

# Emergency department attendance patterns during Ramadan

Taimur Butt,<sup>a</sup> Hameed Ullah Khan,<sup>a</sup> Israr Ahmed,<sup>a</sup> Abdelmoneim Eldali<sup>b</sup>

From the <sup>a</sup>Department of Emergency Medicine and <sup>b</sup>Department of Biostatistics, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

Correspondence: Dr. Taimur Butt · Chairman, Department of Emergency Medicine, King Faisal Specialist Hospital and Research Centre, PO Box 3354, Riyadh 11211, Saudi Arabia · T: +966-11-4647272 · tbutt@kfshrc.edu.sa · ORCID: <http://orcid.org/0000-0003-4949-2344>

Ann Saudi Med 2016; 36(4): 258-264

DOI: 10.5144/0256-4947.2016.258

**BACKGROUND:** Patient attendance in the emergency department (ED) is inherently variable and unpredictable. Resources might be better allocated if use of the ER could be predicted. During the month of fasting (Ramadan), healthy adult Muslims do not eat or drink from dawn to sunset and in the Middle East, social activities occur mostly during night. There is no published data that has reported changes in local ED attendance pattern during Ramadan.

**OBJECTIVES:** Determine if there are differences in tertiary care ED attendance during Ramadan compared to other times of the year.

**DESIGN:** Retrospective, using data from the hospital integrated clinical information system.

**SETTING:** Tertiary care institution in Riyadh, Saudi Arabia.

**PATIENTS AND METHODS:** All ED visits during the Islamic calendar years of 1431-1434 (December 18, 2009-October 13, 2013) were analyzed.

**MAIN OUTCOME MEASURES:** Patient volume, acuity, demographics and admission rate variability between Ramadan and other months.

**RESULTS:** During the study period of 4 years, of 226 075 ED patients, 129 178 (57.14%) patients were seen during the day shift (07:00 to 18:59). During Ramadan, 10 293 (60%) patients presented during the night shift compared with the day shift ( $P < .0001$ ). This trend was seen consistently with no statistically significant differences in admissions 7%, triage acuity or when compared with other months.

**CONCLUSION:** During Ramadan, ED attendance changes as more patients present during the night shift. In Saudi Arabia and possibly other Muslim countries, appropriate resources should be allocated during Ramadan to manage the nocturnal ED patient surge.

**LIMITATIONS:** We believe that the majority of our patients fast, but it is not known how many ED patients were actually fasting during the study period. This study was conducted in a tertiary care hospital and the patient population presenting to our ED is predominantly Muslim; therefore, the results may not be generalized to populations that are not predominantly Muslim.

Emergency Department (ED) patient visits have an inherent natural variability through the day and month to month. The demand for services changes due to seasonal and weekly patterns.<sup>1</sup> ED patient attendance patterns may change during local community events, school holidays, sudden influxes of visitors in town or a festivity such as Ramadan (Muslim month of fasting). To optimize the quality of patient care, efficient patient flow, shorten waiting times and length of stay, a balance between the supply of emergency resources and demand for services must be

maintained. Cost-effective ED staffing plans account for historic patient volumes during peak and trough hours.<sup>2</sup> Also, due to a worldwide shortage of trained and qualified emergency staff, physicians, mid-level providers and nurses, appropriate staffing schedules are required for optimal patient outcomes.<sup>3</sup>

During Ramadan, healthy Muslims do not eat, drink, smoke or have sexual intercourse from dawn to sunset.<sup>4</sup> Muslims follow a lunar calendar and Ramadan is the 9th month. Depending on the sighting of the moon, this may be 29 or 30 days. As a lunar calen-

dar is shorter than the Gregorian calendar by 11 days, Ramadan may fall any time of the year. During summer months the fasting period may be 18 hours long in the region. During Ramadan the change in the sleep-wake cycle is associated with changes in meal schedules, increased food consumption during the night, a decrease in daytime alertness and psychomotor performance and an increase in the intensity of certain diseases.<sup>5</sup> Islam does not mandate fasting for sick persons, children, elderly, travelers, insane, pregnant or lactating and menstruating women.<sup>6,7</sup> However, many of these individuals attempt fasting to fulfill their religious obligations.<sup>8</sup> One epidemiologic study indicated that a majority (79%) of patients with type 2 diabetes fasted for at least 15 days during Ramadan and in another study over half (58%) of peritoneal dialysis patients elected to fast.<sup>9,10</sup> It is quite conceivable that some of these patients may present to an ED with sickness or injury.<sup>11</sup> During Ramadan, social activities like shopping and family recreational activities are more frequent after people have broken their fast and during the night time.

This retrospective study is an attempt to find out whether these social, cultural and religious factors during the month of Ramadan impact ED volume, triage acuity, admission rate and patient demographics in a tertiary care hospital in Riyadh, Saudi Arabia. The patient population presenting to this hospital is predominantly Muslim. To our knowledge, such data from Saudi Arabia has not been published before.

**PATIENTS AND METHODS**

Electronic data on patient visits to the ED of King Faisal Specialist Hospital and Research Centre in the city of Riyadh, Saudi Arabia were retrospectively collected from the Integrated Clinical Information System (ICIS). Permission from the Research Advisory Council (RAC # 2131 154) was obtained before accessing hospital data. The data from February 15, 2010 to October 6, 2013 corresponding to Islamic Calendar Rabi-al-awal 1, 1431 to Dhu-al-Hijja 30, 1434 were collected and analyzed. All ED visits were included and direct admissions to the hospital were excluded. Descriptive statistics for the continuous variables are reported as mean and standard deviation and categorical variables are summarized as frequencies and percentages. Continuous variables were compared by the independent t test or ANOVA as appropriate, while categorical variables were compared by chi-square test. The level of statistical significance was set at  $P < .05$ . The statistical analysis was done by using the software package Statistical Analysis System (SAS version 9.4).

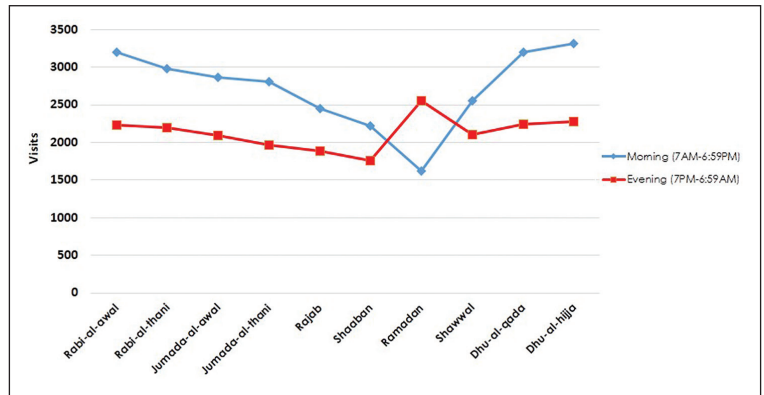


Figure 1. Emergency department patient attendance (1431).

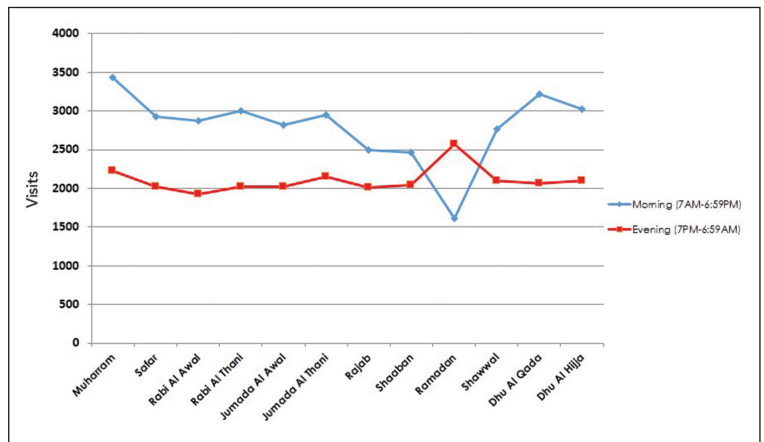


Figure 2. Emergency department patient attendance (1432).

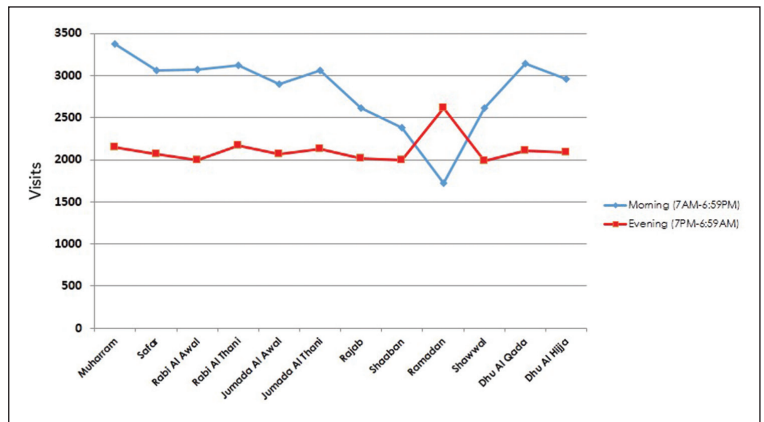


Figure 3. Emergency department patient attendance (1433).

**RESULTS**

Data for the Islamic year 1431 comprises of 10 months (15 February to 7 November 2010). During this period, a total of 48 466 patients were seen in the ED. Of

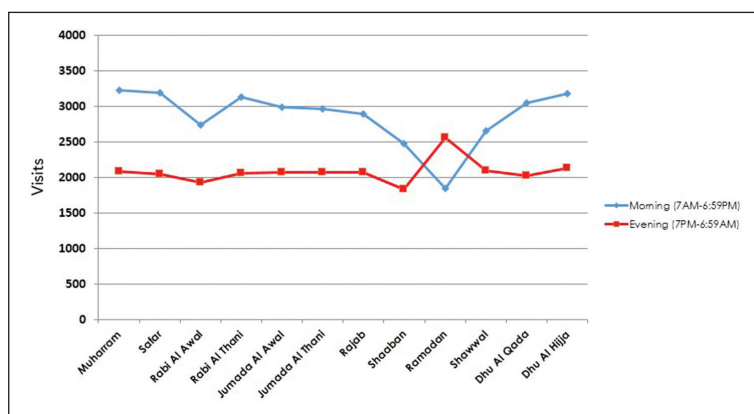


Figure 4. Emergency department patient attendance (1434).

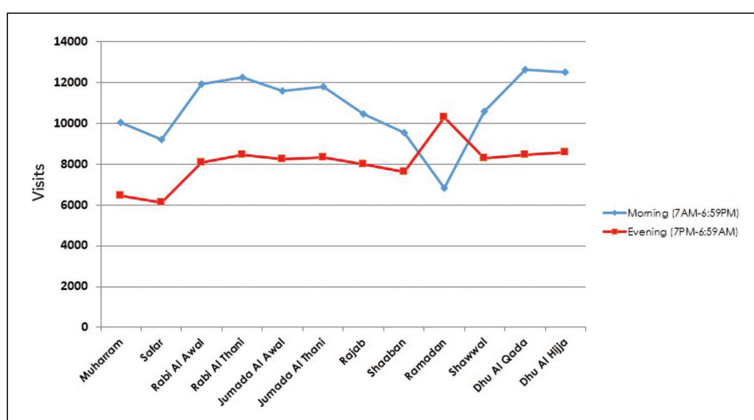


Figure 5. Emergency department patient attendance (1431-1434).

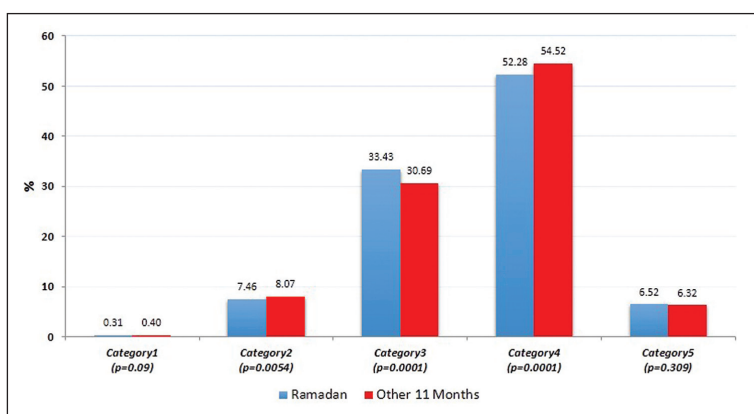


Figure 6. Emergency department triage acuity distribution (1431-1434).

this total, 27,195 (56%) were seen during the day shift (07:00 to 18:59) and 21,271 (44%) were seen during the night [a]shift (19:00 to 06:59). This day to night shift variability in patient volume was statistically significant ( $P<.0001$ ). More patients were seen during the day shift

in all months except during Ramadan, when more patients were seen during the night shift. This difference was also statistically significant when compared with all other months as well as when compared with average for the whole year ( $P<.0001$ ) (Figure 1).

No statistically significant difference was noted among other variables studied between Ramadan and the rest of the year. A total of 44 677 (92%) ED patients were discharged home. There were 37,338 (77%) adults (14 years and above) and 11 128 (23%) pediatric. There were 25 435 females (52%) and 23 018 males (48%). No statistically significant differences were noted when Ramadan was compared with the rest of the months and the entire year (Table 1). A similar trend was seen during the year 1432 (7 December 2010 to 23 October 2011) as noted in Figure 2 and Table 2. During the year 1433 (26 November 2011 to 17 October 2012) similar trend was noted (Figure 3, Table 3). For the year 1434 (15 November 2012 to 6 October 2013) the patient presentation pattern is shown by Figure 4 and Table 4.

During the study period, 1431-1434 (December 2009 to October 2013), a total of 226,075 patients were seen in the ED, 129,178 (57%) patients were seen during the day shift and 96,897 (43%) were seen during the night shift ( $P<.0001$ ). However, during the month of Ramadan, more patients presented to the ED during the night shift after breaking their fast, as compared with all other months or the average of the entire year ( $P<.0001$ ) (Figure 5).

A total of 211,217 (93%) ED patients were discharged home. There were 176 120 (78%) adults and 49 955 (22%) pediatric. Female ED patient visits included 118 562 (52%) while male patients were 107 476 (48%). Among these variables a similar trend continued during Ramadan months. The cumulative results are shown in the Table 5.

Patient triage acuity based on Canadian Triage and Acuity Scale (CTAS) was analyzed for Ramadan and the rest of the months through 1431 to 1434. No association was found in the number of category 1 and 2 (emergent) patients, Category 3 (urgent) patient volume was increased while the category 4 (non-urgent) patient volume was noted to have decreased during Ramadan as compared with the rest of the months (Figure 6).

## DISCUSSION

During the months of Ramadan, the majority of the patients presented to the ED during the night shift after breaking their fast. This change corresponds to the nocturnal culture pattern that develops during this month in a Middle Eastern society.<sup>12,13</sup> Use of the ED by patients

**Table 1.** Patient demographic data, Islamic year 1431.

Months	Total	Arrival time		Disposition		Age		Gender	
		Day	Night	Home	Admit	Adult	Peds	Female	Male
Rabi-al-awal	5423	3194	2229	5153	270	4084	1339	2796	2623
Rabi-al-thani	5172	2982	2190	4727	445	3885	1287	2681	2489
Jumada-al-awal	4947	2860	2087	4485	462	3840	1107	2622	2325
Jumada-al-Thani	4765	2804	1961	4391	374	3715	1050	2433	2332
Rajab	4327	2448	1879	4017	310	3386	941	2323	2004
Shaaban	3974	2217	1757	3667	307	3204	770	2049	1925
Ramadan	4171	1623	2548	3783	388	3300	871	2231	1938
Shawwal	4651	2551	2100	4200	451	3696	955	2406	2245
Dhu-al-qada	5444	3200	2244	5091	353	4086	1358	2925	2516
Dhu-al-hijja	5592	3316	2276	5163	429	4142	1450	2969	2621
Total	48466	27195	21271	44677	3789	37338	11128	25435	23018
Percentage	100	56	44	92	8	77	23	52	48

**Table 2.** Patient demographic data, Islamic year 1432.

Months	Total	Arrival Time		Disposition		Age		Gender	
		Day	Night	Home	Inpatient	Adult	Peds	Female	Male
Muharram	5665	3439	2226	5243	423	4123	1542	3047	2617
Safar	4947	2930	2017	4586	361	3747	1200	2614	2332
Rab-al-awal	4804	2877	1927	4440	364	3702	1102	2484	2320
Rab-al-thani	5020	3001	2019	4615	405	3881	1139	2615	2405
Jumada-al-awal	4840	2818	2022	4406	434	3750	1090	2494	2342
Jumada-al-thani	5104	2948	2156	4676	428	3966	1138	2625	2479
Rajab	4506	2496	2010	4109	397	3564	942	2353	2153
Shaaban	4508	2463	2045	4029	479	3633	875	2312	2196
Ramadan	4181	1614	2567	3743	438	3379	802	2172	2009
Shawwal	4865	2766	2099	43147	518	3842	1023	2571	2292
Dhu-al-qada	5293	3223	2070	4842	451	4091	1209	2737	2556
Dhu-al-hijja	5126	3027	2099	4682	444	3873	1253	2684	2441
Total	58859	33602	25257	53718	5142	45551	13315	36564	28142
Percentage	100	58	43	91	9	77	23	52	48

is based upon convenience, inability to access primary care, lack of insurance or patient perception of an urgent medical condition. This study shows a sudden reversal of the ED patient arrival pattern during the month of Ramadan suggesting that social and cultural factors have a strong influence on the use of the ED by the patients.

To maintain quality of care, resource allocation must match patient care demands. Accurate predictions of future demand and workload can enable optimal staff scheduling and resource allocation.<sup>1</sup> The staff scheduling for the ED shifts can be done by using mathematical calculations, analytical analysis, hospital website activ-

**Table 3.** Patient demographic data, Islamic year 1433.

Months	Total	Arrival time		Disposition		Age		Gender	
		Day	Night	Home	Inpatient	Adult	Peds	Female	Male
Muharram	5522	3379	2143	5046	476	4195	1327	2829	2693
Safar	5118	3056	2062	4584	534	3813	1305	2614	2332
Rab-al-awal	5068	3075	1993	4545	523	3878	1190	2647	2421
Rab-al-thani	5280	3116	2164	4781	499	4044	1236	1805	2475
Jumada-al-awal	4972	2901	2071	4466	506	3860	1112	2679	2293
Jumada-al-thani	5192	3065	2127	4632	560	4070	1122	2707	2481
Rajab	4634	2616	2018	4132	502	3701	933	2523	2110
Shaaban	4372	2380	1992	3891	481	3508	864	2306	2068
Ramadan	4342	1724	2618	3907	435	3507	835	2323	2019
Shawwal	4600	2612	1988	4119	481	3762	838	2425	2172
Dhu-al-qada	4243	3138	2105	4777	466	4121	1122	2759	2481
Dhu-al-hijja	5041	2955	2086	4542	499	3921	1120	2658	2382
Total	59384	34017	25367	53422	5962	46380	13004	31417	27957
Percentage	100	57	43	90	10	78	22	53	47

**Table 4.** Patient demographic data, Islamic year 1434.

Months	Total	Arrival time		Disposition		Age		Gender	
		Day	Night	Home	Inpatient	Adult	Peds	Female	Male
Muharram	5308	3225	2083	4762	546	4040	1268	2759	2549
Safar	5250	3198	2052	4715	535	4002	1248	2759	2494
Rabi-al-awal	4671	5746	1925	4164	507	3689	982	2480	2119
Rabi-al-thani	5203	3138	2065	4693	510	4034	1169	2704	2499
Jumada-al-awal	5062	2985	2077	4545	517	3898	1164	2684	2370
Jumada-al-thani	5036	2969	2067	4554	482	3939	1097	2622	2413
Rajab	4970	2894	2076	4463	507	3911	1059	2633	2336
Shaaban	4315	2476	1839	3862	453	3532	783	2225	2090
Ramadan	4406	1846	2560	3943	463	3642	764	2260	2146
Shawwal	4747	2653	2094	4215	532	3928	819	2458	2288
Dhu-al-qada	5082	3052	2030	4572	510	4042	1040	2608	2470
Dhu-al-hijja	5316	3182	2134	4804	512	4194	1122	2806	2509
Total	59366	34364	25002	53292	6074	46851	12515	30998	28283
Percentage	100	58	42	90	10	79	21	52	48

**Table 5.** Patient demographic data, Islamic year 1431-1434.

Months	Total	Arrival Time		Disposition		Age		Gender	
		Day	Night	Home	Inpatient	Adult	Peds	Female	Male
Muharram	16 495	10043	6452	15 572	923	12 358	4137	8635	7859
Safar	15 315	9184	6131	14 404	911	11 562	3753	8126	7188
Rabi-al-awal	19 966	11 892	8074	18 794	1172	15 353	4613	10 407	9555
Rabi-al-thani	20 675	12 237	8438	19 316	1359	15 844	4831	10 805	9868
Jumada-al-awal	19 821	11 564	8257	18 403	1418	15 348	4473	10 483	9337
Jumada-al-thani	20 097	11 786	8311	18 728	1369	15 690	4407	10 387	9705
Rajab	18 437	10 454	7983	17 208	1229	14 562	3875	9832	8603
Shaaban	17 169	9536	7633	15 885	1284	13 877	3292	8892	8276
Ramadan	17 100	6807	10 293	15 824	1276	13 828	3272	8986	8112
Shawwal	18 863	10 582	8281	17 394	1469	15 228	3635	9863	8997
Dhu-al-qada	21 062	12 613	8449	19 783	1279	16 340	4722	11 029	10 023
Dhu-al-hijja	21 075	12 480	8595	19 909	1169	16 130	4945	11 117	9953
Total	22 6075	129 178	96 897	211 220	14 858	176 120	49 955	118 562	107 476
Percentage	100	57	43	93	7	78	22	52	48

ity volume or daily and hourly patient arrival patterns.<sup>14</sup> Patient acuity, complexity and often social status may affect physician workload. Whereas sicker patients may take more physician time with procedures and consultations, patients with higher social status might require more time for disease discussion and reassurance. To maintain a balance between resource allocation and quality of care, future staff planning should be based on historic patient arrival patterns, day and night visit variability, number of admissions, patient acuity, variation in gender and adult-to-pediatric visit ratio.

ED patient arrival has natural variability while the operating room (OR) schedule has artificial variability. Smoothing the OR schedule can improve ED patient flow.<sup>15</sup> It would be interesting to see if a similar variability is present in the scheduling of surgeries during Ramadan. Likewise, other supporting departments like radiology, pathology, respiratory services, admitting services and others must align their staffing to ED patient care demands. During the month of Ramadan, we change the emergency physician schedule for both the fast track and the main department. Shifts are arranged to match the higher incoming patient volume during the night, without actually increasing the total daily hours of coverage. This study supports our practice as the total volume of patients during Ramadan did not change. In our ED, the on-call and back-up staffing

is maintained without any change throughout the year.

Intermittent fasting during the month of Ramadan has been shown to cause various health effects, including changes in serum glucose, glycosylated hemoglobin, physiological and psychological responses of athletes, LDL cholesterol, electrolyte, seizure frequency and caffeine withdrawal headaches.<sup>16-20</sup> These health effects did not increase ED patient volume in our study.

Patients who are fasting, usually avoid visiting the ED during the day time, and prefer to visit after breaking their fast because if someone is fasting, taking oral medications and intravenous fluids with calories will break the fast. Intramuscular injections and IV fluids without calories are often permitted by religious authorities, but in our experience are commonly avoided by our patients.

As a tertiary hospital, our patient population is quite complex. However, the acuity of illness based on the CTAS did not change significantly during Ramadan. Other variables that did not change significantly included admission rate, discharge rate, gender and age distribution. These findings suggest no significant health effects in our patient population.

We believe that the majority of our patients fast but it is not known as to how many ED patients were actually fasting during the study period. This study was conducted in a tertiary care hospital and the patient popu-

lation presenting to our ED is predominantly Muslim; therefore, the results may not be generalized.

In conclusion, despite natural variability, the monthly ED patient volume, age, gender and the admission rate remained constant throughout the years. There was a significant change in the patient presentation pattern during the month of Ramadan, with a greater

number of patients presenting to the ED after sunset and through the night shift. This nocturnal arrival pattern may be related to religious, social and cultural factors in the region. EDs and other hospital support services in Saudi Arabia and possibly other Muslim countries in the region should adjust their staff schedules accordingly.

## REFERENCES

1. Jones, Spencer S., et al. Forecasting daily patient volumes in the emergency department. *Academic Emergency Medicine* 2008;15(2):159-170.
2. Hall, Randolph, et al. Modeling Patient Flows Through the Health care System. Patient Flow. Springer US, 2013:3-42.
3. Kirsch, Thomas D, et al. The development of international emergency medicine: a role for US emergency physicians and organizations. *Acad Emerg Med.* 1997;4(10):996-1001.
4. Topacoglu H, et al. Impact of Ramadan on demographics and frequencies of disease-related visits in the emergency department. *Int J Clin Pract.* 20015;59(8):900-905.
5. Fazel, M. Medical implications of controlled fasting. *J Royal Soc Med.* 1998;91(5):260.
6. Azizi F. *Ann Nutr Metab.* Islamic fasting and health. 2010;56(4):273-82.
7. Yasemin B. Gomceli , Gulnihal Kutlu, Leyla Cavdar, Levent E. Inan. Does the seizure frequency increase in Ramadan? *Seizure* 2008; 17:671-676.
8. Jamilian M, et al. The Effect of Ramadan Fasting on Outcome of Pregnancy. *Middle-East Journal of Scientific Research* 2015;23(7):1270-1275.
9. Wiley-Blackwell, John Wiley & Sons. The incidence of hypoglycaemia in Muslim patients with type 2 diabetes treated with sitagliptin or a sulphonylurea during Ramadan: a randomised trial. *Int J Clin Pract.* 2011 November; 65(11): 1132-1140.
10. Al Wakeel J, Mitwalli AH, Alsuwaida A, Al Ghonaim M, Usama S, Hayat A, Shah IH. Recommendations for fasting in Ramadan for patients on peritoneal dialysis. *Perit Dial Int.* 2013 Jan-Feb;33(1):86-91.
11. E J Langford, M A Ishaque, J Fothergill, and R Touquet. The effect of the fast of Ramadan on accident and emergency attendances. *J R Soc Med.* 1994 September; 87(9): 517-518.
12. M Fazel. Medical implications of controlled fasting. *J R Soc Med.* 1998 May; 91(5): 260-263.
13. Bogdan A1, Bouchareb B, Touitou Y. Ramadan fasting alters endocrine and neuroendocrine circadian patterns. Meal-time as a synchronizer in humans? *Life Sci.* 2001 Feb 23;68(14):1607-15. *BMC Emerg Med.* 2009; 9:1.
14. Sun, Yan, et al. Forecasting daily attendances at an emergency department to aid resource planning. *BMC emergency medicine* 2009;9(1).
15. Litvak, Eugene. "Optimizing patient flow by managing its variability." front office to front line: Essential Issues for health care Leaders. Oakbrook Terrace, IL: Joint Commission Resources 2005: 91-111.
16. Saada, D. Ait, et al. Effect of Ramadan fasting on glucose, glycosylated haemoglobin, insulin, lipids and proteinous concentrations in women with non-insulin dependent diabetes mellitus. *African Journal of Biotechnology.* 2010;9(1).
17. Azizi F, Rasouli HA. Serum glucose, bilirubin, calcium, phosphorus, protein and albumin concentrations during Ramadan. *MJIRI* 1987;1(1): 38-41.
18. Salehi M, Neghab M. Effects of fasting and a medium calorie balanced diet during the holy month Ramadan on weight, BMI and some blood parameters of overweight males. *Pak J Biol Sci.* 2007;10(6):968-71.
19. Chaouachi A, Leiper JB, Chtourou H, Aziz AR, Chamari K. The effects of Ramadan intermittent fasting on athletic performance: recommendations for the maintenance of physical fitness. *J Sports Sci.* 2012;30 Suppl 1:S53-73.
20. Ibrahim Abu-Salameh, Ygal Plakht, Gal Ifergane. Migraine exacerbation during Ramadan fasting. *The Journal of Headache and Pain* 2010;11(6):513-517.