**Sudan University of science & technology**

**College of graduate studies**

# Study of effect of Diabetes and Hypertension on placental Grading In Second and Third Trimester Using Ultrasonography

**دراسة أثر مرض السكري وارتفاع ضغط الدم على درجات تكوين المشيمة في فترة الحمل الثانية والثالثة باستخدام التصوير بالموجات فوق الصوتية**

***A Thesis Submitted for Partial Fulfillment for the Requirement of (M.Sc).Degree in Medical Diagnostic Ultrasound***

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# الآية

قال تعالى:

[قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ]

صدق الله العظيم
سورة البقرة: الآية (32)

## Dedication

This research is dedicated to my:

Father

Mother

Brothers

Sisters

Friends

## Acknowledgement

I thank almighty God for giving me the strength ,courage and determination in conducting this study, despite all difficulties.

My sincere thanks and appreciation to Dr Mona Ahmed Mohammed for her help me to arrange my thoughts, words and data together.

My thanks must go to Dr Ahmed Mustafa Abu Kona who helped me for data analysis

Also my thanks for my colleagues I thanks them for their good natured support during collection of data. helped me to collect data.

## Abstract

The aim of the study was to determine the effect of diabetes and hypertension on placental grading in second and third trimester using ultrasonography.

Analytical observational study was performed at Giad hospital and Elkamleen hospital in Elgezira state

Study was carried out from (August to November 2018) on 70 pregnant women in second and third trimesters in group of age between 15to 40 years old were chosen by random sampling technique.

The study includes 35 normal pregnancies as control group, 35 diabetes and hypertensions as study group.

The study exclude twins pregnancies, IUGR, maternal systematic lupus Erythematous , maternal thrombotic disorder, Rh, smoking and torch syndrome.

Used longitudinal and Transvers scanning to find placental grading and gestational age.

Data collection sheet was designed to include all variables of the study (maternal age, gestational age in second and third trimester, normal cases, DM, HT and placental grading).

Study found that grades zero and one were more common in second trimester 15% and 56%respectively.

Grade two and three were more common in third trimester both are 37%.

The study showed diabetes effects on placental maturity agree with (Edu 2016).

Hypertension had no effect on placental maturity agree with (JDMS 2017).

The study recommended more research should be done with increased sample volume for more accurate results.

**المستخلص**

هدفت هدف الدراسة إلى تحديد أثر السكري وارتفاع ضغط الدم على درجات تكوين المشيمة في فترات الحمل الثانية والثالثة باستخدام التصوير بالموجات فوق الصوتية، هذه الدراسة وصفية تحليلية أجريت بمستشفى جياد ومستشفى الكاملين بولاية الجزيرة.

أجريت الدراسة في الفترة بين أغسطس إلى نوفمبر 2018م، وقد اختير عينة عشوائية من 70 حالة من الحوامل في الفترة الثانية والثالثة، حيث تراوحت أعمارهن بين 15–40 سنة، وقد اشتملت العينة على 35 حالة طبيعية كمجموعة ضابطة و35 حالة مصابة بالسكري وارتفاع ضغط الدم كمجموعة دراسة.

استبعدت الدراسة حمل التوائم، تأخر النمو داخل الرحم، الذئبة الحمراء للأمهات، عدم توافق الفصيلة، متلازمة تورش، والتدخين. استخدم المسح الطولي والعرضي لإيجاد درجات تكوين المشيمة والعمر الحمل.

صممت استمارة لجمع البيانات ضمنت جميع متغيرات الدراسة (عمر الأم، عمر الحمل، الحالات الطبيعية وحالات مرض السكري وحالات ارتفاع ضغط، ودرجات تكوين المشيمة) وتم تحليل البيانات باستخدام برنامج التحليل الإحصائي (SPSS).

وجدت الدراسة أن درجات تكوين (0)، (I) كانت أكثر شيوعاً في فترة الحمل الثانية حيث كانت (15%) و(56%) على الترتيب، أما درجات تكوين (II) و(III) أكثر شيوعاً في فترة الحمل الثالثة وكلاهما (37%). كما أظهرت الدراسة أن مرض السكر يسبب نقصان في درجات تكوين المشيمة، حيث توافقت مع دراسة (Edu, 2016). وأن ارتفاع ضغط الدم لا يسبب تعجيل في درجات تكوين المشيمة.

أوصت الدراسة بزيادة عدد الحالات في الدراسات القادمة لحصول على نتائج أدق.

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## Abbreviation

| | |
|---|---|
| **IUGR** | Intra Uterine Growth Retardation |
| **DM** | Diabetes Mellitus |
| **HT** | Hypertension |
| **RH** | Rhesus Incompatibility |
| **BPD** | Bi Parietal Diameter |
| **FL** | Femur Length |
| **USG** | Ultra Sonography |
| **SPSS** | Statistical Package for Social Science |
| **TAS** | Trans Abdominal Sonography |
| **TVS** | Trans Vaginal Sonography |

# Chapter One

# Introduction

# Chapter One

# Introduction

## 1.1 Introduction:

The placenta is a fetal organ so it should mature in a fasion similar to that of other fetal organs system. placenta phases of maturation first categorized by granum et al, at 1979 to four grades of maturation according to ultrasonographic variation in placental appearance occurring during gestation.

Grade o chorionic plate appears as asmooth, straight and well defined un broken dense line.

Grade I chorionic plate appears as awelldefinedun broken line but assume may subtle indentation

Grade II chorionic plate develops more marked indentation

Grade III chorionic plate appears interrupted by the indentation (Saliha 2009).

Diabetes mellitus is a common medical complication during pregnancy with maternal and fetal complications including complication specific to pregestational diabetes like nephropathy and Ketoacidosis.Gestational diabetes is defined as carbohydrate intolerance in hyperglycemia of variable severity with onset of first recognition during pregnancy.

It is a major cause of perinatal morbidity and mortality and a significant contributor to bad obstetric history.(Karmkar 2010).

Hypertension is defined as blood pressure higher than 140/ 90mm Hg. The condition is serious concern for some pregnant women.

High blood pressure during pregnancy isn't always dangerous. But it can sometimes cause seven health complicationsfor both mother and developing baby. There are several possible causes of high blood pressure during pregnancy, these include: being overweight or obese, failing to stay active, smoking, drinking alcohol women experiencing their first pregnancy are more likely to have high blood pressure. (Willson, 2017).

## 1.2 Problem of the study:

Different complications associated with Diabetes Mellitus and Hypertension effect on placental grading.

## 1.3 Objectives:

### 1.3.1 General Objective:

To study effect of diabetes mellitus and Hypertension on placental grading in second and third trimester using ultra sonography

### 1.3.2 Specific Objectives:

To determine relation between placental grading and gestational age in second and third trimester.

To compare placental grading between control group and study group

To find the relation between grading and DM and HT.

## 1.4 Over view of study:

- Chapter one ;introduction
- Chapter two ;theoretic l review
- Chapter three ;material and methods
- Chapter four ;result
- Chapter five ;discussion, conclusion and recommendation
- References
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# Chapter Two

# Theoretical background and Previous Studies

# Chapter Two

# Theoretical background and Previous Studies

## 2.1 Theoretical background

### 2.1.1 Placenta Embryology:

As the fetus grows, its demands for nutritional and other factorsincrease, causing major changes in the placenta. Foremost among these isan increase in surface area between maternal and fetal components tofacilitate exchange. (Sadler 2004).

**a. Changes in the Trophoblast**

By the beginning of the second month, the trophoblast is characterized by a great number of secondary and tertiary villi that give ita radial appearance. The villi are anchored in the mesoderm of thechorionic plate and are attached peripherally to the maternal decidua byway of the outer cytotrophoblast shell. The surface of the villi is formedby the syncytium, resting on a layer of cyto trophoblastic cells that in turncover a core of vascular mesoderm .The capillary system developing inthe core of the villous stems soon comes in contact with capillaries of thechorionic plate and connecting stalk, thus giving rise to the extraembryonic vascular system. (Sadler 2004)

During the following months, numerous small extensions sprout fromexisting villous stems into the surrounding lacunar or intervillous spaces.

Initially these newly formed villi are primitive, but by the beginning of the fourth month, cyto trophoblastic cells and some connective tissue cellsdisappear. The syncytium and endothelial wall of the blood vessels arethen the only layers that separate the maternal and fetal circulations.

Frequently the syncytium becomes very thin, and large pieces containingseveral nuclei may break off and drop into the intervillous blood lakes.

These pieces, known as syncytial knots, enter the maternal circulation andusually degenerate without causing any symptoms. Disappearance of

cytotrophoblastic cells progresses from the smaller to larger villi, andalthough some always persist in large villi, they do not participate in theexchange between the two circulations.(Sadler 2004).

**b. Chorion Frondosum and Decidua Basalis**

In the early weeks of development, villi cover the entire surface ofthe chorion. As pregnancy advances, villi on the embryonic pole continueto grow and expand, giving rise to the chorionfrondosum (bushychorion). Villi on the a n embryonic pole degenerate and by the thirdmonth this side of the chorion, now known as the chorion laeve, is smooth. (Sadler 2004).

The difference between the embryonic and ab embryonic poles of the chorion is also reflected in the structure of the decidua, the functionallayer of the endometrium, which is shed during parturition. The deciduas over the chorionfrondosum, the decidua basalis, consists of a compactlayer of large cells, decidual cells, with abundant amounts of lipids andglycogen. This layer, the decidual plate, is tightly connected to the chorion. The decidual layer over the abembryonic pole is the deciduas capsularis. With growth of the chorionic vesicle, this layer becomesstretched and degenerates. Subsequently, the chorion laeve comes in tocontact with the uterine wall (decidua parietalis) on the opposite side ofthe uterus and the two fuses, obliterating the uterine lumen. Hence theonly portion of the chorion participating in the exchange process is thechorion frondosum, which, together with the deciduasbasalis, makes upthe placenta. Similarly, fusion of the amnion and chorion to form the samniochorionic membrane obliterates the chorionic cavity. It is thismembrane that ruptures during labor (breaking of the water). (Sadler2004).z

**2.1.2 Structure of the Placenta**

By the beginning of the fourth month, the placenta has twocomponents: (*a*) a fetal portion, formed by the chorionfrondosum; and(*b*) a maternal portion,formed by the decidua basalis. On the fetal side,the placenta is bordered

by the chorionic plate; on its maternal side, it isbordered by the decidua basalis, of which the decidual plate is mostintimately incorporated into the placenta. In the junctional zone,trophoblast and decidua cells intermingle. This zone, characterized bydecidual and syncytial giant cells, is rich in amorphous extracellularmaterial. By this time most cytotrophoblast cells have degenerated.

Between the chorionic and decidual plates are the intervillous spaces ,which are filled with maternal blood. They are derived from lacunae in the syncytio trophoblast and are lined with syncytium of fetal origin. Thevillous trees grow into the intervillous blood lakes. During the fourth andfifth months the decidua forms a number of decidual septa, which project in to intervillous spaces but do not reach the chorionic plate. These septahave a core of maternal tissue, but their surface is covered by a layer ofsyncytial cells, so that at all times a syncytial layer separates maternal blood in inter villous lakes from fetal tissue of the villi. As a result of thisseptum formation, the placenta is divided into a number of compartments,or cotyledons. Since the decidual septa do not reach the chorionic plate ,contact between inter villous spaces in the various cotyledons ismaintained. (Sadler 2004)

As a result of the continuous growth of the fetus and expansion ofthe uterus, the placenta also enlarges. Its increase in surface area roughlyparallels that of the expanding uterus and throughout pregnancy it coversapproximately15 to 30% of the internal surface of the uterus. Theincrease in thickness of the placenta results from arborization of existing villi and is not caused by further penetration intomaternal tissues. (Sadler 2004).

### 2.1.3 Full Term Placenta

At full term, the placenta is discoid with a diameter of 15 to 25 cm,is approximately 3 cm thick, and weighs about 500 to 600 g. At birth, it istorn from the uterine wall and, approximately 30 minutes after birth ofthe child, is expelled from the uterine cavity. After birth, when theplacenta is viewed from

the maternal side, 15 to 20 slightly bulging areas,the cotyledons, covered by a thin layer of decidua basalis, are clearly recognizable. Grooves between the cotyledons are formed by decidual septa. (Sadler 2004)

The fetal surface of the placenta is covered entirely by the chorionicplate. A number of large arteries and veins, the chorionic vessels ,converge to war dthe umbilical cord. The chorion, in turn, is covered bythe amnion. Attachment of the umbilical cord is usually eccentric andoccasionally even marginal. Rarely, however, does it insert into thechorionic membranes outside the placenta (velamentous insertion).(Sadler 2004).

### 2.1.1.1 Placenta grading:

The placenta is a fetal organ so it should mature in a fashion similar to that of other fetal organ systems. Placental phases of maturation first categorized by Grannum et al, at 1979 to four grades (G) of maturation (0, I, II, III) according to ultrasonographic variation in placental appearance occurring during gestation.

#### 2.1.1.1.1Grade (0) :

The chorionic plate appears as a smooth, straights, and well defined unbroken dense line. This can be seen as early as 12 weeks gestation. The placental substance appears to be homogeneous and devoid of any outstanding echogenic areas. The basal layer also appears homogenous and of the same texture as

theplacental substance.This grade is seen in the first and second trimester.

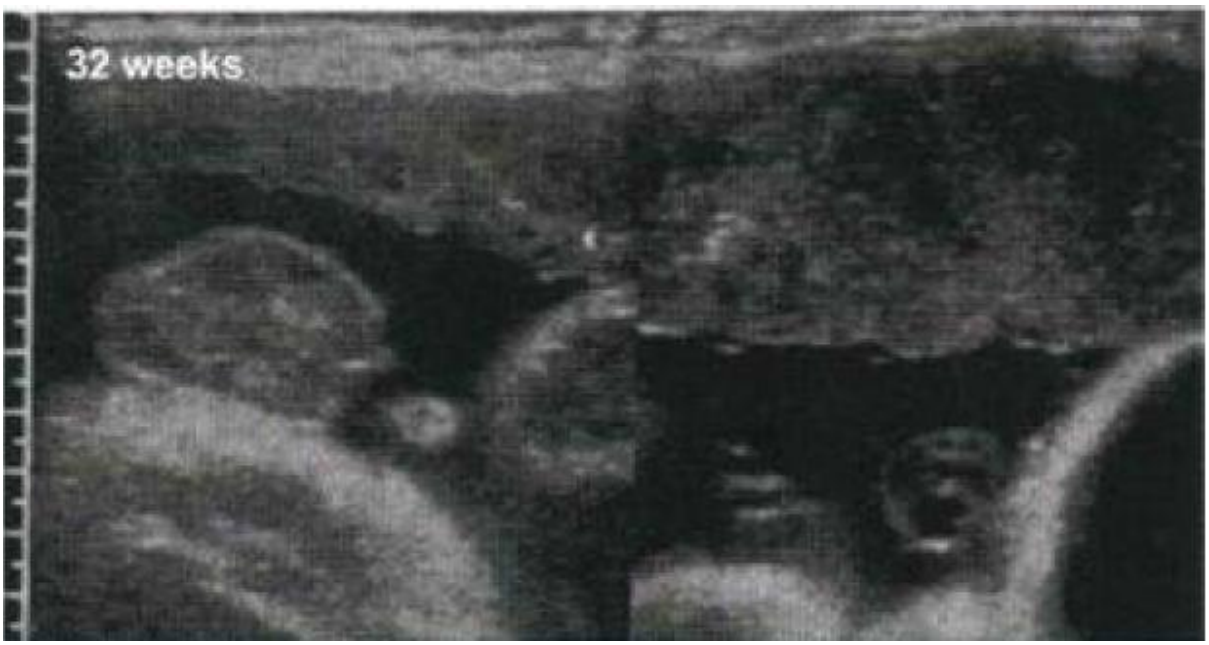


**Figure 2.1 Grade 0 PlacentaLinear array image of an anterior placenta at 32 weeks gestation shows no evidence of placental calcification**

( Burwin Institute Notes 2005).

### 2.1.1.1.2Grade (I) :

The grade I placenta manifests the earliest ultrasonic changes of placental maturation. The chorionic plate appears as a well- defined unbroken line but assumes many subtle undulation. Few scattered echogenic areas (EGAs) appears in the placental substance resulting in a loss of homogenicity. EGAs appear as densities Measuring approximately 1 to 4 mm in length and have their long axis parallel to the basal layer. This grade is usually first noted from as early as 30 to 32 weeks and may persist until term.

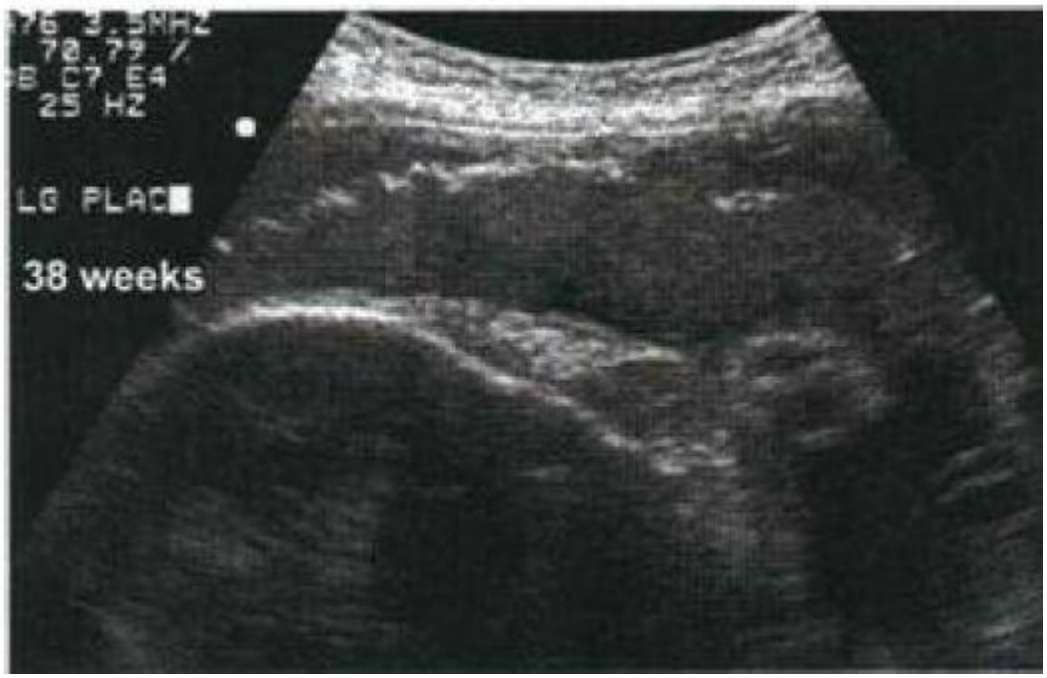


**Figure2-2 Grade 1 Placenta anteriorplacenta at 32 weeks gestation**

( Burwin Institute Notes 2005)..

### 2.1.1.1.3Grade (II) :

The maturational changes in the grade II placental scans involve changes in all three zones. The chorionic plate develops more marked indentations. The placental substance appear to be incompletely divided by the appearance of linear or comma-like echogenic densities that are contiguous with the marked indentations of the chorionic

Plate.It should be noted that at this phase the linear echogenic densities do not reach the basal layer. The EGAs within the placental substance also appear to be more numerous and slightly larger than those in Grade I. The basal layer becomes punctuated with linear echoes which are arranged with their long axis parallel to the basal layer. These areas are larger and more dense than the EGAs which are randomly dispersed inthe placental substance.

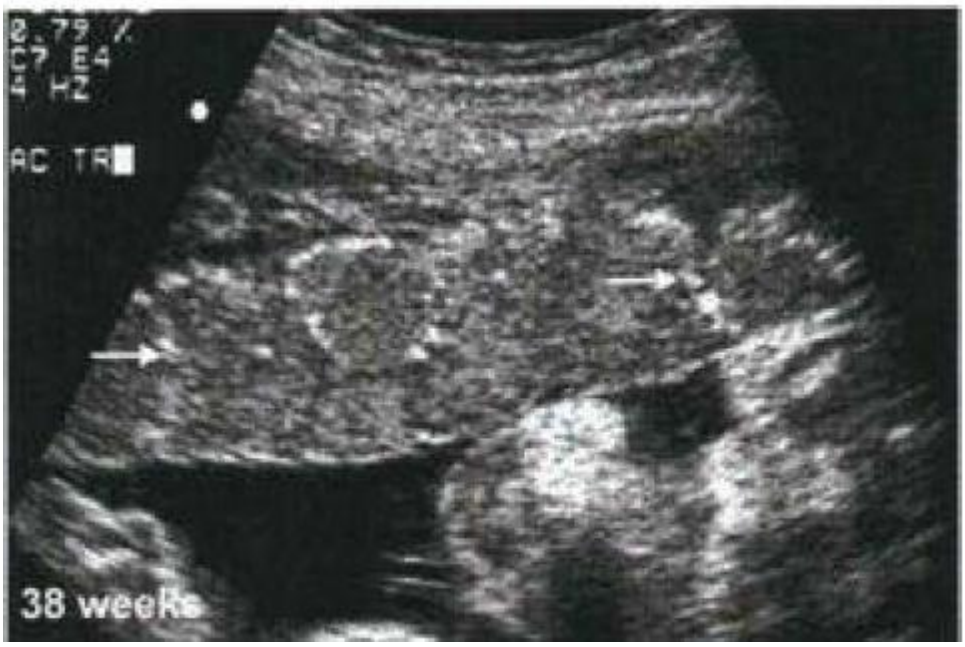


**Figure 2-3 Grade 2 Placenta Anterior placenta at 38 weeks gestation**

( Burwin Institute Notes 2005).

### 2.1.1.1.4Grade (III):

This phase represents the mature placenta. The chorionic plate appears interrupted by the indentations. Which now extend to the basal layer and probably represent the inter cotyl donary septa.These are contiguous with linear echogenic densities. As a result, the placental substance become divided into compartments which presumably demarcate the cotyledons. The central portion of these compartments shows echo sparedor "fallout" areas. In addition, dense, irregularly shaped, echogenic areas appear close to the chorionic plate. They cast acoustic shadows and may measure up to 2 cm in diameter. The echogenic area at the basal layer become larger, more dense, and confluent and in some cases may cast acoustic shad It should be noted that a given placenta may have more than one grade if different sections are examined. In evaluating each scan in this series, the grade assigned corresponded to the most mature portion of the placenta assessed. It is obviously important to visualize as much placental tissue as possible.

(saliha2009)

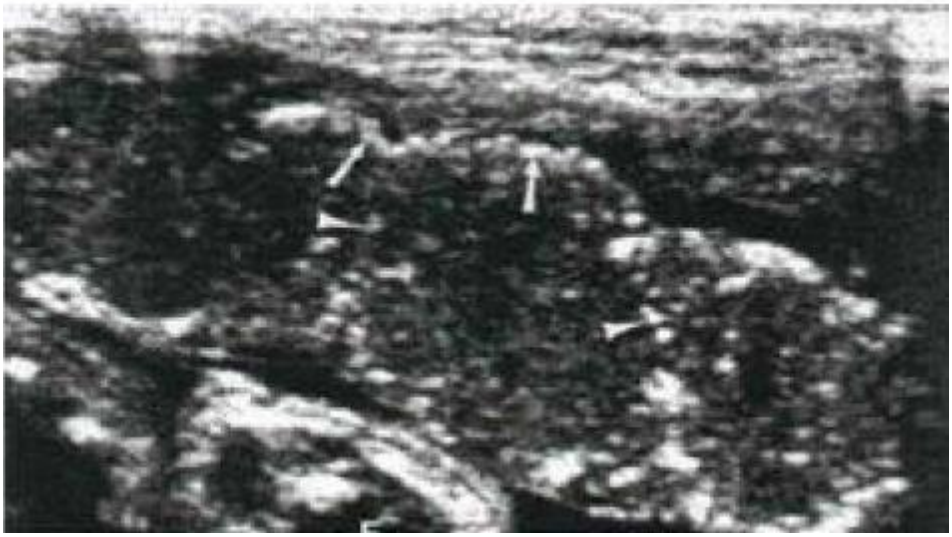

**Figure 2-4 Grade 3 Placenta an anterior placenta**

( Burwin Institute Notes 2005)

### 2.1.2 Placenta Function:

**2.1.2.1** Supply adequate nutrition :Before blood reaches baby it travels through the placenta to reach the umbilical cord that connect mother with baby.

**2.1.2.2** Act like thes kidney; it fillers the blood to dominate the harmful substance that might be hazardous to the health of baby.

**2.1.2.3** Brings backs the bio wastes of baby to system of circulation of mother, which is later discarded from mother baby through the urine.

**2.1.2.4**Itsaves baby form probable infections by separating the blood of mother from baby, thus acting like a filter.

**2.1.2.5** Many hormones are produced from the placenta in mother baby with maximum count of placental lactose that ensure mother has enough level of glucose in blood which enable it to circulate it to baby.

**2.1.2.6** Breaks down the food particles consumed by mother to enable the nutrition to reach faster.

**2.1.2.7**It traps the oxygen inhaled by mother to diffuse into the blood to help it reach the circulation system of baby pathing it through to help it umbilical cord.

It prevents the chance that can make baby form inhaling the amniotic fluids, where can be disastrous.

**2.1.2.8**During the stage of pregnancy, placenta moves while the womb of mother expands and grows. It is the common function of placenta to stay low in the early stages of pregnancy to keep the cervix open for delivery.

**2.1.2.9** The placenta also serves as baby's lung and allows the transmission of oxygen to baby.

**2.1.2.10** The placenta secrets a vast count of female hormones like progesterone and estrogen to stop probable contractions of the uterus before baby has reach the full terms. It also pares way to prepare the maternal tissues and the uterus for baby's delivery.(Dhviya2017)

**2.3.1 Pathology of placentas:**

**2.1.3.1 Placenta previa:**

Placenta previa is defined as a placenta implanted in thelower segment of the uterus, presenting ahead of theleading pole of the fetus. It occurs in 2.8/1000 singletonpregnancies and 3.9/1000 twin pregnancies1 and representsa significant clinical problem, because the patient may needto be admitted to hospital for observation, she may needblood transfusion, and she is at risk for premature delivery.The incidence of hysterectomy after Caesarean section (CS)for placenta previa is 5.3% (relative risk compared withthose undergoing CS without placenta previa is 33).2Perinatal mortality rates are three to four times higher thanin normal pregnancies.3,4The traditional classification of placenta previa describesthe degree to which the placenta encroaches upon the cervixinlabour and is divided into low-lying, marginal, partial,or complete placenta previa.5 In recent years, publicationshave described the diagnosis and outcome of placentaprevia on the basis of localization, using transvaginalsonography(TVS) when the exact relationship of the placentaledge to the internal cervical os can be accurately measured.The increased prognostic value of TVS diagnosis

hasrendered the imprecise terminology of the traditional classificationobsolete.6 This guideline describes the current diagnosisand management of placenta previa and is basedlargely on studies using TVS.(Arsmon ,2007)

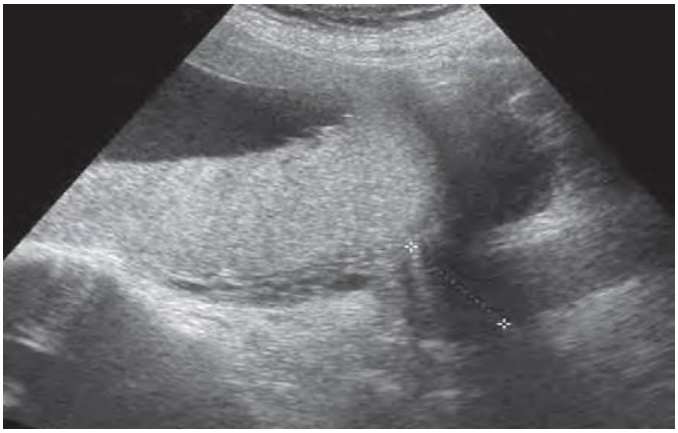

**Figure 2-5 complete placenta previa(Rumak, 2011).**

### 2.1.3.2 Abruptio:

Placetal abruption is the acute separation of the placenta from the uterus prior to delivery of the fetus. The symptoms include pain, uterine tenderness and abdominal pain and it is usually accompanied with vaginal bleeding. Such bleeding, if excessive may cause maternal hypovolemia and shock, while severe forms of abruption result in diminished fetoplacental transfer and consequently may cause fetal death in utero. (Kurjak 2006).

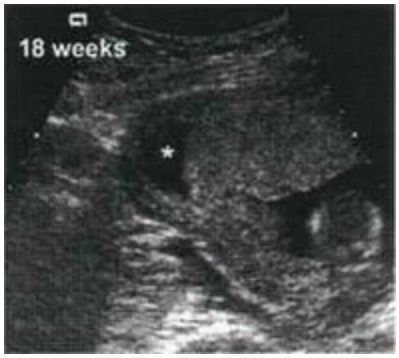


**Figure 2-6: Placental abruption: Sonogram of the placenta shows a**

**cystic area behind the placenta (*) which is the Retroplacental Hematoma**

(Devin 2005)

### 2.1.3.3 Mss and Lesion

Neoplastic lesions of the placenta can be divided into primary and secondary tumors.Secondarytumors which are metastasis for the other body organs,include;melanoma, lung cancer, breast cancerorlymphoma.primary placental tumors can be divided into trophoblastic and non trophoblastic neoplasm. Trophoblastic disease, origin; partial and complete hydatiformmole, invasivmole, choriocarcinoma and placenta site trophoblastic tumor.chorangioma and teratoma belong to group on non trophoblastic tumors**.**

Non trophoblastic tumorous are always benign.in most cases they are small,less than 4cm in diameter,a symptomatic and usually they are accidentally diagnosed during routine ultrasound.

Although larger tumors especially angioma measuring more than 4cm are rarely seen in obstetric practice.large size neoplasm have agreat impact on Hemodynamic of the fetal cardiovascular system**.**(Karolina2011)

#### 2.1.3.3.1chorangioma

Most common benign tumors of the placenta.they are vascular tumor, predominantly single, small, encapsulatedandintraplacental.

The neoplasm are frequent in multiple pregnancies in most cases.

Chorangioma may arise along the umbilical cord,it is most common localization is near placental end**..**(Karolina2011)

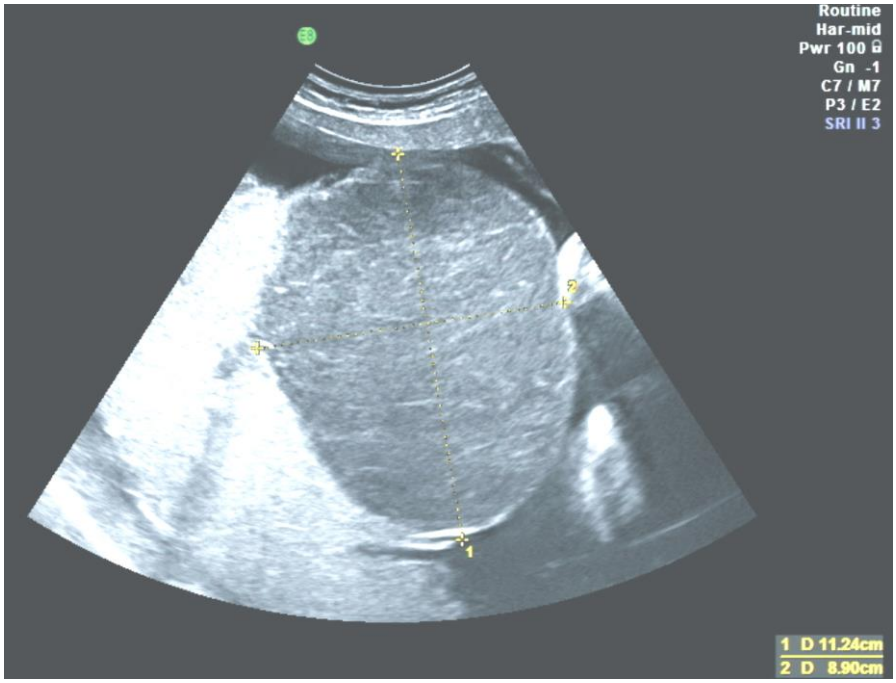


**Figure:2-7.B-mode ultrasound scan of 32-weeks pregnancy with chorangioma. A large, solid mass of the tumor bulges from the placental surface to the amniotic cavity(Karolina2011)**

### 2.1.3.3.2Teratoma

Placental teratoma are very rare.the most frequent localization are;ovary,anterior mediastinum, retroperitoneum,presacraland coccygeal regions.teratoma of placenta have an appearance of heterogenous mass measuring from 2to7.5cm.most commonly they are located between chorion and amnionlayer near the edge of placenta**..**(Karolina2011)

### 2.1.4Physics and Equipment:

Unlike x-rays, sound waves constitute a mechanical longitudinal wave, which can be described in terms of particle displacement or pressure changes. Some of the more important quantities that are described in ultrasound imaging consist of: frequency, propagation speed, pulsed ultrasound, interaction of ultrasound with tissue, angle of incidence, and attenuation. Many of the objects and artifacts seen in ultrasound images are due to the physical properties of

ultrasonic beams, such as reflection,refraction, and attenuation. Indeed, physical artifacts are an important element in clinical diagnosis (Aldrich,2007).

### 2.1.4.1 Ultrasound Interaction with Tissue

As a beam of ultrasound travels through a material, various things happen to it. A reflection of the beam is called anechoic, a critical concept in all diagnostic imaging. The production and detection of echoes form the basis of the technique that is used in all diagnostic instruments. A reflection occurs at the boundary between two materials provided that a certain property of the materials is different. This property is known as the acoustic impedance and is the product of the density and propagation speed. If two materials have the same acoustic impedance, their boundary will not produce an echo. If the difference in acoustic impedance is small, a weak echo will be produced, and most of the ultrasound will carry on through the second medium. If the difference in acoustic impedance is large although, a strong echo will be produced. If the difference in acoustic impedance is very large, all the ultrasound will be totally reflected (Aldrich,2007).

### 2.1.4.2 Angle of Incidence

If a beam of ultrasound strikes a boundary obliquely, however, then the interactions are more complex than for normal incidence. The echo will return from the boundary at an angle equal to the angle of incidence, as shown in. The transmitted beam will be deviated from a straight line by an amount that depends on the difference in the velocity of ultrasound at either side of the boundary. This process is known as refraction, and the amount of deviation is given by the relationship known as Snell’s law, which relates the angle of refraction to the speed of sound in that tissue (Aldrich,2004)

### 2.1.4.3 Attenuation

The intensity of the ultrasound beam is further reduced by attenuation due to various processes such as reflection, refraction, scattering, and absorption. All

these processes divert energy from the main beam. Reflection and refraction occur at surfaces that are large compared with the wavelength of the ultrasound. For objects that are small in comparison with the wavelength, energy is scattered in many directions, and the eventual fate of the ultrasound is to be absorbed as particle vibration and the production of heat. The amount of attenuation varies with the frequency of ultrasound. A high-frequency beam will be attenuated more than a lower frequency. This means that if the examiner wants to penetrate and subsequently image deep into the body, he or she will, in general, have to use a lower-frequency transducer (Aldrich,2007).

#### 2.1.4.4 B-Mode imaging Controls

##### 2.1.4.4.1. Depth/F.O.V. Control

Varying the depth of the F.O.V. varies the write zoom and therefore the number of pixels per cm and spatial resolution potential of the system. It is important not to use excessively large F.O.V's that reduce spatial resolution achievable but also not to 'clip' the F.O.V. too tightly around the region of interest such that relationships with other structures are not show(Wikipedia,2016).

##### 2.1.4.4.2Gain

Refers to the degree of amplification applied to all returning signals. If set too low there will be underwriting of the image and real echo will be lost from the display. If set too high there will be overwriting of the display with art factual noise introduced and also a reduction in contrast resolution as all echoes get progressively brighter (Aldrich,2007).

##### 2.1.4.4.3TGC

The T.G.C. control compensates for the effects of attenuation by progressively increasing the amount of amplification applied to signals with depth (time). The sonographer aims to produce an image of uniform brightness

from top to bottom and this requires regular adjustment of this control during scanning

#### 2.1.4.4.4 Power or Output Control:

This controls the strength of the voltage spike applied to the crystal at pulse emission. Increasing power output increases the intensity of the beam and therefore the strength of echo return to the transducer, i.e. increases signal to noise ratio (SNR). However it also increases the patients ultrasound dose. It is best practice to operate on minimum power and maximum gain, remembering though that no amount of gain can compensate for insufficient power. The obvious alternative to increasing power output if 'dropout' artifact is encountered at depth is to use a lower frequency transducer (Wikipedia,2016).

#### 2.1.4.4.5 Dynamic Range

Refers to the range of echoes processed and displayed by the system, from strongest to weakest. The strongest echoes received are those from the 'main bang' and transducer-skin interface and they will always be of similar strength. As DR is reduced therefore it is the echoes at the weaker end of the spectrum that will be lost. DR can be considered as a variable threshold of writing for weaker signals. For general imaging the DR should be kept at its maximum level to maximize contrast resolution potential. However in situations where low-level noise or artifacts degrade image quality the DR can be reduced to partially eliminate these appearances (Snell,2016).

#### 2.1.4.4.6 Focal Zones

Throughout the scan the sonographer should constantly check the position of the focal zone(s) and ensure they are at the depth of interest. Multiple focal zones can be used to maximize lateral resolution over depth if motion is not encountered, but it is important to minimize the focal zones used when assessing moving structures i.e. a fetal heart (Aldrich,2007).

### 2.1.4.4.7 Frequency

It is best to use the maximum frequency possible to image the region of interest, allowing for adequate penetration to this depth and thus avoiding ‘dropout’ artifact. There are several reasons for this, increasing frequency will; improve axial resolution, produce a better beam shape (longer near field) and increase the return from non-specular interfaces. Transducer frequencies common today are 5-15MHz for superficial work and 2-7MHz for deeper areas (Wikipedia,2016).

### 2.1.5Ultra sound technique:

The earliestsonographic evidence of an established pregnancy is thickeningand increased echogenicity of the endometrial cavity. This finding correlateswith the decidual reaction, which is a response to implantation and hormonalstimulation. A gestational sac is usually visible by transvaginalsonographyatabout 4 to 4.5 weeks' gestational age. The placenta, however, is generallyonly identified at 6 menstrual weeks using the transvaginal approach and at7-9 menstrual weeks using trans abdominal approach. increasedechogenicityand thickening within the decidual reaction around the sac are thesonographic features of the early placenta (Hodlock FP et al, 1987). By 10 to 12 weeks, the diffuse granular texture of the placenta is clearly apparent sonographically. This texture is produced by echoes emanating from the villous tree, which is bathed in maternal blood. After that, the placenta retains this general sonographic texture throughout pregnancy with some variations.

During the second and third trimester, three basic placental structures can usually be identified on ultrasonographicexamination :

1. on the maternal surface-separated from the myometrium and the retroplacental vascular bed~~is a thin, barely visible, broken line corresponding to the basal plate, which does not have a specific echo

pattern and cannot be identified sonographically unless it becomes calcified near term.

2. The placental substance appears as a formhomogeneousstructure, that may or may not change in echo pattern as pregnancy progresses. The fetal surface is usually referred to as the chorionic plate in ultrasonographic terminology. This is the linear echo-dense amniotic membrane, and is clearly visible because of the markedly different acoustic densities ofthe placenta and the amniotic fluid. On careful examination, it is possible to distinguish the chorion, amnion and the insertion ofthe umbilical cord.(Linnie 1995)

## 2.2 Previous Studies:

**Placental damage may be responsible for the fatal complications in pregnancies complicated by diabetes.** There were analyzed the prevalence of gestational diabetes in population of 109 pregnant women, the risk factors and the placental changes associated with gestational diabetes. Test carried out were oral glucose tolerance test at 24 – 28 weeks of gestation, The most powerful predictor was the placental maturity grade, the patients with decreased maturity grade having chance 52 – 6 times higher than those with an increased placental maturity grade to associate gestational diabetes. (Edu2016).

**The study design was observational descriptive and calculate sample size were 125hypertensive pregnant women at 3$^{rd}$ trimester**, all the mothers included in this study were having mean gestational age 34,9 ± 2,33633 weeks the number of grade II and III in hypertensive pregnant women were 58,4%(73/125) and 41,6%(52/125).respectively. Placenta maturity grading increase with hypertension .grade II was observed in more hypertensive pregnancies.(Samreen 2017).

**Effect of hypertension on the maturation process of the placenta which is detected by ultra sonography.**50 Normotensive and 50 hypertensive women was examined by ultr sonograhpy at three period. First between 29 – 32 weeks gestation, second between 33 – 35 weeks, and third after 36 weeks still 40 weeks gestation .The hypertension not cause an acceleration of the placental maturation.(JDMS2017).

# Chapter Three

# Materials and methods

# Chapter three

# Materials and methods

## 3.1 Materials:

### 3.1.1 Patients

This study was carried out on total number of 70 patients in second and third trimester of pregnancy attending department ofobstetrics and Gynecolog yin Gaid hospital and Elkamleen hospital in Elgezira state for check up.

The present patients were divided into normal group and high risk group include (HT, DM,) .

35 pregnant women were normal as control group15 in second trimester 20 in third trimester age (15 – 40) years.

And 35 with (HT, DM,) as study group 17 in second trimester 18 in third trimester age (15 – 40) years.

Inclusion Criteria: HT, DM, – normal pregnancy (control group).

Exclusion Criteria: Twins pregnancy, IUGR, maternal SLE, maternal thrombotic disorder, Rh and smokinew41g.

### 3.1.2 Machines:

Machine areal time with 3.5 MHZ, TA, convex transducer (sono scape, 352 made in China, MINDARY 4900, MEDISON- SONOACEX4 made in Korea).

### 3.1.3 Type of study

Analytical observational study deal with ultrasound finding in pregnant patients.

### 3.1.4 Study area

This study was performed in Giad and Elkamleen hospitals in Elgazira state.

### 3.1.5 Study duration

The study carried out from (August-November).

### 3.1.6 Study population

Pregnant women in second and third trimesters.

### 3.1.7 Sampling and sample size

Random sampling technique was performed among 70 women in second and third trimesters of pregnancy.

### 3.1.8 Study variables

Maternal age ,gestational age(second and third trimester), normal cases, HT, DM ,Placental grading.

## 3.2 Methods:

### 3.2.1 Technique:

With the patients in supine position, Jelly was applied over the abdomen and examination was carried out using sector array 3.5MHz frequency transducers. To scan placenta in reference to placental grding use TAS.

### 3.2.2.Assessing:

The gestational age was assessed by USG by measuring bi- parietal diameter (BPD) and femur length (FL) to correlate the placental grade.

### 3.2.3 Data collection

Data collection sheet which was designed to include all variables to satisfy the study and ultrasound examinations.

### 3.2.4 Data Interpretation:

The data had been interpreted by sonographers according to placental grading(appendce2).

### 3.2.5 Data analysis:

Data had been analyzed by using statistical package for social sciences (SPSS).

### 3.2.6 Data presentation

The data has been presented as figures, tables and graphs

### 3.2.7 Ethical considerations

The ethical approval was granted from the hospital and the radiology department ;which include commitment of no disclose of any information concerning the patient identification.

# Chapter four

# Results

# Chapter four

# Results

**Table 4-1 Proportionof study based on gestational age**

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Valid | Second Trimester | 32 | 45.7 | 45.7 |
| | Third Trimester | 38 | 54.3 | 54.3 |
| | Total | 70 | 100.0 | 100.0 |

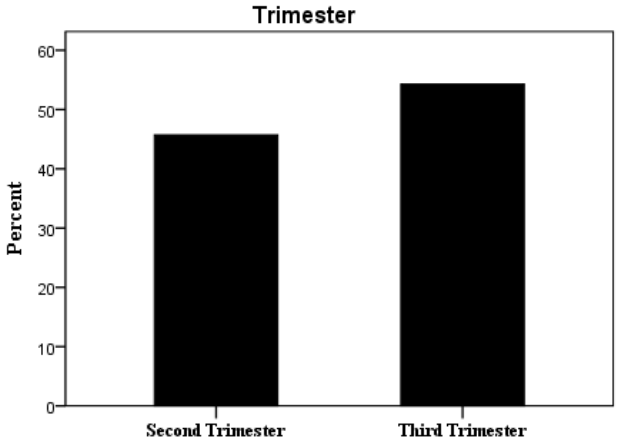


**Figure: 4-1 Proportionof study based on gestational age**

**Table 4-2proportion of study based on status**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Control | 35 | 50.0 | 50.0 | 50.0 |
| | DM | 19 | 27.1 | 27.1 | 77.1 |
| | HT | 16 | 22.9 | 22.9 | 100.0 |
| | Total | 70 | 100.0 | 100.0 | |

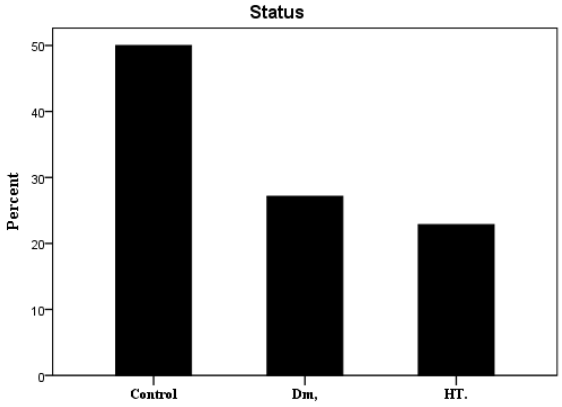


**Figure: 4-2 proportion of study based on status**

**Table: 4-3 proportion ofstudy based on placental grading**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Grade 0 | 5 | 7.1 | 7.1 | 7.1 |
| | Grade I | 28 | 40.0 | 40.0 | 47.1 |
| | Grade II | 23 | 32.9 | 32.9 | 80.0 |
| | Grade III | 14 | 20.0 | 20.0 | 100.0 |
| | **Total** | 70 | 100.0 | 100.0 | |

**Table4-4correlation of placental grading with gestational age**

| **Grade * Trimester Cross tabulation** | | | | | |
|---|---|---|---|---|---|
| | | | **Trimester** | | **Total** |
| | | | **Second Trimester** | **Third Trimester** | |
| Grade | Grade 0 | Count | 5 | 0 | 5 |
| | | % within Trimester | 15.6% | 0.0% | 7.1% |
| | Grade I | Count | 18 | 10 | 28 |
| | | % within Trimester | 56.2% | 26.3% | 40.0% |
| | Grade II | Count | 9 | 14 | 23 |
| | | % within Trimester | 28.1% | 36.8% | 32.9% |
| | Grade III | Count | 0 | 14 | 14 |
| | | % within Trimester | 0.0% | 36.8% | 20.0% |
| **Total** | | Count | 32 | 38 | 70 |
| | | % within Trimester | 100.0% | 100.0% | 100.0% |

**Table4-5 correlation of placental grading with status**

| **Grade * Status Cross tabulation** | | | | | | |
|---|---|---|---|---|---|---|
| | | | **Status** | | | **Total** |
| | | | **Control** | **DM** | **HT.** | |
| Grade | Grade 0 | Count | 4 | 1 | 0 | 5 |
| | | % within Status | 11.4% | 5.3% | 0.0% | 7.1% |
| | Grade I | Count | 11 | 11 | 6 | 28 |
| | | % within Status | 31.4% | 57.9% | 37.5% | 40.0% |
| | Grade II | Count | 10 | 7 | 6 | 23 |
| | | % within Status | 28.6% | 36.8% | 37.5% | 32.9% |
| | Grade III | Count | 10 | 0 | 4 | 14 |
| | | % within Status | 28.6% | 0.0% | 25.0% | 20.0% |
| **Total** | | Count | 35 | 19 | 16 | 70 |
| | | % within Status | 100.0% | 100.0% | 100.0% | 100.0% |

# Chapter five

# Discussion

# Chapter five

# Discussion

## 5.1: Discussion:

This prospective study which include randomly 38 pregnant women on third trimester, 32 on the second trimester for both study and control groups (70) table (4-1).

The result of study found that 19 of study group were had diabetes mellitus (27%). 16 pregnant women with hypertension (23% ) according to grade of placenta in association with control group was found that most of the pregnant women in grade one (31%) while the study group on grade one were (58%) with diabetes mellitus pregnancy , then comes (28%) for both grade 2 and 3. on control and study groups grade two (37%) grade zero on the control (11%) on diabetic pregnancy (5%) which 27% pregnant of the control group, no diabetic pregnancy on grade three that man diabetes will affect the maturity of placenta and this the same result as (Edu, 2016) table (4-5) found that the patients with decrease maturity grade having chance 52-6 times higher than those with an increase placental maturity grade to associate gestational diabetes.

Hypertension on pregnancy showed grad one on control group (58%) , on study group grade one and two had equal(37%) and same percent for control group.

Most of percentage of hypertension same or near to the control group , this means that hypertension on pregnancy had no effect on placenta grading , this was the same result as( JDMS, 2017 ) table (4-5).found that hypertension not cause an acceleration of the placental maturation.

This study was disagree with (Samreen,2017) found that placenta maturity grading increase with hypertension .

## 5.2: Conclusion

- Grade zero was more common in second trimester on study and control groups.16%
- Grade one was more common in second trimester on study and control groups56%
- Grade two was more common in third trimester on study and control groups.37%
- Grade three was more common in third trimester on study and control groups37%
- Diabetes mellitus affect on placenta maturity .agree with (Edu, 2016).
- Hypertension had no affect an acceleration of placenta maturity agree with (JDMS,2017) and disagree with (Samreen, 2017).

## 5.3: Recommendation:

- Use Doppler technique to detect blood flow
- Further study grading on relation to fetal weight and amount of amniotic fluid.
- Increase number of data for more accurate result.
- Use minimum scanning time possible to minimize patient discomfort and to reduce U/S exposure(ALARA principle).
- International guide lines protocol should be followed to gestational age and placental grading.
- Placenta grading should be one of the indices reported during ultra sound examination in the third trimester.

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# Appendices

# Appendix (1)

## Data Sheet

| No | Age | Trimester | Placenta grade | Control | DM | HT |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
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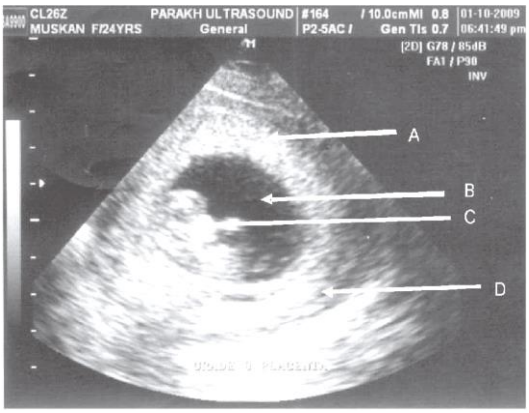
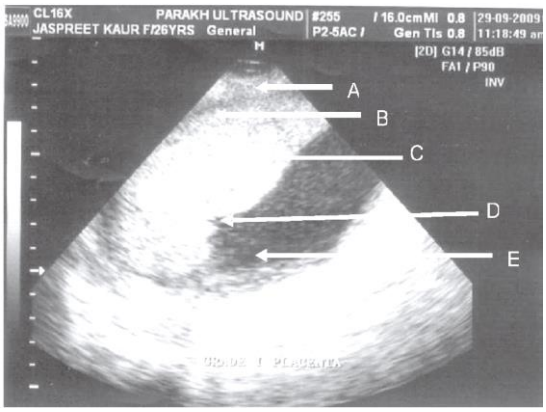
| 34 | | | | | | |
| 35 | | | | | | |
| 36 | | | | | | |
| 37 | | | | | | |
| 38 | | | | | | |
| 39 | | | | | | |
| 40 | | | | | | |

# Appendix (2)

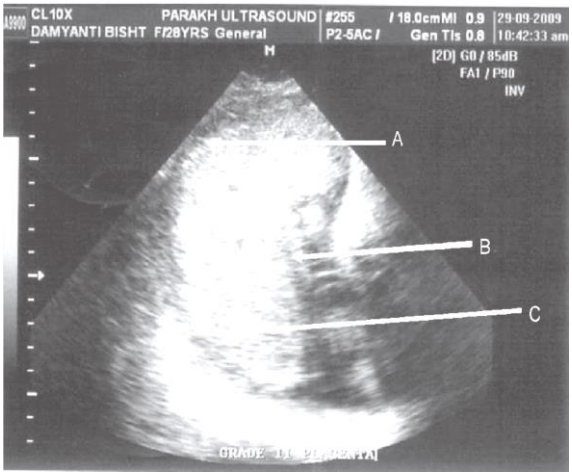
## Images of placental grading ultrasonography



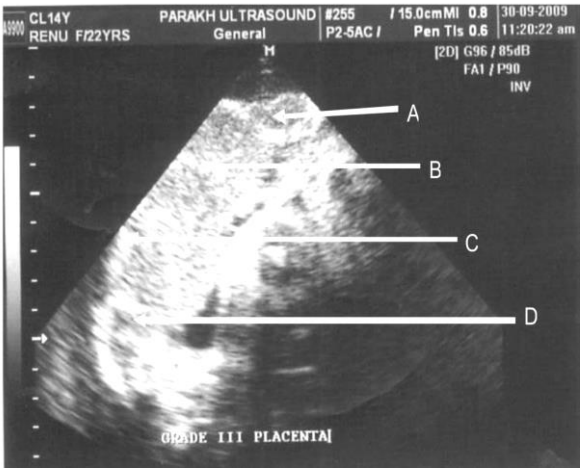

Grade 0 Placenta. A= Placenta; B= Liquor amnii; C= Fetus; D= Uterine wall




Grade 1 Placenta. A= Uterine wall; B= Basal plate; C= Placental substance ; D= Indentation in chorionic plate; E= Liquor amnii




Grade II Placenta. A= Basal plate echoes; B= Chorionic indentation extending up to placental substance; C= Fetus; D= Placental substance comma like echoes




Grade III Placenta. A= Fall out area of cotyledons; B= densities in placental substance; C= Basal layer echoes; D= Chorionic plate indentation extending up to plate