women) in Saharawi refugee camps. This study confirms that the high prevalence of IDA among women of reproductive age in refugee camps, is mainly due to the lack of supplies of iron-rich foods and iron fortified food, and as well as a simplified eating food species.

Further, this study highlights several points; the first point is that the most severe IDA was found in the non-pregnant women who were aged between 30 to 39 years. The second point is that the highest prevalence of IDA among women of reproductive age (both non-pregnant women and pregnant women) was found in Dakla, on the contrary the lowest in EI Aiune; but the consumption of high DDS (from 7 or more food groups) in Dakla is higher than in EI Aiune. The third point revealed that the prevalence of IDA was relatively serious in women who had children aged less than 2 years. Lastly, increasing food diversity and the supply of iron and folic acid is an emergency strategy for the preventing and treatment of IDA among women in the Saharawi refugee camps. This study recommended several strategies to meet the challenges of IDA among women of reproductive age in the Saharawi refugee camps. Increasing dietary diversification is a most important factor in providing a wide range of micronutrients, and to achieve this objective in a development context requires an adequate supply, access and consumption of variety of foods, especially, iron-rich foods and iron fortified food.

Future studies should determine analysis of possible causes of IDA from multiple perspectives such as socio-economic, dietary habits and health conditions, among women of reproductive age (both non-pregnant women and pregnant women) in the Saharawi refugee camps (especially, in Dakla), in order to take a timely strategy to counteract the prevalence of severe anemia. In particular, as this study shows, more research is needed to determine exactly what the relationship between tea, diabetes, pneumonia and IDA is. In any case, these above-mentinal future studies are very interesting and useful; therefore these need to be explored among women (15-49 years) with anemia in the Saharawi refugee camps.

In conclusion, linking WHO and UNHCR development policies to this study for the alleviation of hunger and anemia, with an emphasis on increasing the variety of foods consumed, is probably the urgent strategy for improving IDA sustainably among women of reproductive age (both non-pregnant women and pregnant women) in the Saharawi refugee camps. Worldwide, the cooperation between organizations; WHO-, WFP-, UNHCR- and NGO's strengthening by food aids, programs of supplementation, nutritional education, additional researches, monitoring and evaluation are important part of promotion efforts in public health and nutrition in the Saharawi refugee camps.

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Appendices

1) Women questionnaire (15-49 years), in the Saharawi refugee camps, Tindouf, March 2008.
2) Household questionnaire, in the Saharawi refugee camps, Tindouf, March 2008.
3) Food frequency questionnaire, in the Saharawi refugee camps, Tindouf, March 2008.

Questionnaire for Women 15-49 years

Mortality and nutrition survey in the Saharawi camps, February-April 2008

Date : |__|__| / |__|__| / 2008
Day *Month*

Interviewer ID : |___|___|

Time: **Start** |___|___|:|___|___| **Stop** |___||___|:|___|___|

Woman ID : |____| |_____|_____| |_____|_____| |____|____|
Camp *Cluster* *Household* *Woman*

Camp code
1 =Aiun **2** =Awserd **3** = Smara and 27th **4=**Dakla

Codes: **97= I have not asked**
98= They did not want to answer
99= They do not know

SECTION 5 – QUESTIONNAIRE FOR WOMEN AGED 15-49 YEARS

This section should be filled out for the women aged 15-49 years. If more than one woman lives in the household fill out ONE form for EACH woman.

5.1-	How old are you?		|__|__|
5.2-	Marital status?	1	Married
		2	Not married
		3	Divorced
		4	Widowed
5.3-	Do you know how to write?	1	Yes
		2	No
5.4-	Do you know how to read?	1	Yes
		2	No
5.5-	How long education do you have?	1	None
		2	Less than 6th grade
		3	Up to 6th grade (primary school)
		4	7th to 9th grade (secondary school)
		5	10th to 12th grade (High school/vocational studies)
		6	Higher education
5.6-	Are you pregnant?	1	Yes
		2	No
		3	Don't know
5.7-	How many children do you have? **If none, write 0 and go to 5.10**		Alive |___|___| Dead |___|___|
5.8	How old are they? **Write the age of each one, starting with the youngest**		|__|__| |__|__| |__|__| |__|__| |__|__| |__|__| |__|__| |__|__| |__|__| |__|__| |__|__| |__|__|
5.9-	Are you currently breastfeeding?	1	Yes
		2	No
5.10-	Do you suffer from night blindness (use local term)?	1	Yes
		2	No
		3	Don't Know
5.11	Are you suffering from any of the following conditions? **Read all options and circle all options given**	1	Anemia
		2	Diabetes
		3	Cardiac diseases (hypertension)
		4	Celiac disease
		5	Pneumonia
		6	Other :

		7	No
5.12-	Have you had diarrhoea in the last 2 weeks? (Diarrhoea is three or more loose or watery stools per day)	1	Yes
		2	No
5.13-	Are you getting any of the following foods from the dispenseria?	1	WSB
		2	Plumpy nut
		3	No
5.14	Are you currently taking iron supplements in capsules/liquid?	1	Yes
		2	No
5.15	Are you currently taking Vitamin A supplements in capsules?	1	Yes
		2	No

Questionnaire for Women 15-49 years

Mortality and nutrition survey in the Saharawi camps, February-April 2008

Date :	**|__|__| / |__|__| / 2008** *Day* *Month*
Interviewer ID :	**|___|___|**
Woman ID :	**|____| |_____|_____| |_____|_____| |____|____|** *Camp* *Cluster* *Household* *Woman* ***Camp code*** **1** = El Aiun **2** =Awserd **3** = Smara and 27th **4=**Dakla

Codes: 97= I did not measure
98= They do not want to participate

Anthropometry for women 15-49 years

If the woman is pregnant, measure the MUAC. If not measure height and weight

5.16a-	Weight	|___|___|.___| kg	
5.16b	Estimated weight of clothes	1	1 kg
		2	2 kg
5.17-	Height	|__|__|__|.__| cms	
5.18-	MUAC	|__|__|.__| cms	
		|__| more than 25 cm	
5.19-	Hb measured with Haemocue	|__|__|.__|	
5.20-	Does this woman need referral?	1	Yes
		2	No

Cut off points for anemia in women

	Total	**Mild**	**Moderate**	**Severe**
Women of child bearing age ≥15	<12.0	11.9-11.0	10.9- 8.0	<8.0
Pregnant women	<11.0	10.9-10.0	9.9-7.0	<7.0

Cut off points for MUAC of pregnant women

	Moderate
Pregnant women	<21 cm

Food questionnaire for children and women
Mortality and nutrition survey in the Saharawi camps, March-April 2008

Date: |__|__|.|__|__|.2008
Day Month Year

Interviewer ID: |___|___|

Women Id: |____| |_____|_____| |_____|_____||_____|
Camp Cluster Household Woman

Child 1 Id: |____| |_____|_____| |_____|_____||_____||_____|
Camp Cluster Household Woman Child

Child 2 Id: |____| |_____|_____| |_____|_____||_____||_____|
Camp Cluster Household Woman Child

Camp code
1 =Aiun **2** =Auserd **3** = Smara and 27th **4=**Dakla

Section 7
How many days in the last week did you and child (ren) eat the following:? **Write the number of times, no more than seven per food group.**
Did you and your child(ren) eat any of the following during the last 24 hours? **Mark with an X (Y= yes, N=No and DK= Don't know)**
* means that the food can have been eaten as part of a stew, salad or on it's own.
From where did you get the food groups? **Use the following code. (1= food distribution, 2= purchase, 3=own production, 4=gift, 5= borrow, 6= other, 7= Don't know)**

		Woman				Sources	Child 1				Child 2			
		Yesterday (24 hours)			7 days		Yesterday (24 hours)			7 days	Yesterday (24 hours)			7 Days
	Food groups	Y	N	DK			Y	N	DK		Y	N	DK	
7.1.1	Do you drink milk? **Yes |__| No |__|**													
7.1.1.1	Camel milk (with water)													
7.1.1.2	Goat milk (with water)													
7.1.1.3	Other milk like Candia, powder milk													
7.1.1.4	Milk with cocoa, juice, like Candia, Rubi													
7.1.1.5	Gruel with milk, trigo soup													
7.1.2	Yoghurt (with water)													
7.1.3	Tea or Coffee													
7.1.4	Juice													
7.1.5	Soft drinks (Coke, Fanta, Chinchin, Gazuz)													
7.1.6	Infant formula													
7.1.7	Fortified Blended Foods (WSB)													
7.1.8	Biscuits given at school													
7.1.9	Gruel;trigo, gofio, barley, other													

		Women				**Source**	**Child 1**				**Child 2**			
		Yesterday (24 hours)			**7 days**		**Yesterday (24 hours)**			**7 days**	**Yesterday (24 hours)**			**7 days**
		Y	**N**	**DK**			**Y**	**N**	**DK**		**Y**	**N**	**DK**	
7.1.10	Rice, spagethi, cous cous													
7.1.11	Bread													
7.1.12	Biscuits													
7.1.13	Lentils*, Beans/peas*													
7.1.14	Potatoes*, turnip													
7.1.15	Carrots*, pumpkin													
7.1.16	Spinach													
7.1.17	Tomato*, peppers													
7.1.18	Onion*													
7.1.19	Eggs*													
7.1.20	Meat: Goat camel, chicken*													
7.1.21	Liver*,													
7.1.22	Stomach*, kidney, heart, intestine													
7.1.23	Tuna*, sardines													
7.1.24	Cheese													
7.1.25	Oil, animal fat, Any foods made with fat (e.g. fried potatoes)*													
7.1.26	Margarine*,													
7.1.27	Orange/Clementine/lemon													
7.1.28	Apple/Pear/Banana													
7.1.29	Dates													
7.1.30	Jam													
7.1.31	Chocolate/Sweets/ candies													
7.1.32	Cakes/muffin													
7.1.33	Nuts, peanuts													
7.1.34	Any other foods **(write)**													

7.2 How many main meals did you eat yesterday? |_______|

7.3 How many times did you eat between meals yesterday? |_______|

7.4 How many main meals did your child eat yesterday? |_________| Child 1 |________| Child 2

7.5 How many times the child eat between meals yesterday? |_________| Child 1 |________| Child 2

Date :	**|__|__| / |__|__| / 2008** *Day* *Month*
Interviewer ID :	**|___|___|**
Team number:	**|___|**
Time:	**Start |___|___|:|___|___|** **Stop |___||___|:|___|___|**
Household ID :	**|____| |_____|_____| |_____|_____|** *Camp* *Cluster* *Household* |__________________________________| *Daira* ***Camp code*** **1** = Aiun **2** =Awserd **3** = Smara and 27th **4=**Dakla

Consent: We are conducting a survey on the nutrition and health situation in the camps. I would like to ask you some questions about your household. We will also weigh and measure all the children who are younger than 5 years of age and the women in your household that are 15-49 years old. Any information given will be kept strictly confidential and does not contain any names. This is voluntary and the household can choose not to answer any or all of the questions; however we hope that you will participate since your views are important. Do you have any questions? May I begin now?

YES_______ **NO_______**

Codes: 97= I have not asked
98= They don't want to answer
99= They do not know

SECTION 1– DEMOGRAPHICS

A household is defined as a group of people who routinely eat, cook and have the same ration.
Household members that work and stay occasionally outside the current location, but do eat with the household while present, should be included.

1.1-	What is the sex of the household head?	1	Female
		2	Male
1.2-	What is the marital status of the head of the household? **CIRCLE ONLY ONE OPTION**	1	Married
		2	Divorced
		3	Living apart not divorced
		4	Widow or widower
1.3-	Highest level of education of household head	1	None
		2	Non formal
		3	Less than 6th grade
		4	Up to 6th grade (primary school)
		5	7th to 9th grade (secondary school)
		6	10th to 12th grade (High school/vocational studies)
		7	Higher education
1.4-	How many adults (18-59 years) in your household are engaged in some type of economic activity?	**|__|__|**	
1.5-	Total number of people currently living in the household, in total **|__|__|**	**Males**	Age in yr 0to5: **|__|__|;** 5< >15: **|__|__|;** 15< >49: **|__|__|;** 49+: **|__|__|**
		Females	Age in yr 0to5: **|__|__|;** 5< >15: **|__|__|;** 15< >49: **|__|__|;** 49+: **|__|__|**
1.6-	How many children have been born since the congress in December?	|___|___|	
1.7-	How many people have joined the household since the congress in December?	|___|___|	
1.8-	How many of the people who have joined the household are children under 5 years of age ?	|___|___|	
1.9-	How many people have left the household since the congress in December?	|___|___|	
1.10-	How many of the people who have left are children under 5 years of age?	|___|___|	
1.11-	How many people in total have died since the congress in December?	|___|___|	
1.12-	What was the cause of death? **(Choose from the list below, please choose only one code per person)**	|___| |___| |___|	

1.13-	How many of the people who died were children under 5 years of age?	|___|___|
1.14-	What was the cause of death? **(Choose from the list below, please choose only one code per person)**	|___| |___| |___|

_Codes for Causes of Death of adults	**Cause of Death**	**Descriptions of causes of death**
1	*Cardio vascular diseases*	▪ 'Any cardiac problems'
2	*Diabetes*	▪ As per medical diagnose
3	*Cancer*	▪ As per medical diagnose
4	*'Pnemonia'*	▪ Any respiratory disease
5	*Complications during delivery*	▪ Any death just before, during or after delivery
6	*Other*	▪ Death cause by any of other factors than the ones listed above, including accidental death.

Codes for causes of death of children under 5	**Cause of death**	**Descriptions of causes of death**
1	Diarrhoea	• Any episode of three or more watery stools per day
2	Acute Respiratory Infection (ARI)	• Any infection in the respiratory system
3	Malnutrition	• Any individual presenting with swollen appearance (bilateral oedema) and/ or excessive thinness (wasting)
4	Complications during delivery	• Any perinatal death
5	Mening encephalitis	• Any infection of the brain and the menings
6	Other	• Death caused by any other factors than the ones listed above, including accidental death

Household Questionnaire

Mortality and nutrition survey in the Saharawi camps, February-April 2008

Interviewer ID : |___|___|

Household ID : |____| |_____|_____| |_____|_____|

Camp *Cluster* *Household*

Camp code
1 = El Aiun **2** =Awserd **3** = Smara and 27th **4=**Dakla

Codes: 97= I have not asked
98= They don't want to answer
99= They do not know

SECTION 2 – HOUSEHOLD INFORMATION

2.1-	What type of housing are they living in? **Enumerator Observation**	1	Tent
		2	Tent and brick structures
		3	Brick structures
2.2-	How many tents/ rooms (not including the bathroom and kitchen) does you household have?	|___|___|	
2.3-	What is the main source of drinking water for your household? **(In option number 1 and 3 ask about bore holes Smara, 27th feb and Awserd ask about bore holes and wells for Dakla and Aiun)**	1	From well/bore hole and stored in container by the house
		2	From the common tap and stored in container by the house
		3	From well/ bore holes by the house
		4	Directly from the common tap
		5	From vendor
		6	Other |_________________|
2.4-	How often do you clean your water container?	1	Never
		2	Once per week
		3	Once per month
		4	Once per year
		5	Less than once per year
		6	Other: Once every___________
2.5-	Where do the people in your house go to the toilet? **Circle the main option**	1	Pit latrine/ open pit
		2	Cement latrine
		3	Ceramic latrine
		4	Desert
		5	Other |_________________|
2.6-	Does your household have its own toilet? **If yes, go to 2.8**	1	Yes
		2	No
2.7-	If no, who many other households do you share with?		|___||___|
2.8-	When did you last receive soap?	1	|___||___| weeks
2.9-	When do you wash your hands? **Circle all the answers given**	1	Before eating
		2	After going to the toilet
		3	After handling animals
		4	Before cooking
			Other: |_________________|
2.10-	Do you use soap when you wash your hands? **If yes, go to section 3.**	1	Yes
		2	No
		3	Some times
2.11-	If you do not use soap, why not? **Circle all the answers given**	1	Don't have soap in the HH
		2	Did not receive as part of the ration
		3	Too expensive
		4	Not available in market/ shop
		5	Other:

Codes: 97= I have not asked
98= They don't want to answer
99= They do not know

SECTION 3 – SOURCES OF INCOME / HOUSEHOLD ASSETS

Please complete the table.		During the **last 3 (three) months**, what were your household's most important income sources? (use income source codes, up to two sources)
3.1-	Most important	|__|__|
3.2-	Second	|__|__|

Income source codes: 1 = Formal work; 2 = Informal work; 3 = Remittance; 4 = Own Business; 5 = savings; 6 = Loan; 7 = Gifts

3.3-	Which of these assets you have?	1 = car	2 = refrigerator	3 = Color TV set	|___|___|

SECTION 4 – HOUSEHOLD FOOD PRODUCTION

4.1-	How many of the following animals do your family currently own?	1	None	
		2	Goats	|___|___|
		3	Camel	|___|___|
		4	Chicken and hens	|___|___|
		5	Other:	|___|___| |___|___|
4.2-	Which of the following fruits and vegetables do you grow in your kitchen garden?	1	None	
		2	Tomatoes	
		3	Onions	
		4	Carrots	
		5	Pepper	
		6	Turnip	
		7	Other:	

Household Questionnaire **Mortality and nutrition survey in the Saharawi camps, February-April 2008**
Interviewer ID : |___|___|
Household ID : |____| |_____|_____| |_____|_____| *Camp* *Cluster* *Household* ***Camp code*** **1** = El Aiun **2** =Awserd **3** = Smara and 27th **4=**Dakla

Codes: **97= I have not asked**
98= They don't want to answer
99= They do not know

SECTION 5 – HOUSEHOLD EXPENDITURE & DEBT

		Monetary expenditure **during the** **last 1 (one) month (in Algerian Dinares or in Duros)**		
5.1-	Education, school	|__________|(AD); |__________| (Duro);		
5.2-	Fuel for cooking?	|__________|(AD); |__________| (Duro);		
5.3-	Medical expenses, health care	|__________|(AD); |__________| (Duro);		
5.4-	Clothing, shoes	|__________|(AD); |__________| (Duro);		
5.5-	Repayment of debts	|__________|(AD); |__________| (Duro);		
5.6-	Remittance to relatives and friends	|__________|(AD); |__________| (Duro);		
5.7-	Social events (i.e. expenditure during weddings, funerals, etc.)	|__________|(AD); |__________| (Duro);		
5.8-	Food	|__________|(AD); |__________| (Duro);		
5.9-	Telephone use	|__________|(AD); |__________| (Duro);		
5.10-	Transport (not included above) including travel abroad	|__________|(AD); |__________| (Duro);		
5.11-	During **the past 3 months**, did you or any member of your household borrow money? **If no, go to Section 6**	1 = Yes	2 = No	**|__|__|**
5.12-	If yes why did you borrow?	1 = To buy food	5 = To pay for education	
		2 = To pay for health care	6 = Other	
		3 = To cover expenses on cattle/farm	**|__|__|**	
		4 = To start a business		

Codes: **96= They still have food left from previous distribution**
97= I have not asked
98= They don't want to answer
99= They do not know

SECTION 6 – COPING STRATEGIES

In the **last month**, how frequently did your household resort to using one or more of the following strategies in order to meet your household's needs? **MARK ONE ANSWER PER STRATEGY**

		Never	Seldom (1-3 days / month)	Sometimes (1-2 days / week)	Often (3-6 days / week)	Daily
6.1-	Skip entire day without eating					
6.2-	Limit portion size at meal times					
6.3-	Reduce adult consumption so children can eat					
6.4 -	Borrow food from friends or relatives					
6.5-	Rely on less expensive or less preferred food					
6.6-	Purchase or borrow food on credit					
6.7-	Send household members to eat elsewhere					
6.8-	Accept help from friends/relatives that have collected					
6.9-	Other coping strategies, mention |__________________________|					

SECTION 7 – FOOD AID

7.1- a) When (in weeks) did you receive the following food as food aid?		b) How long did it last?
7.1.1- Wheat	|_________| Weeks	|________| weeks
7.1.2- Rice	|_________| Weeks	|_________| Weeks
7.1.3- Spaghetti	|_________| Weeks	|_________| Weeks
7.1.4- Lentils/ beans	|_________| Weeks	|_________| Weeks
7.1.5- Tuna	|_________| Weeks	|_________| Weeks
7.1.6- Vegetable oil	|_________| Weeks	|_________| Weeks
7.1.7- WSB	|_________| Weeks	|_________| Weeks
7.1.8- Sugar	|_________| Weeks	|_________| Weeks
7.1.9- Tea	|_________| Weeks	|_________| Weeks
7.1.10- Fruits (apple and orange)	|_________| Weeks	|_________| Weeks
7.1.11- Vegetables (carrots and potatoes)	|_________| Weeks	|_________| Weeks

7.2-	Did you exchange or sell any of the commodities you received as food aid? **If no, finish the questionnaire**	1	Yes
		2	No
7.3-	If yes, what did you sell/exchange? **Circle all the answers given**	1	Cereals
		2	Pulses
		3	Oil
		4	Sugar
7.4-	If yes, why did you trade or sell them? **Circle all the answers given**	1	To obtain other/preferred food stuffs
		2	To obtain cash to buy animals
		3	To obtain cash for food for animals
		4	Other: