

Safety of Ramadan Fasting in Children, Adolescents and Young People with Type I Diabetes Ramadan

Zeinab Elhshaeshi¹, Mabruka Ramadan², Faten BenRajab^{3@} and Entisar Aboukanada⁴.

^{1,2,3}Endocrine unit, Department of Pediatric, Tripoli Children Hospital, Libya.

^{2,3}Department of Pediatric, Faculty of Medicine, University of Tripoli, Libya.

⁴Department of Family and Community Medicine, Faculty of Medicine, University of Tripoli, Libya.

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ABSTRACT

Fasting during Ramadan, one of the five pillars of Islam is an obligatory duty for all healthy Muslims from age 12 years. The Quran specifically exempts people with a medical condition from the duty of fasting, especially if it might have harmful consequences. However, many people with diabetes insist on fasting during Ramadan and there is high risk of developing acute complications; the major risk during Ramadan is hypoglycemia and excessive consumption of sweet and fried foods with the sunset and pre-dawn meal may predispose to hyperglycemia and diabetic ketoacidosis.

This study aimed to determine safety of Ramadan fasting, change in HbA1c value & weight among children, adolescents and young people with type 1 diabetes.

A prospective observational study was designed for children adolescents and young people with T1DM - at diabetic clinic in Tripoli Children Hospital- who wish and insist on fasting during Ramadan 1435 lunar year (July 2014).

Patients were revised 3 months before the start of Ramadan for education, they were on Basal- bolus regime either by using multiple daily injections (MDI) or flexible insulin regimen (FIR), Insulin dose was 0.7-1.5 u/kg/day according to the requirement of the individual patient.

109 patients were involved (65.1% were female; mean age was 15.0 years (± 2.9) SD, mean duration for diabetes was 6.4 yrs. (± 4.0) SD. Mean weight before and after Ramadan is the same 61.4 (± 13.9) P value 0.96. Mean HbA1C pre Ramadan 8.9 (± 1.7) compared with 8.6 (± 1.6) after Ramadan P value 0.26. No significant difference in occurrence of hypoglycemia, hyperglycemia and diabetic ketoacidosis (DKA) pre-Ramadan and during Ramadan. We compared 45 patients (Group I) who complete their fast for whole month with 55 patients (Group II) who broke their fast; (median of non-fasting days is 4 days). Mean HbA1C Group I mean 8.6 (± 1.7) pre Ramadan, 8.2 (± 1.5) post Ramadan while Group II mean 9.3 (± 1.7) to 9.1 (± 1.6), DKA was reported only in Group II pre-Ramadan and during Ramadan. In group I hypoglycemic episodes occur in 29 patient pre Ramadan (28 mild and 1 was severe) only 15 patients had mild hypoglycemic episodes during Ramadan P value was 0.003. In group II hypoglycemic episodes occur in 23 patient pre Ramadan (22 mild and 1 severe); 34 patient had episodes of hypoglycemia during Ramadan (29 mild and 5 severe) P value was 0.01, difference between 2 groups was significance P value 0.001. Hyperglycemia in group I occur in 35 patients pre Ramadan, same number had hyperglycemia during Ramadan; in group II episodes occur in 34 patients pre Ramadan which increase to 43 episodes during Ramadan, the difference between 2 groups in occurrence of hyperglycemia during Ramadan was significance P value 0.05.

Conclusion: Children and adolescents older than 12 years and young people with type one diabetes on basal bolus regimen can fast safely during Ramadan provided they have proper education and more glycemic control before Ramadan.

Key words- Fasting, Ramadan; Diabetes; hypoglycemia; hyperglycemia; diabetic ketoacidosis.

INTRODUCTION

Fasting during Ramadan, one of the five pillars of Islam is an obligatory duty for all healthy adult Muslims. Ramadan, a lunar month, it can last for 29 or 30 days and its timing changes with respect to seasons.¹ Depending on the geographical location and season, the duration of the daily fast may range from a few to 20 hours.¹

Muslims who fast during Ramadan must abstain from eating, drinking, use of oral medications, and smoking from predawn to after sunset; however, there are no restrictions on food or fluid intake between sunset and dawn. Most people consume two meals per day during this month, one after sunset and the other before dawn²

Allah (the God Almighty) has mentioned in the Holy Book



of the Muslims (Quran) that the fasting is prescribed for the believers as was prescribed for the people before them, so that they may acquire self-control and god consciousness.³ The Quran specifically exempts people with a medical condition from the duty of fasting, especially if it might have harmful consequences; people with diabetes fall within this category. However, many people with diabetes insist on fasting during Ramadan.¹ To many Muslim the month of Ramadan brings a sense of calm and spiritual satisfaction. There is also strengthening of ties within families and the sense of belonging.⁴ However, there is high risk of developing acute complications like hypoglycemia or ketoacidosis during fasting. The major risk of diabetic who fast during Ramadan is hypoglycemia. On the other hand, the excessive consumption of sweet and fried foods especially with the sunset meal may predispose to hyperglycemia. According to fasting guidelines for diabetic children and adolescents, the following patients are in a very high-risk group for fasting during Ramadan: Severe hypoglycemia within 3 months prior to Ramadan, A history of recurrent hypoglycemia, hypoglycemia unawareness, sustained poor glycemic control, Ketoacidosis within 3 months prior to Ramadan. Type 1 diabetes, acute illness and hyperosmolar hyperglycemia coma within the previous 3 months and chronic dialysis.^{2,5} perhaps the most crucial issue is the realization that care must be highly individualized and that the management plan will differ for each specific patient.² To ensure fasting safely, patients should receive education regarding the following: Self-monitoring of blood glucose at home. Focus on the causation, early recognition, and emergency management of hypoglycemia, hyperglycemia, dehydration, and impending diabetic ketoacidosis, meal planning and dietary advice. Timing and intensity of physical activity and compliance to medications.⁵

A healthy balanced diet should be maintained; Complex carbohydrates are recommended at the predawn meal. Which should be taken as late as possible and simple carbohydrates at the sunset meal. Fluid intake should be increased in the nonfasting hours.

A normal level of activity should be maintained, avoiding excessive activities in hours before the sunset meal.²

The fast should be broken if glucose level is low less than 4 mmol/L (70mg %) or patient experiences signs and symptoms of hypoglycemia and if blood glucose level is more than 16.7 mmol/L (300 mg %).⁵ Some experienced physicians are of the opinion that fasting during Ramadan is safe for type 1 DM patients, including adolescents and older children, with good glycemic control who do regular selfmonitoring and are under close professional supervision.^{6,9}

In Libya, all population are Muslims, where The month of Ramadan has a sacred status and carries spiritual meanings for all Muslims, therefore our diabetic children and adolescents insist to fast as other Muslims. We conducted this study to look into the safety of Ramadan fasting among our patients. The aim of the study is to determine safety of Ramadan fasting in terms of acute complications of diabetes and change in HbA1c value and weight among young people, adolescents and children.

MATERIALS AND METHODS

A prospective observational study was designed for patients with T1DM adolescents and young people who wish and insist on fasting during Ramadan 1435 lunar year (July 2014), at diabetic clinic in Tripoli Children Hospital. Patients were revised 3 months before the start of Ramadan for education and 109 patients were selected to involve in the study, consent was taken verbally from them. All patients on Basalbolus regimen; 52 patients on multiple daily injections (MDI) and 57 patients on flexible insulin regimen (FIR) using carbohydrate count for meal insulin. Insulin dose was 0.7-1.5 u/kg/day according to requirement of individual patient. Adjusted insulin doses started before fasting month and continue during fasting month, they were instructed to do self-blood glucose monitoring 4 times daily or more, and break their fasting if blood glucose less than 70 mg/dl or more than 300 mg/dl, when they feel unwell or symptoms of hypoglycemia and to give insulin correction dose when blood glucose more than 180 mg/dl and do urine test for ketone and contact with doctor by hot line (phone) or visiting clinic. Data were collected by using prepared sheet filled by doctors during clinic visit according to Wt., fasting days and days of breaking fast, HbA1C value and occurrence of hypoglycemia (either symptomatic or if BS <70 mg/dl), hyperglycemia or DKA prior to Ramadan and after Ramadan.

Statistical analysis:

SPSS software version 16, used to analyze the collected data; mean, standard deviation and percentages used for descriptive statistics, chi square used for inferential statistics, and *P* value < 0.05 considered significant.

RESULTS

The results revealed in table (1) that 109 patient were involved in study: 38(34.9%) were male and 71(65.1%) were female; mean age was 15.9 years (± 2.9) SD, mean duration for diabetes was 6.4yr (± 4.0) SD and insulin dose about 1.1 ($\pm .29$) U/kg/d. Table (2) showed Mean weight of all patients before and after Ramadan is same 61.4 (± 13.9) *P* value 0.96. Mean HBA1C pre Ramadan 8.9 (± 1.7) compared with 8.6 (1.6) after Ramadan *P* value 0.26.

Admission before Ramadan by 3 months was reported in 2 patient due to DKA episodes and during Ramadan 5 patients; 1 of them due to hypoglycemia, 2 due to DKA, 2 due to causes are not related to diabetes (table 3); also this table showed 84.4 % of patients who complete fasting whole Ramadan or broke fast for less than 5 days.

Table 2 showed hypoglycemia was reported in 52 patients out of 109 before Ramadan (50 had mild, 2 had severe) compared with hypoglycemia during Ramadan was in 49 patients (44 had mild hypoglycemia, 5 had severe episodes); the different was insignificant *P* value 0.90% and Hyperglycemia occur in 69 patient pre Ramadan (35 during the day, 1 during night, 33 during day and night) compared with hyperglycemia during Ramadan in 78 patients (23 during the day, 18 during night, 37 during day and night).

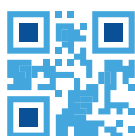


Table 2 showed DKA episodes before Ramadan in 2 patients (1.8%) compared with 3 episodes (2.8%) in 3 patients during Ramadan.

About 54 patients had completed their fast during Ramadan (group I), 55 patients had broken their fast during the Ramadan (group II) and median of non-fasting days was 4 days (Table 3). We compare group I with group II (table 5) we found mean weight of group I is 64.4± (11.8) pre Ramadan , 64.1±(11.2) post Ramadan *P* value was 0.4, Group II weight was 58.5 (±15.2) pre Ramadan, 58.8 (±15.0) post Ramadan *P* value was 0.4. HbA1C mean in group I 8.6(±1.7) pre Ramadan, 8.2 (± 1.5) post Ramadan while Group 2 mean HbA1c 9.3 (±1.7) to 9.1 (±1.6) *P* value was 0.21.

In group I hypoglycemic episodes occur in 29 patient pre Ramadan (28 mild and 1 was severe) only 15 patients had mild hypoglycemic episodes during Ramadan *P* value was 0.003 (Table 4) .

Table 1: Demographic and clinical features of the Participants

Parameters	Number/ %
n	109
Mean (± SD) age during Study (years)	15.9 (± 2.9)
Sex	No (%)
Male	38 (34.9 %)
Female	71 (65.1 %)
Mean (± SD) Duration of DM by years	6.4 (± 4.0)
Mean (± SD) Pre Ramadan -Total daily dose	68.1 (± 2.0)
Treatment	No (%)
MDI	51 (46.8 %)
Flexible	58 (53.2 %)
Mean (± SD) Unit per Kg	1.1 (± .29)
Type of basal insulin	55 (50.5%)
Lantus	54 (49.5 %)
Detemir	
Type of meal insulin	100 (91.7 %)
Novorapid	1 (0.9 %)
Apidra	8 (7.3 %)
Regular	

Table 2: Parameters in pre-Ramadan and at Post of Ramadan for all Patients.

•For all Patients (109)	Pre Ramadan	Ramadan	Difference P value
Mean Hb A1c%	8.9 (± 1.7)	8.6 (1.6)	0.26
Mean Weight (Kg)	61.4 (±13.9)	61.4 (13.5)	0.96
DKA			.99
• Yes	2 (1.8 %)	3 (2.8 %)	
• No	107 (98.2 %)	106 (97.2 %)	
Hypoglycemia			.90
• No	7 (52.3 %)	60 (55.0 %)	
• Mild	50 (45.9 %)	44 (40.4 %)	
• Severe	2 (1.8 %)	5 (4.6 %)	
Hyperglycemia			.061
• No	40(36.7 %)	30 (27.5 %)	
• Day	35 (32.1%)	23 (21.1 %)	
• Night	1 (0.9 %)	18 (16.5 %)	
• Day and Night	33 (30.3 %)	37 (33.9 %)	

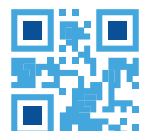
Table 3: Causes of Admission days and causes of non-fasting days.

Parameters	Yes	No
Patients' admission		
Pre Ramadan admission	2 (1.8%)	107 (98.2%)
Ramadan admission	5 (4.6 %)	104 (95.4 %)
Patients' Admission Cause		
Pre Ramadan admission cause		
• DKA	2 (1.8%)	
Ramadan admission cause	1 (.9 %)	
• Hypoglycemia	2 (1.8 %)	
• DKA	2 (1.8 %)	
• Others		
Total Number of Patients who broke fasting	55 patients	
Median of non-fasting days	4 days	
Non fasting cause	(55 patients)	
not related to diabetes complications	20 (36.3 %)	
hypoglycemia	22 (40.0 %)	
hyperglycemia	10 (18.2%)	
DKA	3 (5.4%)	
Non fasting days		
• No	54 (49.5%)	
• One day	11 (10.1%)	
• 2-5 Days.	27 (24.8%)	
• 6-15 days	5 (4.6 %)	
• 16-29 days	12 (11.0%)	

Table 4: Comparison between pre and post Ramada parameters in each group.

Group I (completed fast) n = 54	Pre Ramadan	Ramadan	Difference P value
Group II (had broken fast) n = 55			
Weight			
-Group I	64.4 (± 11.8)	64.1 (± 11.2)	0.4
-Group II	58.5 (±15.2)	58.8 (15.0)	0.4
HbAc1%			
- Group I	8.6 (± 1.7)	8.2 (± 1.5)	0.12
- Group II	9.3 (± 1.7)	9.1 (± 1.6)	0.24
DKA			
- Group I (fasting)			
• No	54	54	----
• Yes	0	0	
- Group II (break fasting)			0.95
• No	53 (96.4 %)	52 (94.5 %)	
• Yes	2 (3.6 %)	3 (5.5 %)	
Hypoglycemia (n)			
- Group I (fasting)			
• No	25 (46.3 %)	39 (72.2 %)	.003
• Mild	28 (51.9 %)	15 (27.8 %)	
• Severe	1 (1.9 %)	0	
- Group II (break fasting)			.01
• No	32 (58.2 %)	21 (38.2 %)	
• Mild	22 (40.0 %)	29 (52.7 %)	
• Severe	1 (1.8 %)	5 (9.1 %)	
Hyperglycemia (n)			
- Group I			
• No	19 (35.2%)	18 (33.3 %)	0.337
• Day	22(40.7 %)	13 (24.1 %)	
• Night	1 (1.9 %)	8 (14.8 %)	
• Day and Night	12 (22.2 %)	14 (25.9 %)	
- Group II			0.10
• No	21 (38.2 %)	12(21.8 %)	
• Day	13 (23.6 %)	10 (18.2 %)	
• Night	0	10 (18.2 %)	
• Day and Night	21 (38.2 %)	23 (41.8 %)	

In group II hypoglycemic episodes occur in 23 patients pre Ramadan (22 mild and 1 severe); 34 patients had



episodes of hypoglycemia during Ramadan (29 mild and 5 severe) *P* value was 0.01 (Table 4). The difference between 2 groups in occurrence of hypoglycemia was significance *P* value 0.001; (Table 5) Hyperglycemia in group I occur in 35 patients pre Ramadan mainly at day time, same number had hyperglycemia during Ramadan but more at day and night; in group II episodes occur in 34 patient pre Ramadan mainly during day and night which increase to 43 episodes mainly at day & night during Ramadan. The difference between 2 groups in occurrence of hyperglycemia during Ramadan was significance *P* value 0.052. Diabetic ketoacidosis: In group I there's no reported DKA episodes; compared with group II patients had 2 episodes of DKA pre Ramadan and 3 episodes in same group during Ramadan. The difference between 2 groups in occurrence of DKA was insignificance *P* value 0.083, as shown in (Table 5).

Table 5: Comparison of parameters between two Groups

Parameters	Group -I Completed fast (n= 54)	Group -II Had broken fast (n= 55)	<i>P</i> value
Mean Age			
• During Study	16.5 (± 2.4)	15.4 (± 3.2)	0.316
Mean Weight			
• Pre-Ramadan	64.4 (± 11.8)	58.5 (±15.2)	0.206
• Post - Ramadan	64.1 (± 11.2)	58.8 (±15.0)	0.141
Mean HbAc1%			
• Pre-Ramadan	8.5 (± 1.7)	9.3 (± 1.7)	0.290
• Post - Ramadan	8.2 (± 1.5)	9.1 (± 1.6)	0.379
DKA			
• Pre-Ramadan			
- Yes	0	1	0.322
- No	54	54	
• Post - Ramadan			
- Yes	0	3	0.083
- No	54	52	
Hypoglycemia			
• Pre-Ramadan			
- No	25 (46.3 %)	32 (58.2 %)	0.228
- Mild	28 (51.9 %)	22 (40.0 %)	
- Severe	1 (1.9 %)	1 (1.8 %)	
• Ramadan			
- No	39 (72.2 %)	21 (38.2 %)	0.001
- Mild	15 (27.8 %)	29 (52.7 %)	
- Severe	0	5 (9.1 %)	
Hyperglycemia			
• Pre-Ramadan			
- No	19 (35.2%)	21 (38.2 %)	0.470
- Day	22(40.7 %)	13 (23.6 %)	
- Night	1 (1.9 %)	0	
- Day and Night	12 (22.2 %)	21 (38.2 %)	
• Ramadan			
- No	18 (33.3 %)	12(21.8 %)	.052
- Day	13 (24.1 %)	10 (18.2 %)	
- Night	8 (14.8 %)	10 (18.2 %)	
- Day and Night	14 (25.9 %)	23 (41.8 %)	

DISCUSSION

Children older than 12 years, adolescents and young people with type 1 diabetes insist to fast Ramadan, they more prone to acute complications as hypoglycemia, hyperglycemia and diabetic ketoacidosis especially those with poor glycemic control. According to expert

opinion⁵, patients with type 1 diabetes (type 1 DM) who fast during Ramadan are at a very high risk to develop adverse events. However, many studies done around the world indicate that fasting in Ramadan is safe for type 2 and type 1 DM patients, including adolescents and older children, with good glycemic control who do regular self-monitoring and are under close professional supervision.^{6,7,10,11}

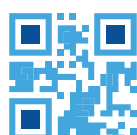
In our study showed 84.4 % of our patients complete fasting whole Ramadan or broke fast for less than 5 days however 49.5 % of our patients complete fasting the whole Ramadan compared with 60.6 % in a study done on 33 diabetic adolescents during Ramadan 2012 in Dhaka, Bangladesh⁷ that is mean safe for diabetic children older than 12 years, adolescents and young people with type 1 diabetes to fast, provided that they should undergo pre-Ramadan assessment and receive appropriate education and have a close follow up during Ramadan.

Weight before and after Ramadan has no significant change in our study with *P* value 0.96 which is going with the AlAlwan, A.A. Banyan study with *P* value 0.1526 and EPIDIAR study which shows unchanged weight in 62.5% of type 1 diabetes patients.¹⁰

Changes in mean Hb A1C before and after Ramadan showed no significant statistical difference, with *P* value 0.26 compared with *P* value 1.000 in AlAlwan, A.A. Banyan study.⁶

In our study 45 % developed hypoglycemia compared with 10% in Dhaka, Bangladesh study.⁷ In other study, eight patients (61.5%) on basalbolus regimen and 4 (44.0%) on conventional insulin broke their fast on at least one occasion because of hypoglycemia.⁸ Whereas our results showed all patients on basalbolus regimen (MDI-FIR) have severe hypoglycemia was only 4.6 % in comparison with 9 % in EPIDIAR study.¹⁰ DKA occurred in 2.8 % of our patients compared with 0 % in AlAlwan, A.A. Banyan⁶ study and Dhaka, Bangladesh⁷ this can be explained by number of patients in this study is more than the other studies. In about quarter of patients developed hypoglycemia in fasting group (group I), all of them were mild attacks with no severe attacks compared with about half of patients developed mild attacks and some patients developed severe hypoglycemic attacks in those who broke their fast (group II), this is supported by results in Dhaka, Bangladesh study; 10.0% patients developed hypoglycemia in fasting group compared with 33.3% of patients who broke the fast.⁷

However if we discuss more we found hypoglycemia (in group I) higher before Ramadan about half of patients had mild attacks and some had severe attacks while during Ramadan only quarter of them in this group developed mild hypoglycemic attacks, and no one had severe attack; the explanation is most probably because this group had better control and followed our instructions for Ramadan fasting. On the other hand, (group II) suffered more hypoglycemic attacks in Ramadan; this explained by those patients had higher mean Hb A1C and less diabetes control. In our



study DKA reported only in minority of patients who all of them from (group II) who broke their fast in comparison with Dhaka, Bangladesh study none had DKA in both groups.⁷The mean hemoglobin A1C value was not change for (group I) pre Ramadan and post Ramadan as well as (Group II), however mean HbA1C value if compared between two group ,it is very clear that (group I) had lower values that indicates better glycemic control for this group; which supported with Dhaka, Bangladesh study.⁷

CONCLUSION

Children and adolescents older than 12 years and young people with type one diabetes on basal bolus regimen can fast safely during Ramadan provided they have proper education and more glycemic control before Ramadan.

REFERENCES

1. Ibrahim AM (2007) Managing diabetes during Ramadan, *Diabetes Voice* **52**, 19-22.
2. Al-Arouj M, Assaad-Khalil S, Buse J, Fahdil I, Fahmy M, Hafez S, et al. (2010) Recommendations for management of diabetes during Ramadan, Update 2010, *Diabetes Care* **33**,1895-1902.
3. MohamednGA, Car N and Muacevic-Katanec D (2002) Fasting of persons with diabetes mellitus,during Ramadan, *Diabetologia Croatica* **31**(2), 75-84.
4. Dakadkeh TK (1992) Parasuicide during Ramadan in Jordan, *Acta psychiatrica scand.* **86**, 253-254.
5. Azad K, Mohsin F, Zargar AH, Zabeen B, Ahmad J, Raza SA, et al. (2012) Fasting guideline for diabetic children and adolescents, *Indian J Endocrinol Metab.* **16**, 516-518.
6. Al Alwan I and Al Banyan A (2010) Effects of Ramadan fasting on children with type 1 diabetes, *Int J Diabetes Mellit.* **2**, 127-129.
7. Bedowra Zabeen, Samin Tayyeb, Biplob Benarjee, Abdul Baki, Jebun Nahar, Fauzia Mohsin, Nazmun Nahar, Kishwar Azad (2014) Fasting during Ramadan in adolescents with diabetes, *Indian Journal of Endocrinology and Metabolism* **18**(1), 44-47.
8. Al Khawari M, Al Ruwayeh A, Al Doub K and Allgrove J (2010) Adolescents on basal bolus insulin can fast during Ramadan, *Pediatr Diabetes* **11**, 96100.
9. Kadiri A, AlNakhi A, ElGhazali S, Jabbar A, Al Arouj M, Akram J, et al. (2001) Treatment of type 1 diabetes with insulin lispro during Ramadan, *Diabetes Metab.* **27**, 482486.
10. Salti I, Bénard E, Detournay B et al. (2004) A PopulationBased Study of Diabetes and Its Characteristics during the Fasting Month of Ramadan in 13 Countries: results of the epidemiology of diabetes and Ramadan1422/2001 (EPIDIAR) study. *Diabetes Care* **27**(10), 2306-11
11. Patel P, Mirakhur A, Karim Mahmoud Abo El-Magd, Abdel Nasser Abo El-Matty and Al-Ghafri D (2007) Type 2 diabetes and its characteristics during Ramadan in Dhahira region, Oman, *Oman Med J* **22**(3), 16-23.

