KETONURIA AND SERUM GLUCOSE OF FASTING PREGNANT WOMEN AT THE END OF A DAY IN RAMADAN

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Abstract- Moslem pregnant women are inclined to fast during the month of Ramadan. Ketonuria and hypoglycemia are harmful in pregnancy. The aim of this study was to find out whether clinical symptoms and/ or calorie deficiency of fasting pregnant women before Eftar (ending of the daily fast) can accurately predict ketonuria and hypoglycemia. In a descriptive study, 185 volunteer fasting pregnant women in Ramadan of 1999 were tested just before Eftar taking into account their clinical symptoms, intake of the previous 24 hours and testing their ketonuria and serum glucose. The positive predictive values of clinical symptoms before breaking the fast for ketonuria and hypoglycemia were 32% and 56%, respectively. The negative predictive values of clinical symptoms for ketonuria and hypoglycemia were 70% and 33%. The positive predictive values of over 500 Kcal deficiency in ketonuria and hypoglycemia were 33% and 57%. Severe calorie deficiency (more than 2000 Kcal) positively predicts ketonuria in 70% of cases and sufficient calorie intake (less than 500 Kcal deficiency) negatively predicts ketonuria in 93% of women. Clinical symptoms and calorie intake were not appropriate criteria for predicting ketonuria and hypoglycemia except in asymptomatic or severely calorie deficient cases or those with sufficient calorie intake whose ketonuria was predicted accurately.
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Key words: Blood glucose, diet, fasting, pregnancy, ketones

INTRODUCTION

Moslem pregnant women intend to keep the Ramadan fast, but they are worried about risking the health of their fetus. Their relatives and family members are also worried about them. The physicians have not yet found a clear answer to the major question concerning pregnancy and fasting: "Is fasting harmful or not?" It has been proved that ketonuria and hypoglycemia are harmful in pregnancy. Ketosis should be avoided in pregnancy because of the possibility of unfavorable effects on fetus. Maternal ketonuria during pregnancy leads to decreased fetal intelligence, therefore fasting and limited carbohydrate intake should be avoided during this period (1). In hunger conditions, the level of free fatty acids (FFA) increases which shows that fatty acids are being released as a source of energy. The increase in FFA causes an increase in their transfer to the liver, where ketones are produced and carried to other sites such as muscles to be used as a source of energy (2). Profound hypoglycemia is harmful to newborn and fetus, as well (3).

Rashed et al studied metabolic consequences of fasting in 11 pregnant women. A considerable decrease in the amounts of insulin, glucose, lactate, carnitine, and increase in the concentrations of triglyceride and hydroxybutirate was observed before breaking the fast. The researchers observed this accelerated starvation pattern in women who continued fasting till the end of pregnancy (4).

Clinical symptoms and the history of 24-hour intake during the fast may be used as predictors of ketonuria and hypoglycemia. There are two groups of

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hypoglycemic clinical symptoms. The first occur because of an increase in secretion of epinephrine e.g., hydrosis, tremor and tachycardia. The second group of symptoms develop as a result of disorders in the function of central nervous system e.g., vertigo, headache, blurred vision and decreased concentration. When the onset of hypoglycemia is gradual, central nervous system signs prevail. It is probable that the epinephrine stage would not be clear (5).

This study shows the role of two clinical markers including diet and subjective clinical symptoms in the prediction of ketonuria and hypoglycemia.

MATERIALS AND METHODS

One hundred eighty-five volunteer pregnant fasting women took part in this cross-sectional study, from 1st to 28th in Ramadan of 1999. Women with coexistent medical diseases or those who were under medication were excluded. The mean duration of fasting was 11 hours and 45 minutes. Clinical symptoms and consumed calories in all cases were studied from 30 minutes before breaking their fast up to the time it was broken. Samples of blood sugar and urine were taken.

The interviewer asked about clinical and subjective symptoms such as vertigo, weakness, impatience and lack of energy, and entered the answers into the questionnaire. The interviewer also asked about the information related to the foods taken at dawn of the same fasting day and from the time of breaking the fast in the last night up to the next dawn. Food intake was recorded based on the women's 24-hour recall.

The women were then divided into three groups of average, overweight and underweight based on their height and wrist circumference, in order to calculate the ideal weight on the basis of height. The ideal weight was multiplied by 40 and added to 500 (the pregnancy need). The resulting figure was equal to the calories needed for 24 hours. The amount of calories consumed during the 24 hours before breaking the fast was calculated considering the eaten foods, and the difference of these two was used to determine the calorie deficiency of the 24 hours before breaking the fast.

The urine samples were studied for the existence of ketones by the use of a special ketone measurement tape manufactured by Kermanshah Bakhtar biochemistry factory. The venous blood sample of the individuals was sent by the interviewer to the reference laboratory immediately after sampling. As soon as the laboratory received the sample, it was tested by the calorimetry method and orthotoloidine solution.

The main variables of the study were subjective clinical symptoms, calorie deficiency, ketonuria, and serum glucose. Data analysis was done by SPSS and EPIG softwares. The positive and negative predictive values, sensitivity and specificity of clinical symptoms and calorie deficiency in the 24 hours before breaking the fast were calculated in predicting the ketonuria and blood sugar.

RESULTS

Of the 185 pregnant fasting women who were studied, 90.3% lived in urban and 9.7% in rural areas. The mean age was 26 years (16-43); 15.7% of the study population were in the first, 50.3% in the second, and 34.1% in the third trimester of pregnancy. 55.4% had an average body size, 32.1% were overweight, 4.3% underweight, and 8.2% obese.

Ninety-five women (51.4%) showed clinical symptoms before breaking their fast and 90 (48.6%) showed no clinical symptoms. The average deficiency of calorie in the studied individuals during 24 hours before breaking the fast was 1202 Kcal. Only 15 women (8.1%) had less than 500 Kcal deficiency, and 170 (91.9%) had more than 500 Kcal deficiency. 127 women (68.6%) had no ketonuria before breaking their fast.

Twenty-five women (13.5%) had 1^+, 19 (10.3%) 2^+, and 14 (7.6%) 3^+ ketonuria. The mean blood sugar before breaking the fast was 56 mg/dl; the minimum was 41mg/dl. Before breaking the fast, 111 (61%) individuals had hypoglycemia (blood sugar below 60 mg/dl). The positive predictive values of clinical symptoms before breaking the fast were 32% for ketonuria and 56% for hypoglycemia. The negative predictive values of clinical symptoms before breaking the fast were 70% for ketonuria and 33% for hypoglycemia (Table 1).

Table 1. Different values of clinical symptoms in ketonuria and hypoglycemia*

Value	Ketonuria	Hypoglycemia
Positive predictive value	95 (32)	95 (56)
Negative predictive value	90 (70)	90 (33)
Specificity	127 (49)	71 (42)
Sensitivity	58 (53)	111 (48)

*****Data are presented as number (percent).

Table 2. Different values of 24 hours calorie intake in ketonuria and hypoglycemia*

Value	24 hours calorie intake	Ketonuria	Hypoglycemia
Positive predictive value	Calorie deficiency >500 kcal	170 (33)	170 (57)
	Calorie deficiency >1000 kcal	126 (33)	126 (58)
	Calorie deficiency >1500 kcal	47 (38)	47 (59)
	Calorie deficiency > 2000 kcal	10 (70)	10 (40)
Negative predictive value	Calorie-sufficient diet	15 (93)	15 (13)
Specificity	Calorie deficiency >500 kcal	127 (11)	71 (2)
	Calorie deficiency >1000 kcal	127 (33)	71 (24)
	Calorie deficiency > 1500 kcal	127 (77)	71 (76)
	Calorie deficiency more than 2000 kcal	127 (2)	71 (94)
Sensitivity	Calorie deficiency >500 kcal	58 (98)	111 (88)
	Calorie deficiency > 1000 kcal	58 (72)	111 (66)
	Calorie deficiency >1500 kcal	58 (30)	111 (25)
	Calorie deficiency > 2000 kcal	58 (12)	111 (3)

*****Data are presented as number (percent).

The sensitivity of clinical symptoms before breaking the fast was 53% for ketonuria and 48% for hypoglycemia. The specificity of clinical symptoms before breaking the fast was 49% and 42% for ketonuria and hypoglycemia, respectively (Table 1). The positive predictive values of more than 500 kcal deficiency during 24 hours before breaking the fast were 33% for ketonuria and 57% for hypoglycemia (Table 2). Severe calorie deficiency (more than 2000 kcal) had a positive predictive value of 70% for ketonuria before breaking the fast (Table 2). The negative predictive value of sufficient calorie intake (24 hours calorie deficiency less than 500 kcal) for ketonuria and hypoglycemia before breaking the fast were 93% and 13%, respectively (Table 2).

Sensitivity of more than 500 kcal deficiency during the last 24 hours was 98% for ketonuria before breaking the fast and 88% for hypoglycemia (Table 2). The specificity of calorie deficiency of more than 500 kcal during the last 24 hours was 11% for ketonuria and 2% for hypoglycemia (Table 2).

DISCUSSION

It is possible that the main symptoms of central nervous system dysfunction do not occur until the blood sugar reaches 20 mg/dl. This is because normal people can increase their cerebral blood flow and carry enough glucose to the brain.

In the current study, it became clear that the clinical symptoms before breaking the fast are not an appropriate criteria for predicting ketonuria and hypoglycemia. It should be kept in mind that no one showed profound hypoglycemia. Indeed, the minimum blood sugar before breaking the fast was 41mg/dl.

Intravenous glucose is prescribed to newborn infants when oral nutrition is not enough to keep blood sugar above 40 mg/dl (3). In this regard, mild hypoglycemia before Eftar dose not seems harmful. On the other hand, we have tested blood sugar just before Eftar and following a more than 11 hours fasting. Hypoglycemia may have occurred sometime before sampling such as 2 pm, and counter-regulatory reactions may have compensated low blood sugar to higher levels as detected by our tests.

Clinical symptoms were able to predict 70% of non-ketonuric patients. In this regard symptom-free women can be reassured to be in a non-ketonuric and nearly safe condition.

If ketonuria occurs during pregnancy hospitalization of pregnant woman for serum therapy is recommended (1). The total process of ketosis will recover by returning to adequate carbohydrate metabolism. In excessive hunger, this return includes eating sufficient amounts of carbohydrate (6).

In this study clinical symptoms were neither sensitive nor specific regarding ketonuria and hypoglycemia.

As previously mentioned, clinical symptoms are expected to occur as an outcome of profound hypoglycemia, which were not found in our study population at all. In the current study it was shown that the amount of calorie consumption is not an appropriate method of predicting ketonuria or hypoglycemia. But when the calorie deficiency is severe (more than 2000 kcal during 24 hours), the ketonuria is predictable in up to 70% and when the calorie consumption is sufficient, non-ketonuria is predictable in up to 93%. That is, severe calorie deficiency is undoubtedly harmful.

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