

## The Effect of Ramadan Fasting on Neonatal Weight in Different Trimesters of Pregnancy

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### Abstract

**Background and Objectives:** several investigations have been done to evaluate the effect of Ramadan fasting on fetal and maternal health, which have all led to controversial results. The role of Ramadan fasting time in birth weight is still unclear. This study evaluated the effect of fasting at different periods of pregnancy on birth weight.

**Methods:** 250 pregnant women fasting at least one day during Ramadan participated in this retrospective cohort study. Subjects were categorized into 3 groups, namely first trimester (n=112), second trimester (n=68) and third trimester (n=70) of pregnancy. Demographic and anthropometric data, obstetric history and history of Ramadan fasting were recorded. After delivery, neonatal birth weight was measured. The mean of weight and frequency of low birth weight in each group were calculated. Probable related factors of low birth weight of neonates with fasting mothers were evaluated.

**Results:** The mean of birth weight in different groups of Ramadan fasting time in first, second and third trimester of pregnancy were  $3411.52 \pm 529.88$ ,  $3214.57 \pm 463.56$  and  $3336.86 \pm 444.89$  gr respectively, which had a statistically significant difference ( $p=0.03$ ). Frequencies of low birth weight in different groups of Ramadan fasting time in first trimester was 8.9%, in second trimester 8.8% and in third trimester it was 7.1%, which had no statistically significant difference ( $p=0.9$ ). Among all evaluated factors, only neonatal sex was related to low birth weight.

**Conclusion:** Time of Ramadan fasting during pregnancy does not affect birth weight.

**Keywords:** Ramadan fasting, Birth weight, Pregnancy, Infant

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### Introduction

Ramadan fasting is one of Muslims' religious duties; they are forbidden to drink, eat, smoke cigarettes and even take medications from sunrise to sunset, but they have no limitations during nights. Based on geographical area and seasons, duration of fasting varies from 11 to 18 hours a day (1). As an Islamic religious rule, Ramadan fasting is not mandatory if there is any

contraindication, such as illness, old age, pregnancy, etc. But most Muslims, even with contraindication, tend to perform Ramadan fasting. Diet changes that provide different metabolic circumstances can disrupt the normal pregnancy course (2). Several studies have been done to examine different aspects of Ramadan fasting on fetus and maternal health during pregnancy, but with controversial results (3-5).

Birth weight is the first health indicator and also a predictive factor of neonatal survival rate, so that the increase in birth weight can significantly decrease neonatal mortality and morbidity rate (6). Although several factors affect birth weight like genetics, medical history, obstetric properties, demographic features, and socioeconomic level, diet and maternal metabolic conditions are also regarded as two important causes of low birth weight (LBW) (7). Previous studies have shown controversies in the effect of Ramadan fasting on neonatal birth weight (4,8,9). It seems that gestational age has an important role in the effect of amount and severity of Ramadan fasting on birth weight based on various growth rates in different trimesters of pregnancy. Determining the time of maximum effects of Ramadan fasting on birth weight along with increasing maternal health during fasting can ease prevention of low birth weight.

As such, this study aims to evaluate the effect of Ramadan fasting on birth weight in different trimesters of pregnancy.

**Methods:**

250 pregnant women, who were fasting at least one day during Ramadan, participated in this retrospective cohort study. This study was done in Kashan province. Samples were selected by non-random simple selection method among pregnant women who were admitted for delivery in one of the two public hospitals in Kashan until the completion of necessary sample size. The participants were categorized into three groups, based on gestational age consisting of first, second and third trimester.

Exclusion criteria were as follows: systemic disorders, multiple pregnancy, gestational age lower than 37 weeks, history of smoking or opium addiction, alcohol consumption, fetal anomaly before Ramadan fasting.

After clarification of the study to the patients, written consent forms were collected. Demographic features (including age, educational level, job, socioeconomic status), anthropometric features (consisting of height, weight, BMI), obstetric history (gravid, parity, delivery approach, gestational disorders), Ramadan fasting history (such as the trimester

Table 1. maternal features based on fasting time during pregnancy

| Features                          |              | Fasting time               |                            |                           | P value |
|-----------------------------------|--------------|----------------------------|----------------------------|---------------------------|---------|
|                                   |              | First trimester<br>(n=112) | Second trimester<br>(n=68) | Third trimester<br>(n=70) |         |
| Age <sup>a</sup>                  |              | 27.82±5.58                 | 28.54±4.68                 | 28.5±4.79                 | 0.56    |
| Weight <sup>a</sup>               |              | 68.39±13.38                | 64.98±9.89                 | 96.06±10.22               | 0.08    |
| Height <sup>a</sup>               |              | 1.61±0.06                  | 1.58±0.07                  | 0.061.61                  | 0.001   |
| job <sup>b</sup>                  | Housewife    | 96(85.7)                   | 59(86.8)                   | 56(80.0)                  | 0.48    |
|                                   | Out working  | 16(14.3)                   | 9(13.2)                    | 14(20.0)                  |         |
| Educational level <sup>b</sup>    | Elementary   | 30(26.8)                   | 23(33.8)                   | 18(25.7)                  | 0.38    |
|                                   | guidance     | 20(17.9)                   | 8(11.8)                    | 14(20.0)                  |         |
|                                   | High school  | 41(36.6)                   | 24(35.3)                   | 18(25.7)                  |         |
| Gravidity <sup>b</sup>            | University   | 21(18.7)                   | 13(19.1)                   | 20(28.6)                  | 0.09    |
|                                   | Primigravida | 48(42.9)                   | 27(39.7)                   | 48(42.9)                  |         |
| Parity <sup>b</sup>               | multigravida | 64(57.1)                   | 41(60.3)                   | 51(72.9)                  | 0.15    |
|                                   | nulliparous  | 0(0)                       | 2(2.9)                     | 0(0)                      |         |
|                                   | primiparous  | 56(50.0)                   | 31(45.6)                   | 29(41.4)                  |         |
| gestational problems <sup>b</sup> | multiparous  | 56(50.0)                   | 35(51.5)                   | 41(58.6)                  | 0.86    |
|                                   | No           | 74(66.1)                   | 43(64.2)                   | 48(68.6)                  |         |
| Duration of fasting <sup>b</sup>  | Yes          | 38(33.9)                   | 24(35.8)                   | 22(31.4)                  | 0.44    |
|                                   | <10 days     | 15(13.4)                   | 13(19.1)                   | 6(8.6)                    |         |
|                                   | 10-20 days   | 28(25.0)                   | 15(22.1)                   | 21(30.0)                  |         |
| Sahari taking <sup>b</sup>        | >20 days     | 69(61.6)                   | 40(58.8)                   | 43(61.4)                  | 0.22    |
|                                   | No           | 6(5.4)                     | 1(1.5)                     | 1(1.4)                    |         |
| Yes                               |              | 106(94.6)                  | 67(98.5)                   | 69(98.6)                  |         |

a: The values presented as mean± SD; b: The values presented as No (%)

of pregnancy during Ramadan fasting, number of fasting days, Sahari meal) were recorded in the constructed questionnaire.

After birth, age and birth weight and sex of the fetus were measured. A standard Digital scale was used for measurement of weight. Birth weight between 2500-4500 gr was considered to be normal and lower than 2500 the low birth weight.

Data were analyzed by SPSS ver.16. Data analyses were done using statistical tests such as chi-square, one way ANOVA, and logistic regression.

Results were reported in terms of absolute and relative frequency, odds ratio, confidence interval 95% (CI 95%) or mean  $\pm$  standard deviation.  $P < 0.05$  was considered to be statistically significant.

## Results

Of all 250 pregnant women, 112 (44.8%) women were in first trimester, 68 (27.2%) in second trimester and 70 (28%) women in third trimester during Ramadan fasting. Maternal

The outcome of all studied pregnancies were healthy and alive neonates. 48.2% of neonates in the group of pregnant women who were fasting during Ramadan in their first trimester, 54.4% in the group of second trimester and 58.6% in the group of third trimester were female ( $P=0.38$ ).

The mean of birth weight in the group of first, second and third trimester were  $3411 \pm 529.88$ ,  $3214 \pm 463.56$ ,  $3336 \pm 444.89$  gr, respectively. The mean of birth weight among different groups was statistically significant ( $P=0.03$ ). Frequency of low birth weight in first, second and third trimester (during Ramadan fasting) was 8.9%, 8.8% and 7.1% respectively, which was not statistically significant ( $P=0.9$ ).

Logistic regression analysis showed that only sex is related to abnormal birth weight of neonates of mothers who were fast during Ramadan. Assumed factors related to low birth weight due to Ramadan fasting during pregnancy have been shown in Table 2.

Table 2. single and multiple variable analyses of probable related factors to low birth weight of neonates of Ramadan fasting mothers

| Variable                                |                  | Low birth weight |                  | P value | Logistic Regression |         |
|---|------------------|------------------|------------------|---------|---------------------|---------|
|   |                  | Yes              | No               |         | OR (CI 95%)         | P value |
| Maternal age <sup>a</sup>               |                  | 26.76 $\pm$ 4.16 | 28.34 $\pm$ 5.19 | 0.18    | 1.04(0.94-1.15)     | 0.44    |
| Gestational age <sup>b</sup>            | First trimester  | 10(47.6)         | 102(44.5)        | 0.69    |                     |         |
|   | Second trimester | 6(28.6)          | 62(27.1)         |         |                     |         |
|   | Third trimester  | 5(23.8)          | 65(28.4)         |         |                     |         |
| Neonatal sex <sup>b</sup>               | Female           | 20(95.2)         | 112(48.9)        | 0.003   | 22.2(2.89-170.68)   | 0.003   |
|   | Male             | 1(4.8)           | 117(51.1)        |         |                     |         |
| Maternal job <sup>b</sup>               | Housewife        | 20(95.2)         | 191(83.4)        | 0.18    | 2.97(0.36-24.65)    | 0.31    |
|   | Out working      | 1(4.8)           | 38(16.6)         |         |                     |         |
| Maternal educational level <sup>b</sup> | Elementary       | 5(23.8)          | 66(28.8)         | 0.53    |                     |         |
|   | Guidance         | 7(33.3)          | 35(15.3)         |         |                     |         |
|   | High school      | 6(28.6)          | 77(33.6)         |         |                     |         |
|   | University       | 3(14.3)          | 51(22.3)         |         |                     |         |
| Gravidity <sup>b</sup>                  | Primigravida     | 8(35.1)          | 86(37.6)         | 0.96    |                     |         |
|   | Multigravida     | 13(61.9)         | 143(62.4)        |         |                     |         |
| Parity <sup>b</sup>                     | Nulliparous      | 0(0)             | 2(0.9)           | 0.97    |                     |         |
|   | Primiparous      | 10(47.6)         | 106(46.3)        |         |                     |         |
|   | Multiparous      | 11(52.4)         | 121(52.8)        |         |                     |         |
| gestational problems <sup>b</sup>       | No               | 14(66.7)         | 151(66.2)        | 0.97    |                     |         |
|   | Yes              | 7(33.3)          | 77(33.8)         |         |                     |         |
| Duration of fasting <sup>b</sup>        | <10 days         | 4(19.0)          | 30(13.0)         | 0.77    |                     |         |
|   | 10-20 days       | 4(19.0)          | 60(26.2)         |         |                     |         |
|   | >20 days         | 13(62.0)         | 139(60.7)        |         |                     |         |
| Sahari taking <sup>b</sup>              | No               | 2(9.5)           | 6(2.6)           | 0.11    | 3.29(0.43-24.85)    | 0.25    |
|   | Yes              | 19(90.5)         | 223(97.4)        |         |                     |         |

a: The values presented as mean  $\pm$  SD; b: The values presented as No (%) properties are shown in Table 1.

### Discussion:

In this study the effect of Ramadan fasting on birth weight, in different trimesters of pregnancy were evaluated; results showed that although means of birth weight in different groups were varied, prevalence of low birth weight in all groups was similar. There is just one study other than the current one having evaluated the role of Ramadan fasting time on birth weight in Saudi Arabia. In line with the results of the current study, Alwasel et al demonstrated that there is no difference in birth weight of neonates with fasting mothers during different trimesters of pregnancy (10). Several studies also evaluated the effect of Ramadan fasting on several specific periods of time that led to different or even controversial results. Ozturk et al showed that Ramadan fasting during second trimester of pregnancy has no significant impact on maternal oxidative stress and birth weight (11). Cross et al. demonstrated that although the prevalence of low birth weight of neonates with mothers who were Ramadan fasting in second trimester of their pregnancy, is higher, the difference is not statistically significant (12). Savitri et al studied 130 pregnant women and showed that Ramadan fasting in first trimester of pregnancy can cause low birth weight (8). The study by Makvandi was conducted to determine the effects of Ramadan fasting on neonatal anthropometric measurements during the third trimester of pregnancy. This was a cross-sectional study, carried out on 300 delivering women in 2013. All participants were divided into fasting (n=150) and non-fasting (n=150) groups. Neonatal anthropometric measurements were compared in both groups. They reported that there were no significant differences between the two groups in terms of birth weight ( $P=0.97$ ) of the neonates. In addition, the prevalence of low birth weight (LBW) was similar in fasting and non-fasting groups ( $P=0.33$ ). They concluded that Ramadan fasting in the third trimester of pregnancy has no adverse effects on neonatal anthropometric measurements (13).

In this study, despite previous studies, effective and destructive factors such as the number of fasting days, diet, maternal physical features and obstetric history were included to validate

the results in data analysis and the relationship between Ramadan fasting time and birth weight. Although the sample size was as large as possible, a study with a more extended population can better validate the results.

Different causes of low birth weight have been identified which can be categorized into 3 groups of maternal, fetal and placental. Nutritional impairment in maternal causes category is one of the most important factors for low birth weight related to Ramadan fasting. Macro and micro nutritional impairments of mothers are considered an independent factor for diminution of birth weight, the removal of which can lead to birth weight improvement (14,15).

Hypoglycemia and eventually ketonemia due to increased catecholamine releasing can cause placental hypo perfusion and lead to growth impairment and lower birth weight (16). Even though lower blood glucose level was detected in fasting pregnant women in second and third trimester of pregnancy, compared to non-fasting pregnant women, these situation did not cause ketonemia or ketonuria, even in summer (with more than 18 hours of fasting) (17). Therefore, nutritional impairment does not directly cause low birth weight in neonates with fasting mothers during Ramadan, because Ramadan fasting is not a complete nutritional deprivation diet; it is just a regimen with changes in time and type of nutrition (18); it is a controlled and limited diet that can provide the minimum required calories (about 2500 kcal per day) during nights (19).

Maternal hormonal alteration can also affect birth weight. For example, studies showed that maternal cortisol serum level is related to birth weight; increased maternal cortisol level can increase chances of low birth weight (20, 21). Ramadan fasting in pregnant women conduces to significant changes in hormonal balance, such as the reduction of leptin, LH, FSH serum level and an increase in cortisol serum level, but the effect of these changes on fetal development and growth is unclear (22, 23).

The majority of investigations about the impact of Ramadan fasting on fetus have been done on term pregnancies. Maternal hormonal alteration due to Ramadan fasting can lead to some events

such as abortion or premature delivery that were neglected in available studies. Therefore, it seems indispensable to conduct more studies in this regard.

Placental growth and developmental disorders are considered another contributory factor in low birth weight. Several investigations have shown that maternal nutritional impairment can cause a decrease in placental weight and so decrease fetal nutritional regimen, which is related to gestational age, duration and manner of impairment (partial or complete) (24).

Alwasel et al. evaluated Ramadan fasting effect on placental weight; they revealed that fasting in second and third trimester of pregnancy can lead to significant decrease of placental weight; however it did not affect neonatal birth weight (10).

Although more studies are needed, it seems that Ramadan fasting effects on placenta is limited to its size and weight but placental function remains in normal range.

### Conclusion:

Having controlled background and destructive factors in this study, it was found that birth weight of neonates of Ramadan fasting mothers is not related to gestational age during fasting. Moreover, Ramadan fasting in different trimesters of pregnancy does not cause chances of increased low birth weight.

### Conflict of interest

The authors declare no conflict of interest with the results of this study.

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### Authors' Contribution

No distribution of duties been defined by authors.

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