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The Nutritional factors affecting Iron Deficiency Anemia among Pregnant Women in the West Bank

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The Nutritional factors affecting Iron Deficiency Anemia among Pregnant Women in the West Bank

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Thesis Approval

The Nutritional factors affecting Iron Deficiency Anemia among Pregnant Women in the West Bank

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Dedication:

That is dedicated to my wonderful mother and father, my lovely husband, my brothers and sisters, all my colleagues and to my supervisor Dr.Amira Amr . It's also dedicated to all pregnant ladies in Palestine.

Researcher: Neveen Wajeeh Shalalfa

Declaration

I make clear that this thesis submitted to the master in public health – epidemiology, and that this thesis has not been submitted for any other higher degree in any university or to any other college or group.

Signed:

Neveen Wajeeh abdelfatah Shalalfa

Date: 15   / 12 /2018

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Researcher:

 Neveen Wajeeh Shalalfa

Abstract

Background:

Ministry of health provide iron supplementation for the pregnant women to prevent iron deficiency anaemia (IDA) and only haemoglobin level test is done for assessing anaemia in the pregnant women.

This study aims to determine the nutritional, sociodemographic, gynecological and obstetrical factors that may affect iron deficiency anemia in pregnant women who attend the primary health care clinics of Ministry of health (MOH) – West Bank.

Methods:

Matched maternal age and gestational age case-control study was conducted from June, 2017 to May, 2018 among pregnant women who initiated antenatal care follow up in the antenatal health care clinics during their first and third trimester, a sample of 342 was selected from three major clinics and three minor clinics in cluster systemic sampling method from the north, centre and south area of West-Bank / Palestine.

A self-administered questionnaires was filled after getting an informed consent from the women, the antenatal care file of each pregnant woman was reviewed to obtain information about blood haemoglobin of the mother and to review the health state. Also, 3 days food record instrument was used to collect dietary data, women were requested to record estimated foods in cups or spoons and beverages as they were consumed throughout the reported three days .Food records were analysed using super tracker, 2011, USAID to obtain micro and macro –nutrients.

After data collection, statistical analysis was performed using SPSS software (version 23, SPSS), logistic regression analysis was implemented. Distribution, frequencies, and cross-tabulation were, 95% confidence interval and p-value <0.05 for statistical significance was considered. T-test, one way ANOVA test, Chi-square test were used.

Results:

The results indicated that, lower educational level, Smoking, economic status had significant positive association with IDA (OR=1.5, 8.833, 1.9 respectively).

Parity of deliveries, repeated abortion, period between current pregnancy and previous (child spacing), density of menstrual cycle were all significantly positively associated with IDA (OR= 2.242, 12.326, 5.723, 4.134, 9 respectively).

There were significant association between protein, iron, and vitamin C intakes and IDA (OR= 2.242, 12.326, 5.723, 4.134, 9 respectively).

Participants' fat and carbohydrates intake were not enough to protect against anemia. (OR: 1.055, 1.017 respectively) (p = 0.062).

Number of meals per day is negatively associated with IDA (OR=0.327, 95% CI=0.162-0.663)(p< 0.002) .   Increase in appetite to food during pregnancy is negatively associated with IDA (OR=0.348, 95%CI=0.190-0.638), (p, 0.001).

Conclusion:

The gynecological factors that cause increase in blood loss are positively associated with IDA .i.e. OCP and loop use, multiparty, recurrent abortion.

The lower educational level, Smoking, economic status have significant positive association with IDA.

The nutritional factors has a major role in IDA and further studies must be done in this field

العوامل التغذوية المؤدية الى فقر دم ناتج عن الحديد في الحوامل في الضفة الغربية

اعداد: نيفين وجيه عبد الفتاح شلالفة

اشراف: د. اميرة عمر

الملخص

تقوم وزاره الصحة الفلسطينية بتزويد النساء الحوامل بأقراص الحديد كوقاية من فقر دم الحديد أثناء الحمل ويتم تقييم حالات فقر الدم من خلال قياس مستوى الهيموغلوبين فى الدم للنساء الحوامل .

تهدف هذه الدراسة الى تحديد العوامل التغذوية المؤدية الى فقر دم الحديد لدى النساء الحوامل اضافه الى تأثير العوامل الاجتماعية وعوامل الصحة الإنجابية .

هذه الدراسة عباره عن دراسة الحالة والشاهد والتي استهدفت النساء الحوامل اللاتي يتابعن رعاية الحمل في عيادات الرعاية الصحية الأولية في ثلاث عيادات رئيسيه وثلاث نقاط صحيه في الضفة الغربية منذ شهر مايو لعام 2017 الى شهر يونيو 2018 , ولقد شملت العينة 342 امرأه وقد تم اختيار العينات مناصفه ما بين الحالات والشواهد مع مطابقه العمر للام وعمر الحمل .

تمت تعبئه المشتركات في الدراسه للاستبيانات بعد توقيع كل المشاركات على نموذج الموافقة بالمشاركة، ثم تم تحليل البيانات باستخدام برنامج (SPSS النسخة 23) وضبطت القيمة الهامه على مستوى 0.05 . وتم تطبيق البرامج الحسابية التالية :

(. T−test, One way ANOVA test , Chi−square test) .

اضافه الى ذلك تم تعبئه سجل للغذاء المتناول بكل مواصفاته وكمياته لمدة ثلاثة أيام من بينهن يوم عطله , ثم تم تحليل محتويات الغذاء باستخدام برنامج SUPER TRACKER,2011

أظهرت نتائج الدراسة أن هنالك ارتباط قوي ايجابي بين فقر الدم ومستوى التعليم والتدخين والحالة الاقتصادية (1.5, 8.8, 1.9)=OR بالترتيب

عدد المواليد والاجهاضات المتكررة وتباعد المسافات ما بين الحمولات واضطرابات الدورة الشهرية كان لها الارتباط الايجابي عند النساء اللواتي يعانين من فقر الدم مقارنه بالنساء اللاتي لا يعانين من فقر الدم (9.5 ,4.134 , 5.723 , 12.326 , 2.242 =OR) بالترتيب.

كما وأن العوامل التغذوية كان لها تأثير كبير وفرق واضح ما بين الحوامل اللاتي يعانين من فقر الدم واللاتي لا يعانين اذ أظهرت الدراسة أن مستويات الاستهلاك اليومي من الحديد وفيتامين سي والبروتين كانت عالية لدى الحوامل الاتي لا يعانين من فقر الدم .

9,4.134,5.723 , 12.326 , 2.242 =OR), بالترتيب(

عدد وجبات الطعام وزياده الشهية خلال الحمل أظهرتا ارتباطا سلبيا مع فقر دم الحديد للنساء الحوامل

(OR=0.327, 95% CI=0.162−0.663),(P< 0.002),

(OR=0.348, 95%CI=0.190−0.638), (p, 0.001).

لقد أثبتت الدراسه أن العوامل النسائيه والانجابيه كاستخدام أقراص منع الحمل او اللولب لتنظيم الحمل و زياده عدد المواليد وتكرار الاجهاضات مرتبطه ارتباطا ايجابيا بفقر دم الحديد للنساء الحوامل , كما وأن العوامل الاقتصاديه والاجتماعيه تحمل نفس الارتباط مع فقر الدم للحوامل , ومن هذه العوامل التدخين والحاله الاقتصاديه ومستوى التعليم .

كما وأثبتت الدراسه أن الغذاء هو أحد أهم العوامل المؤدية الى فقر الدم ونحن بحاجه ماسه الى اجراء بحوث أكثر في هذا المجال .

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ACRONYMS

CDC   Centers for Disease Control

Hb   Hemoglobin

IDA   Iron deficiency anemia

HCT   Hematocrit

RBC   Red blood cell

MCV   Mean corpuscle volume

ACOG   American college of obstetrics and gynecology

ASH   American society of hematology

MCHC   Maternal Care Health Clinics

MOH   Ministry of Health

WHO   World Health Organization

EO   Eating occasion

MCH   maternal and child health

PHC   primary healthcare clinics

OR   Odd ratio

SD   Standard deviation

UNRWA   united Nations relief and works agency for Palestine refugees.

SPSS   Statistical package for social science

OCP   Oral contraceptive pills

RDA   Recommended Daily/Dietary Allowance

DHA   Docosahexanenoic acid

Kg   Kilogram

mg/d	**milligram per day**
g /d	**gram per day**
V/S	**Versus**
Cm	**Centimeter**
mmol	**Millimole**
ng/dl	**Nano gram per deciliter**
µg	**Micro gram**
Kcal	**Kilo calorie**
US	**United state**

Chapter One

1- Introduction.

2- Problem statement.

3- Study justification.

4- Aim.

5- Objective.

6- Feasibility of the study.

1. CHAPTER ONE: BACKGROUND

1.1 Introduction

Anemia is a state of hemoglobin concentration much less than the regular level for the precise age, gender, and physiological circumstance (WHO, 2016). Iron deficiency is a the circumstance that on account of little iron inside the frame that range from iron depletion to deficient in erythropoiesis and to iron deficient anemia (IDA), and it is taken into consideration that IDA has an effect on billions of human beings everywhere, pregnant ladies are one of the essential groups which can be dramatically laid low with iron deficiency anemia (Abdelrahman et al, 2012).

Globally, IDA is discovered in extra than 20% of maternal death (WHO, 2016). Moreover, the anemia prevalence is higher within the first and third trimesters than in the 2d (ACOG, 2008, WHO, 2016).

Pregnancy is considered as one of the most crucial and unique periods in a woman's life, the care given by the health care provider to a pregnant woman during her 280 days of the pregnancy period is known as antenatal care and iron deficiency is highest among infants, children and pregnant women (Ahmad et al ,2011).

IDA in pregnancy is considered the commonest nutritional deficiency disorder all over the world and it is identified and confirmed during antenatal visits by means of simple haemoglobin level (HB) ,(Ahmad et al ,2011). It is estimated that more than 50% of pregnant ladies are diagnosed with anaemia and majority (90%) are due to iron deficiency (ACOG ,2008).

In pregnancy, hemoglobin level (HB) less than 11 gm/dl is identified as anemia in both the first and the third trimesters, but in the second trimester anemia is defined as Hb level less than 10.5 gm/dl (WHO ,2016).

Many factors may lead to iron deficiency anemia in general and spicily during pregnancy, iron deficiency considered as the most common contributing factor of the development of anemia

in pregnancy hence the pregnant woman cannot achieve the increased requirement of iron by diet alone (Beger *et al,* 2011).

Other nutritional factors include, nutritional deficiencies (i.e. vitamin C), nutrient-nutrient interaction (i.e. iron and calcium), drug nutrient interaction (i.e. H2 receptor blockers), as treatment for the ulcers and many other gastrointestinal problems and iron). Food habit and meal pattern (WHO, 2015).

The socioeconomic conditions such as the age, parity, income, housing, family size and education, play an important and crucial role in developing of iron deficiency anemia (Abdulrahman *et al*, 2012).

Blood loss, any defect in metabolism, chronic illnesses and hemolysis are also important factors that affect and effected by IDA and determine the level of IDA complications (ACOG, 2008).

Iron deficiency anemia may additionally purpose many complications that may affect the mother and her unborn baby. those encompass maternal and fetal death, terrible performance in mental and psychomotor baby test, respiratory problems as pneumonia, and pulmonary infarction , also some infantile complication as intra uterine growth retardation, low birth weight babies, abortion, stillbirth and prematurity (Rahman et. al, 2016).

1.2 Problem statement

 IDA is a global important health phenomenon worldwide where 41.8% of pregnant women have IDA in Asia (Rahman *et al*, 2016). IDA leads to 115000 maternal deaths and   a lot of prenatal death, about 59100 death per year (WHO, 2016).

Many factors contributes to IDA, such as, increase of the physiological demand , iron and vitamin C deficiency , chronic disease and multiple comorbidity   ,intestinal parasitic infections, , blood loss, abnormal hemoglobin synthesis, (Stevens *et al*, 2013; Alene *et al*, 2014).

Ministry of Health (MOH) program for antenatal care aims to prevent and treat IDA through providing iron supplement for pregnant women who attend and receive their care in the MOH primary healthcare clinics.

In spite of the fact that the Palestinian ministry of health has protocols for control of iron deficiency anemia in pregnant women booked and receiving the pre natal care at the MOH clinics, the prevalence of anemic pregnant mothers turned into 29.5%. Which is high in general (MOH 2015)

Palestinian programs that are applied to prevent and control nutrition related disease (i.e. iron deficiency anemia) are insufficient and ineffective , it is focusing on the therapeutic care rather than the prevention care , there is also a lack of nutritional surveillance, lack of nutritional intervention or assessment of effective nutritional intervention programs (Abdulrahman *et al*, 2011).

This study is aimed to analyze the underlying nutritional and the sociodemographic factors that affect this health problem (IDA) among pregnant women.

1.3 Justification of the study

 The Palestinian Ministry of Health program in the West Bank provides primary health care services for pregnant women in their primary healthcare clinics (PHC). The MCH (maternal and child health) services aim to prevent anemia by providing the iron supplement tablets and the laboratory tests for each pregnant woman attending the clinics to assess hemoglobin level and prevent anemia.

Prevalence of IDA among Palestinian pregnant women is 29.5 % which is two times higher than that in Europe (MOH, 2015). IDA is a major health problem of multifactorial nature such as socioeconomic state (age, parity, income, housing and education), compliance to supplementation, dealing with medications, the nutritional status and the dietary habits. Malnutrition is considered as the main leading cause of anemia in developing world (Aspura, 2011). Iron deficiency is the most common malnutrition factor (Milman et al , 2011,WHO 2016).

Pattern of meal, nutrients iron interaction and drug-iron interaction play an important role in iron deficiency , enhancers of the absorption of iron include vitamin C, which is desired to be eaten seriously with iron containing foods (Gibson et al , 2005 , WHO,2011).

Many research achieved that verify the awareness about anemia amongst being pregnant and plenty of published research executed to assess the etiology of IDA in pregnancy , however there is missing of studies this is focusing at the dietary elements that may have an effect on IDA in our community although , over the past 30 years ago the socioeconomic conditions have been changed in our country and other Arab and international region which resulted for this reason in adjustments within the dietary conduct and forms of food that is consumed which may also have an effect on the health and the iron level (Abdulrahman et al, 2011).

Based on the above, it's miles apparent that IDA is a preventable situation and well worth studying to lower the prevalence and to enhance the overall health of the pregnant women and their babies, there's loss of studies that cope with IDA underlying nutritional and sociodemographic elements within the West Bank.

This study may enlighten public health policy makers and the Palestinian Ministry of Health to prevent IDA in pregnant women.

1.4. Aim of the study

To determine the nutritional and sociodemographic factors that may affect iron deficiency anemia in pregnant women who attend the primary health care clinics of MOH – West Bank.

1.4.1. Objectives:

1- To determine the sociodemographic factors associated with IDA in pregnant women attending the (MOH) clinics in the West Bank.
2- To assess the nutritional factors that may play a role in IDA during pregnancy.

3- To assess the role of the obstetrical and gynecological factors for the pregnant women in developing IDA.

1.5. Feasibility of the study

The MOH always facillate the access to the clinics and getting the information also the health staff as the researcher is a staff member of the health team of the MOH .

Chapter tow: literature review

1- **Iron deficiency anemia IDA**

> **Definition of IDA**
>
> **Stages of Iron deficiency**
>
> **Prevalence of IDA**
>
> **Etiology of IDA**
>
> **Symptom of IDA**
>
> **Diagnosis of IDA**

2- **Pregnancy and iron**

> **-Iron requirement**
>
> **-Iron supplementation during pregnancy**
>
> **-MOH program for iron supplement**

3- **Nutritional factors affecting IDA**

4- **Socio-demographic factors affecting IDA**

Chapter tow: literature review

2.1. Iron deficiency anemia (IDA)

Anemia is a common public health problem, (Milman, 2011) that is causing an unfavorable status in pregnancy and even in all others (Milman , 2011).

Pregnant women and young children are at higher risk of mortality and morbidity due to anemia because of its consequences and the complications that may occur , IDA leads to hemorrhage, maternal infection, thrombosis , premature labor, intra uterine growth restriction or death , low birth weight and maternal and perinatal mortality,(WHO,2016).

The primary causes of anemia during pregnancy are inadequate intake of dietary iron ,greater fetal demand, and increased blood volume during pregnancy, (WHO, 2016), Although iron absorption is high during pregnancy but the amount of dietary iron absorbed and mobilization of the iron stores are not enough to meet the demand for both the mother and her fetus (WHO ,2016).

Many factors as low education levels, teenage pregnancy, multiple births, poor nutritional status, wrong food habits, parasitic infections, iron supplementation, and abortion are related to IDA (WHO ,2016).

2.1.1. Definition of IDA in pregnancy:

According to the World Health Organization (WHO), IDA in pregnancy refers to a level of Hb much less than 11 g/dl in the first and third trimester and 10.5 g/dl within the 2d trimester (WHO, 2017). it can be also identified as circumstance in which the number of red blood cells and their oxygen-carrying capability is insufficient to meet all of the physiologic demands inside the body, which range from one to another depending on age, sex, altitude, smoking, and the pregnancy health condition (WHO, 2016) .

2.1.2. Stages of iron deficiency:

First stage: Iron depletion

In this stage ,the bone marrow iron stores is reduced , Hb and serum iron is mostly normal, however serum ferritin degree falls to < 20 ng/ml , iron absorption and iron binding capacity is increased as well as the transferrin level ,(Mayo ,2016).

Second stage: Iron deficiency (ID)

Despite the fact that the transferrin level is elevated but erythropoiesis is impaired when serum iron falls to < 50 μg/dl (< 9 μmol/l) and transferrin saturation to < 16% , the serum iron level decreases and the transferrin saturation decreases also ,The serum transferrin receptor level rises (> 8.5 mg/l) and considering the total iron-binding capability its level is is(250 to 450) μg/dl (45to 81 μmol/l) ,in (ID), when iron-binding capacity increase the transferrin saturation decrease ,(Khalafalla et al ,2012).

Final stage (IDA):

The iron stores are depleted to a degree where they could not produce the hemoglobin needed to make enough red blood cells, this level is characterized by decrease in the Hb levels, blood tests at this level will show serious and significant low hemoglobin level and hematocrit . One of the main characteristic of this stage is the development of microcytosis and then hypochromia ,(Khalafalla et al ,2012 , Mayo ,2016).

2.1.3. Prevalence:

The worldwide prevalence of IDA in pregnancy is range from 35 to 60% .It is less than 20% in the industrialized international locations ,Inside the USA, the lowest prevalence (5.7%) ,and the highest is 75% in Gambia, the IDA prevalence is(65–75) % in India (WHO ,2015).

Prevalence of IDA among Palestinian pregnant women is two times higher than that in Europe, which is 29.5% in West bank. In Jordan it is 27.4% (WHO, 2016)

According to the (WHO), the prevalence of IDA is 9% in the developed countries and 41% in the developing countries (WHO ,2015) , Globally and despite all the efforts to control IDA, it is main cause for more than 11500 maternal death and 591,000 prenatal death per year (Balarajan *et al*, 2013).

2.1.4. Etiology of IDA :

Iron deficiency is the common nutritional deficiency which present in 75% of all anemia types that affect the pregnant women. The diet plan in pregnancy play an essential rule in prevention or development of IDA (Chandra et al, 2015) .

Many physiological modifications occur for the duration of the pregnancy, there may be a physiological hemodilution, with a peak all through 20–24 weeks of gestation (milman et al , 2012),and the physiological drop in Hb that arise mainly in the mid-trimester. this drop is because of the high increase in plasma quantity, as compared with RBC mass, which barely increases all through being pregnant , this physiological changing produces relative hem dilution, blood viscosity, helping in the proper circulation of the blood into the placenta (Chandra et al ,2015).

IDA is a result of many factors such as poor nutrition, iron deficiency, micronutrients deficiency as vitamin C low levels, gastrointestinal illnesses together with malaria, hookworm and schistosomiasis , HIV infection and genetically inherited hemoglobinopathies, along with thalassemia is a very important cases that must always rule out, there also may be also a likely association between helicobacter species infection and IDA (ACOG ,2008).

In developing countries, iron-deficiency anemia is generally the end result from inadequate dietary intake and poor nutrition, intestinal worm infections that may cause bleeding, or both ,but in high-income nations, some eating habit as being vegetarian with no consumption of beef and some chronic blood loss pathological conditions associated with malabsorbtion are the main causes(Salamet al ,2009,Sharma et al,2007).

Many of the pregnant women begin pregnant with poor iron stores,(Milman et al, 2012) , so the quantity of iron absorbed from eating regimen, together with that mobilized from the

stores isn't always sufficient to satisfy the maternal needs in pregnancy ,moreover, the increased iron demand during pregnancy is relatively the common cause of IDA (Milman et al, 2012).

Poverty is an important cause of anemia in the residents of the iron deficiency developing nations, mainly kids and pregnant women ,also the cereal-based diet plan that decreases iron bioavailability due to the fact phytates in grains sequester iron in a poorly absorbable complex (Zimmermann et al 2011) . Different not unusual reasons include the blood loss due to heavy menstrual cycle or gastrointestinal bleeding (ACOG, 2008).

The availability of iron is considering as the main rate proscribing factor for RBC manufacturing via bone marrow and so, when iron is poor the iron stores in bone marrow decrease and serum ferritin degree falls associated with decrease inside the erythropoiesis, the serum ferritin <30 µg/l is a marker of depleted iron stores , (Mayo,2016).

2.1.5. Symptoms of iron deficiency anemia:

IDA is classified as , mild , moderate and sever , if Hb 10–10.9 mg/dl then IDA is mild, moderate if Hb level of 7–7.9 mg/dl and severe if Hb level is <7 mg/dl (WHO ,2016)

The symptoms and complains are unnoticeable at the beginning of the first stage and then it is developed to be sever. Fatigue ,weakness ,pallor of the skin ,dyspnea , being dizzy and un steadiness , eating items that are not food .i.e. soup ,soil, ice ,which is called (pica) ,coldness of hands and feet , tongue swelling or even soreness , tachycardia and headaches (Chang et ,2013).

At some point of pregnancy, many dangers and risks affect the IDA women that may threat the health for women and their babies i.e. , extended fatigue, short-term memory loss, reduced interest and decreased overall performance at work, also the low Hb and blood oxygen saturation increase the pressure on the cardiac system which is a very serious issue in pregnancy , lower resistance to infections and blood loss at some point of exertions (Zimmerman et al ,2007) . Cognitive abnormalities and some behavioral abnormal issue may affect the the iron-deficient neonates up to 10 years after iron repletion (Siddiqui et al ,2008).

2.1.6. Diagnosis of (IDA):

First of all , the clinical picture for the pregnant woman is very important , mainly conjunctival pallor ,the oral mucosa, the nail beds also with palmar creases are may be pale too which is correlated negatively with Hb level , the severity of anemia can easily evaluated be accurate physical examination if laboratory tests are not available (ASH, 2016).

2.1.6.1. Full blood count and MCV value:

Allowing the diagnosis of microcytic anaemia and is considered a good screening tool ,In the cases of iron deficiency anemia, a complete cell blood count shows reduced Hb concentration, reduced MCV   ,reduced   the mean cell Hb concentration and mild thrombocytosis (Mayo, 2016).

2.1.6.2. The serum ferritin level:

It is a marker of depleted iron stores with a cut off value of <30 μg/l (ASH , 2016). The iron availability is the rate limiting factor for RBC production by bone marrow, as the iron stores in bone marrow decreases the serum ferritin level falls and erythropoiesis starts to be impaired epically when serum iron is <50 μg/dl (Mayo,2016).

Serum ferritin is a parameter of acute-phase reaction, its concentration increases in many cases i.e. infections, any systemic inflammations, cancers, chronic renal failure and so low levels of serum ferritin is diagnostic of IDA but normal values cannot exclude the iron shortage, and in that situation diminished transferrin saturation is diagnostic (Kalafallah et al,2012).

According to the ferritin level, iron deficiency can be classified as severe ID when the ferritin level is <30μg/L or mild-moderate ID if ferritin <100μg/L and >30μg/L (Khalafallah et al 2012).

2.1.6.3. Peripheral blood smears:

Underneath a microscope investigation for to determination of the size, shape, quantity, and look in addition to evaluate other cells inside the blood to find microcytic hypochromic cells with anisocytosis and poikilocytosis, , (ASH, 2016).

2.1.6.4. Bone marrow iron stores:

It's far the definitive marker of iron deficiency, however it is an invasive manner to apply for most patients, (Mayo,2016).

2.1.6.5. Reticulocyte hemoglobin content:

It is a marker of cellular Hb content, the sensitivity of this test is 93.3%, and it must be taken in consideration with iron and transferrin level (Mayo, 2016)

- **Iron level:**

Anemia may be related to iron deficiency or not and this test is used to differentiate usually accompanied by other tests that measure the body's iron storage capacity, such as transferrin level and ferritin level (Khalafallah et al 2012).

- **Transferrin level:**

  - Evaluates a protein that transports iron in the body and Ferritin level that evaluates the total iron available in the body,.
  - Soluble transferring receptor concentration:

  It is directly proportional with cellular receptor density, revealing total iron demand , this parameter unaffected by the inflammatory states and chronic diseases (Mayo. 2016)

- **Amphipathic b-sheet hairpin peptide (HAMP)**

It is expressed mainly in the liver, as an extended precursor of hepcidin ,it could be a beneficial marker to evaluate iron availability at some stage in being pregnant, however there are few available studies in literature, and maximum of them involve a small range of pregnant patients (ASH, 2016).

2.2. Iron and pregnancy

2.2.1. Iron requirement:

Extra requirements of iron are needed from puberty to menopause due to the physiological modifications and because of excessive blood loss at some point of menstrual cycle. as an end result, iron deficiency is maximum commonplace amongst women in the reproductive age in both developing and evolved countries (Haniff et al, 2007).

There is tow dietary form of iron: heme and nonheme , nonheme iron is present in many plants and iron-fortified ingredients , whereas meat, seafood, and hen incorporate each heme and nonheme iron ,which contributes approximately 10% to 15% of general iron intakes and is formed when iron combines with protoporphyrin (Kaufman , 2016) .

Typically, iron requirement steadily will increase till the third month, in parallel with the accumulation in fetal tissues, the predominant causes of iron deficiency include insufficient intake of iron-rich ingredients and poor bioavailability, iron demand increases about six to seven instances from early pregnancy to the overdue pregnancy (Christensen et al , 2004).

Anemia in pregnancy is a gold slandered indicator that reflect poor health and nutrition, drinking tea often with meals is one of the maximum commonplace bad habits among pregnant women and everyone others mostly, tea incorporates a substance referred to as

(tannin) and research revealed that ingesting tannin with meals can extensively decrease the iron absorption by 60% , coffee also decrease the iron absorption by 50% (Kaufman ,2016) .

2.2.2. Iron supplementation during pregnancy:

During pregnancy , the pregnant needs 27 milligrams a day of iron , which is double the amount needed by women who are not pregnant, This iron is recommended to improve the pregnancy and its effect on the mother and the baby , the mother health and birth outcomes (Sharma et al , 2003 , ACOG 2008). International recommendations in terms of intake levels $(27 - 30)$ mg per day for all pregnant women as advised by the Center for Disease Control and Prevention and the WHO ,(WHO , 2016).

Iron tablets are one of the main supplements for the pregnant women in the ante natal care clinics because it is difficult for many women to reach the requirement of iron (Scholl et al, 2011). The use of iron during pregnancy is a preventive tool to improve maternal hematological status in general and to improve the baby weight and health and so the WHO has long recommended the prenatal use of iron (WHO, 2015).

Pregnant women need additional amounts of minerals to prevent IDA such as vitamin C, a good source of vitamin C at the same meal when eating iron-rich foods is recommended , for example, have a glass of orange juice at breakfast with an iron-fortified diet is available (Scholl et al, 2011).Reduction in intake of vitamin A and vitamin C; the absorption promoter of the non-heme iron play significant rule of IDA (De Bonset et al,2005).

Milman et al studied the gastrointestinal side effects of iron supplement in pregnancy by randomizing blindly 404 healthy women in four groups receiving varying amounts iron as supplement (20, 40, 60 or 80 mg of iron/day as ferrous fumarate. The results showed little difference in gastrointestinal effects between the different levels of supplemental intake and compliance to supplement intake was also reported to be similar. But constipation and black feces are more frequent in those taking 80 mg/day (Milman,et al, 2006).

2.2.3. MOH program for iron supplementation and pregnancy care in Palestine:

MOH in Palestine adopted the WHO recommendations and program for the iron supplementation of the pregnant women which consider iron as a very important supplement tablet for all the pregnant women in the anti natal care clinics it is given for the pregnant women for free.

Iron and folic acid supplementation program should ideally form part of an integrated program of antenatal care that promotes adequate gestational weight gain and should be given from the 13 week of pregnancy till 6 weeks post-delivery .(WHO 2016).

Oral supplement of 30 mg iron is available for free among pregnancy as capsules or tablets (soluble, tablets, dissolvable and modified-release tablets), (WHO 2012).

2.3. The nutritional factors affecting (IDA)

Dietary sources of iron come in two forms: heme and nonheme iron.

- Heme iron is found in animal products, such as red meats, fish, and poultry.
- Nonheme iron is found in plant foods such as lentils and beans, and is found in iron-enriched and iron-fortified foods.

 Nonheme iron is less efficiently absorbed into the body than heme iron and need enhancers as vitamin C. (Haufman , 2016)

2.3.1. Nutrient-Iron Interaction:

The interaction with any other nutrient within the complement or in meals that affect the absorption or utilization of iron .i.e. adding 50 milligrams of vitamin c to an iron- meal triple the absorption of iron (Haufman , 2016)

Advanced deficiency of vitamin A is considered serious state that is, it affect formation of the RBC (ASH ,2016)

Bioavailability of food iron is strongly stimulated by means of enhancers and inhibitors in the diet consumed, and iron absorption can range from 1% to forty%, depend on the mix of enhancers and inhibitors that is found in the diet.(WHO, 2001)

Enhancers of iron absorption include: (WHO, 2001)

1- The haem iron, which is found in meat, and seafood

2- Vitamin C which is very important and available , it can be found in fruits, potatoes and some vegetables i.e. green leaves

Inhibitors of iron absorption include: (WHO, 2001)

1- Phytates: one of the most important absorption inhibitors that is found in cereal grains, legumes, seeds and nuts.

2- Inositol material;

3- Tannins: it is the strongest inhibitors proof against the impact of enhancers .i.e. tea, cocoa, herbals as oregano and coffee.

4- Milk and milk products that contains calcium.

2.3.2. Drug-Iron Interaction:

Food will have an effect on the manner a medication works by way of increasing or decreasing the quantity of medicine and absorption, food actually affect the rate at which the body process or remove the medications.

 Iron affect the absorption of many medicinal drugs. for that reason, it's miles pleasant to take iron dietary supplements as a minimum 2 hours earlier than or 2 hours after taking some medications as tetracyclines , doxycycline , minocycline and quinolones that include ciprofloxacin , norfloxacin and levofloxacin (Haufman , 2016)

2.3.3. Meal pattern:

It is an overarching construct that is often used to describe individuals' eating patterns at the level of a 'meal', such as a main meal (for example, breakfast, lunch or dinner) or a smaller-sized meal (for example, supper or snack), (Meiselman,2009).

The neutral terms 'eating occasion' (EO) or 'eating event' are also used to describe any occasion where food or drink is ingested, and therefore incorporates all meal types. Meals have been described according to three constructs:

 (1) patterning (for example, frequency, spacing, regularity, skipping, timing)

(2) format (for example, types of food combinations, sequencing of foods, nutrient profile/content).

 (3) context (for example, eating with others or with the family, eating in or out of home) . (Meiselman,2009).

Inadequate intake of some kinds of heme iron rich food as chicken is significantly associated with anemia and the high consumption is associated with lower prevalence of anemia (Baig et al ,2008) , this finding was written in the report of WHO, which stated that in developing countries inadequate intake of dietary iron is the main causes of anemia during pregnancy (De Benoist et al, 2008).

There are many variables for the meal pattern such as:

1- Frequency of eating occasion (EO) : the mean number of meals and snacks per a day which is usually measured by 24 hr Dietary recall , weekly food diary , and meal patterns questionnaire (Bellisle et al ,2003) .

2- Regularity of meals which is defined as the consistency of EO frequency and spacing , ,and one of its methods of assessment is food records (3days), (Haufman , 2016).

3- Meal skipping usually omits breakfast, lunch or dinner (Smith et al, 2010) , Single questionnaire items and meal patterns questionnaire are used to assess it (Smith et al, 2010).

2.3.4. Energy during pregnancy:

Extra requirement of 69 kcal/d for the first trimester, 266 kcal/day for the second one and 496 kcal/day within the last trimester of being pregnant is needed , in general, additional 76,530 kcal is needed (ACOG ,2008).

2.3.4.1. Macronutrients for pregnant woman

1- Protein

Protein requires more attention during pregnancy among all the macronutrients to support protein synthesis, in order to maintain maternal tissues and fetal healthy growth, mainly during the third trimester (Kaufman ,2016)

During pregnancy, it should be increased by 1 g/day in the first trimester, 8 g/day in the second trimester, and 26 g/day in the third trimester (Kaufman ,2016).

2- Fat

During pregnancy, the quality of fats is more important than their total amount, especially for fetal development and infant growth. But   during pregnancy and lactation it is thus not necessary to change the overall fat intake (Koletzko et al 2007).

3- DHA

DHA is the major polyunsaturated fatty acid, it is essential for brain and retinal development of the fetus during pregnancy, Inadequate intakes are associated with low consumption of fish rich in omega-3 (Koletzko ,2011).

2.3.4.2. Micronutrient during pregnancy

1- Iron

Meat, fish, legumes and green leafy vegetables are the main dietary sources of iron. The absorption of iron is closely linked to the overall diet and the individual nutritional status. For example, phytates and polyphenols are able to inhibit the absorption of non-heme iron, which is favored by ascorbic acid or by the consumption of meat and fish, generally, the human body is able to absorb 2%–13% of non-heme versus about 25% of heme iron (Koletzko ,2011).

International recommendations in terms of intake levels range from the 27 mg per day for all pregnant women as advised by the Center for Disease Control and Prevention and the WHO to the 30–60 mg as advised by the Italian RDA .

2- Folic acid

There is great need to supplement maternal folic during pregnancy, through food fortification or via the use of supplements in the preconception period (Berti et al, 2016).
The RDA during pregnancy increases by 50% for pregnant as compared with non-pregnant women of childbearing age (600 µg/day vs. 400 µg/day). Folic acid should be given two months before conceiving and till reaching 800 µg/day (US Preventive Services Task Force 2009). The use of folic acid-based supplements is considered as safe (Berti 2016).

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3- Vitamin D

There is no homogeneous consensus on its recommended intakes, but generally it is importance as prophylaxis from deficiency, during pregnancy and breastfeeding (Edward et ai, 2010).

2.4. Socio demographic factors that affect IDA in pregnancy:

Sociodemographic factors means the important background information about the population , such as age, sex, race, educational status, income, and geographic location.

It is recommended that the socio-economic status of women should be enhanced in line with the Millennium Development Goals to prevent anemia and to enhance pregnancy outcomes (WHO , 2016) , and during the last 30 years the socioeconomic state of the population has been changed in the West Bank and other Arab countries which resulted in changes in the nutritional habits and types of food consumed (Abdulrahman et al, 2011).

Socio economic status is found to be a major explanation for the women having IDA and most ladies from low income category were more iron deficient (Sharma et al ,2007) . It is proven that poverty is main cause of anemia in the multitude of people living with iron deficiency in developing countries, especially children and pregnant women (Sharma et al ,2007)

Pregnant women with low educational level is significantly related to the prevalence of IDA and sickness (Kefiyalew et al , 2014) . Generally, health education is an essential factor to reduce the prevalence of anaemia (Microwsky et al ,1998), so health education and preventive measure during pregnancy are crucial factor for both mother and their offspring's health because each pregnant woman is at risk during pregnancy even low risk pregnancy (Alan et al , 2014 , Ahmed et al ,2011 .

Anemia is usually occur in teenager mothers due to their unplanned pregnancies and the suboptimal nutrition status (Kefiyalew et al , 2014) , There is nutritional deficiencies at beginning and throughout the primary prenatal period for this age group (Kefiyalew et al , 2014)

Smoking

The recommendation to abstain from smoking in pregnancy is mandatory, because of the increased risk of infant low birth weight, respiratory diseases, development of asthma and allergy and preterm delivery (WHO, 2016).

Smoking during pregnancy may also affect breastfeeding: cigarette smoke is resulting in a reduced supply of this in related to the infant (WHO, 2015, Subramony et al, 2008).

2.5. Conceptual farm work

This study is aimed to describe the nutritional and socio-demographic factors that is related to IDA in pregnant women in a primary health care clinics in West-Bank/ Palestine. The study is intended to provide beneficial records that would help in figuring out possibly regions for precise intervention for the improvement of reproductive health and IDA preventing measures.
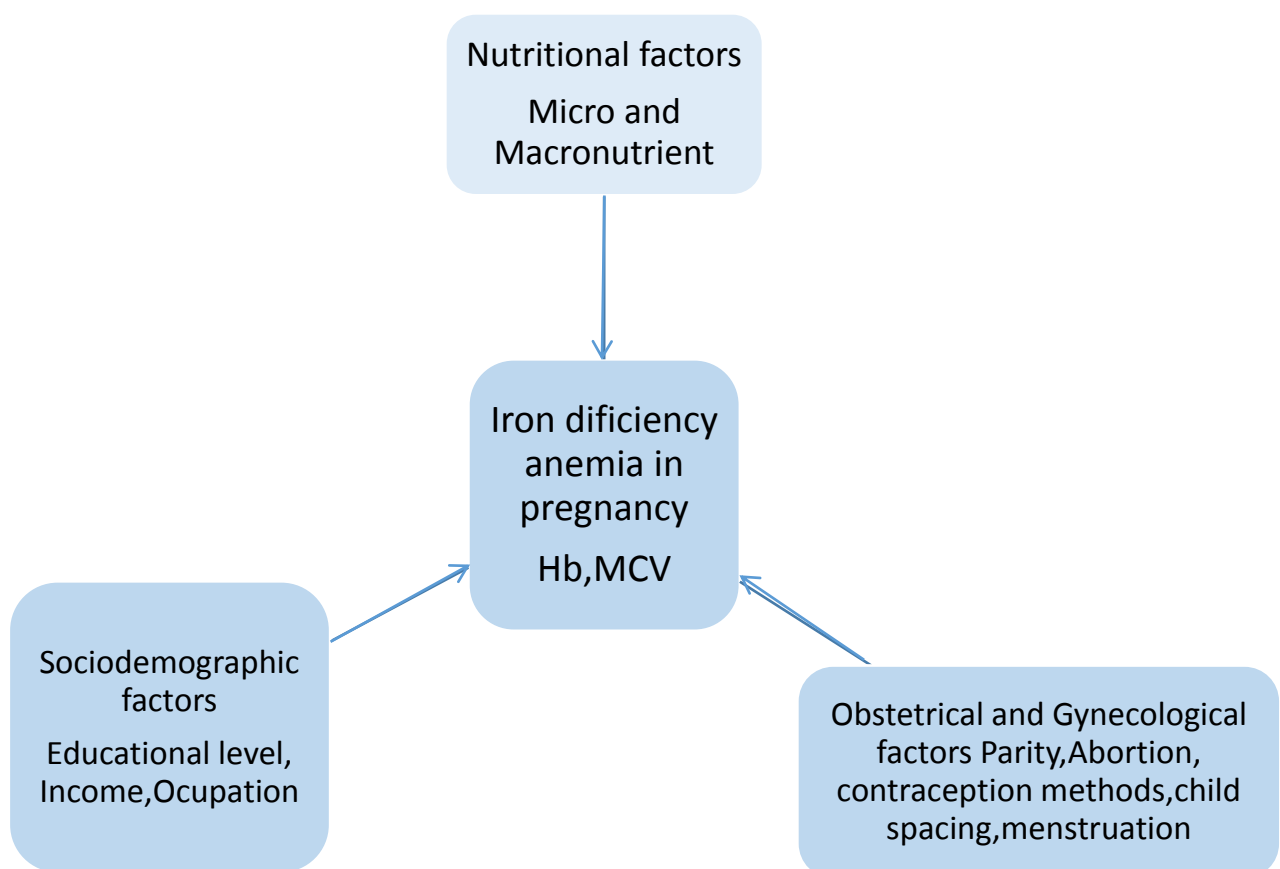
Fig. (2.1): Conceptual farm work of the study

2.6. Study variable and operational definitions

2.6.1. The dependent variable:

Iron deficiency anemia (IDA): the hemoglobin concentration of less than 11 g/dl in the first and third trimester and 10.5 g/dl in the second trimester.

2.6.2. The independent variables:

Occupation: It is what the pregnant women doing, that is, the activities that bring an income for her families, It is classified as worker and nor workers.

Educational level: Depending on the years of studying, primary school studying (1-10) years , secondary (11-12) years, and college or university any more than 12 years .

Family income: The average of money earned by the family members, lower than 3000 shekel, or more than 3000 shekel

Parity: The number of the delivered children by the women.

Abortion: Fetus or embryo removal or expulsion from the uterus during the first 20 weeks of gestation or less, recurrent abortion if more than three consecutive abortions.

Contraception method usage: Any method or device used to prevent pregnancy, oral pills. Loop (helix), injections, condoms or natural way.

Child spacing: the period between the current pregnancy and the previous one .

Micronutrients: An element or substance (minerals or vitamins) that is essential in minute amounts and play major role in iron bioavailability, i.e. vitamin C or calcium.

Macronutrients: Chemical element or substance (such as fat, carbohydrate or protein) that is essential in relatively large amounts to the growth and health of a living organism.

Chapter three: Methodology

3.1 Study design

Matched case-control study was conducted from June, 2017 to May, 2018 among pregnant women who initiated antenatal care follow up in the antenatal health care clinics during their first and third trimester. Using the WHO definition for diagnosis of anaemia in pregnancy, the participant pregnant women were categorized into the case and control group based on the haemoglobin level test result on their visit to antenatal care clinics and they were matched depending on the mother age and the trimester case group (Hb level <11 g/dl) and control group (Hb level between 11 g/dl-15.5 g/dl inclusive), (Mayo .2016, ACOG, 2008, WHO, 2016).

 The inclusion criteria:

- Pregnant women who came for antenatal care follow up during their first or third trimester and who are willing to take part in the study after getting informed consent during the study period.

The exclusion criteria:

- Severely ill pregnant women thus unable to respond to the questionnaire or not willing to take part in the study,

- All the women in second trimester

- Women with diabetes, hypertension, thalassemia, haemophilia,

- Any hereditary conditions that prevent iron absorption

3.2 Sample size determination

Sample size calculations were conducted in the StatCalc module of EpiInfo (EpiInfo™ version 3.5.1, U.S. Canters for Disease Control and Prevention, Atlanta, GA, USA). The following assumptions were considered to determine the sample size : prevalence of iron deficiency anaemia in pregnant women in Palestine is 29.5% , the study was powered to detect an odds ratio of 2.0 with 95% significance and 80% power, case to control ratio 1:1. , and by

considering 10% non-response error, the total number of study participants were 342, of these 171 were cases and 171 were controls.

3.3. Sampling technique

Cluster systematic sampling method:

Sampling : West Bank was divided into north ,south and middle operational areas to select the study clinics , from each area one major and one minor clinic were randomly selected (major clinics are in cities and minor in villages).

The selected clinics were the following:

1- North area of the West Bank: Nablus district (Al Makhfya as a major clinic and Queseen as a minor clinic)
2- Middle and central area (Rammalla central clinic and Birzeit as minor clinic)
3- South area : (AlRamma as central clinic and Ithna as a minor clinic)

Numbers of study participants were allotted from each health antenatal care clinic proportional to their average client size by referring the registration books of each antenatal care clinic (**Table 3.1**). Thus, mathematically, average number of pregnant women who attended antenatal care in each health facilities multiplied by the total sample size (N=342), divided by the total sum average number of pregnant women attended in all the antenatal care clinics (1150).

Table 3.1: calculated sample size of pregnant women allocated to each antenatal care clinic.

Health clinics	Remaining files	Calculated sample	Sample	cases	Control
Al RAMMA	200	(200/1150)*342	60	30	30
ITHNA	160	(160/1150)*342	48	24	24
RAMALLA	250	(250/1150)*342	74	37	37
BIRZIT	190	(190/1150)*342	56	28	28
AlMAKHFYA	200	(200/1150)*342	60	30	30
QYSEEN	150	(150/1150)*342	44	22	22
Total	1150		342		

3.4. Data collection procedure

Data were collected using questionnaires and by reviewing the antenatal care follow up files of each pregnant woman who gave their consent to participate in the study.

The questionnaire include five groups of participants' characteristics, namely: personal data, socio-demographic, health state and life style, obstetric and dietary data . Following an interview, on the same day, the antenatal care file of each pregnant woman was reviewed to obtain information about blood haemoglobin of the mother and review the health state. IDA in pregnant women according to the WHO description is based on the haemoglobin parameter (who 2016) therefore, in this study, only the haemoglobin and MCV parameters were used to determine IDA in pregnant women.

The inclusion criteria included having health records in the antenatal healthcare clinics. The exclusion criteria include having a recorded disease associated with anemia such as thalassemia minor and sickle-cell disease (SCD). Also women with the following pre-pregnancy conditions , kidney, liver, heart, pulmonary, and endocrine diseases; infectious

diseases, high blood pressure; diabetes Mellitus , obstetric diseases, such as preeclampsia and bleeding. Receiving or donating blood during pregnancy, and preterm birth (less than 37 weeks) were excluded. The confidentiality of the subjects were considered and the individuals' names were not mentioned.

Using WHO criteria, pregnant women whose haemoglobin level between 11-15.5 g/dl were considered as control (non-anaemic) and those with a haemoglobin level below 11 g/dl were selected as case (anaemic), (WHO, 2016). Women clinical status and laboratory results were rechecked and cross-checked from their follow up history files. The data collectors in all health clinics were the researcher, nurses, doctors and nutritionists who were trained for one day at each clinic and gathering data was done five days /week.

The dependent variables were serum Haemoglobin level (Hb), Mean Corpuscular Volume (MCV). The independent variables were educational level, household income, family size, health state, number of prenatal care visits, parity, abortions, pre-pregnancy weight status, pregnancy weight status, dietary pattern, and food intake.

For food consumption, a 3 days food record instrument was used , women were requested to record measured foods and beverages as they were consumed throughout the reporting three days .

The pregnant women were given written instructions to help them include details for all foods and beverages consumed, such as brand name, preparation method, portion size was estimated using measuring cups and spoons and then analysed using super tracker, 2011 programme.

3.5. Data analysis

After gathering the data, SPSS software (version 23, SPSS) and statistical analysis were performed. Then outcome variables were dichotomized into 1= cases and 0 = controls and two steps (Bivariate and Multivariate) logistic regression analysis was implemented. Distribution, frequencies, and cross-tabulation were used to find out how the study sample was distributed in each variable. To investigate the association between dependent and independent variables crude and adjusted odds ratio were computed at 95% confidence interval and p-value < 0.05 for statistical significance.

T-test was used to compare average values (means) of iron, vit C, protein, carbohydrates, fat and energy consumption . One way anova test was used to find out the difference in mean between different groups with micronutrients and macronutrients intake. Chi-square test was used to compare proportions. A level of significance of 5% was used.

3.6. Validity and Reliability testing

The questionnaire was tested for face validity with referral to experts in the field (Dieticians, Academics and Statisticians). The pilot testing results was tested for Cornbrash's α internal consistency factor using SPSS version 23. And it is found to be α > 0.72 which is acceptable to proceed.

3.7. Ethical considerations

- The research was evaluated and agreed by the Faculty of Public Health and the Ethical Committee at al Quds University.
- Ministry of Health approval to perform the study and collect data in its clinics was also taken.
- The agreement of the pregnant women on the participation in our study, by using the (consent form) that include the aim and objective of our study and the pregnant role in it.
- Confidentiality of the results was declared and was used for the research purposes only

Chapter Four: Data analysis and Results

Chapter Four: Data analysis and Results

In this chapter we will present the analysis ways that were used and the results which include the distribution of participants by frequencies and percentages with mean and standard deviations.

Also the results of comparing means tests (dependent t-test and ANOVA), chi square test will be presented to show the associations between dependent and independent variables. Results of binary and multivariate regression will be presented.

4.1. Descriptive analysis

1. **Clinics**

Table (4.1): Distribution of participants by clinic

Clinic	Frequency	Percent of participants%
Al-RAMEH- HEBRON	60	17.4
IDNA – HEBRON	48	14.5
RAMALLAH	74	21.5
BERZEIT – RAMALLAH	56	16.9
AL-MAKHFEYAH – NABLUS	60	17.4
QUSEN – NABLUS	44	12.2
Total	342	100.0

Table (4.1) shows the distribution of the study participants according to the clinic where they receive the health care services, 31.9% of the participants were from Hebron (South), 38.4% Ramallah (Central) and 29.6% Nablus (North).

Table (4.2): General characteristics of cases and controls

Characteristics	Cases (n=171)	Controls (n=171)	All participants	p-value
Height (cm)				**0.552**
Mean	161.3	161.0	161.2	
SD	3.02	4.62	3.9	
Weight before pregnancy (kg)				**0.858**
Mean	64.9	64.7	64.8	
SD	10.3	10.2	10.3	
Hemoglobin (HB)				**0.000***
Mean	9.7	12.4	11.1	
SD	0.86	0.89	1.7	
Education Years				**0.000***
Mean	12.1	13.9	13.0	
SD	3.2	3.2	3.3	
Current Smoking				**0.000***
Yes	60 (35.1%)	7 (4.1%)	67 (19.6%)	
No	111 (64.9%)	164 (95.9%)	275 (80.4%)	
Gestational age				**0.516**
1st trimester	72 (42.1%)	78 (45.6%)	150 (43.8%)	
3rd trimester	99 (57.9%)	93 (54.4%)	192 (56.2%)	

*Significance at p≤0.05

Table (4.2) shows that Three hundred forty tow pregnant women with 171 cases and 171 controls were recruited in this study. The response rate was 100%. Of the total population of the study 43.8% were in the First trimester of the pregnancy and 56.2% were in third trimester, the second trimester pregnant women were excluded from the study as the different case definition of anemia (Hb less than 10.5 g/dl) and the least prevalence of anemia at this stage of pregnancy.

 The mean of participants' weight before pregnancy was (64.8 kg)for all participants, (64.7) kg for controls, and (64.9 kg) for anemic cases. The mean of participants' height was (161.2 cm) for all participants, (161.0 cm) for controls, and (161.3) cm for anemic cases. The mean of hemoglobin for the total population of the study was (11.1) g/dL with (9.7) g/dL for cases and (12.4) g/dl for controls. The average hemoglobin and education years, of the case group were all significantly lower than those in the control group (p < 0.05). It was found that (35.1%) of the cases were smoker in pregnancy while only (4.1%) of controls were smoker during

pregnancy   that means that smoking is significantly and positively associated with IDA, (p < 0.05).

Table (4.3): Socio-demographic Characteristics of cases and controls

Characteristics	Cases (n=171) N(%)	Controls (n=171) N(%)	All participants N(%)	p-value
Residence Place				**0.365**
City	112 (65.5)	116 (67.8)	228 (66.7)	
Village	59 (34.5)	55 (32.2)	114 (33.3)	
Number of family members				**0.000***
2-5 members	87 (50.9)	127 (74.3)	214 (62.6)	
6-10 members	78 (45.6)	39 (22.8)	117 (34.2)	
>10 members	5 (2.9%)	5 (2.9)	10 (2.9)	
Occupation				**0.000***
Working	54 (31.6)	107 (62.6)	161 (47.1)	
Not working	117 (68.4)	63 (36.8)	180 (52.6)	
Monthly income (sheikel)				**0.000***
<1000 sheikel	9 (5.3)	10 (5.8)	19 (5.6)	
1000-3000 sheikel	90 (52.6)	43 (25.1)	133 (38.9)	
>3000 sheikel	72 (42.1)	118 (69.0)	190 (55.6)	
Type of household				**0.000***
Ownership	89 (52.0)	138 (80.7)	227 (66.4)	
Rented	82 (48.0)	30 (17.5)	112 (32.7)	
Having health insurance				**0.116**
Yes	76.0 (76.0)	140 (81.9)	270 (78.9)	
No	24.0 (24.0)	31 (18.1)	72 (21.1)	

Significance at p≤0.05

Out of 342 participants, 228 (65%) lived in the urban area (city), and 114 (33.3%) were from rural areas (villages), residency place is not significant with IDA ,health insurance also shows no significant difference between cases and controls . Most of the controls (80.7%) own their home but only (52%) of the cases and that show negative association with IDA (p=0.000) and about (52.6%) were housewives by occupation.

Most of the case group average monthly family income 1000- 3000 Shekel (52.6%) compared to the control group (25.1%) with statistical difference (p-value 0.000). Also smoker participants were more likely to get anemia by OR=8.833 times (CI: 3.925-19.881) which was statistically significant (p=0.000)

Table (4.4) : Some medical characteristics of cases and controls

Characteristics	Cases (n=171) N(%)	Controls (n=171) N(%)	All participants N(%)
History of anemia in previous pregnancy			
Yes	98 (57.3)	36 (21.1)	134 (39.2)
No	73 (42.7)	135 (78.9)	208 (60.8)
Type of iron treatment for current Anemia			
Iron tablets	163 (95.3)	…..	
Iron by injection	5 (2.9)	.....	
Iron tablet intake/day			
One tablet/day	19 (11.1)	26 (15.2)	45 (13.2)
Two tablets/day	132 (77.2)	9 (5.3)	141 (41.2)
Three tablets/day	18 (10.5)	--	18 (5.3)
Regularity of iron supplement intake			
Yes	67 (39.2)	149 (87.1)	216 (63.2)
No	102 (59.6)	20 (11.7)	122 (35.7)
Reasons of irregularity of iron supplement intake			
Forgetfulness	27 (15.8)	13 (7.6)	40 (11.7)
Causing side effects	35 (20.5)	5 (2.9)	40 (11.7)
Not convinced of its importance for pregnancy	5 (2.9)	1 (0.6)	6 (1.8)
Possible adverse effects on fetus	19 (11.1)	5 (2.9)	19 (5.6)
No reasons neither do not like to intake the iron	20 (11.7)	13 (7.6)	25 (7.3)
Other medications used in pregnancy			
H2 Receptor Antagonist			
Yes	122 (71.3)	23 (13.5)	145 (42.4)
No	46 (26.9)	136 (79.5)	182 (53.2)
Calcium supplement			
Yes	102 (59.6)	32 (18.7)	134 (39.2)
No	68 (39.8)	131 (76.6)	199 (58.2)
Levothyroxine			
Yes	13 (7.6)	8 (4.7)	21 (6.1)
No	155 (90.6)	153 (89.5)	308 (90.1)
Number of meals/day			
One meal	44 (25.7)	3 (1.8)	47 (13.7)
2 meals	87 (50.9)	16 (9.4)	103 (30.1)
3 meals	27 (15.8)	69 (40.4)	96 (28.1)

>3 meals	10 (5.8)	82 (48.0)	92 (26.9)
Apatite to food during pregnancy			
Increase	19 (11.1)	88 (51.5)	107 (31.1)
Decrease	109 (63.7)	25 (14.6)	134 (39.2)
No change	40 (23.4)	57 (33.3)	97 (28.4)

Table (4.4) shows that 57.3 % of the cases were previously diagnosed to have anaemia during the previous pregnancy while only 21.1% of the controls were previously diagnosed , and 95.3% of the cases were used tablet regimen for treatment in different dosage as follow: 11.1% one tablet/day, 77.2% two tablets/day, and 10.5% three tablets/day.

It is obvious that 59.6% of cases did not take iron tablets supplement regularly due to different reasons including: 15.8% due to forgetfulness, 20.5% believing that they cause side effects, 11.1% reported that they have adverse effects on fetus, 11.7% said no reasons for not taking Iron tablets regularly, and only 2.9% of them said that it is not important in pregnancy.

Regarding medications in pregnancy, 71.3% and 13.5% of cases and controls, respectively, reported that they were taking H2 Receptor Antagonist, 59.6% and 18.75 were taking calcium supplement, and 7.6% and 4.7% were only taking Levothyroxine.

For meal frequency, (76.6% vs. 11.2%) of cases and controls were taking one to two meals per day respectively, while 24.6% and 88.4% respectively, were taking more than 3 meals per a day. A total of 63.7% of cases reported that the appetite during pregnancy decreased, and on the other side only 14.6% of controls experienced this condition.

Table (4.5): The Hb level among cases, controls and both groups

	Status	N	Mean	Std. Deviation	p. value
hemoglobin (Hb)	Cases	171	9.76	0.860	
	Controls	171	12.38	1.24	0.000
	Both	342	11.10	1.60	

Table (4.5) shows that the mean of Hb was 9.8 g/dl among the anemic cases and 12.4 g/dl among controls. There is negative association between smoking and IDA.

Table (4.6): Health symptoms in relation to iron deficiency anemia among cases and controls

	Cases		Controls		Crude Odds Ratio (COR)(CI 95%)	p-value
	N	%	N	%		
Dizziness and nausea						
Rarely	23	6.9	121	36.3	0.659 (0.292-1.488)	**0.217**
Sometimes/often	147	44.1	42	12.6	1.063 (0.946-1.194)	
Vomiting						
Rarely	30	9.1	127	38.4	0.668 (0.339-1.316	**0.163**
Sometimes/often	140	42.3	34	10.3	1.089 (0.447-1.252)	
Anorexia						
Rarely	22	6.6	128	38.6	0.538 (0.231-1.253)	**0.106**
Sometimes/often	148	44.6	34	10.2	1.092 (0.973-1.226)	
Pallor of the Face						
Rarely	23	6.9	129	39.0	0.790 (0.357-1.747)	**0.363**
Sometimes/often	146	44.1	33	10.0	1.036 (0.921-1.165)	
Constipation						
Rarely	19	5.7	88	26.6	0.734 (0.299-1.802)	**0.363**
Sometimes/often	151	45.6	73	22.1	1.037 (0.935-1.151)	
Gastric pain.						
Rarely	15	4.5	81	24.5	0.974 (0.884-1.073)	**0.393**
Sometimes/often	154	46.7	80	24.2	1.304 (0.495-3.432)	
Breathlessness						
Rarely	34	10.3	104	31.4	0.938 (0.803-1.096)	**0.266**
Sometimes/often	135	40.8	58	17.5	1.284 (0.704-2.341)	

Table (4.6) shows the results of (Chi Square (X^2) analysis, showing that there is no significant relation between the mentioned health symptoms and the anemia status of the studied population ($p<0.05$).

Table (4.7) : Crude (COR) and Adjusted Odds Ratio (AOR)(CI 95%)of Association of anemia with socio-demographic related factors among the study population.

Characteristics	Cases (n=171) N(%)	Controls (n=171) N(%)	Crude Odds Ratio (COR)(CI 95%)	p-value	Adjusted Odds Ratio (AOR)(CI 95%)	p-value
Residence Place			**0.853 (0.543-1.340)**			
City	112 (65.5)	116 (67.8)	0.949 (0.817-1.102)	**0.283**	0.442 (0.216-0.905)	**0.026***
Village	59 (34.5)	55 (32.2)	1.050(0.688-1.603)		2.263 (1.105-4.637)	
Number of family members			**0.388 (0.245-0.614)**			
1-5 members	87 (50.9)	127 (74.3)	0.711(0.602-0.838)	**0.000***	0.335 (0.167-0.673)	**0.002***
>5 members	5 (2.9%)	5 (2.9)	1.832(1.351-2.486)		2.986 (1.487-5.994)	
Occupation			**0.261 (0.167-0.410)**			
Working	54 (31.6)	107 (62.6)	0.499(0.167-1.410)	**0.000***	0.271(0.116-0.635)	**0.003***
Not working	117 (68.4)	63 (36.8)	1.912(1.514-2.413)		3.690 (1.575-8.644)	
Monthly income (sheikel)			**3.044 (1.946-4.762)**			
<3000 sheikel	9 (5.3)	10 (5.8)	1.883(1.440-2.461)	**0.000***	1.102 (0.496-2.444)	0.812
>3000 sheikel	72 (42.1)	118 (69.0)	1.044(0.735-1.457)		0.908 (0.409-2.014)	
Type of household			**0.241 (0.145-0.400)**			
Ownership	89 (52.0)	138 (80.7)	0.648(0.556-0.755)	**0.000***	0.346 (0.166-0.724)	**0.005***
Rented	82 (48.0)	30 (17.5)	2.684(1.841-3.911)		2.887 (1.381-6.038)	
Having health insurance			**0.781 (0.461-1.321)**			
Yes	76.0 (76.0)	140 (81.9)	0.950(0.852-1.059)	**0.215**	0.576 (0.263-1.260)	0.167
No	24.0 (24.0)	31 (18.1)	1.216(0.801-1.847)		1.737 (0.794-3.802)	
Education			2.669 (1.552-4.587)			
School stage	79 (46.2)	48 (28.1)	1.552(1.203-2.002)	**0.000***	1.175 (.524-2.636)	0.695
College and higher	38 (2202)	61 (35.7)	0.581(0.430-0.787)		0.851 (0.379-1.908)	
Smoking			**12.750 (5.533-30.484)**			
No	111 (64.9)	164 (59.6)	0.693 (0.623-0.771)	**0.000***	0.077 (0.024-0.245)	**0.000***
Yes	60 (35.1)	7 (4.1)	8.833 (3.925-19.881)		13.038 (4.079-41.675)	

*Statistically significant p≤0.05, COR crude odd ratio, AOR adjusted odd ratio

Table (4.7) shows the distribution of participants according to their socio-demographic characteristics and their associations with the anemic situation of participants (Chi Square (X2) and multivariate regression for the associations of variables. Participants who are from village are a little bit more risky for anemia than those were from city.

Participants who had completed only the school education had OR=1.5 times to be anemic compared with those continue to college or higher educational level, that is education level is negatively associated with IDA. Smoking is highly associated with anemia with Odds Ratio (OR) = 8.833 (CI: 3.925-19.881) (P=0.000) for smokers compared to non-smokers. Families with less than 3000 shekel per month are more likely to get anemia by 1.8 times in comparison with those with less than 3000 shekel per month and its effect of the monthly income is statistically significant (p=0.000) with negative association with IDA.

Women who are not working (housewives) are more likely risky for anemia rather than those who are working by 1.9 times and p=0.000 which reflect the statistically significant effect of working on protection against anemia. Women from family with more than 5 members are more likely to be anaemic by 1.8 times, that's mean, there is appositive association between number of family members and IDA.

Participants who live in a rented houses are more likely to be anemic by OR=2.9 times (p=0.005), compared with those own their house.
Not having health insurance appeared to have an effect on getting anemia by OR=1.7 times, but this effect is not significant (p= 0.167).

Table (4.8) : Crude (COR) and Adjusted Odds Ratio (AOR) of Association of anemia and the gynecological and obstetrical characteristics of cases and controls

Characteristics	Cases (n=171) N(%)	Controls (n=171) N(%)	All participants N(%)	Crude Odds Ratio (COR)(CI 95%)	p-value	Adjusted Odds Ratio (AOR)(CI 95%)	p-value
Current pregnancy order							
1st	32 (18.7)	42 (24.6)	74 (21.6)	1 (reference)		1 (reference)	
2nd	19 (11.1)	49 (28.7)	68 (19.9)	0.440(0.220-0.879)	0.020*	0.499 (0.072-3.445)	0.481
3rd	39 (22.8)	34 (19.9)	73 (21.3)	1.430(0.746-2.741)	0.281	2.243 (1.242-4.050)	**0.007***
4th and more	81 (47.3)	44 (25.7)	125 (36.5)	2.242(1.242-4.050)	**0.007***	5.100 (2.681-9.700)	**0.000***
Period between current pregnancy and the previous one							
<one year	22 (12.9)	15 (8.8)	37 (10.8)	1 (reference)		1 (reference)	
1-2 years	80 (46.8)	26 (15.2)	106 (31.0)	9.538 (4.122-22.071)	0.000*	51.524 (4.438-598.231)	**0.002***
2-3 years	31 (18.1)	59 (34.5)	90 (26.3)	2.067 (.903-4.731)	0.000*	11.512(2.817-47.041)	**0.001***
>3 years	8 (4.7)	33 (19.3)	41 (12.0)	5.723 (2.144-15.274)	0.086	3.909(1.022-14.955)	**0.046***
MCH (Mother and Child Health Care) center regular visits							
Yes	86 (50.3)	91 (53.2)	177 (51.8)	1 (reference)		1 (reference)	
No	85 (49.7)	78 (45.6)	163 (47.7)	1.154 (0.752-1.770)	0.512	0.849 (0.306-2.354)	0.754

Menstrual cycle regularity before pregnancy							
Yes	131 (76.6)	152 (88.9)	283 (82.7)	1 (reference)		1 (reference)	
No	38 (22.2)	9 (5.3)	47 (13.7)	4.134 (1.927-8.866)	0.000*	0.967 (0.157-5.965)	0.971
Length of menses (days)							
1-6 days	99 (8.2)	156 (29.2)	255(74.5)	1 (reference)		1 (reference)	
7-10 days	72 (49.7)	15 (62.0)	87 (25.4)	7.625 (4.022-14.453)	0.000*	8.783 (2.605-29.609)	**0.000***
Heaviness of menses							
Light	7 (4.1)	72 (42.1)	79 (23.1)	1 (reference)		1 (reference)	
Moderate	82 (48.0)	92 (53.8)	174 (50.9)	6.545 (3.242-13.215)	0.000*	9.717 (2.635-35.834)	**0.001***
Heavy	82 (47.9)	5 (2.9)	88 (25.4)	8.485 (9.702-40.314)	0.000*	71.036 (8.132-620.486)	**0.000***
Contraceptive use							
Yes	123 (71.9)	85 (49.7)	208 (60.8)	2.468 (1.574-3.871)	0.000*	2.560 (0.178-36.901)	0.490
No	47 (27.5)	82 (48.0)	129 (37.7)	1 (reference)		1 (reference)	
Type of contraception							
Tablets (pills)	24 (14.0)	15 (8.8)	39 (11.4)	5.000 (1.768-14.144)	0.002*	1.786 (0.396-8.063)	0.451
CT Loop(helix)	80 (46.8)	14 (8.2)	94 (27.5)	12.698 (4.813-33.505)	0.000*	3.771 (0.951-14.959)	0.059
Condom	3 (1.8)	23 (13.5)	26 (7.6)	.404 (0.107-1.519)	0.180	0.217 (0.032-1.454)	0.115
Contraceptive injection	14 (8.2)	13 (7.6)	27 (7.9)	2.393 (0.804-7.120)	0.117	1.536 (0.255-9.252)	0.639

Natural	5 (2.9)	24 (14.0)	29 (8.5)	1 (reference)		1 (reference)	
Gestation age							
1st trimester	72 (21.1)	78 (22.8)	150 (43.9)	1.114 (.726-1.709)	0.621	1.546 (0.443-5.399)	0.494
3rd trimester	99 (28.9)	93 (27.2)	192 (56.1)	1 (reference)		1 (reference)	

*Statistically significant at p≤0.05.

AOR : adjusted odd ratio

COR : crude odd ratio

Table (4.8) shows the distribution of participants according to the gynecological and obstetrical characteristics and the binary regression (Odds Ratio (OR) to show the effect of independent variables (gynecological and obstetrical characteristics) on the dependent variable (the status of participant (anemic or not anemic).

As can be seen from the table, 125 (36.5%) of the participated women were having 4 deliveries and more, 47.3. % were considered anemic cases compared to 25.7% non-anemic women. Parity is positively associated with anemia.

21.6 % of the cases have no previous history of abortions while 66.1% of controls haven't history of any abortion, 66.1% of cases were with a history of one or two abortions and 12.3% were three or more, compared with controls whom shows that 28.7% have a history of one or two abortion and 3.5% three or more, Recurrent of abortion is positively associated with IDA.

It is obvious that 80 (46.8%) of the study participants cases and 26 (15.2%) of controls had an age gap of 2 years between the pregnancies, and 33 (19.3%) of controls had >3 years of age gap, the significance difference appeared in the 1-3 years (p = 0.000).

It was found that controls were regularly visiting the MCH and private specialized doctor (91.2% and 45.6%) respectively. Menstrual cycle was regular among 76.6% and 88.9% of cases and controls respectively. 49.7% and 62.0% of cases and controls had a menstrual cycle with length of 3-6 days respectively, while about 42.1% of cases had a 7-10 days menses. It was found that menses was more heavy among cases rather than controls (47.9% vs. 2.9%) respectively. 123(71.9%) of cases and 85 (49.7%) had a prior history of contraceptive use before becoming pregnant. Loop was the common contraception method used by cases (46.8%), while condom and natural method were the common ways used by controls (13.5% and 14.5%). The majority of both cases and controls (29.2% and 22.2%) had used contraceptives for 1-2 years.

The menstrual cycles length is different between cases and controls , for the controls, 62% are regular with length of 7-10 days, and 49.7% of participated cases are regular with length 7-10 ,length of menstrual cycle is positively associated with IDA.

It is found that 60.8% of women used contraceptives in different ways: Pills (11.4%), Loop (27.4%), Male condoms (7.6%), injection contraceptive (7.9%), and natural way (8.5%). Only 10.2% of them were using contraceptives for less than one year and the rest were using them for one year and more. A total of 192 (56.1%) of studied women were in the third trimester of their pregnancy.

Also the table shows the results of the binary regression (Odds Ratio) to show the effects of these characteristics on getting anemia. It is seen from the table that the anemic status of pregnant women is associated with: parity of deliveries (OR=2.242, 95)(p=0.007); repeated abortion (OR=12.326, 95)(p=0.000); period between current pregnancy and previous delivery (OR=5.723, 95%) (p=0.086) among 3 years and more group but the significance difference appeared in the 1-3 years (p=0.000); irregular menstrual cycle (OR=4.134, 9) (p=0.000); the heaviness of menstrual cycle, moderate and heavy (OR=6.545)(p=0.000). Using of contraceptive methods (OR=2.468, 95) (p=0.000) ; type of contraception mainly pills (OR =5), and loop(OR =12.698). While the other factors are not significant.

For the multivariate regression (adjusted logistic regression) of obstetrical and gynecological characteristics and their effects on getting anemia among pregnant women. Some of these characteristics still have effects like: increase in deliveries times, increase in abortion times, increase in period between pregnancies, duration (length) of menstrual cycle > 7 days, and increase in heaviness of menstrual cycle.

Table (4.9) : Association (binary regression) between some medication and dietary characteristics and anemia in women:

Characteristics	Cases (n=171) N(%)	Controls (n=171) N(%)	Crude Odds Ratio (COR)(CI 95%)	p-value	Adjusted Odds Ratio (AOR)(CI 95%)	p-value
Regularity of iron intake						
Yes	67 (39.2)	149 (87.1)	1 (reference)		1 (reference)	
No	102 (59.6)	20 (11.7)	5.072 (3.226-7.973)	**0.000**	2.488 (0.659-9.390)	0.179
Medications						
H2 Receptor Antagonest						
Yes	122 (71.3)	23 (13.5)	1 (reference)	**0.000**	1 (reference)	
No	46 (26.9)	136 (79.5)	13.99 (7.983-24.535)		0.069 (0.012-0.393)	**0.003***
Calcium supplement						
Yes	102 (59.6)	32 (18.7)	1 (reference)	**0.000**	1 (reference)	
No	68 (39.8)	131 (76.6)	5.611 (3.414-9.220)		0.178 (0.036-0.892)	**0.036***
Thyroid gland (Levothyroxin)						
Yes	13 (7.6)	8 (4.7)	1 (reference)	0.238	1 (reference)	
No	155 (90.6)	153 (89.5)	1.756 (0.690-4.471)		4.749 (0.386-58.404)	0.224
Number of meals/day						
One meal	44 (25.7)	3 (1.8)	0.012 (0.033-0.045)	**0.000**	32.659 (1.648-647.020)	**0.022***
2 meals	87 (50.9)	16 (9.4)	0.031 (0.014-0.067)	**0.000**	8.570 (1.026-71.582)	**0.047***
3 meals	27 (15.8)	69 (40.4)	0.327 (0.162-0.663)	**0.002**	4.444 (0.520-37.973)	0.173
>3 meals	10 (5.8)	82 (48.0)	1 (reference)		1 (reference)	
Apatite change during pregnancy						
Increase	19 (11.1)	88 (51.5)	1 (reference)		1 (reference)	
Decrease	109 (63.7)	25 (14.6)	0.057 (0.030-0.108)	**0.000**	0.759 (0.099-5.835)	0.791
No change	40 (23.4)	57 (33.3)	0.348 (0.190-0.638)	**0.001**	0.531 (0.062-4.511)	0.562
Total	171(100%)	171(100%)				

*Statistically significant at $p \leq 0.05$

Table (4.9) shows the association between some medication, the appetite and the number of meals with IDA. About 58.5% of participants taking oral iron tablets as a medication in regular basis (63.2%). Other types of medications were found to be used by participants including: H2 Receptor Antagonist (42.4%), Calcium supplements (39.2%), and only 6.1% taking treatment for hypothyroidism.

Binary Logistic regression analysis (Odds Ratios (OR)) was carried out to assess the possible relationship and the results showed that IDA is significantly negative associated with regular intake of iron supplement (COR =5.072, 95% CI =3.226-7.973, p=0.000).

Positive association between H2 Receptor Antagonist use and IDA (COR=13.99, 95% CI=7.983-24.535) (, p= 0.000) is found.

There is positive association between Calcium supplement and IDA (COR=5.611, 95% CI= 3.414-9.220), (p=0.000).

Number of meals per day is negatively associated with IDA (OR=0.327, 95% CI=0.162-0.663)(p< 0.002),

In addition, increase in appetite during pregnancy is negatively associated with IDA (OR=0.348, 95%CI=0.190-0.638), (p,0.001).

Table (4.10) : Distribution of participants according to their daily intake of macro and micronutrients

	Status	Number	Mean	Std. Deviation	Significance P-value
Macronutrients					
protein intake in gram per day	Case	171	**36.47**	10.25	0.001
	Control	171	**66.62**	7.81	
carbohydrates intake in gram per day	Case	171	**73.80**	16.66	0.000
	Control	171	**136.13**	30.91	
fat intake in gram per day	Case	171	**32.50**	7.92	0.166
	Control	171	**49.43**	8.95	
Micronutrients					
iron intake in milligram per day	Case	171	**11.62**	2.71	0.000
	Control	171	**23.05**	5.76	
vitamin C intake in milligram per day	Case	171	**58.21**	10.67	0.274
	Control	171	**74.21**	10.27	

Total energy intake in kilo calorie per day

	Case	733.6 Kcal
	Control	1255.9 Kcal

Table (4.10) shows that the means of all macronutrients and micronutrients (protein, carbohydrates, fat, iron, and vitamin C) daily intake by participants are less in the cases than controls. The means of these nutrients (protein g/ dl, carbohydrates g /dl, fat g/ dl , iron mg/ dl, and vitamin C mg/ dl) were 36.5, 73.8, 32.5, 11.6, and 58.2 among cases respectively. There are significant differences in means of these nutrients intak between cases and controls. It seems that controls were taking these nutrients in higher amounts than the cases as 66.6, 136.1, 49.4, 23.1, 74.2, respectively,

Anemic women were also suffering from lower daily energy intake compared by controls.

*1gram of protein= 4 kcal, 1gm of carbohydrates= 4 k cal , 1 gm of fats=9 k cal

Table (4.11) : The odds ratio (OR) for daily intakes of macro and micronutrients

Hb		Sig. P-value	Odd Ratio (OR)	95% Confidence Interval for OR	
				Lower Bound	Upper Bound
Controls					
	protein intake	0.000	1.128	1.067	1.192
	carbohydrates intake	0.062	1.017	.999	1.036
	fat intake	0.061	1.055	.998	1.116
	iron intake	0.048	1.129	1.001	1.274
	Vitamin C Intake	0.013	1.060	1.012	1.111

Table (4.11) shows that the association between protein, iron, and vitamin C , and anemia (OR: 1.128, 129,1.060,respectively),)(p< 0.005) is negatively statistically significant.

Participants' fat and carbohydrates intake are weakly associated. (OR: 1.055, 1.017 respectively), (p = 0.062).

Table(4.12) : Results of one way ANOVA for the association of taking micronutrients and anemia

ANOVA Table			Sum of Squares	Df	Mean Square	F	Sig. p-value
HB level * protein intake in gm per day	Between Groups		67.7	51	1.328	22.721	**0.000***
	Within Groups		16.8	288	.058		
	Total		84.5	339			
HB level * carbohydrates intake in gm per day	Between Groups		60.8	69	.882	10.041	**0.000***
	Within Groups		23.7	270	.088		
	Total		84.5	339			
HB level * fat intake in gm per day	Between Groups		41.9	41	1.022	7.141	**0.000***
	Within Groups		42.6	298	.143		
	Total		84.5	339			
HB level * iron intake in mg per day	Between Groups		64.6	24	2.694	42.579	**0.000***
	Within Groups		19.9	315	.063		
	Total		84.5	339			
HB level * vitamin C intake in mg per day	Between Groups		37.8	46	.823	5.159	**0.000***
	Within Groups		46.7	293	.159		
	Total		84.5	339			

Table (4.12) shows the differences between the groups (the anemic and the nonanemic) to assess the association between IDA and the intake of these ingredients

The associations are all statistically significant (**p-value 0.000)**

Chapter Five: Discussion

5. Discussion of results

Iron deficiency anaemia (IDA) among pregnant women in the Palestinian population is a public health problem, it might be associated with several factors such as, genetic factors, inadequate health care, malnutrition or bad habit, low socioeconomically status, or might be due to lack of knowledge and awareness (Addis et al ,2014 ,Abdelrahman et al,2012).

This study is aimed to analyze the underlying nutritional risk factors and the sociodemographic factors that may affect this health problem.

5.1. Socio demographic and economic factors

It is observed that among anaemic participants pregnant women, (26.9%) had mild anaemia, (22.8%) had moderate anaemia, and none had severe anaemia.

The average of (Hb) and education years of the case group were all significantly lower than those in the control group, the prevalence of severe anaemia is expected to be more in the less educated group . A study done by Rohra and his colleagues speculates that adverse haemoglobin status of pregnant women attending public sector hospital might be due to the socioeconomic status as well as low level of education (Rohra et al ,2008) , Another study was done by Hyder in Bangladesh concluded that 56% of the pregnant women had attended school for at least a year (Hyder et al, 2013)

Smoker participants were risky and more likely to get anemia by OR=8.833 times (CI: 3.925-19.881) which was statistically significant (p=0.000) ,the link between tobacco use and iron deficiency anemia is found in our current study and elsewhere (Chelchowska et al 2016),(Subramoney et al 2008).

Although this study was not designed to determine the prevalence of smoking among pregnant women, but to our knowledge, there have been no previous studies evaluating the prevalence of smoking in pregnant women in the West Bank or its effect . However, the high prevalence of current smoking in our study sample indicates the need to develop prevalence studies and plans for smoking cessation programs during pregnancy.

According to data from the literature, pregnancy promotes smoking cessation, and many of the smokers and former smokers did not know that smoking cessation treatment was available.(Fontanella et al 2012) Furthermore, it is reported that mothers feel guilty about smoking during pregnancy (Fontanella et al 2012). Therefore, considering smoking cessation and treatment before or during pregnancy could be effective tools.

Most of the cases average monthly family income falls below 3000 Israeli Sheikel (52.6%) compared to the control group (25.1%) with statistical difference (p-value 0.000.).

The evidences have been shown from the survey conducted in 2008, which revealed that West Bank households' poverty rates were (48%), that affect the life style and quality and quantity of food (WHO 2009).

A number of researchers have reported that the high prevalence of IDA occur among people living in chronic poverty (Sharma et al ,2003).

IDA among women from the lower monthly income families in our study and in any other studies is may explained in part by the fact that heme iron is almost absent from their diets or even not taking the iron supplement , The results of this study showed that anemia is significantly negative associated with regular intake of iron supplement (COR =5.072, 95% CI =3.226-7.973, p=0.000),it is the same as result of many other studies which showed significant association between IDA and irregularity of iron supplement and poor diet,

(Gupta et al , 2013 , Mayo Clinic, 2016 , Taylor et al ,2015)

In respect to the number of children, it is clear from the data that most women were more likely to have many children, Women from family with more than 5 members are more likely to be anaemic by 1.8 times. A study in Kisumu, Western Kenya result in the fact that prevalence of anemia was higher in women with family size >7 compared to their counterparts (Jemal et al 2009)

It may be explained that the women of the lower social class are more likely to develop IDA during pregnancy, because they are: 1) less aware of adequate diet during pregnancy, 2) more likely to have multiple pregnancies, 3) reluctant to use

contraceptives and keep an appropriate interval between pregnancies, and 4) less likely to take iron tablets for prophylactic purposes.

5.2. Gynaecological and obstetrical factors

In this study , maternity and obstetric characteristics play a significant role in IDA during pregnancy. i.e. increased parity , increased abortion times mainly more than three, and the period between pregnancies.

Multi-parity:

IDA of pregnant women is associated positively with parity of deliveries (OR=2.242), women with more than 4 pregnancies are 2,2 more chance to be affected.

This finding is consistent with the study done in Turkey in which pregnant women with parity of four or more were 2.2 times more anemic compared to those with parity less than four (Karaoglu et al 2010) . Multiparty may induce IDA by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery, Primiparous pregnancies were found to be at a higher risk of IDA compared to pregnancies with parity of 1 to 2 (Delpisheh et al 2006).

Use of contraception:

In this study, pills and loop (helix) were strongly associated with IDA development, the length of menstrual cycle of > 7 days, and increased density of menstrual cycle were also positively associated with the development of IDA .

Oral contraceptive pills (OCP) and loops (helix) generally cause heavy and irregular menses which lead to IDA (WHO, 2016). Hormonal contraceptives like OCP have its risk of menorrhagia and irregular menses and so more IDA than others kinds of contraception (ACOG ,2008).

Haile and his colleagues (2016) showed that the prevalence of IDA in OCP users was lower than that in our population , but they used haemoglobin < 12 g/dl to define anaemia, and the Iron status is vary with the type of OC used. the progestin generation pills is associated with high ferritin concentration and the fourth-generation pills that has ant androgen activity results in a lower intermenstrual

bleeding effect and they are not common used in our primary care clinics . This finding probably explains the difference.

Child spacing

It is obvious from the result of the study that the cases mainly apart 1-2 years in between pregnancies, but controls apart mainly 2-3 years duration, which has been shown to be negatively associated with IDA. The possible reason could be that child spacing minimizes bleeding during delivery and give a time for more self-care and easily to get the demand of iron for the mother body only rather than the mother and her foetus and enhances iron reserve in the body, limiting of births or using family planning to control and space births is a key contributing factor to the prevention of anaemia during pregnancy.

Having too many under five children or too frequent birth is among the key predictors of anemia in Ethiopia identified by the current analyses. This is also consistent with the findings of other studies (Abriha et al , 2014, Gebremedhin et al ,2011)

Many studies reflected that most of the anemic pregnant women were multi gravida and less child spacing and so, multiparty and short birth spacing may lead to anemia in women (Woldemariam et al, 2002)

Abortion

From the results, it has been shown that recurrent abortions (more than 3and even 2) were strongly associated with IDA , which is consistent with guidelines and consideration (WHO ,2016 , ACOG, 2008).

An old study done in India resulted in negative association between abortions and IDA , this is an old study , the methodology , the tools of analysis or may the social stigma attached to abortion at that time had limited the number and/or types of abortions reported and so results in that. Despite this, there was a positive correlation between the number of spontaneous abortions and the likelihood of developing anaemia at final HB reading (Prema, 1979).

The prevalence of anemia was seen to be increased with the number of abortion where the probability of being anemic among women's who had history of abortion was 5

times more likely to be higher than who had no history of abortion and this could be resulted because abortion exposes women to loss of more blood and might expose them to periods of hemorrhage which depletes body stores of iron that leads to extra requirement of iron than usual (Tadesse et al, 2017)

Many studies showed that women who experienced abortion or terminated pregnancy before the index pregnancy were found to have a 2.63 times higher risk of developing anemia than those who did not (Uche et al ,2010, Wiebe at al ,2006)

Anti-acid medications usage during pregnancy

In this study ,there is positive association between the anti-acid medications usage during pregnancy and development of IDA , it is well documented that antacids have been shown to reduce the absorption of iron ,also patients taking antacids for digestive complaints may prove to have gastrointestinal disease and that all is related to IDA ,(Kepczyk et al , 1999).

A study in Journal of Internal Medicine, used data from more than 50,000 patients and showed that continuous anti acid, increased the risk of iron deficiency. People using one tablet of 20 mg anti acid or more daily had a higher risk of iron deficiency compared with people using less than one tablet daily (Tran et al, 2018)

5.3. Nutritional factors

Dietary iron is found in a variety of foods, seafood, green leafy vegetables, dark chocolate, beef liver, and nuts, also ,iron-fortified foods include cereal and most other grain products, , but iron is particularly high in red meats and so, meats regulations are implemented by the Food and Drug Administration (FDA). People who consume diets with little to no intake of meats or iron-fortified foods, such as vegans and vegetarians, have a great need for any other sources of iron (National Institutes of Health, 2015)

In this study most of the cases were taking iron tablets for treating anaemia, in different dosage as follow: 11.1% one tablet/day, 77.2% two tablets/day, and 10.5% three tablets/day, and this means that there is no problem in compliance which has lead us to think in another causes such as the nutrition . There is no significant

difference between the cases and the controls in (Dizziness, nausea, vomiting , pallor, dyspnoea or constipation) symptoms in the studied population ,But anaemic women had 1.3 times more to suffer from stomach pain, and 1.2 times from Anorexia. This is might be because these are the most tow common symptoms occur in the first and third trimester. There are more than 60 studies in meta-analysis on the use of iron supplements in pregnancy. A total of more than 40,000 women took part in the studies and the results show that, if women have normal iron levels, taking 30 mg of iron per day as a prophylaxis doesn't have any noticeable health benefits for them or for their children. Although iron supplements were found to lower the risk of anaemia, they didn't influence the number of preterm births, the number of babies with a low birth weight (under 2,500 grams) or infections in pregnant women (Pena-Rosas ,2015).

Calcium

The recent results showed that IDA is positively associated with regular intake of Calcium supplement , Some studies in young women have found no effect of calcium supplementation on serum ferritin or hemoglobin concentrations   (Sokoll   et al ,1992).

Some studies have investigated whether milk product consumption may impact iron absorption. In a randomized crossover trial over 4 days, the consumption of a glass of milk with 3 main meals, or the consumption of calcium-fortified foods providing an equivalent amount of calcium, did not inhibit nonheme-iron absorption (Grinder, 2004), Another study, found that the addition of milk or yogurt to a plant-based diet did not affect iron bioavailability (Rosado et al 2005), the calcium in our study is pure supplemental and for long term which might cause the observed difference.

Ascorbic acid (vitamin C)

Vitamin C is protective from IDA with negative association with it , It has a strong iron absorption promoting potential effect. In this study , the effects of   iron, and vitamin c intake was protective agent (OR: 1.129,1.060, respectively) and these effects were statistically significant to prevent anaemia.

 Ascorbic acid supplements or an increased intake of ascorbic acid rich foods could have important public health implications on IDA , especially in populations on a mainly plant food based diet (Institute of health ,2015).

The main enhancers of non-haem iron absorption are ascorbic acid (WHO, 2015).

Macronutrient

The means of proteins, carbohydrates, fats, were 36.5 g, 73.8g, 32.5 g, per day among cases, respectively. There were significance differences in means of these nutrients intake (except fat) between cases and controls.

The result has been shown that there are effects of protein, iron, and vitamin c intake for not getting anemia (OR: 1.128, 129, 1.060), respectively ($p< 0.005$) and these effects are negatively associated and statistically significant.

Participants' fat and carbohydrates intake are not enough to protect from getting anemia. (OR: 1.055, 1.017 respectively), (p =0.062).

The effects of protein were statistically significant as protective agent from IDA.

Protein is one of the iron absorption enhancer as shown in sharma et al whom conclude that Iron absorption can be increased by enhancers (haem, proteins, ascorbic acid and fermentation) and decreased by inhibitors (phytic acid, fibres, calcium, tannins, tea, coffee, chocolate and herbal infusion) ,(Sharma et al , 2003).

The evidence showed that dietary factors such as low consumption of red meat, vegetables, cereals and fruits have been reported to be associated with IDA.(Institute of health ,2015).

Literature also revealed that consumption of heme iron rich food sources (chicken) were associated with lower prevalence of anemia (Belachew et al 2006)   . This could be because chicken is a rich source of heme iron, which is highly bioavailable and has an enhancing effect on non-heme iron absorption and that reflect the negative association between protein and IDA (Belachew et al 2006)

An intervention study investigating the effect of adding protein or phytate (in the form of soy protein) ,It is found that serum ferritin concentrations increased when women consumed either 40 g of soy protein isolate or whey protein per day as a meal replacement over a 24 week period(Swain et al 2002).

Inadequate intake of chicken as source of protein and heame iron, may increase the occurrence of IDA (Monsen et al 1982).

WHO stated that in developing countries inadequate intake of dietary iron is the main causes of anemia during pregnancy (De Benoist 2005).

The results of this study are compatible with the WHO diet recommendations for the IDA patients.

WHO recommendation for diet for IDA adult (who, 2016):

1- High protein and low carbohydrates diet.

2- Getting adequate daily protein from meat, soy or plant food combinations such as beans or lentils with rice.

3- Reduce or eliminate refined sugar from the diet.

4- Small amounts of honey or molasses are allowed.

5- Cut the complex carbs (whole grains) from the diet.

6- The iron in fruits and vegetables is not easily absorbed, these food items are essential for nutrients such as vitamin which is enhancer for iron absorption.

Chapter Six: Conclusion and Recommendations

6.1. Conclusion

This study is consistent and correlated with many others studies in addressing the association between socio-demographic, gynaecological and obstetrical factors .
The nutritional factors mainly the negative association of iron, vitamin , protein with IDA in pregnancy was the main conclusion

It is observed that the some of the aetiologies of iron deficiency remains the same over the decades. i.e. multiparty, short birth spacing, poor socio economic status. Lack of education about the effect of the nutritional factors and the bad dietary habits is responsible for high prevalence of IDA in pregnancy in West –Bank .

The prevention of IDA in pregnant women depend on the level of knowledge about nutritional factors that may associates with IDA , early and successful utilization of iron supplementation ,diagnostic tools and treatment options.

It is not only needed to prevent anaemia by supplementation but also to address the nutritional factors, the socio-economic and cultural factors associated with it . All of these factors should be enhanced in line with the Millennium Development Goals .These goals include eradicating extreme poverty, reducing child mortality rates, improving maternal health, fighting disease and epidemic, and developing a global partnership for development and they all will help to prevent anaemia in pregnancy

6.2. Recommendation

-For MoH :

1- To continue its strategy in IDA prevention and treatment and to introduce a comprehensive health education program through patient counselling, and more nutritional education to raise awareness among IDA pregnant women.

2- Create integration between clinics and hospitals systems for better management of IDA pregnant and to know the exact outcome on the lady and her baby. It is also important to ensure completeness of patient files .

3- Implementation of health promotion program targeted the pregnant women and their families about nutritional iron deficiency anaemia.

-For future research :

1- Longitudinal studies in depth to study the cause-effect relationship between the nutritional factors and IDA.. This could be useful for decision makers to plan properly for IDA in Palestine

2- Further research and individualized education about nutrition and its crucial association with IDA in pregnancy is necessary.

6.3. Limitations

In this study Hb and MCV level were used to diagnose anaemia instead of using Ferritin level based on studies conducted by WHO.

The time and unavailability of fund were important limitations

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8. APPENDICIES

أنا الباحثه **نيفين وجيه الشلالفه** من كليه الصحه العامه –جامعه القدس , أدعو حضراتكن للمشاركه في هذه الدراسه بعنوان (العوامل التغذويه التى قد تؤدي الى فقر الدم في السيدات الحوامل في الضفه الغربيه)من خلال تعبئه الاستبيان المرفق ,ونؤكد لك ان هذه الدراسه علميه وسوف يتم التعامل مع المعلومات بسريه تامه ولن تتم مشاركتها مع أي شخص أو استخدامها بشكل شخصى .

المشاركه طوعيه بشكل كامل وبامكانكن رفض المشاركه , وان اخترتن المشاركه يرجى الاجابه على جميع الأسئله بشكل واضح ودقيق .

سيتم تعبئه هذا الجزء من قبل الباحثه :

الطول (سم)	
الوزن قبل الحمل (كغم)	
الوزن الحالي (كغم)	
عمر الحمل الحالي (أسبوع)	

<u>**القسم الأول :**</u>

<u>**معلومات عامه عن المشاركه :**</u>

1- الاسم (اختياري)..

2- تاريخ الميلاد ....

3- مكان السكن   1-مدينه   2-قريه   3-مخيم

4- رقم الهاتف (اختياري)...............

<u>**القسم الثاني:**</u>

<u>**معلومات اقتصاديه واجتماعيه :**</u>

1- عدد أفراد الأسره المتواجدين في المنزل

     1- 2-5 أفراد

     2- 6-10 أفراد

     3- أكثر من 10

2- المهنه ؟؟ 1-تعمل , ماهو عملك ....   2- لا تعمل

3- دخل الأسره الاجمالى (بالشيكل)

     1- أقل من 1000

     2- من 1000 – 3000

     3- أكثر من 3000

4- نوع السكن الحالى   1- ملك   2-ايجار

5- عدد سنوات الدراسه (المدرسه وما بعدها) ؟.................... سنه

<u>**القسم الثالث :**</u>

<u>**نمط الحياه والحاله الصحيه العامه :**</u>

1- هل لديك تامين صحي   1-نعم   2-لا

2- هل تم تشخصيك (عن طريق الطبيب)بفقر دم الحديد في اي حمل سابق ؟

     1-نعم

     2-لا

3- هل أخبرك الطبيب أو الممرضه بأنك تعانين من فقر دم الحديد في هذا الحمل ؟؟   1-نعم   2-لا

6-في حال الاجابه بنعم عن السؤال الخامس, ماهي خطه العلاج التى تتبعينها؟(يمكن اختيار أكثر من اجابه)

1- حميه غذائيه
2- أدويه

6_ اذا كنت تتبعين علاجا دوائيا فما نوعه ؟
1- أقراص الحديد
2- الحديد عن طريق الوريد

7- اذا كنت تتبعين العلاج الدوائى(أقراص الحديد) فما عدد الأقراص التى تأخذينها؟

1- واحده يوميا
2- اثنتان يوميا
1- ثلاثه أقراص يوميا.

8-هل تتناولين أقراص الحديد في الحمل الحالي بانتظام ؟   1- نعم   2- لا

9-اذا كانت الاجابه لا فما هو السبب لعدم تناولك اقراص الحديد؟(يمكن اختيار أكثر من اجابه)

1- النسيان
2- لانها تسبب أعراض جانبيه مزعجه مثل الامساك او الم المعده
3- انت غير مقتنعه انها مهمه في الحمل
4- خوفا من ان يكون لها تأثير على الجنين
5-لا يوجد سبب محدد لكن لا احب اخذ اي ادويه

10-هل تأخذين أي من الأدويه التاليه بشكل مزمن ؟

(ستقوم الباحثه بمساعدتك للاجابه عن هذا السؤال).

الدواء	نعم	لا
ادويه مضادات الحموضه RECEPTOR H2 ANTAGONEST		
مقويات الكالسيوم		
ادويه نشاط الغده الدرقيه LEVOTHYROXIN		

11- هل تدخنين (السجائر أو الأرجيله) حاليا: 1-نعم   2- لا

في حال الاجابه بنعم :

82

أدخن سجائر بمعدل ....في اليوم ؟

1- أقل من علبه

2- 1-3 علب

3- أكثر من 3 علب.

أدخن الأرجيله بمعدل ....رأس في الاسبوع ؟

1- 1-2

2- 3-4

3- 5 أو أكثر .

12- هل كنت تدخنين سابقا؟   1-نعم   2-لا

13-منذ متى تركت التدخين ؟

1- أقل من ست شهور

2- من 6شهور الى 11 شهر

3- من سنه الى 3 سنوات

4- أكثر من 3 سنوات

5- منذ بدايه الحمل الحالى

14-كم معدل ساعات نومك ؟

1- أقل من 4 ساعات

2- من 4- 6 ساعات

3- من 7- 8 ساعات

4- أكثر من 8 ساعات

القسم الرابع :

الصحه الانجابيه

1- ما هو ترتيب الحمل الحالي ؟

2- الاول

3- الثاني

4- الثالث

5- الرابع

6- الخامس

7- أكثر من 5

2- كم عدد الاجهاضات التى تعرضت لها ؟(الاجهاض هو فقدان الحمل بعمر أقل أو يساوي 24 اسبوع)

1- لم اتعرض لأي اجهاض

2- 2

3- 3

4- أكثر من ثلاثه

3- اذا لم يكن هذا حملك الاول فما هي الفتره ما بين الحمل السابق وهذا الحمل ؟

1-أقل من سنه

2-1-2 سنه

1- 3-2سنوات

4-أكثر من 3 سنوات

4- هل تعانين من نزيف مهبلي في الحمل الحالي ؟   1- نعم   2- لا

5- هل عانيت أو تعانين من أي من هذه الاعراض اثناء الحمل الحالي (ضعى x في المكان المناسب)

العرض المرضى	نادرا	أحيانا	غالبا
الدوخه والغثيان			
التقيؤ			
فقدان الشهيه			
شحوب الوجه			
الامساك			
ألم في المعده			
ضيق التنفس			

6- هل تراجعين مركز الامومه والطفوله بانتظام ؟   1- نعم   2- لا

7- اذا كانت الاجابه لا فهل تراجعين طبيب مختص بالحمل والولاده في القطاع الخاص ؟

1- نعم   2- لا

8- هل الدوره الشهريه منتظمه ؟   1- نعم   2- لا

9- كم عدد ايام الدوره الشهريه ؟

1- أقل من 3 ايام

2- 3-6 أيام

3- 7-10 أيام

4- أكثر من ذلك

10- تعتبر دورتك الشهريه ؟
1- خفيفه
2- متوسطه
3- ثقيله
4- ثقيله جدا

11-   هل استخدمت أ ي من موانع الحمل قبل الحمل الحالي ؟ 1-نعم   2-
لا

12-   اذا كانت الاجابه نعم فما هي الوسيله التى تم استخدامها ؟
1- اقراص منع الحمل
2- اللولب
3- العوازل المطاطيه
4- الابر مانعه الحمل
5- غير ذلك , مثل ....

13-   ماهى المده الزمنيه التى استخدمت بها هذا المانع؟
1- أقل من سنه
2- 1-2 سنه
3- 2-4 سنه
4- أكثر من 4 سنوات

الجزء الخامس :

المعلومات الغذائيه:

1- أتناول يوميا .... وجبات , الوجبه هي (حاله من حالات الأكل التى تكون في زمن محدد ويتناول الناس فيها أغذيه تم اعدادها وتجهيزها مثل الفطور ,الغداء,العشاء)
1- وجبه واحده
2- وجبتين
3- 3 وجبات
4- أكثر من 3 وجبات

2- كيف تتغير شهيتك نحو الاكل في الحمل ؟
1- تزيد
2- تنقص

الرجاء تعبئه الجدول المرفق لمده ثلاث أيام (بما فيها يوم العطله)بكافه أنواع الطعام التى تم تناولها طيله اليوم وكمياتها (ستساعدك الباحثه في ذلك),

التاريخ ....   اليوم ....

الوصف(مشوي. مقلى.مطبوخ)	الكميه	نوع الطعام	الوجبه
			الافطار
			وجبه خفيفه
			الغداء
			وجبه خفيفه
			العشاء
			وجبه خفيفه

عنوان البحث :

The Nutritional factors affecting Iron Deficiency Anemia among Pregnant Women in the West Bank

الموقع: حيث سيتم اجراء الدراسة في عيادات الرعاية الاولية التابعة لوزارة الصحه الفلسطينيه في نابلس ورام الله والخليل .

أنا الباحثه نيفين وجيه شلالفه أقوم ببحث بعنوان :

The Nutritional factors affecting Iron Deficiency Anemia among Pregnant Women in the West Bank

هذا البحث يهتم بدراسة العوامل التغذويه المؤديه الى فقر دم الحديد لدى النساء الحوامل في الضفه الغربيه , من خلال هذه الدراسة سأقوم بتجميع معلومات من ملفاتكن لها علاقة بنتائج الفحوصات الطبية خاصه فحص الدم والسيره النسائيه الطبيه والصحيه وكذلك تعبئة استبانة من خلال توجيه الاسئلة لكن وتعبئه السجل الغئائي لمده ثلاثه أيام , لن تستخدم هذه ا لمعلومات الا لاغراض البحث العملي فقط . كمشاركه فى هذا البحث العلمى لك الحرية في طرح أى سؤال أو إستفسار عن هذا البحث خلال اي مرحله من المرحل. يرجى العلم بأن المشاركة بهذا البحث عمل طوعي بحت ولكن الحرية المطلقة بالموافقة او عدمها. قراركم بعدم المشاركة فى هذا البحث العلمى لا يترتب عليه اى تبعات.

لقد قرأت الوصف أعلاه من هذه الدراسة. وقد تمت الاجابة على جميع أسئلتي. وأنا أعلم أنه يمكنني ان ارفض المشاركة. أعطي موافقتي بحرية على المشاركة في هذه الدراسة . اسم المشارك .... توقيع المشارك: ....

الباحث: نيفين شلالفه

رقم الهاتف **0597117959**

مشرفه الدراسه: د.أميره عمرو