

Original Article**The effect of Ramadan fasting on fetal growth and Doppler indices of pregnancy**Maryam Moradi<sup>a</sup>**Abstract**

**BACKGROUND:** The aim of this study was to determine the effect of Ramadan fasting on fetal growth and Doppler indices of pregnancy.

**METHODS:** Fifty two healthy pregnant women of second or third trimester, 25 in fasting group and 27 in non fasting group were included. Growth parameters including biparietal diameter (BPD), femoral length (FL), abdominal circumference (AC), estimated fetal weight, amniotic fluid index and also Doppler indices of both uterine and umbilical arteries (including peak systolic and end diastolic velocity, systolic to diastolic ratio, resistive and pulsatility indices) were evaluated by Gray scale and colour Doppler imaging for each women two times, in the beginning and at the end of Ramadan.

**RESULTS:** Increases in BPD, FL, AC and fetal weight within one month were similar in two groups. Amniotic fluid index also were similar in two groups. There was not any statistically significant difference in abnormal Doppler indices of uterine or umbilical artery between two groups.

**CONCLUSIONS:** The results of present study show that Ramadan fasting has no adverse effect on fetal growth, amniotic fluid volume or maternofetal circulation.

**KEYWORDS:** Doppler Ultrasonography, Fetal development, Pregnancy, Ramadan.

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Ramadan is a holy month in the Islamic calendar in which healthy adults abstain from food and drink during the day light hours from dawn to sunset. Pregnant women are exempt and allowed to choose fasting or non fasting state, regarding to their abilities. Many women are interested and able to fast, but they worry about their fetus and ask the doctor about possible complications.

Fasting induce dehydration and also induce some metabolic changes, including significant fall in glucose level and also increase the level of fatty acid, hydroxy butyrate, cholesterol and triglyceride.<sup>1,2</sup> On the other hand Sufficient uteroplacental blood flow is necessary for fetal growth and wellbeing.<sup>3</sup>

Doppler study of uterine and umbilical arteries is appropriate tool to assess vitality and outcome of pregnancy.<sup>4</sup> Therefore, it is acceptable to measure sonographic growth indices and also uteroplacental and fetal vascular

Doppler exam, for evaluating possible effect of fasting. In previous studies, no significant adverse effects on fetal development,<sup>5,6</sup> or uterine arterial blood flow<sup>7</sup> were showed, but some abnormal changes of biophysical scoring were noted.<sup>8</sup> Most of previous studies were performed when Ramadan was concordant with autumn and winter.<sup>5-8</sup> The aim of this study was to determine the possible adverse effect of fasting in long hot days of late summer on growth parameters, uterine and umbilical flow indices and also amniotic fluid volume.

**Methods**

This case-control study was performed at Shahid Beheshti Hospital of Isfahan University of Medical Sciences from 21 August to 23 September 2009 (during the month of Ramadan). The Ethical committee of Isfahan University of Medical Sciences approved this study (project number 288129).

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Seventy eight women in two equal groups, volunteer for fasting (group 1) and non volunteer for fasting (group 2) were invited. All of them were pregnant women of second or third trimester with singleton pregnancy. Another inclusion criterion was absence of any medical or pregnancy related disease, according to history taking and physical examination which were done by gynecologist.

After obtaining informed consent, primary information including mother's age, parity, weight and gestational age according to the last menstrual period (LMP) were collected. Then examination by gray scale and colour Doppler ultrasound were done between 21-23 August (at the beginning of Ramadan) by one radiologist with Siemens G50, 3.5- 5 MHZ Curvilinear probe and were repeated during 21-23 september 2009 (the end of Ramadan) by the same radiologist.

For each woman, biparietal diameter (BPD), femoral length (FL), abdominal circumference (AC) and amniotic fluid index (AFI) were measured.<sup>9</sup> In addition, gestational age related to BPD (Age-BPD), FL (Age -FL), AC (Age-AC) and estimated fetal weight (EFW) according to Hadlock 1 formula<sup>9</sup> were noted. Then both uterine arteries were examined by color Doppler sonography and the mean of both uterine-artery Doppler indices including peak systolic velocity (PSV), end diastolic velocity (EDV), systolic to diastolic ratio (S/D ratio), resistive index (RI) and pulsatility index (PI) were determined. All of these indices were also determined for umbilical artery.

These women were asked to note the number of days they can fast and the hours of each fasting day.

Exclusion criteria of this study were:

1) Women with any abnormal finding in first

gray scale or colour Doppler examination.

2) Women of group 1 who had less than 15 days of fasting.

3) Women who did not return for second exam.

Data was analyzed by SPSS version 17 and were reported as Mean value with the standard deviation. Data was compared with independent sample t-test and Mann-Whitney U. P-values less than 0.05 were considered significant.

## Results

In the first exam one woman of control group was excluded because abnormal Doppler indices of uterine artery (In spite of gestational age of 27 week, there was early diastolic notch which is abnormal finding).<sup>10</sup> After one month, 14 women of fasting group were excluded because they did not tolerate enough days of fasting (13 women) or did not return for second exam (1 woman). Moreover, 11 women of control group were excluded because they did not return for second exam (8 women), preterm rupture membrane (1 woman) and delivery (2 women). Finally, 52 women, 25 in fasting group (Cases) and 27 in non fasting group (Controls) were Included and data were analyzed. The mean of fasting day among fasting women was  $23 \pm 6$  days. Maternal age, parity, primary weight and LMP related gestational age and mothers' weight gain during one month were similar in two groups (Table 1).

After one month (Ramadan) increase in biparietal diameter ( $\Delta$ BPD), femoral length ( $\Delta$ FL), abdominal circumference ( $\Delta$ AC), fetal weight (fatal weight gain) and also increase in gestational age related to BPD ( $\Delta$ Age-BPD), FL ( $\Delta$ Age-FL) and AC ( $\Delta$ Age-AC) were similar in two groups without statistically significant difference (Table 2).

**Table 1.** Comparison between maternal Characteristics of fasting and control groups (Mean $\pm$  SD)

Maternal Characteristics	Fasting group	Non fasting group	P-value
Age (year)	28.3 $\pm$ 5.5	28.3 $\pm$ 5.5	0.99
Parity	1.8 $\pm$ 0.9	2.0 $\pm$ 1.0	0.43
Primary weight (Kg)	67.9 $\pm$ 10.5	71 $\pm$ 14.1	0.38
Weight gain (Kg)	1.86 $\pm$ 1.36	2.00 $\pm$ 1.48	0.72
Gestational age related to LMP (week)	24.2 $\pm$ 6.3	23.9 $\pm$ 6.3	0.87

**Table 2.** Comparison between fetal growth indices of fasting and non fasting groups

Fetal growth indices	Fasting group	Non fasting group	P-value
ΔBPD (mm)	11.64 ± 3.6	11.81 ± 3.6	0.86
ΔAge-BPD (week)	3.72 ± 1.5	4.23 ± 0.7	0.13
ΔFL (mm)	12.4 ± 8.8	10.0 ± 3.3	0.19
ΔAge-FL (week)	3.7 ± 1.7	3.9 ± 0.9	0.59
ΔAC (mm)	42.1 ± 13.0	46.2 ± 13.6	0.27
ΔAge-AC (week)	3.8 ± 1.2	4.18 ± 1.2	0.32
FWG (g)	571 ± 339	562.5 ± 301	0.92

Data are presented as Mean ± SD.

ΔBPD: Increase in biparietal diameter; ΔAge-BPD: Increase in gestational age according to biparietal diameter; ΔFL: Increase in femoral length; ΔAge-FL: Increase in gestational age according to femoral length; ΔAC: Increase in abdominal circumference; ΔAge-AC: Increase in gestational age according to abdominal Circumference; FWG: fetal weight gain.

**Table 3.** Comparison between amniotic fluid index of fasting and non fasting groups

Amniotic fluid index	Fasting group	Non fasting group	P-value
AFI 1	151.4 ± 24.5	150.5 ± 31.3	0.90
AFI 2	139.8 ± 25.2	142.1 ± 26.8	0.75
P-Value	0.09	0.25	

Data are presented as Mean ± SD .

AFI1: Amniotic fluid index of first exam; AFI2: Amniotic fluid index of second exam.

There was also no significant difference between mean of amniotic fluid index (AFI) in first and second exams (Table 3).

There was not any case of Oligohydroamnios among two groups. Analysis of Doppler indices of uterine and umbilical arteries including PSV,

EDV, S/D ratio, RI and PI showed that there was not any statistically significant difference among two groups in both first and second exam (Table 4). In each group, Doppler indices before and after Ramadan were also compared (Table 4).

**Table 4.** Comparison of uterine and umbilical Doppler flow indices between fasting and non fasting group in first and second exam

		First exam (beginning of Ramadan)			Second exam (end of Ramadan)			P-value 1 <sup>st</sup> vs. 2 <sup>nd</sup> exam in fasting group	P-value 1 <sup>st</sup> vs. 2 <sup>nd</sup> exam in non fasting group
		Fasting group	Non fasting group	P-value	Fasting group	Non fasting group	P-value		
Umbilical artery	PSV (cm/s)	38.1 ± 9.0	40.7 ± 12.3	0.40	40.7 ± 9.4	37.5 ± 9.9	0.23	0.14	0.23
	EDV(cm/s)	11.8 ± 5.4	10.9 ± 5.4	0.56	14.3 ± 4.6	13.5 ± 4.8	0.54	0.05	0.01
	S/D ratio	3.6 ± 1.1	4.1 ± 1.2	0.16	2.9 ± 0.5	2.9 ± 0.5	0.65	<0.001	<0.001
	RI	0.70 ± 0.08	0.73 ± 0.07	0.12	0.65 ± 0.05	0.64 ± 0.06	0.56	<0.001	<0.001
	PI	1.21 ± 0.32	1.31 ± 0.26	0.24	1.06 ± 0.17	1.02 ± 0.19	0.51	0.33	0.32
Uterine artery	PSV (cm/s)	147.1 ± 38	142.7 ± 37.9	0.67	136.6 ± 40.8	131.4 ± 46.9	0.67	0.27	0.21
	EDV(cm/s)	67.3 ± 22.6	62.9 ± 22.5	0.49	64.2 ± 22.9	64.1 ± 23.5	0.99	0.52	0.99
	S/D ratio	2.3 ± 0.6	2.5 ± 1.3	0.41	2.1 ± 0.44	2.1 ± 0.4	0.74	0.13	0.33
	RI	0.54 ± 0.08	0.56 ± 0.1	0.54	0.51 ± 0.08	0.53 ± 0.12	0.55	0.03	0.02
	PI	0.88 ± 0.28	0.95 ± 0.40	0.44	0.81 ± 0.25	0.80 ± 0.25	0.94	0.29	0.02

Data are presented as Mean ± SD.

PSV: Peak systolic velocity; EDV: End diastolic velocity; S/D ratio: Systolic to diastolic ratio; RI: Resistive Index; PI: Pulsatility Index.

## Discussion

This study showed that in healthy pregnant mothers of second and third trimester, there was not any undesirable effect on fetal growth due to Ramadan fasting. Not only increase in growth indices (BPD, FL, AC, EFW) were similar in fasting and non fasting groups, but also in comparison with normal range values for gestational age,<sup>9</sup> there was not any mismatched value. Similar findings were reported by Dikensoy et al.<sup>6</sup> This study also showed no significant difference in amniotic fluid index, before and after Ramadan fasting. Similar findings were reported by Kamyabi et al.<sup>11</sup>

Ramadan is a lunar month in Islamic calendar which is not constant. It changes related to season and each year is about 10 days sooner than previous year. Kamyabi's study was performed when Ramadan was in November, however this study was performed in August with possibly more expected dehydration due to warm days, but there was not any abnormal amniotic fluid index among fasting women. One possible explanation is that regardless of acute dehydration, there is no evidence of chronic dehydration in Ramadan.<sup>12</sup>

Doppler indices of uterine and umbilical arteries showed there is no significant difference between both groups in the beginning and at the end of Ramadan. In each group, comparison of Doppler indices before and after Ramadan showed that there is no significant change in PSV and PI of umbilical artery and PSV, EDV and S/D ratio of uterine artery. There were significant increase in EDV and decrease in S/D ratio and RI of umbilical artery in both groups. This can be due to normal changes during one month.<sup>10</sup> However, it is not assumed to be important, because it was seen in both groups. Similarly, there is significant decrease in RI of uterine artery in both groups. Decrease of uterine artery PI in control group

is more significant than fasting group, however in comparison of all indices with normal range Values<sup>10</sup> for gestational age, there was not any abnormal index. Therefore, overallly no abnormality of uteroplacental or umbilical circulation was found.

Mirghani et al also showed no associated significant changes in uterine artery Doppler velocitometry due to Ramadan fasting,<sup>7</sup> but again their study was performed when Ramadan occurred in October. In addition to metabolic changes which are directly resulted from fasting,<sup>1</sup> dehydration can induce some metabolic changes.<sup>13</sup> Despite more expected dehydration in this study, there was not any disorder in uteroplacental or umbilical circulation. Alwasel et al,<sup>14</sup> in their study which carried out when Ramadan was occurred in October to December, showed that despite similar mean birth weight, placental weight were lower among fasting women. Possible explanation is that dietary changes during Ramadan influence placental growth, once the maternal blood supply is established and maternal blood enters the placenta.

Although concordance of Ramadan with late summer in Iran is pointed as the difference with previous studies, however this is the most important limitation factor of this study. Concordance of Ramadan with summer caused difficulties in finding women who volunteered or could tolerate fasting. More similar studies are recommended when Ramadan is in summer season.

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## Conflict of Interests

Author has no conflict of interests.

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