

## Association between Fasting of Ramadan and Risk Factors of Diabetes: A Study from Rajshahi City in Bangladesh

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**Abstract:** The purpose of the study is to identify the association between fasting of Ramadan and risk factors of diabetes through  $\chi^2$ -test using the data of 297 Muslim diabetic patients collected from Rajshahi Diabetes Association, Rajshahi, Bangladesh. It is seen that 61.3 and 38.7% respondents perform religious activities regularly and irregularly respectively. But 86.2% respondents perform Ramadan fasting in which 57.6% and 28.6% respondents perform fasting in Ramadan regularly and irregularly respectively. The majority of respondents (79.5%) are belonged to >40 years of age where 68.7% perform fasting in Ramadan. Most of the respondents with performing Ramadan fasting (52.5%) are in middle (41-60 years) age group and they have a greater risk of diabetes with increasing their age especially after age 40 years. Again, 55.6 and 56.2% patients with fasting in Ramadan have normal blood pressure and normal weight respectively. So, fasting of Ramadan helps to keep blood pressure normal and to control weight of body which is very important for diabetic patients. During Ramadan fasting, there are 56.5% patients whose diabetic situation is decreasing or stable, 62% patients whose gastric have been decreasing and 48.1% patients whose weight of the body have been losing. Again, only 11.8% patients with fasting in Ramadan have a habit of smoking at present and the rest of them are not smoking at present. Also, it is found that respondent's age, occupation, living house, blood pressure, perform religious activities, diabetic situation during performing Ramadan, gastric decreasing during performing Ramadan, losing weight during performing Ramadan and smoking habit are significantly associated with fasting in Ramadan. So, Ramadan fasting can play an important role for controlling blood pressure, weight of the body, gastric, diabetes and for avoiding habit of smoking which is very essential for healthy life.

**Key words:** Bangladesh, blood pressure, BMI, diabetes, gastric, Ramadan,  $\chi^2$  test

### INTRODUCTION

Ramadan is a holy month for Muslims in the world. It is a time of worship, self-regulation, self-discipline, austerity, charity and self-training, with hope that this training will last beyond the end of Ramadan. Fasting in Ramadan is one of the main pillars of Islam and obligatory for all healthy Muslim adults. Also, it can be good for one's health and personal development. No food or drink may be consumed from dawn to sunset (The Holy Quran, Sura 2, Verses 183-185). The majority of Muslims fast from dawn to dusk during the whole month of Ramadan to fulfill religious criteria. However, certain groups are exempted from fasting temporarily or permanently including the disabled individuals with acute or chronic diseases, the travelers and the expecting and nursing mothers (The Holy Quran, Sura 2, Verses 183-185). So, certain diabetics may be exempted from fasting. Diabetes is classed as a metabolism disorder and a chronic non-communicable disease having serious health,

economic and social consequences which is characterized by high level of blood glucose resulting from defects in insulin production, insulin action or both. It is a major public health care problem with rapidly increasing incidence and long term complications and a leading cause of illness and death across the world (Meo, 2010). Also, it is an incurable life-long disease with devastating complications which ends up in severe disability and death (James *et al.*, 2002). Globally, diabetes is the fourth biggest cause of death affecting countries of all income groups (IDF, 2007). Wild *et al.* (2004) estimated that the number of diabetic patients globally will have increased from current 171 million to 366 by 2030. In United States, an estimated 23.6 million (about 7.8% of the total population) people have diabetes (American Diabetes Association, 2007). About 7.4% of the adult population in Australia has diabetes (Dunstan *et al.*, 2002). Various studies in Bangladesh have reported that the prevalence of diabetes is from 4 to 13% among adults with some variations by rural and urban settings (Rahim *et al.*, 2007;

Rahim *et al.*, 2004; Sayeed *et al.*, 2004). Again, the prevalence of diabetes in several countries with large Muslim populations appears to be similar to the rates observed in western countries and increasing by 10% per year as a result of urbanization and socioeconomic development (King *et al.*, 1998). In world, about 1 billion people are Muslim. Although the Quran exempts sick people from fasting, many Muslim diabetic patients may not perceive themselves as sick and are keen interested to fast. A large epidemiological study of Muslims with diabetes in 13 Muslim countries showed that 43% of patients with type 1 and 79% of those with type 2 diabetes fasted during Ramadan (Salti *et al.*, 2004). Most of the Muslim diabetic patients still prefer to fast without medical guidance which exposes themselves to certain risks as a direct consequence of fasting actually when hypoglycaemia occurs. Most Muslim religious authorities accept that if a person is advised by a trusted health professional (such as a doctor or nurse) that fasting is harmful to his or her health, then that person is exempted from fasting (Beshyah, 2009). In a large observational study, patients who fasted during Ramadan without attending a structured education session had a fourfold increase in hypoglycaemic events, whereas those who attended an education programme focusing on Ramadan had a significant decrease in hypoglycaemic events (Bravis *et al.*, 2010). This entails improving patient education as well as tailoring the treatment to meet the needs of this group of people with diabetes to minimize the possible risks (Hassanein, 2010). So, having diabetes does not mean that patients can not fast. However, a significant number of patients persist in fasting against the advice of their doctors and the permission of religious authorities (King *et al.*, 1998).

There are currently over 3 million people with diabetes in Bangladesh and this will reach 11 million by the year 2030 (Wild *et al.*, 2004). Also, Wild *et al.* (2004) reported that diabetes is affecting more people in low income than high income countries. Moreover, medical expenditure for diagnosed diabetic patients is, on average, up to three times higher than in patients without diabetes (Zimmet, 2009). So, diabetes poses a serious threat to developing countries like Bangladesh. As a developing country, Bangladesh does not have the sufficient resource to tackle this threat. Despite advances in diabetic treatment, management and self-care, the number of diabetic patients is increasing day by day with rapidly increasing total population in Bangladesh. In this situation, it would be difficult to ensure basic needs including food, cloth, education, shelter, health and communication for a large number of populations within the limited geographic area. Nevertheless, it offers an opportunity for primary prevention although the population with pre-diabetic conditions is always much

larger than the diabetic population. ICDDR (2009) suggested that primary prevention may reduce the burden of diabetes in the community. Studies in Finland, United States and China demonstrated that diabetes can be prevented in more than half of the individuals with pre-diabetic conditions through interventions to modify lifestyles (Li *et al.*, 2008; Tuomilehto, 2005; Knowler *et al.*, 2002). Since the change in eating patterns occurs during Ramadan which breaks previous habits, fasting in Ramadan represents an excellent opportunity to initiate healthy lifestyle changes which is very essential for diabetics. Moreover, the physiological effect of fasting includes lower of blood sugar, lowering of cholesterol and lowering of the systolic blood pressure. Fasting during the month of Ramadan causes weight loss and decrease in calorie intake which is correlated with a decrease in meal frequency (Khaled & Belbraouet, 2009). In fact, Ramadan fasting which gives a real motivation for self management would be an ideal recommendation for treatment of mild to moderate, stable, non-insulin diabetes, obesity and essential hypertension. So, the purpose of this study is to assess the association between fasting of Ramadan and risk factors of diabetes.

## METHODS AND MATERIALS

There are 297 Muslim diabetic patients who were interviewed during 13 August 2009 to 29 October 2009 by some socio-economic, demographic, diabetic disease and health consciousness related questions from Rajshahi Diabetes Association, Rajshahi, Bangladesh using purposive sampling technique. In the present study, bivariate analysis is used to test the association between the categorical variables by applying chi square test for the above purpose. In  $\chi^2$ -test, performing Ramadan fasting is considered as the variable Y which takes values 1 and 0 is classed in the following way:

$$Y = \begin{cases} 1, & \text{if the respondents perform Ramadan fasting} \\ 0, & \text{otherwise} \end{cases}$$

The other variables which are used in  $\chi^2$ -test are presented in the table.

## RESULTS AND DISCUSSION

The results of association between perform Ramadan fasting among some selected socio-economic, demographic, diabetic disease and health consciousness related behaviours of diabetic patients have been demonstrated in Table 1. This table shows that 61.3 and 38.7% respondents perform religious activities regularly and irregularly, respectively in which 57.6 and 28.6%

Table 1: Association between fasting in Ramadan and Some selected socio-economic, demographic, diabetic disease and health consciousness related variable of diabetic patients

Variable	Perform Ramadan		Total	$\chi^2_{cat}$ and $\rho$ value	Significance level of association at 10%
	No	Yes			
<b>Perform religious activities</b>					
Regular	11(3.7 %)	171 (57.6%)	182 (61.3%)	$\chi^2_{cat} = 23.792$ , df = 1 $\rho = 0.000$	Significant
Irregular	30 (10.1%)	85 (28.6%)	115 (38.7%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Age group</b>					
Early age ( $\leq 40$ years)	9 (3%)	52(17.5 %)	61 (20.5%)	$\chi^2_{cat} = 7.647$ , df = 2 $\rho = 0.022$	Significant
Middle age (41-60 years)	17 (5.7%)	156 (52.5%)	173 (58.2%)		
Older age ( $>60$ years)	15 (5.1%)	48 (16.2%)	63 (21.2%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Sex</b>					
Male	22 (7.4%)	116 (39.1%)	138 (46.5%)	$\chi^2_{cat} = 0.990$ , df = 1 $\rho = 0.320$	Insignificant
Female	19 (6.4%)	140 (47.1%)	159 (53.5%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Education</b>					
0-5 years	19 (6.4%)	92 (31%)	111 (37.4%)	$\chi^2_{cat} = 1.775$ , df = 2 $\rho = 0.412$	Insignificant
6-10 years	12 (4%)	82 (27.6%)	94 (31.6%)		
$>10$ years	10 (3.4%)	82 (27.6%)	92 (31%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Occupation</b>					
Service	6(2 %)	52 (17.5%)	58 (19.5%)	$\chi^2_{cat} = 8.494$ , df = 4 $\rho = 0.075$	Significant
House wives	14 (4.7%)	116 (39.1%)	130 (43.8%)		
Business	3 (1%)	30 (10.1%)	33 (11.1%)		
Day labor	7 (2.4%)	24 (8.1%)	31 (10.4%)		
Doesn't work	11 (3.7%)	34 (11.4%)	45 (15.2%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Living house</b>					
Building	17 (5.7%)	81 (27.3%)	98 (33%)	$\chi^2_{cat} = 10.221$ , df = 2 $\rho = 0.006$	Significant
Tin shed	9 (3%)	122 (41.1%)	131 (44.1%)		
Mud made	15 (5.1%)	53 (17.8%)	68 (22.9%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Blood pressure</b>					
Normal	23 (7.7%)	165 (55.6%)	188 (63.3%)	$\chi^2_{cat} = 9.595$ , df = 2 $\rho = 0.002$	Significant
More than normal	9 (3%)	73 (24.6%)	82 (27.6%)		
Less than normal	9 (3%)	18 (6.1%)	27 (9.1%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Body mass index (Bmi)</b>					
Under weight ( $<18.5$ )	24 (8.1%)	167 (56.2%)	191 (64.3%)	$\chi^2_{cat} = 3.255$ , df = 3 $\rho = 0.354$	Insignificant
Normal weight (18.5-24.9)	13 (4.4%)	75 (25.3%)	88 (29.6%)		
Over weight (25.0-29.9)	1 (0.3%)	8 (2.7%)	9 (3%)		
Obesity ( $>29.9$ )	41 (13.8%)	256 (86.2%)	297 (100%)		
Total	6 (2%)	9 (3%)	9 (3%)		
<b>Diabetic situation during performing Ramadan</b>					
Increase	0 (0%)	9 (3%)	9 (3%)	$\chi^2_{cat} = 70.160$ , df = 3 $\rho = 0.000$	Significant
Decrease	0 (0%)	91 (30.6%)	91 (30.6%)		
Stable	0 (0%)	77 (25.9%)	77 (25.9%)		
Unknown	41 (13.8%)	79 (26.6%)	120 (40.4%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Gastric decreases during performing Ramadan</b>					
No	41 (13.8%)	72 (24.2%)	113 (38%)	$\chi^2_{cat} = 77.453$ , df = 1 $\rho = 0.000$	Significant
Yes	0 (0%)	184 (62%)	184 (62%)		
Total	43.8%)	256 (86.2%)	297 (100%)		
<b>Losing weight during performing Ramadan</b>					
No	41 (13.8%)	113 (38%)	154 (51.9%)	$\chi^2_{cat} = 44.169$ , df = 1 $\rho = 0.000$	Significant
Yes	0 (0%)	143 (48.1%)	143 (48.1%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Increasing diabetes because of food habit</b>					
No	19 (6.4%)	125 (42.1%)	144 (48.5%)	$\chi^2_{cat} = 0.087$ , df = 1 $\rho = 0.767$	Insignificant
Yes	22 (7.4%)	131 (44.1%)	153 (51.5%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		

Table 1: (Continue)

Variable	Perform Ramadan		Total	$\chi^2_{cal}$ and $\rho$ value	Significance level of association at 10%
	No	Yes			
<b>Increasing diabetes because of hypertension</b>					
No	35 (11.8%)	191 (64.3%)	226 (76.1%)	$\chi^2_{cal} = 2.248$ , df = 1 $\rho = 0.134$	Insignificant
Yes	6 (2%)	65 (21.9%)	71 (23.9%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Increasing diabetes because of tension</b>					
No	26 (8.8%)	168 (56.6%)	194 (65.3%)	$\chi^2_{cal} = 0.076$ , df = 1 $\rho = 0.782$	Insignificant
Yes	15 (5.1%)	88 (29.6%)	103 (34.7%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		
<b>Smoking habit</b>					
Smoking at present	12 (4%)	35 (11.8%)	47 (15.8%)	$\chi^2_{cal} = 6.460$ , df = 2 $\rho = 0.040$	Significant
Smoking at past	11 (3.7%)	82 (27.6%)	93 (31.3%)		
Never smoking	18 (6.1%)	139 (46.8%)	157 (52.9%)		
Total	41 (13.8%)	256 (86.2%)	297 (100%)		

respondents perform fasting in Ramadan. Most of the diabetic patients (79.5%) are belonged in the middle (41-60 years) and older (>60 years) age group of which 68.7% diabetic patients perform fasting in Ramadan. Among total 297 respondents, the majority number of diabetic patients (86.2%) perform Ramadan in which early ( $\leq 40$  years), middle (41-60 years) and older (>60 years) age group contains 17.5, 52.5 and 16.2% diabetic patients respectively. So, people with Ramadan fasting are more in middle (41-60 years) age group than other age group. It's also demonstrated that people are more affected by diabetes after reaching 40 years of age which is similar to other studies (Kasim *et al.*, 2010; Hussain *et al.*, 2007; Kim *et al.*, 2006; Bener *et al.*, 2005). Of 297 respondents, 46.5 and 53.5% diabetic patients are male and female respectively in which 39.1 and 47.1% perform fasting of Ramadan. So, it is clear that female diabetic patients with performing Ramadan are more than that of male diabetic patients and they are more affected by diabetes than male. Studies in various population reported that sex is one of the major risk factors and female are more vulnerable (Hussain *et al.*, 2007; Habori *et al.*, 2004; Sayeed *et al.*, 2004; Rahim *et al.*, 2004). Most of the diabetic patients (37.4%) have completed 0-5 years of schooling where 31% perform Ramadan, 31.6 and 31% patients have completed 6-10 and >10 years of schooling respectively in which 27.6% (both category) perform Ramadan. The majority number of patients (43.8%) is housewives in which 39.1% perform fasting in Ramadan and 15.2% patients do not work because of their physical illness where 11.4% perform Ramadan fasting. Among the rest of the diabetic patients who perform Ramadan, 17.5%, 10.1 and 8.1% are servicemen, businessmen and day labor respectively. Again, most of the living house of the respondents (44.1%) are tin shed in which 41.1% perform Ramadan and 27.3 and 17.8% respondents perform Ramadan whose living house is building and mud made respectively. Also, it is clear that diabetes affects more in low income group which is supported by Wild *et al.* (2004). There are 63.3, 27.6 and 9.1% respondents whose blood pressure is normal, more than normal and less than normal respectively in which 55.6, 24.6 and 6.1% patients

perform fasting in Ramadan. Although hypertension is very important risk factor of diabetes (Ghosh *et al.*, 2010; Kasim *et al.*, 2010; Sanchez-Viveros *et al.*, 2008; Kim *et al.*, 2006), it is clear that Ramadan fasting helps to keep blood pressure normal which is very important for diabetic patients. Among 86.2% respondents who perform Ramadan, 2, 56.2, 25.3 and 2.7% respondents have under weight, normal weight, over weight and obesity respectively which clarify that fasting in Ramadan helps to control weight of the body which is essential for diabetic patients. But obesity and weight gain are considered to be among the most substantial risk factors for developing type 2 diabetes mellitus (Schienkiewitz *et al.*, 2006). According to Azizi and Siahkolah, (2003), over weight subjects lose more weight during Ramadan than those deemed normal or under weight. Again, the respondents whose diabetic situation is increasing, decreasing, stable and unknown during fasting in Ramadan is 3, 30.6, 25.9 and 26.6%, respectively which indicates that during Ramadan fasting, diabetic situation is decreasing or stable which is essential for controlling diabetic. Of 86.2% diabetic patients, 62% patient's gastric have been decreasing during fasting of Ramadan in which 24.2% patients have not decreased their gastric at that time and 48.1% patient's weight have been losing during Ramadan fasting. So, it is clear that fasting in Ramadan plays an important role for decreasing gastric or losing weight. It is similar to the results other studies. Khaled and Belbraouet, (2009) has found that fasting during the month of Ramadan causes weight loss. It has been shown that a loss of about 4.5 to 9 kg is helpful and should be maintained on a long-term basis to avoid rapid regaining of weight pre fasting level (Klein *et al.*, 2004). Again, it is observed that 44.1, 21.9 and 29.6% respondents whose diabetes is increasing because of food habit, hypertension and tension respectively perform Ramadan fasting and 42.1, 64.3 and 56.6% respondents whose diabetes is not increasing because of food habit, hypertension and tension respectively perform Ramadan. It implies that diabetic patients are poorly controlling their diabetes. But poor control of diabetes is significantly associated with an increase in diabetes (Kasim *et al.*, 2010). Again, most of

the patients whose diabetes is increasing because of food habits decrease in daily calorie intake during fasting. A decrease in daily calorie intake has been seen as one of the advantages in Ramadan fasting (Khaled *et al.*, 2006; Khaled and Belbraouet, 2009). Among 86.2% diabetic patients who perform fasting in Ramadan, 27.6 and 11.8% have a habit of smoking at past and present respectively and 46.8% respondents have never smoking. So, it is clear that fasting in Ramadan keeps out from smoking which is essential for healthy life.

From the Table 1, it has been found that respondent's age, occupation, living house, blood pressure, perform religious activities, diabetic situation during performing Ramadan, gastric decreases during performing Ramadan, losing weight during performing Ramadan and smoking habit are significantly associated with fasting in Ramadan. It is supported by other studies. Khaled and Belbraouet (2009) has found that fasting during the month of Ramadan causes weight loss and decrease in calorie intake, which is correlated with a decrease in meal frequency. A decrease in daily calorie intake has been found as one of the advantages in Ramadan fasting (Khaled *et al.*, 2006; Khaled and Belbraouet, 2009). On the other hand, other variables are insignificant with Ramadan fasting.

### CONCLUSION

In this study, 61.3 and 38.7% respondents perform religious activities regularly and irregularly respectively and 86.2% respondents fast in Ramadan in which 57.6 and 28.6% respondents perform regularly and irregularly. Moreover, 39.1% male and 47.1% female perform fasting in Ramadan. It is seen that 79.5% are belonged to >40 years of age where 68.7% fast in Ramadan. It is also observed that most of the respondents with fasting in Ramadan (52.5%) are in middle (41-60 years) age group and they have a greater risk of diabetes with increasing their age. The majority number of diabetic patients with fasting in Ramadan have normal blood pressure (55.6%) and normal weight (56.2%). So, Ramadan fasting helps to keep blood pressure normal and to control weight of body which is very important for diabetic patients. Most of the respondent's diabetic situation (56.5%) is decreasing or stable during Ramadan fasting and 26.6% is unknown about diabetes situation at that time. Again, 62% patient's gastric have been decreasing and 48.1% patient's weight have been losing during fasting of Ramadan. So, Ramadan fasting plays an important role for decreasing gastric or losing weight which is very important for healthy life. There are 44.1, 21.9 and 29.6% respondents with fasting in Ramadan whose diabetes is increasing because of food habit, hypertension and tension respectively and 42.1, 64.3 and 56.6% respondents whose diabetes is not increasing because of food habit,

hypertension and tension respectively perform fasting of Ramadan. Only 11.8% have a habit of smoking at present and the rest of them are not smoking at present during Ramadan. So, Ramadan keeps out of smoking which is essential for better life. Also, it is found that respondent's age, occupation, living house, blood pressure, perform religious activities, diabetic situation during performing Ramadan, gastric decreasing during performing Ramadan, losing weight during performing Ramadan and smoking habit are significantly associated with fasting in Ramadan. Finally, it may conclude that Ramadan fasting can play an important role for controlling blood pressure, weight of the body, gastric, diabetes and for avoiding habit of smoking which is very essential for healthy life.

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