

RAMADAN AND DIABETES MELLITUS

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Rehana is a third-year medical student at Lancaster University. She conducted a study about Ramadan and whether this has an effect on glycaemic control. This topic was of personal interest to her as she fasts every year along with her family, some of whom have diabetes mellitus and still fast during Ramadan. Hence this study allowed her to have an insight into glycaemic control during this period and whether fasting should be avoided in people with diabetes.

INTRODUCTION

Diabetes mellitus is a chronic endocrine disorder characterised by hyperglycaemia. Primary diabetes mellitus accounts for 95% of all cases of diabetes mellitus. It can be separated into two categories depending on their pathogenesis: type 1 (insulin-dependent diabetes mellitus (IDDM)), or type 2 (non-insulin-dependent diabetes mellitus (NIDDM)). Both types of diabetes result in impaired glucose metabolism. IDDM is an autoimmune disorder characterised by antibody-mediated destruction of the insulin secreting B-cells in the islets of Langerhans of the pancreas. This results in insulin deficiency. The exact pathogenesis of NIDDM is unclear, although genetic factors and environmental factors are thought to play a role. Type 2 is characterised by increasing insulin resistance in the body.

Management of diabetes involves maintaining blood glucose levels within normal or near normal limits. This can be achieved in several ways: insulin can be injected before meals; oral medication can be taken that can either increase insulin sensitivity (biguanides, eg metformin) or increase its secretion (sulphonylureas, eg gliclazide; and meglitinides, eg repaglinide). Control of blood glucose can also be achieved with the modification of diet alone or a combination of the above therapies.

Haemoglobin A1c (HbA1c) values can be used to measure the level of blood glucose and are used as a guideline for the level of glycaemic control achieved by the patient. National Institute of Clinical Excellence (NICE) guidelines recommend that the target HbA1c for diabetic patients should be between 6.5%-7.5% as people with poorly controlled glucose levels are at greater risk of diabetes-related complications such as ischaemic heart disease and microvascular disease, for example kidney and eye disease.⁽¹⁾ Guidelines also exist for the target blood pressure of a diabetic. People with diabetes are at a higher risk of vascular complications such as coronary disease and stroke.⁽¹⁾ Diabetics are also more likely to have high blood pressure and this further increases their risk of future vascular complications.⁽²⁾ The British Hypertension Society (BHS) recommends that the blood pressure of someone with diabetes should be maintained at less than 130/80 mmHg.⁽³⁾

RAMADAN

In the ninth month of the Islamic lunar calendar Muslims fast. The ninth month is the holy month of Ramadan. Fasting is obligatory for all adult Muslims, as it is one of the five pillars of Islam. Ramadan lasts up to 29 or 30 days each year. As the timing of Ramadan is based on the lunar cycle, Ramadan does not occur at the same time every year and, depending on the geographical location and season, the duration of the daily fast varies between 12-20 hours. During this month Muslims abstain from eating and drinking from *Sehri* (Arabic for dawn) until *Iftar* (Arabic for sunset). Oral drug intake is also prohibited during this period. After *Iftar* these restrictions do not apply and there is no limit to what one can eat or drink until *Sehri*.

Ramadan has implications for healthcare providers as adherence to treatment becomes an issue; fasting Muslims can only ingest medication between sunset and dawn. The *Qur'an* states that those who are ill and pregnant need not fast, especially if fasting leads to harmful consequences.⁽⁴⁾ A large number of diabetics participate in Ramadan although they are exempt from fasting.⁽⁵⁾ A population-based epidemiological study of diabetics in 13 Islamic countries found that approximately 43% of patients with type 1 diabetes and 79% of patients with type 2 diabetes fast for at least 15 days during Ramadan.⁽⁵⁾ It is estimated that 40-50 million Muslim diabetics worldwide fast during Ramadan.⁽⁶⁾

Glycosylated haemoglobin

Glucose molecules in blood attach themselves permanently to haemoglobin molecules in red blood cells. This produces glycosylated haemoglobin. The greater the glucose concentration in the blood, the greater amount of glycosylated haemoglobin. HbA1c values measure the percentage of glycosylated haemoglobin to normal haemoglobin in the blood. The life span of a red blood cell is 120 days and HbA1c values therefore give an average of blood glucose levels in the last two to three months. The normal range for HbA1c is 4-6.5%. A value of less than 7.5% for diabetics indicates good control of blood glucose.⁽²⁾

METHOD

To obtain data for this retrospective database review, the database at a general practitioner (GP) practice in Accrington was searched. People who had attended the diabetic clinic at the practice and had their HbA1c values taken were used. Not all HbA1c values were included in this study. The criterion for inclusion was that the HbA1c value was of an Asian person and was collected during December 2007 or January 2008. A second set of HbA1c values that had been taken in June or July 2008 was also included in the study.

The effect of Ramadan on fasting was investigated in 30 South Asians (15 females, 15 males) aged 26-78 years with type 2 diabetes. The effect of fasting on glycaemic control was determined. The blood pressure and body mass index (BMI) of the study population was also recorded. Data was compared with a control group of 424 type 2 diabetics in the same practice.

The month of Ramadan in 2007 occurred from mid-September 2007 until mid-October 2007. Therefore any HbA1c values recorded in December 2007 or January 2008 would look at the levels of blood glucose during the month of Ramadan. Paired values were taken to compare the level of blood glucose in Ramadan to a period when the patient wasn't fasting. Six months after Ramadan was chosen as the second sample. Any HbA1c values recorded in June 2008 or July 2008 were included.

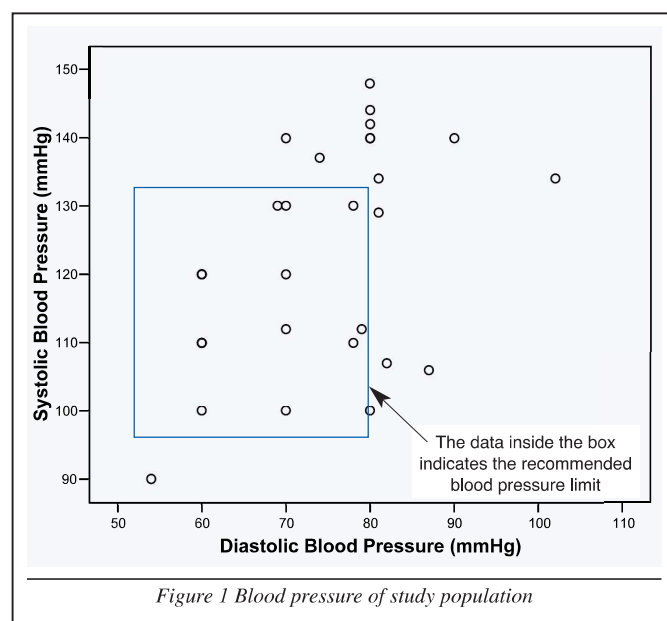
RESULTS

	N	Minimum	Maximum	Mean	Standard deviation
Systolic blood pressure (mmHg)	30	90	148	122	15.9
Diastolic blood pressure (mmHg)	30	54	102	74	11
Body mass index (Kg/M ²)	30	19	43	28	5.2

Table 1 Average blood pressure and BMI in study population

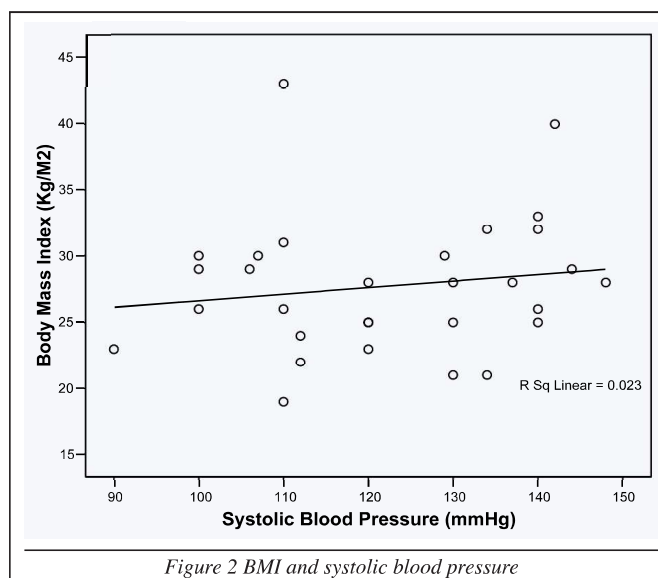
The average blood pressure (122/74 mmHg) was within the recommended guidelines for target blood pressure in diabetics. The BMI of the study population was within the overweight category.

Figure 1 shows the systolic and diastolic blood pressure of the study population.



BMI related to systolic blood pressure

There was no relationship between systolic blood pressure and BMI in the study population (see figure 2).



Diabetes mellitus type 2 and age

	N	Minimum	Maximum	Mean	Standard deviation
STUDY POPULATION					
Age (years)	30	26	78	54	12.1
ALL TYPE 2 DIABETES					
Age (years)	424	13	92	62	13.9

The mean age in the study population was 54 years. The mean age of all type 2 diabetes patients at the practice was approximately 8 years older at 61.9 years.

Diabetes mellitus type 2, age and gender

Study population: gender and age (years)			
Gender	Mean	N	Standard deviation
Male	56	15	13.7
Female	53	15	10.5
Total	54	30	12.1

Diabetes mellitus type 2, age and ethnicity

Asian diabetics were approximately 10 years younger than Caucasian diabetics at the practice ($p < 0.0005$).

All type 2 diabetes: ethnicity and age (years)			
Ethnicity	Mean	N	Standard deviation
Asian	58	259	13.7
Caucasian	68	165	12.4
Total	62	424	13.9

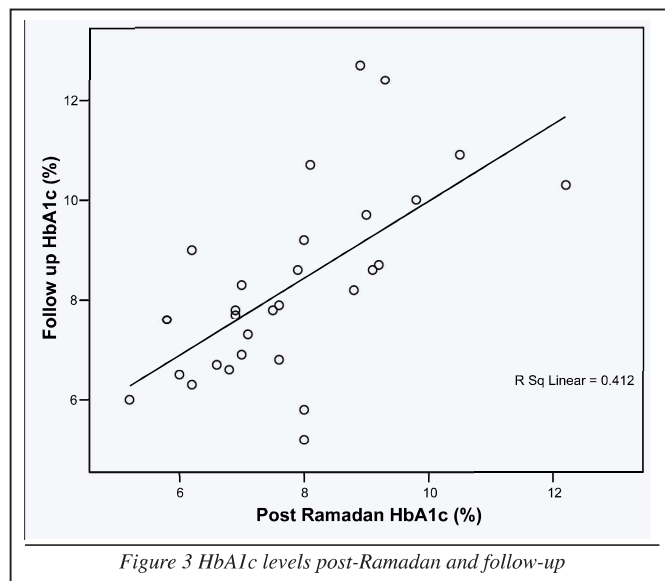
Diabetes mellitus type 2, gender and ethnicity

The study population had 30 patients with type 2 diabetes, of whom 15 were female and 15 were male. This 50% ratio of male:female was representative of the number of male and female Asians with type 2 diabetes at the practice (132 and 127 respectively).

Ramadan and glycaemic control in diabetes mellitus type 2
The following table shows the mean HbA1c values for post-Ramadan (HbA1c (%)) and the follow-up (HbA1c (%)1).

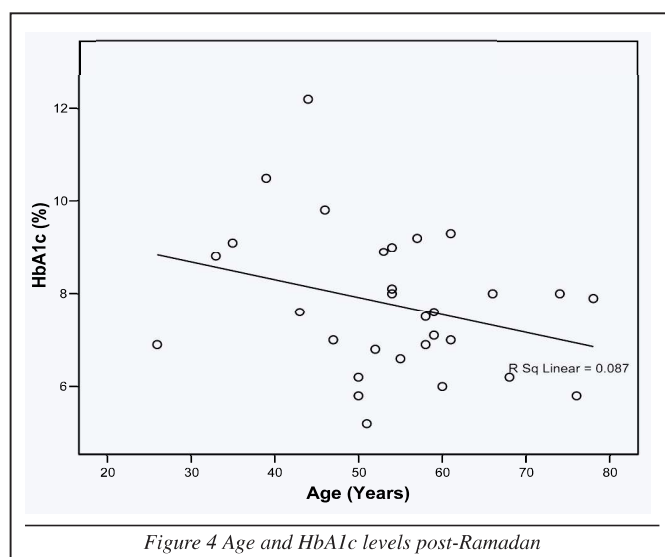
Mean HbA1c values					
	N	Minimum	Maximum	Mean	Standard deviation
HbA1c (%)	30	5	12	8	1.5
HbA1c (%) 1	30	5	13	8	1.9

There was an increase in HbA1c values from post-Ramadan to the follow-up. A paired t-test failed to show statistical significance. The correlation between values was 0.417.



Age and HbA1c levels

There was no significant difference between age and HbA1c levels. However, both post-Ramadan and follow-up HbA1c levels showed a negative correlation (see figures 4 and 5) indicating better glycaemic control achieved by older patients.

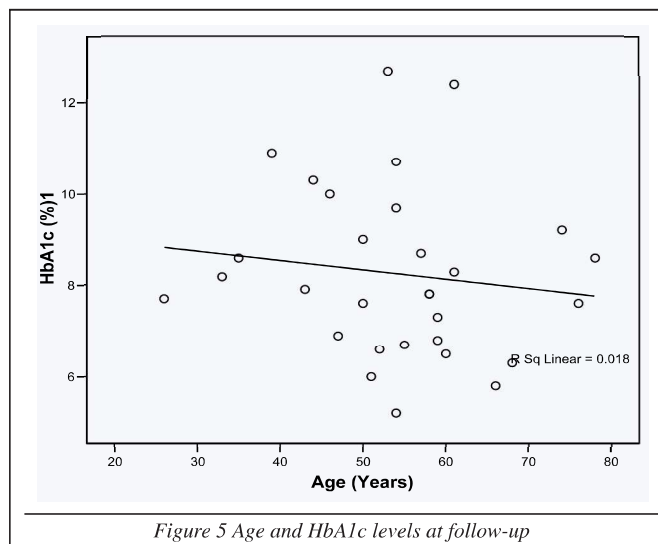


Gender, BMI, systolic and diastolic blood pressure

After statistical analysis it was determined that only BMI had a significant difference between males and females in the study population. Diabetic females were significantly more overweight than diabetic males.

Gender		BMI (Kg/M ²)
Male	Mean	25.7
	N	15
	Standard deviation	3.1
Female	Mean	29.7
	N	15
	Standard deviation	6.1

Table 2 Females have significantly higher BMI



DISCUSSION

In the present study of 30 South Asian type 2 diabetics the participants' average blood pressure was within the guideline's recommendation. All the study participants had attended the diabetic clinic regularly for check-ups. It appears that the patients who attend diabetic clinic have good control over their blood pressure.

There was no relationship between systolic blood pressure and BMI ($r^2=0.023$). One would expect from readings that the relationship would be stronger.⁽²⁾ This could indicate good management of diabetics who attend the diabetic clinic.

There was no significant difference between the ages of women and men in the study population. As women live longer than men we thought the study population would represent this. The opposite was found with females on average being younger than the males. An interesting insight into the types of patients attending the diabetic clinic is that the upper and lower quartile of Asian males and females in all type 2 diabetes patients is about the same. However, the Asian females that attended the diabetic clinic had an upper quartile age below that of the Asian diabetic male. We conclude that that older Asian females are less likely to attend diabetic clinic than younger Asian females. One explanation for this could be the language barrier. Not many older Asian females speak or understand English and hence find it difficult to communicate with the diabetic nurse. A link worker working together with the diabetic nurses may improve attendance rates of older Asian female diabetics by translating for the patient. Another reason could be that many Asian women are kept away from health services (because of *purdah*) and spend most of their time in their home. This is mainly a cultural belief that is passed down from generation to generation; the older females are more likely to adhere to this as they are more traditional than the younger Asian females.

There was a significant difference between ethnicity and age of patient with type 2 diabetes. The mean age of Asian diabetics was approximately ten years younger than the Caucasians. It is known that South Asians have a genetic susceptibility to insulin resistance and hence are more prone to developing diabetes,⁽⁷⁾ which may explain this difference.

The difference between the HbA1c levels post-Ramadan and in the follow-up was approaching significance ($p=0.076$). We believe if a larger sample population had been studied a significant difference may have been found. This indicates better glycaemic control in Ramadan than another period in the patients' lives when they were not fasting. This was consistent with the work of Maislos *et al*⁽⁸⁾ who showed that HbA1c levels decreased significantly during Ramadan and attributed this improvement in the decrease in the number of meals during Ramadan. Khatib *et al*⁽⁹⁾ also found that glycaemic control of male volunteers improved during Ramadan. The limitations of the study were that the study included a small sample size. The study only analysed HbA1c during Ramadan and there was a lack of follow-up measurements of HbA1c levels at a time when the patient wasn't fasting.

Sulimani⁽¹⁰⁾ found no difference in HbA1c levels of nine diabetic patients before and after Ramadan. The limitation of this study is the small sample size. Some other studies also agree with Sulimani, in that they found no change in HbA1c levels during Ramadan.⁽¹¹⁾

The standard deviation is smaller in the mean HbA1c levels post-Ramadan than the follow-up. This suggests that Asians in Ramadan live a similar lifestyle as their HbA1c levels are similar. From the findings in this study we recommend that health care providers should ask patients what they change during Ramadan; some people completely change their lifestyle such as the types of food and drink they consume during this month. Patients should then be encouraged to continue with this lifestyle throughout the year as better glycaemic control is achieved during Ramadan and the maintenance of the lifestyle may achieve better glycaemic control all year round.

There were several limitations to this study. As this was a retrospective database review and HbA1c levels of all Asians during the two time periods were recorded we assumed that all the study population was fasting in 2007 and hence the first HbA1c level reflected glycaemic control during Ramadan. However, some patients may not have participated in Ramadan and others may not have fasted for the whole month. The study also did not take into account whether the study population's medication for their diabetes had been modified for Ramadan, which could explain the better glycaemic control. The study also had only 30 participants, which is not a large enough sample to be representative of the 271 Asian type 2 diabetes patients at the practice. Patients' lifestyle changes during Ramadan were not taken into account, ie the types of food and drinks that were consumed, which would have an effect on glycaemic control.

A further area of research could be to consider the same objective – whether Ramadan has an effect on glycaemic control in diabetic patients – but to have a better study design. One could still carry out a retrospective database review but make Muslim patients who attend diabetic clinics fill out a questionnaire asking them whether they are fasting during Ramadan, the number of days they fast, and whether they have any change in their medication and lifestyle during

Ramadan. The number of hours that the fast lasted for should also be determined and a larger study sample should be selected.

Some studies have suggested that dehydration during Ramadan may trigger retinal vein occlusion in patients.^(4,12) However, there is little literature on this topic and therefore this could be another area of research.

CONCLUSION

The data in this study shows that better glycaemic control is achieved during Ramadan. Diabetic patients should be encouraged to maintain their lifestyle that they had during Ramadan all year round to achieve better glycaemic control all year round. A link worker is also recommended to work alongside the diabetic nurses to improve the attendance rates of older Asian females at the diabetic clinic.

Many studies have been done examining the effect of Ramadan upon diabetic patients. These studies conclude fasting during Ramadan is safe for type 2 diabetics.^(6,11,13,14)

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