

Is there any effect of Ramadan fasting on stroke incidence?

Bener A, Hamad A, Fares A, Al-Sayed H M, Al-Suwaidi J

ABSTRACT

Introduction: Over one billion Muslims fast worldwide during the month of Ramadan. Fasting during Ramadan is a radical change in lifestyle for the period of a lunar month. The objective of this study was to investigate whether Ramadan fasting has any effect on the incidence of stroke and its outcome in a geographically-defined population.

Methods: We retrospectively reviewed a 13-year stroke database and studied the data on Muslim patients who were hospitalised with stroke over a 13-year period from January 1991 to December 2003. Patients were divided according to the time of presentation in relation to the month of Ramadan, one month before, during, and one month after Ramadan. The number of hospitalisations for stroke in various time periods was analysed. The age of presentation, gender, cardiovascular risk factor profiles (smoking status, hypertension, hypercholesterolaemia, diabetes mellitus, and pre-existing cardiovascular disease) were analysed. We also studied the trends of in-hospital mortality, morbidity and acute medical care provided.

Results: Overall, 335 Muslim patients were hospitalised for stroke. Their mean age and standard deviation were 56.99 and 13.9 years, respectively. The number of hospitalisations for stroke was not significantly different in the month of Ramadan (29 cases), when compared to the month before Ramadan (30 cases) and the month after Ramadan (29 cases). Risk factors included for stroke were not significantly different in Ramadan when compared to the month before and after Ramadan. These associated diseases were hypertension, diabetes mellitus, hypercholesterolaemia, acute myocardial infarction, and congestive heart failure.

Conclusion: This study demonstrated that no significant difference was found in the number of hospitalisations for stroke while fasting during the month of Ramadan when compared to the non-fasting months.

Keywords: cerebrovascular accident, fasting, Ramadan fasting, stroke

Singapore Med J 2006; 47(5):404-408

INTRODUCTION

One of the five fundamental rituals of Islam, the religion professed by over one billion people, is fasting during the month of Ramadan. Muslims neither eat nor drink anything from dawn till sunset⁽¹⁾. The time of observance differs each year because it follows the lunar calendar. The fasting period from dawn to sunset varies with the geographical site and the season. In the summer months and northern latitudes, the fast can last up to 18 hours or more. Muslims observing the fast must not only abstain from eating and drinking, but also from taking oral medications, smoking, as well as receiving intravenous fluids and nutrients⁽¹⁾. During the Ramadan fast, Muslims eat two meals a day, one before dawn and the other shortly after sunset. This change of meal schedule is accompanied with changes in sleeping habits (shortening time of sleep)⁽¹⁾. The medication schedule during the day is also changed due to fasting, which may have an effect on stroke patients.

Cardiovascular disease (CVD) and stroke are approaching epidemic proportions worldwide, and are associated with substantial public and personal burdens⁽²⁻⁹⁾. Stroke is one of the major causes of death and disability in most developed countries⁽⁷⁻⁹⁾. Fasting during Ramadan is essentially a radical change in lifestyle for the period of one lunar month that may affect cardiac and stroke patients^(2-3,10). During the month of Ramadan, Muslims in the Arabian Gulf usually consume very high caloric food, they neither diet nor exercise, and they sleep and work for shorter hours. Despite the number of Muslims

Department of Medical Statistics and Epidemiology
Hamad Medical Corporation and Hamad General Hospital
University of Qatar
PO Box 3050
Doha
Qatar

Bener A, PhD, MFPHM, FRSS
Professor and Head

Department of Neurology

Hamad A, MBBS, CABM
Specialist

Department of Cardiology and Cardiovascular Surgery

Fares A, MBBS, FRCS
Consultant

Al-Suwaidi J, MD, FACC
Consultant

Department of Family and Community Medicine

Al-Sayed HM, MBBS, CABM
Consultant

Correspondence to:
Professor Abdulbari Bener
Tel: (974) 439 3765
Fax: (974) 439 3769
Email: abener@hmc.org.qa

worldwide, there is lack of data on stroke incidence during Ramadan. The objective of this study was to investigate whether fasting during Ramadan has any effect on the incidence of hospitalisation for stroke and its outcome.

METHODS

This study was conducted in the State of Qatar in the Arabian Gulf. The estimated population of the State of Qatar for the year 2003 was 724,125. Approximately 30% of the population were Qatari nationals and 95% of them were Muslims (the majority of adults fast regularly during Ramadan), and the rest are expatriates, mostly from the Middle East, South Asia and Southeast Asia. In the last decade of the 20th century, cardiovascular diseases were the leading causes of morbidity and mortality in Qatar and this trend is increasing⁽²⁻⁶⁾. This study was based at Hamad General Hospital, Doha. This hospital provides inpatient and outpatient medical and surgical care for the residents of Qatar and is the only tertiary-care centre in the country, making it ideal for population-based studies. All patients with stroke requiring hospitalisation in Qatar were treated at this hospital. Access to healthcare during Ramadan is comparable to the rest of the year.

The database of the Hamad General Hospital was used for this study. Data were collected from the clinical records written by physicians at the time of the patients' discharge from the hospital, according to predefined criteria for each data point. All patients presenting with stroke requiring hospitalisation over the 13-year period between 1991 and 2003 were retrospectively identified. The age of presentation, gender, cardiovascular risk factor profiles (smoking status, hypertension, hypercholesterolaemia, diabetes mellitus, and pre-existing CVD), were analysed. The physicians reported the events in a prescribed form, which included items related to neurological deficits, trends of symptoms and past history. We checked death certificates regularly.

Time periods corresponding to the month of Ramadan in the Gregorian calendar have been established, since the lunar calendar is 11-12 days shorter than the solar year⁽¹⁾. To reduce the effects originating from seasonal changes to a minimum, and to use the data as a control, we evaluated the figures for one month before, during, and one month after Ramadan and the rest of the year, by going back and forward from the period of Ramadan (29-30 days) in a particular year. More than 95% of Qatari adults fast without fail during the month of Ramadan.

The classification of the type of stroke was done according to the criteria of stroke defined by

the World Health Organisation⁽¹¹⁻¹²⁾. The definition includes most cases of subarachnoid haemorrhage, intracranial haemorrhage and cerebral infarction. Cases of transient ischaemic attacks or those with asymptomatic lesions detected by brain imaging (silent infarction) are excluded. Only patients with first stroke during the study periods were registered, and included in the measurement of stroke incidence and the 28-day case fatality rate. The presence of diabetes mellitus was determined from the patient's previous or current medical record of a documented diagnosis of diabetes mellitus that had been treated with medication or insulin^(2,5-6). Hyperlipidaemia was determined by the demonstration of a fasting cholesterol >5.2 mmol/L in the patient's medical record, or any history of treatment for hyperlipidaemia by the patient's physician. The presence of hypertension was determined by any documentation in the medical record of hypertension or if the patient was on treatment for hypertension⁽⁶⁾. For smoking history, patients were divided into current cigarette smokers, past smokers which was defined as abstinence from smoking for more than six months, and those who never smoked^(2,5-6).

The data were coded and entered into a computer using Statistical Package for Social Sciences (SPSS) version 12.0 (Chicago, IL, USA). Data are expressed as mean \pm standard deviation (SD) unless otherwise stated. Student's t-test was used to ascertain the significance of differences between mean values of two continuous variables and Mann-Whitney test was used for non-parametric distribution. chi-square analysis was performed to test for differences in proportions of categorical variables between two or more groups. In 2x2 tables, the Fisher exact test (two-tailed) was used instead of chi-square, in particular when sample size was small. The level of $p < 0.05$ was considered the cut-off value of significance.

RESULTS

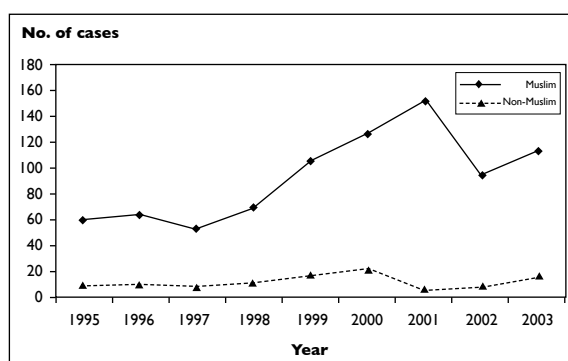
A total of 335 Muslim patients were admitted over a 13-year period from January 1991 to December 2003; 238 (71.0%) were males and 97 (29.0%) were females. Their mean age was 56.99 ± 13.9 years. Overall, 60.0% had a history of acute myocardial infarction, 47.8% of total patients had diabetes mellitus, 29.6% had hypertension, 17.6% had hypercholesterolaemia, and 41.5% were smokers (males 46.7% versus females 3.5%). During the year 2003, mortality rate of stroke cases were 1.5 per 100,000 population.

The number of patients hospitalised with stroke during Ramadan, one month before and after Ramadan, their clinical characteristics and outcomes

Table I. Baseline clinical characteristics, biochemical profile, therapy and outcome of stroke compared with patients before, during and after Ramadan.

Variables	Before Ramadan n (%)	During Ramadan n (%)	After Ramadan n (%)	Monthly average* n (%)
Frequency	30	29	29	27
Gender				
Male	21(70.0)	23(79.3)	20(69.0)	19(70.4)
Female	9(30.0)	6(20.7)	9(31.0)	8(29.6)
Nationality				
Qatari	16(53.3)	14(48.3)	13(44.8)	14(51.9)
Non-Qatari	14(46.7)	15(51.7)	16(55.2)	13(48.2)
Age group				
<50 years	19(63.3)	19(65.5)	22(75.9)	19(70.4)
≥50 years	11(36.7)	10(34.5)	7(24.1)	8(29.6)
Smoking habit				
Smoker	12(40.0)	16(55.2)	11(37.9)	11(40.7)
Non-smoker	18(60.0)	13(44.8)	18(62.1)	16(59.3)
Complications				
Diabetes mellitus	11(36.7)	16(55.2)	15(51.7)	13(48.2)
Hypertension	7(23.3)	9(31.0)	7(24.1)	8(29.6)
Hypercholesterolaemia	3(10.0)	4(13.8)	7(24.1)	5(18.5)
Acute myocardial infarction (AMI)	16(53.3)	18(62.1)	20(69.0)	16(59.2)
Anterior	6(20.0)	6(20.7)	4(13.8)	5(18.5)
Inferior	9(30.0)	8(27.6)	13(44.8)	9(33.3)
Old MI	4(13.3)	6(20.7)	4(13.8)	4(14.8)
Congestive heart failure	7(23.3)	6(20.7)	12(41.4)	5(18.5)
Procedure				
Thrombolysis	6(20.0)	5(17.2)	8(27.6)	8(29.6)
Laboratory data				
Total cholesterol	2.9±2.1	3.7±2.9	4.7±2.9	3.9±2.3
Triglyceride	1.0±0.76	1.6±1.4	1.6±1.4	1.5±1.2

* remaining nine months

**Fig. 1** The trend of stroke cases among Muslim & Non-Muslim populations during the period (1995 - 2003).**Table II. In-hospital medical therapy at time of admission.**

Variables	Before Ramadan n (%)	During Ramadan n (%)	After Ramadan n (%)	Monthly average n (%)
Frequency	30	29	29	27
Drugs administered during admission				
Aspirin	19(63.3)	13(44.8)	18(62.1)	15(55.1)
Beta-blockers	1(3.3)	1(3.4)	3(10.3)	3(10.1)
Ace inhibitors	4(13.3)	5(17.2)	5(17.2)	5(19.8)
Calcium channel blockers	0(0)	3(10.3)	2(6.9)	2(6.1)

are shown in Table I. There was no statistically significant difference found between the periods for the incidence of stroke. There was also no significant difference found between the periods in other clinical characteristics of these patients, such as age of

presentation, gender, cardiovascular risk factor profiles (smoking status, hypertension, hypercholesterolaemia, diabetes mellitus, and pre-existing coronary heart disease), or concomitant presentation of acute myocardial infarction with stroke.

Table II shows the in-hospital medical therapy at the time of admission. There were no statistically significant differences between the periods in relation to the various medications given, namely: aspirin, beta-blockers, ACE inhibitors and calcium channel blockers. The trend of stroke cases in the Muslim and non-Muslim populations during the period 1995-2003 are shown in Fig.1, where a tendency for the stroke cases to increase in both Muslim and non-Muslim populations during the recent years is observed.

DISCUSSION

We found no significant differences in the number of hospitalisation for stroke during Ramadan, when compared to the rest of the year. To the best of our knowledge, there is only one reported study by Akhan et al⁽¹⁰⁾ on the incidence and hospitalisation of stroke cases during Ramadan. The investigators reported no significant differences in the incidence of stroke in relation to fasting during Ramadan. This is consistent with our present study results. Gumma et al⁽¹³⁾ reported an increase in plasma triglycerides (TG) accompanied by a decrease in total cholesterol (TC). However, according to Fedail et al⁽¹⁴⁾, TC levels increased during Ramadan fasting while TG levels were unaffected. El-Hazmi et al⁽¹⁵⁾, demonstrated that TG and TC levels decreased after the first week, and subsequently increased towards the end of Ramadan. Recently, Maislos et al⁽¹⁶⁾ studied the effect of fasting in 22 healthy subjects and reported an increase in plasma high-density lipoprotein (HDL) levels by 23% after four weeks of fasting.

Our recent reports have shown that there was no significant difference in the number of hospitalisations for acute coronary syndromes and congestive heart failure while fasting during Ramadan when compared to the non-fasting months^(2,4). More recently, it was reported that the incidence of stroke during Ramadan was not significantly different from the other months of the year, and blood pressure control on hypertensive patients taking medications was not affected by fasting during Ramadan⁽¹⁷⁾.

The present study included the whole Muslim population in the State of Qatar, where more than 95% of the population fast regularly. The current study did not find any positive or negative effects of Ramadan fasting during the holy month of Ramadan on the stroke occurrence. This is consistent with other reported studies^(2,3,10,18). Akhan et al⁽¹⁰⁾ reported on patients with stroke admitted to the hospital in Isparta Province in Turkey. The stroke incidence of subjects older than 25 years has been found to be 137 per 100,000 people. There were no

statistically significant differences between the age and sex distribution of patients during Ramadan compared to other months. Similarly, Kutluhan et al⁽¹⁸⁾ evaluated 815 patients with stroke from 1990 to 1995 in Istanbul, and did not find any significant difference in the stroke rates between Ramadan and the other months.

The current study demonstrated that in a more defined geographical population where more than 65% of the total population fast regularly, there was no change in the frequency of hospitalisation for stroke patients while fasting during Ramadan. Furthermore, it described complete clinical characteristics, mode of therapy and outcome of these patients. Usually, fasting during Ramadan alters body composition, blood constituents and physical performance. A recent study from Kuwait⁽¹⁹⁾ reported that Ramadan fasting had no adverse effect on the subjects when performing aerobic exercise at submaximal level. The mild changes in cardiorespiratory responses could be due to dehydration, abstention from consumption of substances with negative inotropy and circadian rhythms.

The major limitation of our study is its retrospective analysis of a prospective registry. Secondly, although there were no significant differences in the number of hospitalisations for stroke during Ramadan when compared to the rest of the year, it is possible that there are differences in the timing of presentation because of the changes in circadian rhythm associated with fasting during Ramadan; this data was not captured in our study and further studies are required. Lastly, there is no data on those who either refused to come to hospital, died prior to arrival, or died at home from acute stroke.

In conclusion, the present study included the whole Qatari population and the stroke incidence was calculated over a 13-year period. Our findings indicated that the pattern of fasting during Ramadan does not increase the frequency of hospitalisation for stroke incidence. They also confirmed other reported studies that there is no statistically significant difference between stroke rates in the Ramadan fasting month and other non-fasting months.

REFERENCES

1. Bener A, Galadari S, Gillett M, et al. Fasting during the holy month of Ramadan does not change the composition of breast milk. *Nutrition Research* 2001; 21:859-64.
2. Al Suwaidi J, Bener A, AlBinali H, Numan MT. Does hospitalisation for congestive heart failure occur more frequently in Ramadan: a population based study (1991 - 2001). *Int J Cardiol* 2004; 96:217-21.
3. Al Suwaidi J, Bener A, Sulaiman A, AlBinali HA, Salam AM. A population based study of Ramadan fasting and acute coronary syndromes (1991 - 2001). *Heart* 2004; 90:695-6.

4. Al Suwaidi J, Bener A, Behair S, AlBinali HA. Mortality caused by acute myocardial infarction in Qatari women. *Heart* 2004; 90:693-4.
5. Bener A, Al Suwaidi J, Al Jaber K, Al-Marri S, Elbagi IAE. The epidemiology of hypertension and its associated risk factors in the Qatari population. *J Human Hypertens* 2004; 18:529-30.
6. Bener A, Al Suwaidi J, El-Menyar A, Gehani A. The effect of hypertension as a predictor of risk for congestive heart failure patients over a 10-year period in a newly developed country. *Blood Pressure* 2004; 13:41-6.
7. Thorvaldsen P, Kuulasmaa K, Rajakangas AM, et al. Stroke trends in the WHO Monica project. *Stroke* 1997; 28:500-6.
8. Truelsen T, Prescott R, Gronbaek M, Schnohr P, Boysen G. Trends in stroke incidence: the Copenhagen City Heart Study 1997; 28:1903-7.
9. Bonita R, Broad JB, Beaglehole R. Changes in stroke incidence and case-fatality in Auckland, New Zealand, between 1981 and 1991. *Lancet* 1993; 342:1470-3.
10. Akhan G, Kutluhan S, Koyuncuoglu HR. Is there any change of stroke incidence during Ramadan. *Acta Neurol Scand* 2000; 101:259-61.
11. Aho K, Harmsen P, Hatano S, on behalf of the participants in the WHO Collaborative Study on the Control of Stroke in the Community. Cerebrovascular disease in the community: results of a WHO collaborative study. *Bull World Health Org* 1980; 58:113-30.
12. Apslund K, Bonita R, Kuulasmaa K, et al. Multinational comparisons of stroke epidemiology: evaluation of case ascertainment in the WHO MONICA Stroke Study. *Stroke* 1995; 25:355-60.
13. Gumaa KA, Mustafa KY, Mahmoud NA, Gader AM. The effect of fasting in Ramadan: serum uric acid and lipid concentration. *Br J Nutr* 1978; 40:573.
14. Fedail SS, Murphy D, Salih SY, Bolton CH, Harvey RF. Changes in certain blood constituents during Ramadan. *Am J Clin Nutr* 1982; 336:350-3.
15. El-Hazmi MAF, Al-Faleh FZ, Al-Mofleh I. Effect of Ramadan fasting on the values of hematological and biochemical parameters. *Saudi Med J* 1987; 8:171-6.
16. Maislos M, Abou-Rabiah Y, Zuili I, Iordash S, Shany S. Gorging and plasma HDL-cholesterol - the Ramadan model. *Eur J Clin Nutr* 1998; 52:127-30.
17. Perk G, Ghanem J, Aamar S, Ben-Ishay D, Bursztyn M. The effect of the fast of Ramadan on ambulatory blood pressure in treated hypertensives. *J Hum Hypertens* 2001; 15:723-5.
18. Kutluhan S, Sandikci Y, Aytekin S. The relationship of Ramadan with cerebrovascular disease. *J Vakif Gureba Hospital*; 1996; 21:269-74.
19. Ramadan J. Does fasting during Ramadan alter body composition, blood constituents and physical performance? *Med Princ Pract* 2002; 11 Suppl 2: 41-6.