

CLINICAL INVESTIGATION

Effects of Ramadan Fasting on Stroke

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Abstract: The effects of fasting on humans have not been adequately investigated. Ramadan fasting is a great opportunity for scientific research due to its peculiar nature. With this in mind, we conducted research on the effects of Ramadan on stroke, which is one of the most common causes of death in adults.

Patients hospitalized solely for ischemic stroke and intracerebral hemorrhage were evaluated retrospectively. The ratio of these cases to other patients hospitalized in the neurology department was determined. The in-hospital clinical course and mortality rates of the patients with stroke were evaluated.

Within the entire cohort, the most frequently encountered type of stroke was ischemic ($P < 0.05$). The proportions of hemorrhagic and ischemic strokes had no statistically significant differences between the periods before Ramadan, during Ramadan, and after Ramadan ($P > 0.05$). The ratio of hemorrhagic stroke decreased in hypertensive patients during Ramadan ($P < 0.05$). In diabetic patients, the ratio of ischemic stroke increased in the month of Ramadan significantly ($P < 0.05$).

Although Ramadan fasting had an adverse effect on diabetic patients with ischemic stroke, there was no negative effect on hypertensive patient with hemorrhagic stroke or stroke frequency. However, further prospective studies are needed to confirm our results. We think that to understand the effects of Ramadan fasting on stroke in humans evaluation in terms of risk factors such as diabetes and hypertension is required.

Key Words: Ramadan, fasting, diabetes, hypertension, stroke

Introduction

One of the 5 fundamental rituals of Islam is fasting during the month of Ramadan. Muslims neither eat nor drink anything during the month, between dawn and sunset (1). Fasting may last 11-20 h depending on geographical location and season. Following hunger during the above-mentioned period, at sunset people usually eat a large meal, and pray for a long time, which requires some effort. Before dawn, people have a meal (sahoor) and then perform their morning prayers.

Ramadan fasting has some probable negative effects on sick people; the obligation that the daily calorie intake be taken in 1 or 2 meals instead of 3 to 5 has an adverse effect. The obligation that physically demanding prayers be performed after a heavy meal, and after sahoor (which is before dawn), in relatively cold weather walking to the

mosque seems to be unwise for heart disease patients. The other probable negative effects are that while hungry patients cannot take any drugs, such as antihypertensive or antiaggregant drugs, and the regulation of diabetes mellitus is also negatively affected by an unfamiliar diet type (2-4). Moreover, during hot weather and in warm climates a higher possibility of hemoconcentration should also be considered. Although sick people are exempt from Ramadan fasting, most do not conform to this recommendation because of cultural factors. Some 99.2% of people living in Turkey are Muslim and at least 66% of the population fast regularly during Ramadan (4).

Ramadan fasting is a great opportunity for scientific research due to its peculiar nature. Despite the fact that it concerns the Muslim community of more than 1 billion

people, the effects of fasting on humans have not been adequately investigated. With this in mind, we have conducted research on the effects of Ramadan on stroke, which is one of the most common causes of death in adults (5).

Materials and Methods

The case histories of patients at the Neurology Department of Numune Training and Research Hospital (which is one of the busiest neurology departments in Ankara) who were hospitalized there for ischemic stroke and intracerebral hemorrhage were evaluated retrospectively. Time periods corresponding to the month of Ramadan in the Gregorian calendar were established, since the lunar (Muhammadan) calendar is 11-12 days shorter than the solar year. Therefore, the month of Ramadan shifts about 11-12 days a year and coincides with different times of the year. To reduce the effects of climate to a minimum, and to use the data for control purposes, we also evaluated them before, during, and after Ramadan by going back and forward from the period of Ramadan (29-30 days) in a particular year.

Patients hospitalized solely for ischemic stroke and intracerebral hemorrhage were included in this study. The ratio of these cases to other patients hospitalized in the neurology department was determined. The diagnosis of ischemic stroke and intracerebral hemorrhage was established on the basis of history and examination, and supplemented by imaging of the brain (computed tomography and magnetic resonance imaging). The mortality rates of the patients with stroke were

compared in 3 periods. The diagnosis of hypertension was made based on the history of the patient, and if the patient was using antihypertensive medication with a blood pressure over 160/90 mmHg. Diagnosis of diabetes mellitus was considered in patients who had a positive history of diabetes mellitus and who were taking an antidiabetic agent or had high blood glucose levels in follow-up.

Data are given as arithmetic mean ± standard deviation. Parametric values were compared with one-way ANOVA and Student’s t test. The ratio of the diseases and mortality rates between the periods of during, before, and after Ramadan was analyzed with X² and Fisher’s exact tests. Statistical significance was considered as P < 0.05.

Results

The clinical characteristics of the 793 patients are shown in Table 1. The frequency of hypertension, diabetes mellitus, heart disease and history of stroke was not significant between the periods before, during and after Ramadan (P > 0.05).

The age distribution of patients was not significantly different between the periods during, before and after Ramadan (P > 0.05). Mean age at the onset of ischemic stroke was 65.4 ± 13.0 y for Ramadan and 65.3 ± 11.3 and 66.1 ± 12.6 for before and after Ramadan, respectively. Mean age at the onset of intracerebral hemorrhage was 63.8 ± 11.7 y for Ramadan and 62.5 ± 11.1 and 60.7 ± 13.6 for before and after Ramadan, respectively.

Table 1. Clinical characteristics of the patients with stroke.

	BR	R	AR	Sig.(BR-R)	Sig(R-AR)
n	263	247	283	NS	NS
Female, n	137	149	138	NS	NS
Age (y ± SD)	63.9 ± 11.2	64.6 ± 12.4	63.4 ± 13.1	NS	NS
DM (%)	19.8	21.1	18.7	NS	NS
HT(%)	58.6	59.5	58.7	NS	NS
HD(%)	41.1	42.5	37.5	NS	NS
HS(%)	28.1	26.3	25.1	NS	NS

(DM: Diabetes mellitus, HT: Hypertension, HD: Heart disease such as valvular or non-valvular atrial fibrillation, coronary artery disease, HS: History of stroke, SD: Standard deviation, BR: before Ramadan, R: during Ramadan, AR: after Ramadan, Sig: significance, NS: non-significant)

There were no statistical significant differences in the sex ratio between 3 periods ($P > 0.05$).

The distribution by diagnosis of patients hospitalized according to the periods before, during, and after Ramadan over the entire study period is given in Table 2. Within the entire cohort, ischemic stroke is the most frequently observed clinical pattern of disease ($P < 0.05$). The ratios of hemorrhagic and ischemic stroke were not significantly different in the 3 periods ($P > 0.05$).

We also evaluated whether Ramadan fasting had any influence on in-hospital mortality rates. The mortality rates of patients with ischemic and hemorrhagic stroke were not significantly different between the periods before, during, and after Ramadan ($P > 0.05$).

The proportion of patients with stroke according to diabetes mellitus and hypertension is given in Table 3. It is clearly shown that in diabetic patients the ratio of ischemic stroke in Ramadan was significantly higher than before and after Ramadan ($P < 0.05$ and $P < 0.05$ respectively). In hypertensive patients, the ratio of intracerebral hemorrhage was significantly lower in Ramadan than before and after Ramadan ($P < 0.05$ and $P < 0.05$ respectively).

Discussion

Within the entire cohort we found no changes in total stroke frequency during Ramadan, in concordance with previous studies. In these studies, Akhan et al. (2000) evaluated 1579 patients with stroke from 1991 to 1995 retrospectively. They found no negative or positive effects of Ramadan fasting on stroke frequency (6). In the same way, Ince et al. (1997) and Kutluhan et al. (1996) evaluated stroke patients and found no significant differences between Ramadan and other times of the year (7,8). However, in these studies, they did not take into consideration risk factors such as diabetes and hypertension. In contrast to these studies, we found that the ratio of hemorrhagic stroke decreased in hypertensive patients during Ramadan ($P < 0.05$), and in diabetic patients, the ratio of ischemic stroke increased ($P < 0.05$).

Diabetes mellitus is known to be a risk factor for ischemic stroke (9). It is generally feared that the regulation of diabetes mellitus might be negatively affected by Ramadan fasting and that it might precipitate hypoglycemia. However, in previous studies, there were no events suggestive of hypoglycemia in diabetic patients treated with oral hypoglycemic agents (10,11). In

Table 2. Distribution by diagnosis of the patients hospitalized due to stroke during the study periods.

	BR	R	AR	Sig.(BR-R)	Sig.(R-AR)
Stroke	78.9	78.4	72.6	NS	NS
Ischemic Stroke (%)	52.0	53.3	46.4	NS	NS
Intracerebral hemorrhage (%)	27.0	25.1	26.2	NS	NS
Others	21.0	21.6	27.4	NS	NS

(Others: other neurologic disorders such as encephalitis, polyneuropathy, muscle disease, epilepsy, BR: before Ramadan, R: during Ramadan, AR: after Ramadan, Sig: significance, NS: non-significant)

Table 3. Proportion of patients with stroke according to diabetes mellitus and hypertension.

	BR	R	AR	Sig.(BR-R)	Sig.(R-AR)
Patient with diabetes mellitus	(%)	(%)	(%)		
Ischemic stroke	23.2	31.9	21.5	$P < 0.05$	$P < 0.05$
Intracerebral hemorrhage	12.2	10.9	12.7	$P > 0.05$	$P > 0.05$
Patients with hypertension					
Ischemic stroke	39.9	41.4	42.2	$P > 0.05$	$P > 0.05$
Intracerebral hemorrhage	78.9	67.6	76.5	$P < 0.05$	$P < 0.05$

(BR: before Ramadan, R: during Ramadan, AR: after Ramadan, Sig: significance)

addition, there was a tendency for the mean fasting blood glucose level to increase. This degree of hyperglycemia does not seem to cause any serious complications such as ketoacidosis. Dietary indiscretion during the non-fasting period with excessive gorging (the obligation of the daily calorie intake as 1 or 2 meals instead of 3 to 5) is a common practice among Muslims, and this, in combination with reduced physical activity, contributes to the tendency for hyperglycemia (10,11). Other possible factors include the decision by patients to reduce or completely stop their medications for fear of hypoglycemia. In addition, polyuria and hot weather, in the absence of drinking, may cause dehydration and hyperglycemia. In experimental studies, hyperglycemia was shown to influence neurological recovery negatively in cerebral ischemia (12-17). Hyperglycemia aggravates lactic acidosis, which plays a role in the pathogenesis of brain injury (14). In Ramadan fasting, the reason for the increase in the rate of ischemic stroke in diabetic patients may be related to hyperglycemia in this period.

Hypertension is the most important risk factor for the development of intracerebral hemorrhage (5). To our knowledge, the effects of hunger on hypertension and the cardiovascular system are well established (18). When hungry, catecholamine inhibition and reduced venous return cause a decrease in the sympathetic tone, which leads to a fall in blood pressure, heart rate and cardiac output (19,20). In our study period, the duration of fasting varied between 12:38 and 16:46 h. Taking into account the fact that fasting in Ramadan includes this period, the catecholamine levels may be expected to be affected by fasting and decrease. Hussein et al. reported a reduced heart rate during Ramadan, concluding that

this was due to the inhibition of catecholamine production during hunger. Moreover, Habbal et al. (1998) reported that in patients with essential hypertension, the fasting was well supported and the variations of blood pressure were minimal during Ramadan (21). On the other hand, Muslims alter their life style and have a more sedentary life both spiritually and physiologically during the month of Ramadan (22). Although stress control has not been shown to have an important beneficial effect on blood pressure, it is known that hypertension is markedly affected by excitatory psychoemotional influences (23). Muslims alter their sleeping habits and there are 2 periods of sleeping and 2 periods of non-sleeping in a day during Ramadan (24). While open to discussion, in step with this changing regimen it is expected that the diurnal profile of cortisol, which has an influence on blood pressure, will change (24,25).

In conclusion, although Ramadan fasting had an adverse effect on diabetic patients with ischemic stroke, there was no negative effect on stroke frequency, and the hypertensive hemorrhagic stroke ratio is lower. However, further prospective studies are needed to confirm our results. We think that to understand the effects of Ramadan fasting on stroke in humans an evaluation of diabetes and hypertension is required.

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