



## The Value of Magnetic Resonance Imaging in Pregnant Women in Iraq According to a Cross-Sectional Study of 148 Patients

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**Abstract:** The data were collected from 148 Iraqi pregnant women who underwent MRI during pregnancy between August 2023 and August 2024. MRI is a member of a family of prenatal diagnostic techniques that are designed to obtain genetic, biochemical, physiological, and anatomical information with the aim of assessing the correct development of the fetus during pregnancy and preventing potential complications. This study aims to ascertain the value of magnetic resonance imaging (MRI) in pregnant women in Iraq. A cross-sectional study of 148 patients was conducted, with data analysed using IBM SPSS. The analysis considered demographic information to determine the existence of statistical relationships between MRI and pregnancy. Furthermore, the true value of the parameters of this study and the arithmetic mean were identified.

Fetal MRI plays an important role in clinical work and is an important supplement to ultrasound. It has a profound effect on the fetal central nervous system, especially in the diagnosis and differential diagnosis of central dysfunction, which is of great value. This article will discuss the safety, conditions of use and validity of each fetal MRI system.

This study will conclude that fetal MRI has developed rapidly in recent years and has become an important research tool for the diagnosis of fetal diseases. The advantages of fetal MRI are that it can clearly identify complex structural defects; however, its shortcomings remain. The question of how to obtain clear multi-directional images remains unanswered. Future research will focus on this matter, contributing to the further clinical application of fetal MRI.

**Key words:** MRI, BMI, Pregnant, Fetal, Accuracy, Sensitivity.



## Introduction

In recent years, magnetic resonance imaging (MRI) has become a crucial diagnostic tool, enabling the confirmation of cases with uncertain ultrasound diagnoses. This is due to the capacity of MRI to provide detailed anatomical information about the fetus that is not discernible through ultrasound. To illustrate, the assessment of the soft palate is challenging with ultrasound, whereas MRI facilitates the observation and diagnosis of the cleft palate [1]. All living organisms are continuously exposed to natural electromagnetic fields, which are, however, weak and non-ionizing and thus largely imperceptible to the human senses. Magnetic resonance imaging (MRI) has become a fundamental instrument in the investigation of numerous pathological conditions. Its use has increased during pregnancy, and it is even employed to diagnose alterations in prenatal development that are not sufficiently discernible with ultrasound. The consequences of exposure to magnetic fields on pregnant fetuses remain poorly understood [2,3,4]. The inherent complexity of the variables involved makes it challenging to quantify the risks. Nevertheless, there is evidence that attempts to limit the use of this method have been made despite the limited information available. This systematic review aims to identify the basic information on the effects of MRI on the fetus [5,6,7].

The study was conducted on a cohort of over 1.4 million births between 2003 and 2015, with a comparison between women who underwent MRI scans and those who did not. The research involved following up with the children until they reached four years of age. Following the analysis of the data, it was determined that the performance of an MRI scan during the first trimester of pregnancy did not elevate the likelihood of stillbirth, the occurrence of birth defects, or the risk of mortality shortly after birth. Furthermore, there was no discernible increase in the probability of vision loss, hearing loss, or the development of cancer during pregnancy. The initial trimester of childhood. [8,9,10,11]

Over a period of more than 30 years, thousands of women have undergone this test, and no evidence has been found to suggest that any child has been harmed as a result. Indeed, a study conducted by Canadian researchers reached the definitive conclusion that MRI does not pose any risk to the fetus during the first trimester of pregnancy, which is the period during which the main fetal organs are formed. [12,13,14]

Consequently, in instances where an MRI examination is deemed necessary by the attending physician and ultrasound imaging is insufficient, an MRI can be performed on the pregnant woman. [15,16,17] It is important to note that MRI is a non-invasive procedure that does not utilise X-rays. Instead, it employs radio waves and a strong magnet to provide images. In conclusion, although ultrasound remains the most rapid and cost-effective method for evaluating the fetus, MRI is increasingly employed to supplement the anatomical examination of suspected malformations diagnosed by ultrasound. This diagnostic test enables the generation of superior images of the anatomical structures of the foetus, facilitating a more comprehensive evaluation of the foetal anatomy.

## Material and method

Fetal MRI is a diagnostic imaging technique that employs the use of electromagnetic radiation to create an image of the fetal anatomy. This technique employs the use of a powerful magnetic field to alter the position of water molecules within the body, which are then detected when they move, thereby enabling the generation of an internal image and the visualization of the fetus. Fetal MRI is a safe procedure that produces images of superior quality to those obtained by ultrasound. Furthermore, the current devices are capable of performing studies rapidly and producing a clear image even when the fetus is in motion. This procedure is recommended for patients whose pregnancies are more than 20 weeks in duration, ensuring that the fetus is of sufficient size and that diagnostic images can be obtained. In this study, a cross-sectional study was conducted in Iraq, during which demographic



information and data were collected from several different hospitals. In this study, data were collected from 148 Iraqi pregnant women who underwent MRIs during pregnancy. MRI is a member of a family of prenatal diagnostic techniques that are designed to obtain genetic, biochemical, physiological, and anatomical information with the aim of assessing the correct development of the fetus during pregnancy and preventing potential complications and diseases. The value of fetal MRI lies in the quality and clarity of the images obtained, which permit a more detailed and accurate appreciation of the differences between tissues. This implies that it is employed in specific instances where ultrasound is inadequate.

In this study, a series of questionnaires were employed to facilitate the interpretation of patients' responses regarding the utilisation of the aforementioned technique. The questionnaires encompassed a comprehensive array of inquiries, including those designed to elicit general information from pregnant women about the employed technique. Additionally, they encompassed questions pertaining to the positive and negative aspects of soft tissue super contrast, diagnostic accuracy, treatment planning, safety profile, and the general safety of MRI during pregnancy. The integration of these questions enabled a comprehensive and accurate evaluation of the employed technique, facilitating the interpretation of the nature of the relationship between MRI and pregnancy.

### Statistical analysis

In this study, the analysis was conducted according to the IBM soft spss program, where the data was analyzed with demographic information to determine the existence of statistical relationships between magnetic resonance imaging and pregnancy. In addition, the true value of the parameters of this study and the arithmetic mean were identified, as well as the value of the logistic regression to determine the risk factors in this study.

**Results Table 1- General demographic results of patients**

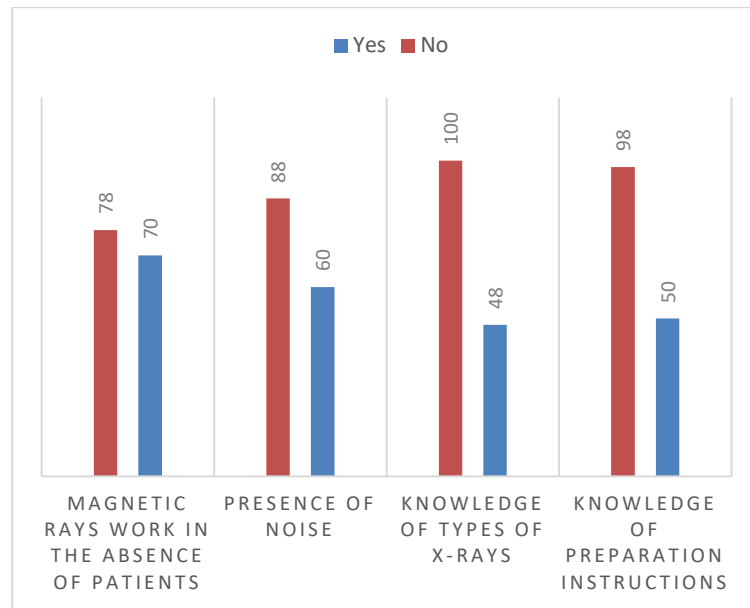
v	Value
Age	
Mean and sd	29+4.45
BMI	
Mean and sd	33.4±3.4
GA at prenatal MRI (weeks)	
Mean and sd	22.9+4.8
Interval between prenatal ultrasound and MRI (weeks)	
Mean and sd	5.2+1.9
Level of education	
Illiterate	10(6.7)
Intermediate	12(8.1)
Primary	15(10.1)
Secondary	70(47.2)
University	40(27.02)
Occupation	
Business	12(8.1)
Domestic	30(20.2)
Employee	50(33.7)
Freelancer	56(37.8)
Residence	
Rural	40(27.02)
Urban	108(72.9)



**Table 2- Questionnaire to provide general information to pregnant women about the technology used.**

v	Description
1. Do you know the preparation guidelines before an MRI scan? Yes	100(77.5)
No	48(32.4)
2. Are you aware of the types of radiation used in MRI? Yes	80(54.05)
No	68(45.9)
3. Do you know there is the noise produced by MRI scanners? Yes	60(40.5)
No	88(59.45)
4. Do you think the MRI scanner is on if there are no patients? Yes	50(33.7)
No	98(66.2)
5. Do you know there is a contrast agent used in some cases? Yes	77(52.02)
No	77(52.02)
9. Can a pregnant woman be giving an MRI contrast agent? Yes	18(12.16)
No	130(87.8)
Patient safety Yes	120(81.08)
no	28(18.9)

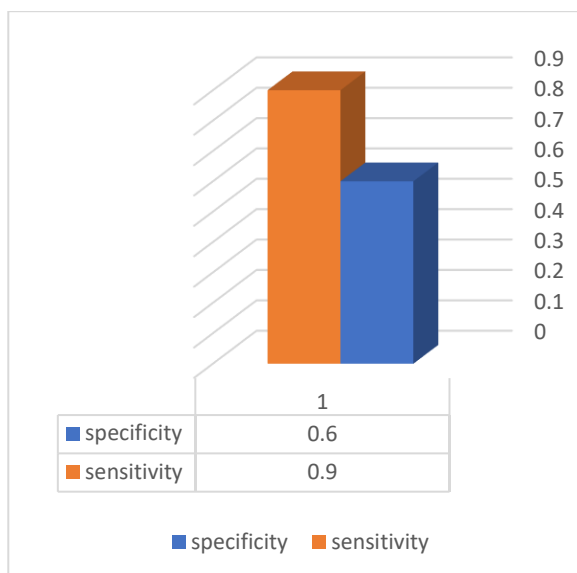
**Fig 1- Assessment outcomes between MRI and residence**



**Table 3- Questionnaire to know the effect of MRI on pregnant women.**

v	Yes	No
providing superior soft tissue contrast	110(73.32)	38(52.67)
Diagnostic Accuracy	139(93.9)	9(6.08)
Treatment Planning	115(77.7)	33(22.2)
Safety Profile	122(83.4)	26(17.5)
MRI is generally considered safe in pregnancy	100(67.5)	48(32.4)
where specific MRI signs can predict adverse maternal outcomes such as severe bleeding	90(60.8)	58(39.1)
Maternal Outcomes	113(76.3)	35(23.6)

**FIG 2- Identify pregnant women's significant risk factors for congenital anomalies,**



## Discussion

This study examined the utility of magnetic resonance imaging (MRI) in pregnant women in Iraq, employing a cross-sectional study of 148 patients. The age range of the subjects was between 23 and 38 years, and the mean body mass index was  $33.4 \pm 3.4$ , indicating a high prevalence of overweight and obese pregnant women. Magnetic resonance imaging (MRI) can be defined as a diagnostic technique that provides detailed images of the human body using magnetic fields produced by a large magnet, thus avoiding exposure of the patient to ionising radiation, which is a characteristic of computed tomography (CT). [18,19] The technique is capable of providing a three-dimensional image of the internal anatomy of the body and is employed for the diagnosis of a wide variety of pathological conditions due to its ability to visualise internal organs, including the skeleton and joints. This indicates that MRI is employed in numerous fields of study. There are no particular contraindications during pregnancy for Iraqi patients. Nevertheless, despite the absence of evidence concerning the sensitivity of the foetus to the magnetic fields and radio frequencies utilised in these investigations, MRI is not advised for pregnant women, particularly during the initial three months of pregnancy. [20]

It is inadvisable for individuals with pacemakers, neurostimulators, or intracranial aneurysm clips to undergo magnetic resonance imaging (MRI) due to the potential for the magnetic fields generated by the equipment to disrupt the normal functioning of these devices. Furthermore, the examination is contraindicated for individuals who have undergone surgery or experienced trauma and have foreign metal structures of various types within their bodies, particularly if they are in close proximity to vital organs. [21] This is to prevent the magnetic fields generated by the machine from causing displacement or overheating of the foreign bodies. Such devices typically include prostheses, screws, and nails utilized in orthopedic procedures. However, other devices employed in various surgical specialties, such as angioplasty of arteries and veins, are also made of materials that may pose a risk during MRI scanning. Those who have undergone the implantation of artificial lenses for the treatment of cataracts prior to the mid-1980s or who have been fitted with metallic heart valves should be advised to refrain from undergoing an MRI scan. Despite the advent of novel materials that do not impede investigation, it remains prudent to disclose all prior surgical procedures. In the event of uncertainty, the treating physician may consult with the facility where the operation was conducted to ascertain the compatibility of the material employed or arrange an initial X-ray to exclude the presence of metallic elements. [22]

The 2014 Guidelines indicate that fetal MRI is not a routine prenatal screening method; rather, it is an auxiliary and complementary tool for prenatal ultrasound diagnosis. It is therefore recommended that a relevant ultrasound diagnostic report issued by an experienced sonographer should be obtained



prior to performing a fetal MRI. The indications for fetal MRI are primarily neurological and non-neurological abnormalities. [23] The primary indications for fetal MRI include central nervous system abnormalities and neck masses with the potential to invade the trachea. Fetal ventriculomegaly is defined as the enlargement of the lateral ventricles in the absence of a clear aetiology. The results of prenatal imaging examinations indicate that the intraventricular diameter of the lateral ventricle in the transverse or coronal position of the fetal head is  $\geq 10$  mm. Fetal ventriculomegaly is relatively common during the second and third trimesters. The incidence of this disease varies considerably between different research reports, with figures ranging from 0.15% to 2.00% (3). The disease is more prevalent in male fetuses, with an incidence ratio of 1.7:1.4 between males and females. [24]

In the majority of cases, the bilateral ventricles of human fetuses display a degree of asymmetry, with the occipital angle of the fetal lateral ventricle exhibiting a slight widening relative to the anterior angle. As the time of birth approaches, the size difference between the occipital angle and the anterior angle will gradually decrease. Fetal MRI has the capacity to achieve high soft tissue resolution and to perform multi-directional and multi-parameter imaging. In addition to measuring the width of the fetal ventricles, fetal MRI can also identify and diagnose other abnormalities related to the central nervous system, providing more effective information than prenatal ultrasound diagnosis. In cases where the gestational age is less than 18 weeks, the results of fetal MRI are not optimal due to the small size of the fetus, fetal movements, and the incomplete development of the corpus callosum or cerebellar vermis. European and American medical authorities recommend it that prenatal ultrasound examinations be performed more frequently when the gestational age is between 18 and 20 weeks. The 2014 guidelines advise that fetal MRI be scheduled between 20 and 22 weeks of gestation, which allows for more effective evaluation and treatment of confirmed or suspected fetal anomalies. The development of the fetal nervous system, in particular, undergoes significant changes with increasing gestational age. Therefore, the timing of fetal MRI examinations and the interpretation of examination results should be based on the gestational age of the fetus. For instance, neuronal migration is complete at approximately 24 weeks of gestation. The diagnostic sensitivity of fetal MRI for gray matter heterogeneity after 24 weeks is 77%, while the sensitivity before 24 weeks is only 44%. [10] The third trimester is the optimal time for fetal MRI and assessment of cortical development and tracheal stenosis due to neck mass [18].

## Conclusion

Currently, magnetic resonance imaging (MRI) is becoming an increasingly crucial tool in obstetric clinical practice, offering valuable insights complementary to those provided by ultrasound (US) in the diagnosis of certain pregnancy-related conditions and fetal central nervous system abnormalities. The diagnostic and evaluative capabilities of MRI are of significant clinical importance. However, the safety of MRI during pregnancy remains a topic of ongoing debate. This article will provide a comprehensive review of the primary applications and safety aspects of MRI in obstetrics.

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