

Ramadan Fasting: Do we need more evidence?

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Over a billion Muslims fast worldwide during Ramadan each year. This religious practice, contributes to their health as well as their spiritual growth. However, available evidence regarding the health benefits of Ramadan fasting is scarce and highly contentious. Although Islam exempts patients from fasting, many conceivably fast, and their clinical condition is prone to deteriorate due to persistent gap between current expert knowledge and conclusive strong evidence regarding the pathophysiologic and metabolic alterations of fasting. In this article, we summarize the results of initial studies regarding the effects of Ramadan fasting on some clinical conditions, alterations of body composition and clinically important outcomes of patients with previous history of cardiovascular disease, asthma or renal colic disease. Our studies have shed light on several outcomes in favor of Ramadan fasting, and encourage those afflicted to consult their physicians and follow medical and scientific recommendations. In this review we aimed to present relevant evidence, clarify future scope and provide suggestions for future investigations.

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Introduction

Ramadan, the 9th lunar month, is the holiest month in the Islamic calendar. In this month, throughout the world, millions of Muslim fast from dawn to sunset every day; they refrain from drinking and eating during this time (1).

Ramadan fasting and body composition

Body weight and Body Mass Index (BMI)

Weight reduction can be optimally accomplished with a multimodal approach by adopting a healthy lifestyle through diet modification, physical activity and possible pharmacological therapy (2). However, in Ramadan, reduction in total body weight, percentage of fat and resting metabolic rate have been attributed to reduced food intake and different nutritional behaviors (3, 4). Heterogeneous findings regarding the effect of fasting on BMI, the changes in BMI and nutrients (carbohydrates, fats, proteins, vitamins, and

minerals) intake during Ramadan fasting (RF) may be due to the varying levels of physical activity of the subjects. Since Ramadan retreats 11 calendar days each year, it traverses all seasons over time, and it may fall during summer or winter, physiologic changes during RF may be influenced by climatic conditions (5). Most studies indicate noticeable weight and BMI decrease after RF compared with pre-Ramadan. Despite the insignificant alterations in the total energy intake, Amena S et al. found a significant reduction in total weight and BMI after 4 weeks of Ramadan (6). The results of another survey showed a downward trend in BMI in the second week of Ramadan compared to baseline, although it increased significantly after Ramadan (7). Similar results have been reported in healthy subjects in Jordan, while other studies have attributed the weight loss during Ramadan to lower calorie intake (8,9). It is possible that

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weight loss could be attributed to efficient utilization of body fat during fasting. The results of a study by Unalacak and colleagues showed that fasting during Ramadan led to a significant weight loss in obese patients. The researchers showed that the weight loss was 2.9 kg in obese patients compared with 0.9 kg in non-obese ones. Moreover, BMI of obese patients reduced dramatically compared to non-obese individuals (10). Also, Fakhrzadeh et al. found that fasting caused a significant reduction in weight and BMI in men and waist circumference in women (11). By contrast, a study from Saudi Arabia reported weight gain during Ramadan (12). Meanwhile, the results of a small study on a number of elite rugby players by Bouhlel et al. showed a remarkable reduction (28.2%) in the energy intake along with meager decreases in body mass (2.2%) and body fat (1.3%) at the end of Ramadan (13). Nevertheless, in a similar study Chaouachi et al. reported that energy and macronutrient intake of elite fasting judo athletes remained unchanged during Ramadan despite significant decrease in body mass and body fat (14), and even no changes in BMI or body fat during Ramadan (15). Changes in FPG (fasting plasma glucose) may occur due to changes in body weight and physical activity habits, amounts and types of food, gorging after breaking the fast, and irregularity of medication compliance. A moderate weight loss of about 5% has shown modifications in glycemic and blood pressure control, improvement of insulin action, reduction of fasting plasma glucose concentrations, and improvement of lipid concentrations (16, 17). Proposed decrease in body weight can be attributed to reduction in beverage intake, and also it can be due to a decrease in glycogen-bound water stores, extracellular volume reduction secondary to a lower sodium intake, and a moderate degree of dehydration with slight loss of body tissue.

Body Water

Insignificant decrease in BMI may reflect changes in body water. Under normal circumstances, one can expect a decrease in resting and physical activity during RF due to a decrease in total body water and dehydration. The extent of total body water loss or dehydration and electrolyte imbalance during RF depends on the season Ramadan falls in. Body

water changes during Ramadan may also depend on climate, physical activity habits, and physical fitness of the fasting individual (18). Hence, adaptation to fasting may involve hormones that regulate body water and electrolyte status (4, 19, 20). The results of a study by Jasem R et al. showed variations in serum osmolarity, sodium, and minimal bicarbonate are not statistically significant in the more physically active group. Researchers suggested that the high water turnover which is likely presented in the active group, allowed more precise regulation of the body water than the lower water turnover that was presented in the sedentary group (21). During Ramadan, signs of dehydration have been characterized by increased levels of either hematocrit percentage or hemoglobin concentration, and plasma osmolarity (13, 21, 22). Results of a study by Khaled T et al. indicated a similar increase in hemoglobin concentration in resting state, hematocrit percentage, and plasma osmolarity during Ramadan between faster and non-faster groups. The state of dehydration has been attributed to the reduction of drink intake (23). Among the above mentioned studies, only one has highlighted the effects of moderate aerobic exercise during Ramadan on blood indicators of body water status. This research revealed that following aerobic exercise, mean hematocrit and hemoglobin concentrations were significantly higher during Ramadan fasting than during the non-Ramadan normal diet. It suggests a state of dehydration which is amplified during Ramadan due to the cumulative effect of loss of water which was not stored again (13). Contrarily, Karli et al. observed no changes in body composition and water status during Ramadan in elite power athletes (24). Heterogeneous findings might contribute to difficulties in the reliability of measuring tools of total body water during Ramadan. Most of the studies indicate that RF induces dehydration marked by an increase in the values of blood and body water status markers. But no detrimental effects on health have yet been directly attributed to negative water balance at the levels that may be created during Ramadan.

Changes of fat mass and fat free mass during fasting

The main limitation of the BMI is that the actual composition of body weight is not taken

into account: additional body weight may be made up of adipose tissue or muscle hypertrophy. Both of these markers are considered excess masses. On the other hand, decreased BMI may be due to a fat-free mass (FFM) deficit (sarcopenia) or a mobilization of adipose tissue or both combined. The concepts of fat-free mass index (FFMI) and fat mass index (FMI) are the same as the BMI but use of dichotomous model appears to be of interest in the classification of overweight = high fat patients and underweight = low fat lean patients. The division of BMI into FFMI and FMI is obviously not possible without associated measurements of body composition. By determining these indices, quantification of the amount of excess (or deficit) of FFM, respectively FM, can be calculated for each individual (25). Fat-free mass (FFM) and fat mass (FM) are important in the evaluation of nutritional status. Significant changes in FM and FFM occur during fasting and are consequences of imbalances between energy intake and energy needs associated with an increasingly inactive lifestyle.

Several studies showed changes in FM and FFM during Ramadan due to the changes in dietary pattern. In a study of Amena Sadiya et al., the level of FFM, FM, FM% and FFM% showed a slightly downward trend, with almost one kilogram and one percent between first week and fourth week of Ramadan, respectively (6). In a study performed by Mirzaei et al. significant changes in body composition and almost a two kilogram reduction in FFM and FM was reported in participant athletes (26). In another study, the change in FFM level was less than what was reported in the former study during Ramadan (27). However, another study showed that body weight, BMI, and FFM were not significantly different before and post Ramadan in fasting trained athletes and that the variability of body water (BW) and FFM were below one kilogram throughout the study (24). The alterations in the results are mainly contributed to the effect of BMI on FM and FFM, as changes in the two markers are related to changes in the BMI level.

Depending on factors such as daily nutritional habits or seasons that Ramadan occurs in, Ramadan fasting leads to alterations in the body composition of various populations

and hence, raises the needs for more clinically controlled investigations.

Ramadan fasting and cardiovascular disease

Today, the most common cause of death in the world is cardiovascular disease and every year a large number of people will be added to the patients in this group who need constant control and medical care. One of the concerns of the patients is fasting during Ramadan. These patients' tendency to fast in Ramadan, leads them to consult physicians to ensure no harm to their bodies.

Due to the importance of nutritional care in these patients and use of medications that have a significant role in controlling their diseases, in this section, studies about the effects of fasting on this population and the available literature are discussed.

Important issues by all Muslims, including those who suffer from cardiovascular disease, are faced in Ramadan fasting. Despite extensive research on cardiovascular disease, since Ramadan fasting is not a high priority in the West, the effects of fasting on these diseases has not been studied extensively (28). Body fat is affected by nutritional habits, different fats in the diet, the percentage of simple sugars in the diet and also physical activity (29, 30).

One of the common question of the patients with history of heart disease is whether or not Ramadan fasting is safe. Studies about the effects of Ramadan fasting on blood lipids, anthropometric parameters such as height, weight, blood pressure, heart rate, and other risk factors are limited and the results are inconsistent and inconclusive (31, 32). A study by Hamad Hospital in Doha, Qatar was performed during ten years on 20856 Qatari citizens by Alsuwaidi and his colleagues. Acute myocardial infarction and unstable angina among fasters were not noticeable one month before and after Ramadan. However, some of the obtained results in other studies showed that there is a relation between fasting and biochemical factors, hormones and blood lipids. Noteworthy, is that this research was carried out based on a large sample; therefore, its results are more valid compared to other studies with smaller sample size (33). In a similar study of 5 years with 815 participants, no relationship was observed between stroke

and its risk factors with Ramadan fasting (34). In another study by Alsuwaidi et al. on 119 cardiac patients with congestive heart failure (CHF), 228 patients with angina pectoris, 22 patients with atrial fibrillation (AF), 11 patients with prosthetic metallic valve, 370 patients with myocardial infarction, 195 patients with coronary artery bypass surgery, and 177 patients with percutaneous coronary intervention, researchers observed that 91.2% of patients were able to fast and only 6.7% said that they were uncomfortable; hence suggesting the effects of Ramadan fasting on cardiac patients with steady state of heart were negligible (35).

In the 1980s, scientists found that a heart attack prognosis varies based on the time of incidence (circadian), and that heart failure occurs more often when waking. However, in a study by Alsuwaidi et al. researchers showed that although the incidence of disease in Ramadan did not change, the time of the incidence was different due to sleeping and eating patterns. In people who fasted, admission to emergency wards between 5–8 am was less and between 3–4 am and 5–6 pm was more common (36).

We also performed a study on 82 volunteers (38 males and 44 females) with a history of Acute Coronary Syndrome, metabolic syndrome or stroke who fasted for at least 10 days. We measured HS-CRP, lipid profile, homocysteine, and HOMA-IR, and performed complete blood counts (CBC) 1–5 days before and after Ramadan. Moreover, the height, waist circumference, weight and blood pressure were measured.

We showed that there was no significant difference between the mean serum level of FBS, insulin, HOMA-IR and homocysteine before and after Ramadan in patients with a history of cardiovascular disease. Additionally mean serum level of CRP, cholesterol LDL, and TG decreased significantly after Ramadan whereas the mean serum level of HDL increased. Mean weight and BMI decreased significantly after Ramadan. Of note, no significant changes in the mean systolic blood pressure, diastolic blood pressure, and heart rate were observed in patients after Ramadan.

The results of this study showed that fasting can improve some markers of CVD risk factors in patients with cardiovascular disease (37). To

our knowledge, this study was the first to assess the effects of Ramadan fasting on patients with a previous history of cardiovascular disease based on Framingham risk score. Notwithstanding the restrictions of this single center pilot study, the results showed striking improvement in 10 year coronary heart disease risk scores and cardiovascular risk factors such as lipids profile, systolic blood pressure, BMI, and waist circumference.

Fasting in itself is not harmful for heart patients. There is no significant correlation between fasting and exacerbation of cardiovascular diseases. Age and age-related diseases and duration of fasting are considered major factors in recommendation of fasting.

Ramadan fasting and renal diseases

The importance of measurement and controlling the effects of environmental factors such as humidity and temperature in different seasons in which Ramadan falls have been ignored, as hot and humid climate have been shown to exacerbate the occurrence of renal colic disease in former studies.

Results of a survey on 574 participants in Varamin, one of the hottest cities of Iran on the relation between monthly admissions of kidney stone cases and Ramadan fasting showed that the highest prevalence of kidney stones was in warm months of the year (June 8.1%), (July 3.11%) and (November 5.10%), whereas the incidence rate in Ramadan was similar to the cold half of the year. Therefore, high temperature was a more effective factor in the onset of kidney stones than Ramadan fasting (38).

We performed a prospective observational study to compare the incidence of referrals to emergency wards, due to symptoms of renal colic disease, on 610 fasted patients with previous history of renal colic disease in different stages. The results of this study indicated that the admission of the patients with kidney stone increased during the first 2 weeks of Ramadan. However, acceptance rate decreased during last 2 weeks and even after Ramadan. We found a significantly higher proportion of admissions of fasting patients with renal colic disease during the first two weeks of Ramadan compared with the other periods ($P < 0.05$). Nonetheless, the number of

admissions followed a downward trend in the last two weeks of Ramadan (39).

Ramadan fasting and asthma

In recent years, the prevalence of asthma has been increasing, especially in developing countries including Iran. Patient's tendency towards Ramadan fasting is a concern due to its exacerbating effects on the symptoms of the disease.

A large cross sectional study in Qatar investigated the effects of fasting on the frequency of hospitalization in 1590 patients with Asthma (901 men and 689 women) with a mean age of 30 years. Functional parameters of lung ventilation capacity of patients were measured in 3 periods, before, after and during Ramadan. Results did not show significant differences between the mean of these parameters. The results of this study showed that fasting did not affect the frequency of hospitalization and mean of spirometric parameters (40).

The results of a study conducted in Pakistan on 46 non-smoker healthy subjects showed that Ramadan fasting had no deteriorating effects on expiratory flow rate; however FEF75 and FEF75-85 increased during Ramadan compared to pre-Ramadan (41, 42).

Another study was performed at Nikan health Institute of Iran Medical University on 117 healthy volunteers; the results indicated an increase in the MMEF%. Overall, this study represents the increased respiratory volume associated with weight changes during Ramadan and suggests that it probably improves lung function (43).

We also performed a small prospective cohort pilot study of 29 (19 female and 10 male) participants in which well-controlled asthmatic patients with stable symptoms, aged 47 ± 12 years were investigated. The average duration of fasting was 26.5 days. Assessments of spirometric variables, daily peak expiratory flow, peak expiratory flow variability by home peak expiratory flow monitoring, as well as clinical symptoms of asthma including dyspnea, cough, wheezing, and chest tightness were carried out. The results of this study showed not only no significant deterioration in the clinical symptoms of asthma including dyspnea, cough, wheezing, and chest tightness, but also improvements in peak expiratory flow and variability (44).

Patients with uncontrolled asthma are exempt from fasting in order to prevent exacerbation of clinical status and the occurrence of asthmatic attacks. However, previous studies showed that fasting has no detrimental effect and can even improve asthma symptoms in patients with controlled disease. Although patients with controlled asthma can fast with regular consumption of drugs and enough drinks between iftar and sahur, they are encouraged to consult with their physicians before Ramadan to be considered for individual differences.

Overall summary and Conclusion

Our current preliminary observations suggest some beneficial effects of Ramadan fasting, including improved cardiovascular disease markers, whereas some of our results raise concerns for more attention to the management of fasting patients with type 2 diabetes, and implementations to preserve the fat free mass and improve alterations in body composition of healthy subjects.

It is our hope that the information provided within this review will initiate the design of future investigations focused on the health benefits of Ramadan fasting for healthcare providers.

Furthermore, different confounding variables such as variability in daily fasting time, differences in ethnicity and demographics of study participants, smoking status, medication, cultural virtues and diversity in dietary habits have made it difficult in these studies to make a definitive conclusion about the safety of fasting for specific patient groups. Hence, current recommendations regarding the effects of Ramadan fasting on human health are heterogeneous findings based on expert opinion, rather than conclusive evidence, with dietary norm of the subjects, being the major cause of mixed findings.

Collectively, little consensus exists regarding the effects of Ramadan fasting on the majority of health related outcomes and making comparisons between available literature is therefore not relevant due to several underlying confounding variables. In future research, attempts should be made to eliminate or minimize the effects of several confounders as only through careful control within the research design will reliable results pertaining to the health effects of Ramadan fasting be obtained.

High-quality prospective randomized controlled trials are encouraged to support and modify expert evidence with indigenous and international strong conclusive evidence-based clinical practice for various fasting patients.

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