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Effect of Ramadan fasting on incidence of cerebrovascular stroke in Egyptian patients with Type 2 Diabetes Mellitus

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ABSTRACT

Diabetes is an independent risk factor for stroke disease. Fasting during Ramadan, Muslims must abstain from eating, drinking, taking oral medications, and smoking from the exact time of dawn until time of sunset; in this study we investigated if there is impact of Ramadan Fasting on incidence of Cerebrovascular stroke among Patients with Type 2 Diabetes Mellitus. This cross sectional study was conducted in medical ICU of Zagazig University Hospitals, in months of Sha'ban, Ramadan and Shawwal, in 1436; total numbers of 220 patients diagnosed as cerebrovascular stroke were enrolled in. All of them were subjected to: full history taking and clinical examination, routine investigations and special investigations (CT brain & MRI brain).

Results: There was no significant difference in total frequency of Cerebrovascular stroke (ischemic, hemorrhagic) between patients with diabetes admitted during the month of Ramadan and other months before or after. However, during Ramadan, there was numerical but statistically not significant increase in number of patients with ischemic stroke than hemorrhagic stroke.

Conclusion: Fasting during Ramadan does not increase the frequency of hospitalization for stroke as whole. Although; there is numerical increase in frequency of ischemic stroke than hemorrhagic stroke.

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1. Introduction

Stroke is one of the major causes of death and disability. Stroke prevalence is approximately 5/1000 population but in 65 to 74 year old is 50/1000 in men and 25/1000 in women. Stroke incidence is 2.3/1000 [1].

Diabetes is an independent risk factor for stroke disease. Compared with patients without, patients with diabetes have at least twice the risk for stroke, and approximately 20% of

patients with diabetes will die from stroke, making it one of the leading causes of death in this population. Diabetes duration has also been shown to increase the risk of ischemic stroke disease, with every year of diabetes duration increases the risk by 3% [2]. Hyperglycemia has been shown to increase the size of ischemic stroke and worsen the clinical outcome following a stroke [3].

Ramadan is lunar month, all healthy adult Muslims must fast the whole month from dawn to nightfall according to

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the Muslim's holy book (Qur'an) but, there is exception like sick or women during menses, pregnancy or lactation [4]. About 43% patients with type 1 diabetes and 79% with type 2 diabetes fast during Ramadan [5]. Fasting during Ramadan is essentially a radical change in lifestyle for the period of one lunar month that may affect cardiac and stroke patients [4].

This study aimed to study To detect if there is impact of Ramadan Fasting on Cerebrovascular Accident among Patients with Type 2 Diabetes Mellitus in Intensive Care Unit.

2. Patients and methods

This cross sectional study was conducted in the medical ICU, Zagazig University Hospitals, over a period of 3 lunar months (Sha'ban, Ramadan, and Shawwal) in 1436, corresponding to months (May, June, July and August) in 2015. This study included 220 patients (113 males and 107 females) with a mean age of 66.2 ± 11.7 years and all above 18 years old. 73 patients (28 patients with diabetes and 45 patients without diabetes), 72 patients (32 patients with diabetes and 40 patients without diabetes) and 75 patients (30 patients with diabetes and 45 patients without diabetes), were admitted to ICU with recent CVA during Sha'ban, Ramadan, and Shawwal respectively. Patients with ischemic heart disease, and Patients with metabolic coma, hepatic encephalopathy or uremic encephalopathy were excluded. Written informed consent was obtained from all participants if oriented or their relatives if not, and all protocols were approved by Zagazig Institutional Review Board (IRB).

All subjects of the study were subjected to detailed history of present illness and past history of previous hospital admission. General and Thorough neurological examination with fuel Laboratory investigations and APACHE II scores were calculated. Diagnosis of CVA was made using Computed Tomography of the Brain (Hi-Speed Dual CT) was done for all patients admitted, In cases of unclear clinical diagnosis; magnetic resonance imaging (1.5 Tesla superconducting MR imager).

3. Statistical analysis

Data are expressed as the mean \pm standard deviation (SD), median with range, or the number of patients with percentage as appropriate. The demographic, clinical and laboratory parameters were assessed. The collected data and calculations were performed, summarized, tabulated and analyzed by using computerized software statistical packages (SPSS for Windows® version20). The significance of differences between groups was assessed by the independent samples t-test. Chi-square test (X^2) exact was used to compare proportions.

The significance Level for all above mentioned statistical tests done. A two-tailed p-value < 0.05 was considered statistically significant.

4. Results

See Tables 1–7.

Table 1 – Clinical characteristics of all patients admitted to our medical ICU before, during & after Ramadan with cerebrovascular stroke.

Whole group	Before Ramadan		During Ramadan		After Ramadan		Total	test	P	Sig
	N = 73	N = 72	N = 75	N = 75	220					
Age years (mean \pm SD)	64.7 \pm 11.6		66.5 \pm 12		66.2 \pm 11.7			1.1	0.568	NS
Sex	Male	N	32	36	45	113	3.949	0.139	NS	
		%	43.8%	50.0%	60.0%	51.4%				
	Female	N	41	36	30	107				
		%	56.2%	50.0%	40.0%	48.6%				
Smoking	No	N	54	51	44	149	4.437	0.109	NS	
		%	74.0%	70.8%	58.7%	67.7%				
	Yes	N	19	21	31	71				
		%	26.0%	29.2%	41.3%	32.3%				
Hypertension	No	N	22	24	17	63	2.166	0.339	NS	
		%	30.1%	33.3%	22.7%	28.6%				
	Yes	N	51	48	58	157				
		%	69.9%	66.7%	77.3%	71.4%				
Diabetes Mellitus	No	N	45	40	45	130	0.595	0.743	NS	
		%	61.6%	55.6%	60.0%	59.1%				
	Yes	N	28	32	30	90				
		%	38.4%	44.4%	40.0%	40.9%				
Fasting	No	N	72	22	71	165	113.063	0.000*	SIG	
		%	98.6%	30.6%	94.7%	75.0%				
	Yes	N	1	50	4	55		<0.001		
		%	1.4%	69.4%	5.3%	25.0%				
Antidiabetic Treatment	Insulin	N	12	6	12	30	4.81	0.090	NS	
		%	42.9%	18.8%	40.0%	33.3%				
	OAD	N	16	26	18	60				
		%	57.1%	81.3%	60.0%	66.7%				

Table 2 – Clinical characteristics of patients with diabetes admitted before, during & after Ramadan with cerebrovascular stroke.

Diabetic group			BR	R	AR	Total	F	P
			N = 28	N = 32	N = 30	N = 90		
Age			63.1 ± 12.1	63.7 ± 10.3	63.9 ± 9.1	63.6 ± 10.4	0.06	0.968
Sex	Male	No	9	16	19	44	5.66	0.059
		%	32.1%	50.0%	63.3%	48.9%		
	Female	No	19	16	11	46	3.20	0.202
		%	67.9%	50.0%	36.7%	51.1%		
Smoking	No	No	22	22	17	61	3.20	0.202
		%	78.6%	68.8%	56.7%	67.8%		
	Yes	No	6	10	13	29	51.4	0.000*
		%	21.4%	31.3%	43.3%	32.2%		
HPN	No	No	5	9	0	14	9.49	0.009*
		%	17.9%	28.1%	0.0%	15.6%		
	Yes	No	23	23	30	76	51.4	0.000*
		%	82.1%	71.9%	100.0%	84.4%		
Fasting	No	No	27	8	29	64	51.4	0.000*
		%	96.4%	25.0%	96.7%	71.1%		
	Yes	No	1	24	1	26	4.81	0.090
		%	3.6%	75.0%	3.3%	28.9%		
Treatment	insulin	No	12	6	12	30	4.81	0.090
		%	42.9%	18.8%	40.0%	33.3%		
	OAD	No	16	26	18	60	4.81	0.090
		%	57.1%	81.3%	60.0%	66.7%		

Regarding Clinico-demographic characters of patients with diabetes before, during & after Ramadan; there were significant differences as regard hypertension and fasting, P value = 0.009 and < 0.001.

Table 3 – Baseline laboratory results of all patients admitted before, during & after Ramadan with cerebrovascular stroke.

Whole group	Before Ramadan	During Ramadan	After Ramadan	test	P
RBS	134.2 ± 52.6	141.9 ± 56.3	141.4 ± 60.1	1.2	0.556
HbA1c (mmol/mol)	6.5 ± 1 (48)	6.5 ± 1.1(48)	6.5 ± 1.1 (48)	0.1	0.955
WBCs × 10 ³ μL	10.3 ± 3.4	10.9 ± 4	11 ± 3.7	0.9	0.630
Hb gm/dl	11.8 ± 1.5	12.3 ± 2	12.4 ± 1.8	4.1	0.126
Platelets × 10 ³ μL	260.1 ± 67.9	259.7 ± 78.1	251.9 ± 68.6	0.5	0.792
Total Bilirubin mg/dl	0.8 ± 0.2	0.7 ± 0.2	0.7 ± 0.2	7.7	0.022
Albumin gm/dl	3 ± 0.6	3.1 ± 0.6	3 ± 0.7	0.9	0.635
protein gm/dl	6.7 ± 0.9	6.8 ± 0.8	6.7 ± 0.9	0.6	0.724
ALT μ/l	20.1 ± 5.9	15.5 ± 6.4	15.6 ± 6.3	27.5	0.000
AST μ/l	31 ± 7.5	30.9 ± 6.7	27.6 ± 7.1	9.7	0.008
Waist Circumference	89.7 ± 6.5	91.3 ± 6	93.2 ± 6.3	10.7	0.005
Cholesterol mg/dl	141 ± 58.2	143.4 ± 55.5	144.4 ± 57.1	0.3	0.866
Triglycerides mg/dl	108 ± 62.2	106.8 ± 62.9	110.5 ± 65.7	0.1	0.967
HDL mg/dl	45.8 ± 17	41.3 ± 16.9	42.9 ± 18.1	2.2	0.330
LDL mg/dl	86.6 ± 43.7	88.6 ± 42.3	90.1 ± 44.1	0.2	0.893
INR	1 ± 0.1	1.1 ± 0.1	1 ± 0.1	0.1	0.953
S.Creat.mg/dl	1.1 ± 0.3	1.2 ± 0.5	1.1 ± 0.3	3.8	0.153
S. Urea mg/ dl	28.5 ±	29.9 ± 3.9	30.3 ± 3.7	8.6	0.013

There was a significant difference as regard total Bilirubin, ALT, AST, Waist circumference and urea; p = 0.022, <0.001, 0.008, 0.005 And 0.013 However, no significant differences was found as regard mean blood glucose, HbA1C, WBCs, Hb, Platelets, Albumin, total protein, Cholesterol, Triglycerides, HDL, LDL, INR, S. Creatinine and urine analysis.

* Serum Creatinine mg/dl.

5. Discussion

Ramadan fasting is one of the five pillars of Islam. About one billion Muslim adults worldwide refrain from food, water, and oral drug intake from dawn to sunset during Ramadan fasting. Ramadan fasting could not induce any harmful effect in young healthy subjects.

This study was an effort to detect if there is an impact of Ramadan Fasting on Cerebrovascular Accident among Patients with Type 2 Diabetes Mellitus. Our prospective cross-sectional study included patients admitted in medical ICU, Zagazig University hospital over a period of three lunar months (Sha'ban, Ramadan, and Shawwal) in 1436 Hijri, cor-

Table 4 – Baseline laboratory results of patients with diabetes admitted before, during & after Ramadan with cerebrovascular stroke.

Lab in DM	BR	R	AR	Test	P	
Random Bl Glucose	197.1 ± 25.3	197.4 ± 36	208.2 ± 38.6	3.09	0.214	
Hb A1c %	7.6 ± 0.7	7.5 ± 0.5	7.6 ± 0.5	1.17	0.556	
WBCs × 103 µL	10 ± 3.2	10.9 ± 3.6	11.2 ± 3.3	2.45	0.293	
Hb gm/dl	11.9 ± 1.7	12.2 ± 2	12.8 ± 1.7	3.90	0.142	
Platelets × 103 µL	262.1 ± 70.4	264.5 ± 70	257.8 ± 70.7	0.34	0.844	
T. Bilirubin mg/dl	0.8 ± 0.2	0.7 ± 0.3	0.7 ± 0.2	0.54	0.763	
Albumin gm/dl	2.9 ± 0.7	3 ± 0.6	3.3 ± 0.6	4.28	0.118	
protein gm/dl	6.5 ± 0.9	6.8 ± 0.8	7 ± 0.8	5.76	0.056	
ALT µ/l	20.6 ± 6	14.4 ± 5.2	13.7 ± 4.7	21.7	0.000	
AST µ/l	31.8 ± 7.6	30.9 ± 6.5	27.3 ± 7.1	6.15	0.046	
W. Circumference	89.1 ± 6.6	91.6 ± 6.5	92.7 ± 5.1	6.21	0.045	
Cholesterol mg/dl	131.2 ± 58.1	142.9 ± 61.4	143.8 ± 53.9	1.87	0.392	
Triglycerides mg/dl	98.7 ± 49.4	105.3 ± 69.8	94 ± 41	0.15	0.929	
HDL mg/dl	47.6 ± 17.7	42.3 ± 18.7	45.8 ± 17.2	0.99	0.608	
LDL mg/dl	82.1 ± 43.5	87 ± 47.6	90.4 ± 38.6	0.72	0.698	
INR	1 ± 0.1	1 ± 0.1	1 ± 0.1	0.42	0.812	
S.Creat.mg/dl	1.1 ± 0.2	1.1 ± 0.4	1.2 ± 0.3	0.07	0.968	
S. Urea mg/ dl	29.6 ± 3.2	30.3 ± 4.2	31.1 ± 3.6	3.63	0.163	
Urine analysis	Normal	No	2	0	4.53	0.104
		%	7.1%	0.0%	0.0%	
	abnormal	No	26	32	30	
		%	92.9%	100.0%	100.0%	

Regarding laboratory characters of patients with diabetes before, during & after Ramadan; there were significant differences as regard AST, ALT, Waist Circumference, P value = 0.46, <0.001, 0.45

Table 5 – Distribution of C.V. INSULT among patients with diabetes before, during and after Ramadan.

Patients with DM			Before Ramadan	During Ramadan	After Ramadan	total	X2	P
			N = 28	N = 32	N = 30	N = 90		
CT or MRI Brain	brain edema	N	1	2	0	3	3.31	0.507
		%	3.6%	6.3%	0.0%	3.3%		
	Hemorrhage	N	16	13	15	44		
		%	57.1%	40.6%	50.0%	48.9%		
	Infarction	N	11	17	15	43		
		%	39.3%	53.1%	50.0%	47.8%		

There was a numerical increase in cerebral infarction during Ramadan than the month before and after

responding to months (May, June, July, and August) in 2015. All of them diagnosed as a cerebrovascular stroke.

A total of 220 patients were studied; (73 patients before Ramadan, 72 patients during Ramadan and 75 patients after Ramadan). There were no statistically significant differences as regard age the studied population in the three lunar months; month before, during and month after Ramadan (64.7 ± 11.6 y, 66.5 ± 12 y and 67.1 ± 11.1 y) respectively and sex(113 male (51.4%) and 107 female (48.6%).

There were no statistically significant differences as regard risk factors for stroke (hypertension, smoking, DM), APACHE II score between the three lunar months (before, during and after Ramadan) (P > 0.05).

In our study, it was observed that there was non-significant difference neither in random blood glucose nor HbA1C during Ramadan compared to other months (P > 0.05); As regard patients with diabetes (N = 90) and also all study population (N = 220); which may indicate that Ramadan fasting not significantly alters glycemc control and this

was in concordance with Kamar M et al, 2014, who clarified that there was no significant difference in fasting blood glucose during Ramadan [6]. However this is contradictory to the EPIDIAR study, 2001 who reported a decrease in fasting glucose and an increase in the frequency of severe hypoglycemia during Ramadan in a population including both types 1 and 2 patients [5]. This is also contradictory to Norouzy et al, 2012 who showed that fasting during Ramadan deteriorated the glycemc control in Type 2 diabetes patients [7].

In our study, There were no significant differences as regard lipid profile (triglycerides, total cholesterol, HDL and LDL) during fasting (P > 0.05) in patients with diabetes and also all study population. This is in concordance with (Sulimani RA et al., 1991), (Dehghan MR et al., 1994), (Cesur M et al., 2007) and (El-Mitwalli A et al., 2009) who clarified that most patients with either type 1 or type 2 diabetes do not show significant changes in lipid profiles during Islamic Fasting [8–11].

Table 6 – Distribution of C.V. INSULT among patients with diabetes as regard fasting.

Patients with diabetes as regard fasting			Fasting		Total	X2	P
			No	Yes			
			64	26	90		
CT or MRI Brain	brain edema	N	3	0	3	3.5	0.175
		%	4.7%	0.0%	3.3%		
	Haemorrhage	N	34	10	44		
		%	53.1%	38.5%	48.9%		
	Infarction	N	27	16	43		
		%	42.2%	61.5%	47.8%		

Regarding the distribution of C.V. INSULT among patients with diabetes as regard fasting; there were no significant between fasting and non-fasting group.

Table 7 – Glasgow Coma Scale & APACHE II Score of patients with diabetes as regard fasting.

DM	Fasting		T	P
	No	Yes		
Glasgow Coma Scale	9 (4–14)	9.5 (4–14)	–0.2	0.851
APACHE II (Score)	18 (6–24)	13 (7–21)	–3.6	0.000

APACHE II Score among patients with diabetes; it was significantly lower in fasting than non-fasting group.

There was a statistically significant decrease in alanine aminotransferase, aspartate aminotransferase; ($P < 0.05$) in all study population and also in patients with diabetes. This is in contradictory to Mafauzy M et al (1990), and El-Mitwalli A et al (2009); who revealed that; in patients with diabetes, serum concentrations of blood urea nitrogen creation, uric acid, alanine aminotransferase, aspartate aminotransferase, protein and albumin values show no significant changes during Ramadan fasting. This may be due to the fasting of about 16 h with a low-fat diet that may lead to a decrease in liver enzymes [11,12].

In our study, there was no significant difference in frequency of stroke (ischemic, hemorrhagic) between patients admitted during the month of Ramadan and the month before or after, this was in concordance with many previous prospective studies in which there were no significant differences in total stroke frequency [4,11,13], nor in the number of hospitalization for stroke (ischemic, hemorrhagic) during Ramadan, when compared to the rest of the year [14].

On the other hand; Hassan H. et al, clarified a significant difference in the stroke frequency before and during Ramadan, when compared to the month after Ramadan that may be related to diet attitude and fluid intake after Ramadan as well as positive emotional factors and moving towards erratic eating behavior after the obligatory restriction during Ramadan [15].

In patients with diabetes, there was no significant difference in frequency of stroke (ischemic, hemorrhagic) considering age & sex distribution who admitted during the month of Ramadan and other months before or after it.

In our cross-sectional study; During Ramadan fasting, in patients with diabetes, there is a non-significant numerical increase in the frequency of ischemic stroke than the frequency of hemorrhagic stroke ($P > 0.05$), It was statistically

non-significant; may be due to small sample size in our study. Also, Abdullah et al found that in summer weather is too hot and the fasting hours is long, fasting during Ramadan was found to be an independent risk factor for stroke, and specifically ischemic stroke [16]. this can be explained by dehydration and so increased blood viscosity in this period resulting from hot weather and polyuria, in absence of drinking, which may increase the risk of thrombotic stroke.

In addition, hyperglycemia can result in osmotic diuresis and contribute to volume depletion. Intravascular space contraction can contribute to a hypercoagulable state due to an increase in clotting factors, a decrease in endogenous anticoagulants and impaired fibrinolysis [17].

Also, It was noted that As regard APACHE II it was significantly lower in fasting than nonfasting stat which may point toward better outcome in fasting rather non fasting patients.

The major limitation of our study is no statistics on those who refused hospitalization, died before arrival, or died at home from acute stroke as well as stroke incidence all over the country during Ramadan.

6. Conclusion

Fasting during Ramadan does not increase the frequency of hospitalization for stroke as whole. Although; there is numerical increase in frequency of ischemic stroke than hemorrhagic stroke.

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Conflict of interest

There is no conflict of interest.

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