

# Glycemic Control among Pregnant Diabetic Women on Insulin Who Fasted During Ramadan

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This article has Continuous Medical Education (CME) credit for Iranian physicians and paramedics. They may earn CME credit by reading this article and answering the questions on page 326.

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## Abstract

**Background:** Ramadan fasting for pregnant women with diabetes remains controversial and underreported. The objective of this study was to determine the glycemic control in pregnant diabetic women on insulin who fasted during Ramadan.

**Methods:** This was a retrospective study carried out over a period of three years including pregnant diabetic women, who were on short-acting, intermediate-acting, or a combination of them, and opted to carry out Ramadan fasting. Glycemic control was assessed before, middle and after Ramadan fasting.

**Results:** Thirty seven women opted to fast with 24 (64.9%) of them had type 2 diabetes mellitus and 83.8% of them required combined insulin (short-acting, intermediate-acting) therapy. The age of the participants was 32.13±4.68 years, and the age of their pregnancies was 25.60±7.12 weeks when the study was performed. The median number of days fasted was 25 days, and most of the women were able to fast for more than 15 days. There was no difference between glycemic control of type 2 diabetes mellitus and gestational diabetes mellitus women prior to fasting. In the middle of Ramadan, serum fructosamine decreased in both groups. However, only serum HbA1c reduced in gestational diabetes mellitus after Ramadan.

**Conclusion:** the findings indicate that pregnant diabetic women on insulin were able to fast during Ramadan and that their glycemic control was improved during fasting period. They may also suggest that instead of absolute ban on fasting for pregnant diabetic women more practical approach and close consultation with health care providers might be more helpful.

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**Keywords** • Fasting • insulin • diabetes • pregnancy • gestational diabetes

## Introduction

Ramadan is a holy month for Muslims, in which healthy adult individuals are obliged to fast from dawn to sunset. Pregnant women are among those who are exempted from fasting. Despite that, many pregnant Muslim women fast,<sup>1</sup> against the standard medical advice.<sup>2</sup> Among these are pregnant women with diabetes, who are in need of insulin but perceive themselves to be fit to carry out the fasting.

Several studies,<sup>3,4</sup> conducted on healthy pregnant women during Ramadan have shown no detrimental effects or complications on them or their fetuses. These two studies, which compared fasting pregnant women with non fasting ones, showed lower serum levels of glucose and cholesterol with no evidence of ketonuria in fasting women. Moreover, there were no adverse effects on intrauterine fetal health. During the day when fasting is being carried out, food, drink or any oral intakes are not permitted. These contribute to an overall reduced caloric intake in most individuals. Diabetic adults, who fast during Ramadan, are of the same concern, especially if they are on insulin injections. Compliance to medications,<sup>2,5,6,7</sup> and adjustment to meal pattern are other issues to consider. In Malaysia, which is near to the equator, the daytime fast is about 14 hours. Such a long daytime renders glycemic control a difficult task.

Every year during Ramadan, many pregnant women with diabetes attempt to fast and continue to be on insulin. They usually seek the advice from health care providers on the dose and timing of insulin administration to enable them to fast. Pregnant women with diabetes, who insist on Ramadan fasting, require a reduction in the dose of insulin, since there is a general reduction in caloric intake. This requires diligent blood glucose adjustment and monitoring to ensure maternal and fetal well-beings. It can only be successful with commitments from health care providers and dedication on the parts of the patients.

Studies by Dikensoy et al.<sup>3,4</sup> did compare healthy pregnant women who were fasting during Ramadan with those who did not fast. Up to the time when this current study was proposed, there was no published data on pregnant diabetics in Ramadan fasting. Therefore, the present study was conducted to analyze the glycemic control in pregnant women with diabetes, who were on insulin therapy and fasted during the month of Ramadan.

## Material and Methods

This study was approved by the Institutional Ethics and Clinical Research Committee.

It was a retrospective study of a cohort of pregnant women with diabetes conducted in a tertiary hospital (Universiti Kebangsaan Malaysia Medical Centre) during the month of Ramadan in 2007-2009. All women with diabetes during pregnancy who were on insulin and opted to carry out Ramadan fasting were included in the study. Fasting pregnant women with gestational diabetes (GDM), or type 2 dia-

betes mellitus (T2DM) requiring insulin treatment were included. The participants were managed by a combined team of doctors consisting of endocrinologists and obstetricians. The insulin regimen during Ramadan fasting was tailored according to the participants' regimen during the non fasting days with reductions in daily doses during Ramadan. The women were either on short acting insulin, intermediate acting insulin, or a mixture of them. The insulin injections during the daytime were omitted for the period of fasting. Insulin (short acting, Actrapid<sup>®</sup> 100 units/ml; Novo Nordisk, Brazil) were given half an hour prior to iftar (sunset meal) and sahur (dawn meal). If intermediate acting insulin (Insulatard<sup>®</sup>, 100 units/ml; Novo Nordisk, Bagsvaerd, Denmark) were required, this would have been given prior going to sleep.

Since the participants opted to fast despite medical advice, they were counseled for possible complications, which may affect them or their fetuses. They were advised to break their fast with the advent of any signs and symptoms of hypoglycemia, even if they were mild. The women were visited one week prior to Ramadan (pre-Ramadan), during the second week of Ramadan (mid-Ramadan) and a week after Ramadan (post Ramadan). At each visit, blood samples were obtained for laboratory measurements including HbA1c and serum fructosamine. Favorable serum levels of HbA1c and fructosamine were 3.4-6.1% and 205-285 mg/dl, respectively. Fasting pre-meals (iftar and sahur) and pre-bed blood glucose monitoring at home were carried out. The participants were educated for the signs and symptoms of hypoglycemia. If such signs and symptoms were present, blood glucose levels were determined.

The maternal clinical characteristics consisting of age, parity, types of diabetes and insulin usage were analyzed. Maternal glycemic control was determined at three different stages of Ramadan fasting (pre, mid and post Ramadan). Statistical analysis was performed using Statistical Package for Social Science (SPSS version 12). The Chi-square test was used to analyze the rate and frequencies, and t test was used for the analysis of qualitative data. A P value of less than 0.05 was deemed significant.

## Results

There were 37 women, who opted to fast in Ramadan during the 3-year period. The majority consisted of women with T2DM (24, 64.9%), while the rest (13, 35.1%) had GDM. All of

them required insulin injections to achieve good glycemic control. The maternal demographic data consisting of maternal ages, parity, gestational age and type of insulin used showed no statistical difference between the T2DM and GDM groups (table 1).

The majority of T2DM women were primigravidae while that of GDM group were multiparae. Most of the women were in their second trimester during the study period. The combined regime of short and intermediate acting insulins (basal bolus regime) was the most commonly used in both groups. The median number of days fasted was 25 days for both groups. Most of the women were able to fast for more than half of the month (>15 days). There was no reported hypoglycemic events in the study, as the participants had already been advised to break the fast even before the hypoglycemic events could set in.

There was no statistically significant difference between the T2DM and GDM groups in terms of glycemic control at one week before Ramadan fasting (pre-Ramadan). However, serum level of HbA1c tended to be higher in the GDM group (table 2), and serum fructosamine levels tended to be lower in T2DM group. During the second week of Ramadan (mid-Ramadan) serum levels of both HbA1c and fructosamine in both groups were lower compared to the relevant levels prior to Ramadan. Compared to onset and mid-Ramadan there was a clear reduction in the levels of serum

fructosamine in both groups (T2DM and GDM) at post-Ramadan, while HbA1C tended to drop only in the GDM group.

Compared to pre-Ramadan measurements, serum fructosamine levels in all the three groups (T2DM alone, GDM alone, or combined TDM and GDM) were lower after Ramadan fasting. No major complication such as fetal distress or death was reported during the month among the participating women.

## Discussion

The growing concern about the risks of fasting during Ramadan in adults with medical problems, especially among diabetes patients, have prompted authorities all around the world, particularly in countries with Muslims majority, to update recommendations and guidelines on the management of diabetes during Ramadan.<sup>8,9</sup> The revised recommendations are made to reduce possible complications especially with hypoglycemia during the fasting period as well as uncontrolled hyperglycemia after the sunset meal.<sup>10,11</sup> Ramadan-focused educations have resulted in minimizing the complications of hypoglycemia during pregnancy by empowering pregnant patients to change their lifestyles.<sup>11,12</sup>

All the medical diabetes guidelines formulated so far,<sup>8,9,13</sup> for Ramadan fasting prohibit pregnant diabetes from fasting during Ramadan, since it is categorized as a high risk pregnancy. Despite being exempted from Ramadan

**Table 1:** Demographic characteristics of pregnant women with type 2 diabetes mellitus (T2DM) or gestational diabetes mellitus (GDM)

	Combined n=37 (100%)	T2DM n=24 (64.9%)	GDM n=13 (35.1%)	P value
Age (years)	32.1±4.7	32.3±4.7	31.8±4.8	0.598
Parity				
Primigravidae	18 (48.65%)	14 (58.33%)	4 (30.77%)	0.105
Multiparae	19 (51.35%)	10 (41.67%)	9 (69.23%)	
Gestational age (week)	25.00	24.00	25.50	0.378
Type of Insulin				
Short acting	6 (16.2%)	2 (8.3%)	4 (30.8%)	0.770
Short & Intermediate	31 (83.8%)	22 (91.7%)	9 (69.2%)	

Age is presented as mean±SD, parity and types of insulin as number (percentage), and gestational age as median.

**Table 2:** Serum levels (median) of HbA1c (%) and fructosamine (mmol/L) of pregnant women with type 2 diabetes (T2DM) or gestational diabetes (GDM) at the onset, middle and after Ramadan fasting

	Combined n=37	T2DM n=24	GDM n=13	P value
Onset Ramadan				
HbA1c %	5.9	5.8	6.2	0.567
Fructosamine	223.0	225.0	218.0	0.849
Middle Ramadan				
HbA1c %	5.8	5.8	6.1	0.202
Fructosamine	214.0	219.5	214.0	0.644
After Ramadan				
HbA1c %	5.7	5.8	5.6	0.218
Fructosamine	204.0	210.0	195.0	0.228

fasting by Islamic fiqh rulings, in reality many of pregnant women including those with diabetes during pregnancy insist on carrying out this religious duty as they perceive themselves to be healthy. As health providers, it is our obligation to ensure that the fasting is carried out without complications so as to ensure the safety of women with pregnant diabetes and their fetuses. Denying patients' wishes to fast may complicate the matters since, such patients may ignore the medical advices and modify their own treatment, which can endanger their health and that of their fetuses. Consenting to their request, on the other hand, will ensure their compliance and reduce any untoward effect of their decision.

Over the three years period in which the present study was performed, a total of 37 pregnant diabetic women insisted on carrying out the Ramadan fasting despite medical advices. To ensure safety, they had to commit themselves to good glycemic controls after being told of possible untoward risks to themselves and their fetuses. Clinical features of these women did not reveal any statistical difference with majority (64.9%) of them being Type 2 diabetes. Many women in their second trimester fasted as they felt physically better as compared to their hyperemesis period, which had occurred in their first trimester. However, more patients did not fast in their third trimester, since this period is more physically demanding and the patients are more likely to feel tired. Although the mean ages (table 1) in the T2DM and GDM groups were about the same, majority of T2DM group who fasted were primigravidae and majority of patients in the GDM group were multiparae. This reflects that these women were relatively newly-diagnosed and had mild diabetes (HbA1c below 6.2%) to start with.

Most of the women were able to successfully undergo Ramadan fasting for more than 15 days, with a median of 25 days in each group. One patient, who was in her third trimester, fasted only for two days, since she felt tired during the fasting days. There were no hypoglycemic events in these women. Since majority of the participating women had T2DM, the combined regimen of insulin (short-acting and intermediate-acting) was mostly used. Intermediate-acting insulin was added to short-acting insulin if the fasting hyperglycemia remained a problem. Similar insulin injections were given to fasting non pregnant women with T2DM needing insulin therapy in a previous study.<sup>8</sup> In the present study, the insulin injections were given at pre

dawn meal and prior to sunset meal, similar to guidelines advocated and recommended for non pregnant patients.<sup>8,13</sup>

Despite scarcity of published studies on Ramadan fasting in pregnant women, earlier studies,<sup>3,4</sup> showed that mild dehydration did not lead to adverse effect on intrauterine fetal development in healthy pregnant women. Moreover, it was observed that maternal blood glucose level was significantly reduced.<sup>3,4,14</sup> A similar findings were observed in the present study, where there was no deterioration in the glycemic control, and a significance proportion of women were still able to achieve the glycemic targets. However, post prandial monitoring, which could have a better assessment of the hyperglycemic state, was not undertaken. During Ramadan fasting, the patients fasted for 4 weeks at the most. Comparing such a period to the rest of non fasting days in the remaining 34 weeks of pregnancy, during which regular meals with more calorie are taken, one would expect a worse or more challenging hyperglycemia to occur during the non fasting days. Dikensoy et al in their studies,<sup>3,4</sup> compared healthy pregnant women who fasted during Ramadan with those who did not, and showed that maternal glucose levels were significantly lower in the fasting group.

Another study assessing placenta sizes in normally-pregnant women, however, showed that the mean placental weight was lower in those whose mothers were fasting.<sup>15</sup> Nonetheless the overall long term effect on children whose diabetic mothers fast during pregnancy has not been studied yet. In another study by Malhotra et al.<sup>14</sup> on Asian pregnant mothers fasting during Ramadan, it was shown that babies born to mothers who had fasted during Ramadan had a mean birth weights similar to birth weights of similar children in Europe. Thus, the only immediate and major fetal event namely fetal death, which may be a limitation of the present study, was considered. It is proposed to repeat the present study with a larger sample size looking at the overall pregnancy results, condition of placenta and the outcomes of neonates.

Although both groups (T2DM and GDM) were relatively in good control at the start of the study (table 2), HbA1c was insignificantly higher in GDM group. Further reductions in both in HbA1c and serum fructosamine were seen in the middle of fasting month (week 2) in both groups. After Ramadan, there was a definite decrease in serum fructosamine levels in both T2DM and GDM groups.

The GDM group showed reductions in glycaemic controls shown by HbA1c and serum fructosamine levels throughout Ramadan. This is probably explained by a relatively less insulin resistance in these patients compared to T2DM. However, the overall effect had clearly revealed reduction of fructosamine levels (recent control, during Ramadan) in both T2DM and GDM. A similar reduction was described in other earlier studies,<sup>3,4,14</sup> on healthy pregnant women.

Recent studies,<sup>16,17</sup> on non pregnant diabetic adults, who fasted during Ramadan had no adverse effects were seen on the heart, lung, liver, kidney, eyes, hematological profile, and endocrine and neuropsychiatric systems in well-educated and well-committed T2DM patients. Similarly in the present study, no major morbidity to the maternal and fetal health (for example, fetal death) due to Ramadan fasting was observed. In fact a significant number of women were able to achieve desired glycaemic control. In the only study published recently,<sup>18</sup> insulin usage in those requiring insulin therapy, with vigilant monitoring, was tolerable during Ramadan fasting. Diligent monitoring combined with commitment from patients and health providers have proven that pregnant diabetics on insulin can achieve good glycaemic control without complications during Ramadan fasting.

One limitation of the present study was the small sample size. Studies involving pregnant diabetic women carrying out Ramadan fasting is under-reported. Given such a limited publication, the present study, though with a small sample size, hopes to shed some light on the subject of fasting during Ramadan. However, further larger scale randomized studies are recommended to make the findings more meaningful statistically, and to provide a better understanding of the issue.

## Conclusion

The findings of the present study indicate that pregnant diabetic women on insulin were able to fast during Ramadan, and that their glycaemic control was improved during fasting period. It is timely to reconsider and evaluate current recommendations, which prohibit pregnant diabetic women from fasting. The findings might be taken as evidence to suggest that instead of absolute ban on fasting for pregnant diabetic women more practical approach and close consultation with health care providers might be more helpful.

**Conflict of Interest:** None declared

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