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Fetal Well-Being Tests and Maternal Fasting in the Holy Month of Ramadan

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ABSTRACT

Background & Objective: Fasting in the holy month of Ramadan is one of the 5 pillars of Islam. The effect of fasting on the health of mothers and their babies remains relatively unknown. Many pregnant women and gynecologists are concerned about possible complications related to fasting and its effects on the health of the fetus. This study aimed to investigate the effect of maternal fasting during holy Ramadan on fetal health tests.

Materials & Methods: In this Cohort study, 23 healthy pregnant women who were in the second and third trimesters and had a singleton pregnancy and were fasting and 23 non-fasting that referred to university clinics in Kashan, Iran, from 30 March to 20 April 2023 were included in the study. Maternal blood sugar and biophysical profiles including non-stress testing, fetal breathing, fetal movement, fetal tone and qualitative measurement of amniotic fluid volume were evaluated. After collecting the data and entering the SPSS.17 software, the data was analyzed.

Results: The findings of the study showed that a statistically significant difference was observed in the ratio of blood sugar status in the non-fasting and fasting pregnant women. However, no statistically significant difference was observed regarding the normal ratio of amniotic fluid volume, fetal tone, fetal movement, fetal breathing and non-stress tests.

Conclusion: According to the results of the study, Islamic fasting or the mother's hunger from the Morning Prayer to the evening prayer does not have a negative effect on the fetal well-being testing.

Keywords: Fasting, Fetal Movement, Pregnancy, Biophysical Profile

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1. Introduction

Fasting in the holy month of Ramadan is one of the 5 pillars of Islam. In this blessed month, fasting from dawn (fajr) to dusk (maghrib) is obligatory for all healthy people and all able-bodied Muslims abstain from liquids, food, oral medicines, and smoking from sunrise to sunset **(1, 2)**. According to the Qur'an, fasting in this holy month is not permissible if there are any risks to people's health. Shariah rulings exempt pregnant and lactating women from participation when abstaining from food and liquids can cause health risks for themselves or their children **(3)**. Due to cultural reasons and religious beliefs, some pregnant and lactating women fast during the holy month of Ramadan **(4)**. Because the holy month of Ramadan is in the lunar calendar, every year it starts about ten days earlier than the previous solar year. Each month of Ramadan lasts 29 to 30 days, so almost three-quarters of babies born to Muslim mothers face the holy month of Ramadan during their fetal life **(5)**. The effect of fasting during the holy month of Ramadan on pregnancy is almost unknown.

The few studies that have examined this issue have often reported conflicting results **(6)**. For example, Bilsen & co-workers suggested that the biophysical profile and respiratory patterns of the fetus are affected by Ramadan fasting **(7)**. Examining the effect of fasting in the holy month of Ramadan in pregnant women without diseases such as diabetes and cancer is the goal of other studies **(8-11)**. However, the effect of fasting on healthy pregnant women and their fetuses has been less studied. Because both health care providers and pregnant and lactating women who wish to fast are relatively unaware of the effects of fasting during the holy month of Ramadan, the connection between decisions and recommendations is often weak. For example, some women may not share their decision to fast with health care providers for fear of rejection and disapproval **(12)**. Considering the fact that most babies born to Muslim mothers are exposed to Ramadan during pregnancy, it is important to investigate this issue.

Maternal fasting during pregnancy is associated with a significant decrease in maternal plasma glucose concentration, which is associated with a significant increase in human placental lactogen concentration **(13)**. A decrease in plasma glucose levels during pregnancy indicates that the utilization of glucose by the developing fetus is increased, and this is not fully compensated by increased hepatic glucose production after absorption. The glucose required by the growing fetus is probably provided by the increase in plasma glucose level after a meal **(14)**. Considering the mentioned points and the importance of the health of pregnant mothers and their children, we decided to give a definitive answer to this constant question of whether fasting affects the health of the fetus by examining the health of the fetus through fetal health tests during pregnancy.

2. Materials and Methods

2.1 Study Design and Setting

This cohort study was conducted at university clinics in Kashan, Iran, from 30 March to 20 April 2023.

2.2 Participant Recruitment

23 healthy pregnant women who were in the second and third trimesters and had a singleton pregnancy and were fasting and referred to university clinics in Kashan, Iran during the holy month of Ramadan and 23 healthy pregnant women who were in the second and third trimesters and had a singleton pregnancy and were not fasting were included in the study. Fasting from dawn to dusk was almost 15 hours. Biophysical profiles including fetal breathing movements, fetal movement, fetal tone and qualitative measurement of amniotic fluid volume were evaluated. Due to the possible dehydration of the mother during fasting, the amount of amniotic fluid was checked. After collecting the data and entering the SPSS 17 software (IBM, USA), the data was analyzed. The inclusion criteria for the study included healthy pregnant women in the second and third trimesters with a singleton pregnancy (determined by the first day of the last menstrual period (LMP) and confirmed by the initial ultrasound between 6–12 weeks of pregnancy) referred to the clinics of Kashan University of Medical Sciences and the exclusion criteria were the presence of any medical disease such as hypertension, diabetes mellitus or any obstetric problems such as gestational diabetes, preeclampsia, multiple pregnancy, fetal growth restriction and unwillingness to participate in the study. In general, healthy singleton pregnant women with no underlying disease fast, and no cases were excluded from the study.

Due to the power of the test 0.8 and alpha 0.05 and the information available in the study of Glazier & co-workers and ten percent sample loss, the women were divided into 2 groups of 23 people, including exposure (fasting) and control (non-fasting) groups **(15)**. The exposure group included pregnant women with 12-hour fasting, and the control group included non-fasting pregnant women who had consumed food 1–2 hours before the visit.

2.3. Sample size

According to the previous studies and using the minimum sample size comparison formula to compare the averages in two independent communities, based on 95% confidence level and the test power of 80%, and alpha 0.05 and ten percent sample loss, and the information available in the study of Glazier co-workers, two groups of 20 people are needed to conduct the study **(15)**.

$$n = \frac{(s_1^2 + s_2^2)^2 (z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2}{(\bar{x}_1 - \bar{x}_2)^2}$$

2.4 Data Collection

The study started on the 12th of the holy month of Ramadan. Fasting mothers were fasting for ten days or more. Fasting mothers eat suhoor (food like lunch) and consume enough fruits and liquids between iftar and suhoor. All participants underwent a complete history and general and midwifery examination. The examinations were done in the last hours of fasting, that is, after at least 12 hours of abstinence. Mothers' blood sugar was measured with a glucometer, and a non-stress test was done for all participants. Then, all women were referred to the radiology ward for ultrasonographic assessments, biometry scans and the biophysical profile (BPP). All women underwent regular prenatal visits once every 2 weeks for 28–36 weeks of gestation and every week after 37 weeks until delivery.

2.5 Ultrasound Assessment

All ultrasound examinations were performed using the WS80A ultrasound machine (Samsung Company, South Korea) with a CA1-7A curved array 1.0-7.0 MHz transducer. The ultrasound specialist did not know about fasting or non-fasting of pregnant women.

2.6 Biophysical profile assessment

The BPP components included fetal breathing movements, fetal movement, fetal tone, and qualitative measurement of amniotic fluid volume, which was given a score of two for each normal parameter and a score of zero for abnormal.

2.7 Ethical consideration

The ultrasound specialist did not know about fasting or non-fasting of pregnant women. All women underwent regular prenatal visits once every two weeks for 28–36 weeks of gestation and every week after 37 weeks until delivery. The ethical committee of Kashan University of Medical Sciences, Kashan, Iran, has approved this study with the Code of Ethics. IR.KAUMS.MEDNT.REC.1401.238. Before enrollment, written informed consent was obtained from all mothers. This article is the result of a research

project entitled The Effect of Maternal Fasting During Ramadan on Fetal Health Tests in 2023.

2.8. Statistical analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS), version 17.0, (SPSS Inc., Chicago, Illinois, USA). Frequency and percentage were used to describe qualitative variables, and mean, and standard deviation were used for quantitative variables. Fisher's exact test was used for analysis. The predetermined level of significance was $P < 0.05$.

3. Results

3.1. Study Population

In this cohort study, 46 women in the second and third trimesters were examined. The demographic characteristics of women in both groups were similar.

3.2 Blood Sugar Assessment

The difference in blood sugar (BS) status in the group of non-fasting and fasting pregnant women was statistically significant (P = 0.042). The non-fasting women had higher BS than the fasting, so that most of the fasting women had BS less than 100 (60.6 percent) and none of the women had BS higher than 120, but most of the non-fasting women had BS in the range of 101-119, and three of them had BS higher than 120.

3.3 Non-Stress Test Assessment

In this study there was no significant relationship between fasting and repetition of NST.

Table 1. Frequency of NST recurrences in fasting and non-fasting pregnant women

Frequency of NST	Fasting N (%)	Non-fasting N (%)	Total N (%)	p-value*
One	20 (54.1)	17 (45.9)	37 (100)	0.265
Two	3 (33.3)	6 (66.7)	9 (100)	
Total	23 (50)	23 (50)	46 (100)	

* Fishers Exact test

3.4 Amniotic Fluid Assessment

In the current study, all fasting pregnant women had a normal amniotic fluid index.

Table 2. Frequency distribution of amnionic fluid index (AFI) in fasting and non-fasting women

Amniotic fluid index	Fasting N (%)	Non-fasting N (%)	Total N (%)	p-value*
Normal	23 (51.1)	22 (48.9)	45 (100)	0.41
Abnormal	0	1 (100)	1 (100)	
Total	23 (50)	23 (50)	46 (100)	

* Fishers Exact test

3.5 BPP Assessment

In the present study, no significant statistical difference was observed in the biophysical evaluation. Non-stress tests were reactive in both groups; the fetal tone profile was normal in groups of fasting and non-fasting mothers, and there was no statistically significant difference (P value = 0.99), and two groups scored two for fetal breathing, and there was no statistically significant difference between them (P. value = 0.69). Also, fetal movements were normal in both groups, and there was no significant difference between fasting and non-fasting groups (P. value = 0.99). Regarding the normal state of amniotic fluid volume (P. value = 0.99) there was no significant difference between the two groups. (Table 3).

Table 3. Frequency of fetal health parameters in fasting and non-fasting women

parameters		fasting N (%)	non-fasting N (%)	P value*
amniotic fluid volume	Abnormal	0	1(4.3)	0.99
	Normal	23(100)	(95.7) 22	
fetal tone	Abnormal	0	1(4.3)	0.99

parameters		fasting N (%)	non-fasting N (%)	P value*
	Normal	23(100)	(95.7) 22	
fetal movement	Abnormal	0	1(4.3)	0.99
	Normal	23(100)	(95.7) 22	
fetal breathing	Abnormal	5(21.7)	3(13.1)	0.69
	Normal	18(78.3)	20(86.9)	
BPP score	8	5(21.7)	3(13.1)	0.35
	10	18(78.3)	20(86.9)	
blood sugar	≤100	20(87.0)	13(56.6)	0.04
	101-119	3(13.0)	7(30.4)	
	≥120	0	3(13.0)	

***Fishers Exact test**
BPP: biophysical profiles

Also, no significant relationship between blood sugar according to BPP score was observed (Table 4).

Table 4. Frequency of blood sugar according to BPP score

Blood sugar	BPP score		P value*
	10 score N (%)	8 score N (%)	
≤100	27(81.8)	(18.2) 6	0.70
101-119	8(80.0)	2(20.0)	
≥120	3(100)	0	
total	38(82.6)	8(17.4)	

***Fishers Exact test**
BPP: biophysical profiles

4. Discussion

In this study, all non-fasting women and 22 of the fasting women had normal amniotic fluid index, and no significant relationship between amniotic fluid volume and the condition of pregnant women was seen. Abd-Allah Rezk et al **(16)** reported in a study conducted in Egypt that there was no significant difference between fasting and non-fasting women in terms of the amniotic fluid index. Also, a study was conducted in Egypt by Khalaf et al **(17)** on 97 fasting women and 124 control women. It showed that fasting in Ramadan has no effect on the volume of amniotic fluid in the last month of pregnancy, or it may improve it. The above studies are consistent with our study. But the study conducted by Seckin et al **(18)** in Turkey on 82 fasting pregnant women and 87 non-fasting women who were matched in terms of maternal age, fertility and gestational age showed a significant decrease in amniotic fluid volume. During the fasting period, it was observed in the fasting group that it was not consistent with our study **(18)**.

A significant relationship in terms of blood sugar was seen in fasting and non-fasting pregnant women ($P<0.05$), and non-fasting people had higher blood sugar than fasting people. The tests were done in the last hours of fasting and after at least 12 hours of abstinence. In a study conducted in Turkey, Dikensoy et al **(19)** reported that the average maternal glucose level in the study group was significantly lower than the control group. The results of the studies of Malhotra et al **(20)** in the United Kingdom and Prentice et al **(21)** in the Gambia also showed that blood glucose levels were reduced in fasting pregnant women, which is consistent with our study.

In this study, no significant relationship was found in terms of fetal breathing movement in pregnant and non-pregnant women. However, a study conducted by Mirghani et al **(22)** on 63 healthy pregnant women with uncomplicated singleton pregnancy at 30 weeks of pregnancy and more showed that the continuous variation of fetal respiratory movements significantly decreased ($P = 0.02$) during fasting compared to non-fasting **(22)**. Also, the results of Mirghani et al **(23)** study showed that maternal fasting is associated with a

decrease in fetal breathing movements. It is not consistent with our study.

In the present study, no significant relationship between fetal tone and the fasting status of pregnant mothers was observed. Mirghani et al **(23)** also did not observe a significant relationship between fetal tone and fasting status of pregnant women, which is consistent with our study. However, Mirghani et al **(22)** reported that fasting was significantly associated with the reduction of fetal upper limb movements compared to other changes in fetal tone during fasting. This may be due to observer bias in focusing on the upper limb of the fetus instead of other parts when assessing tone.

5. Conclusion

According to the results of the study, fasting in pregnant women, despite the decrease in maternal blood sugar compared to non-fasting, does not affect the parameters of amniotic fluid volume, fetal tone, fetal movement, fetal breathing and NST. Therefore, fasting does not have a negative effect on fetal health factors. But women should be under prenatal care. However, commenting on fasting for pregnant women needs more extensive research.

6. Declarations

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Ethical Considerations

The ethical committee of Kashan University of Medical Sciences, Kashan, Iran, has approved this study with the Code of Ethics. IR.KAUMS.MEDNT.REC.1401.238. Before enrollment, written informed consent was obtained from all mothers.

Authors' Contributions

Marzieh Talebian and Sedigheh Hosseinimousa designed the study and conducted the research. Marzieh Talebian, Leila Niknam, and Seyed Gholam Abbass Moosavi monitored, evaluated, and analyzed the result of the study. Reihaneh Faghihi performed ultrasound examinations. Further, Marzieh Talebian reviewed the article. All authors approved the final manuscript and took responsibility for the integrity of the data.

Conflict of Interest

The authors declare no conflict of interest.

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Data availability

Data supporting the findings of this study are available upon reasonable request from the corresponding author.

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