

THE EFFECT OF FASTING IN HEALTH AND DISEASE: A SYSTEMATIC REVIEW -  
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## ABSTRACT

**Introduction:** The Muslim population worldwide has a higher incidence of cardiovascular disease and the incidence may rise in this population during Ramadan. This review assessed the available published literature that examined the effect of fasting on the activities of daily living and related behaviors in persons with cardiovascular disease. **Method:** We selected and reviewed 15 out of 65 published articles concerning the impact of Ramadan on lifestyle behaviours and its effects on cardiac rehabilitation between 2000 and 2017 were reviewed. Studies were identified in such sources as Academic Search Complete, Google Scholar, PsycInfo, PsycArticles, Medline and CINAHL Plus. The search terms were: behavior change, cardiac rehabilitation, cardiovascular disease, diet, exercise, fasting, medication, physical activity, sleep, smoking, and treatment. **Results:** The available evidence overall suggests that fasting can have a beneficial effect on such factors as blood cholesterol levels, body weight and blood pressure; however, benefits are rarely sustained in the long-term. Other behavioral changes such as non-adherence to medication, diet and exercise regimens have more negative consequences in people with cardiac disease. **Conclusions:** Changes in lifestyle behaviours secondary to fasting, especially during Ramadan may have positive and negative impacts on people with cardiovascular disease. Healthcare professionals are encouraged to find innovative ways to engage fasting people in healthy lifestyle choices, especially during the month of Ramadan.

**KEY WORDS:** Ramadan, fasting effects, cardiovascular disease, cardiac rehabilitation

## INTRODUCTION

There are 1.6 billion Muslims in the world today; this figure is expected to increase to 2.2 billion by 2030.<sup>[1]</sup> This population has a high incidence of cardiovascular disease<sup>[2]</sup> and is particularly difficult to engage in cardiac rehabilitation programmes.<sup>[3]</sup> A number of reasons have been proposed for the low attendance in and compliance with cardiac rehabilitation in this population,<sup>[4,5,6]</sup> including the influence of religious observances during Ramadan.<sup>[6]</sup> Research in this area is limited and few studies have explored the influence of Ramadan on the behaviour of Muslims living in Europe and North America.

Ramadan is the ninth month of the Islamic lunar calendar, lasting 29 to 30 days. It is characterised by an abstinence of taking food, drink, smoking and sexual activity from sunrise to sunset. Although individuals with a medical condition are exempt from this practice, many ignore this recommendation due to religious conviction.<sup>[7]</sup> Fasting is essentially a radical change in lifestyle during the Ramadan period that may pose adverse effects to patients with cardiac conditions.<sup>[8]</sup>

However, the evidence is not always clear-cut; indeed it has been suggested that Ramadan may have a positive impact on cardiac health as well<sup>[9]</sup>

**Aim:** The purpose of this article was to conduct a systematic review of the published literature regarding the impact of fasting in Ramadan on lifestyle behaviours in Muslims population and patients with cardiovascular (CV) disease. Also, recommendations for healthcare practitioners and innovative interventions for this population have been presented regarding the importance of participation in various cardiac rehabilitation programs.

## METHODS

**Design:** A narrative approach was used to conduct this systematic review, following the guidelines and reporting standards outlined by Green et al.<sup>[10]</sup>

**Search Strategy:** Studies were identified, using Academic Search Complete, Google Scholar, PsycInfo, PsycARTICLES, Medline and CINAHL Plus. The literature search covered the period from 2000 to 2017.

The following terms were searched both separately and in various combinations as keywords anywhere in the article: “*Cardiac rehabilitation*”, “*cardiovascular disease*”, “*Ramadan*”, “*fasting*”, “*physical activity*”, “*exercise*”, “*diet*”, “*smoking*”, “*sleep*”, “*behaviour changes*”, “*medication*” and “*treatment*”.

**Quality Appraisal:** All articles were appraised for quality, using the critical review form for qualitative articles.<sup>[11]</sup> Quantitative articles were appraised using a tool developed by Armijo-Olivo, et al.<sup>[12]</sup> The tools were modified in order to assign a score for the criteria. The articles were rated as “*strong, moderate or weak*” before being assigned for detailed review.

**Selection Outcomes:** A total of 15 out of 65 articles met the inclusion criteria, all of which had used statistically acceptable and quantitative methods for their data analysis. The inclusion criteria were as follows:

- Published articles between 2000 and 2017.
- Published in English and in international journals with high impact ratings.
- Articles must contained information in one or more of the following areas:

- Effect of fasting in Ramadan on cardiovascular disease.
- Impact of fasting on lifestyle behaviors.
- Impact of fasting on attending cardiac rehabilitation.

Articles that did not meet the selection criteria were excluded from the review. The contents of each selected article were examined carefully for the title, sample size, purpose of the study, design, findings, conclusions and recommendations.

## RESULTS

In general, expert cardiologists advise that people with certain cardiovascular conditions must be cautious about fasting, since it may adversely affect their health. Some adverse effects have been reported in cardiovascular patients, especially in those with co-morbidities, such as diabetes, a fasting blood glucose of 150 mg/dL or higher, obesity, extreme underweight, hypertension, chest pain, high level of uric acid in the blood, stressful life style, or high blood LDL or low HDL. Details of my findings from this systematic review are presented in Table 1.

**Table 1: Summary of Findings.**

Study	Findings
Akhan et al, 2000	The number of patients with stroke was not different during Ramadan compared to other months.
Karaagaoglu et al, 2000	In Ramadan, 9.7% of cardiac patients stopped taking drugs and 18.8% could not follow their diets. Patients also complained of fatigue and feeling too weak to work.
Comoglu et al, 2003	Fasting had adverse effects on diabetic patients with ischemic stroke but not on hypertensive patients with hemorrhagic stroke, or its frequency.
Fakhrzadeh et al, 2003	Fasting was seen as a practical method of protecting patients against coronary heart disease.
Al-Suwaidi et al, 2004	No significant differences were found in the number of hospitalizations for congestive heart failure in Ramadan compared to other months.
Chamsi-Pasha et al, 2004	Fasting in Ramadan had minimal effects on patients with stable cardiac disease.
Saleh et al, 2004	Significant changes occurred in patients’ lipid panel during Ramadan and lasting a month afterward. Fasting may prevent atherogenicity and cardiovascular (CV) disease.
Al-Suwaidi et al, 2005	91.2% of CV patients were able to fast during Ramadan but only 6.7% felt their condition worsened with fasting. Most patients took their medications and complied with dietary instructions (83% vs 69%). The adverse effect of fasting on patients with stable CV disease was minimal during Ramadan.
Al-Suwaidi et al, 2006	Changes in the timing of food intake and sleep pattern may be important in the circadian rhythm of adverse CV events.
Bener et al, 2006	The number of hospitalizations and CV risk factors for stroke was not significantly different during Ramadan compared to other months.
Norasyikin et al, 2010	Fasting had a beneficial effect on body weight, BMI, BP and lipid profiles in patients with multiple CV risk factors. During Ramadan, HDL levels increased and lasted for one month later, but it was not sustained thereafter.
Hajek et al, 2011	Fasting during Ramadan may be protective against cardiac diseases in patients with multiple CV risk factors.
Hajek et al, 2011	There was a decline in body weight and BMI during Ramadan in CV patients; however, the weight loss was quickly regained after Ramadan.
Sow et al, 2016	There was a transient decline in BMI but returned to the baseline level 6 weeks after Ramadan. No adverse changes seen in CV parameters.
Golbidi et al, 2017	Fasting activates cellular stress response, improves autophagy, modifies apoptosis and alters hormonal balance. Intermittent fasting is better tolerated and provides somatic and psychological benefits in patients.

**Key:** BMI = body mass index; BP = blood pressure; CV = cardiovascular; HDL = high-density lipoproteins; LDL = low density lipoproteins; TG = triglycerides.

## DISCUSSION

### Incidence of Cardiac Events among Muslims during Ramadan

Numerous studies have consistently found no significant difference in hospitalisations for cardiac events during Ramadan compared to the months before or after Ramadan.<sup>[13,14]</sup> For instance, Akhan *et al.*<sup>[8]</sup> concluded that fasting during Ramadan had no effect on stroke incidents when compared to other non-fasting months. Similarly, Bener *et al.*<sup>[14]</sup> retrospectively reviewed a 13-year database for Muslim patients and found no significant differences in the number of hospitalizations for stroke while fasting during Ramadan, compared to that for non-fasting months.

Indeed, evidence has also indicated a reduction in the number of hospitalizations for coronary events during Ramadan<sup>[15]</sup> However, the decline could mean lack of referrals or avoidance of the patients to stay in hospitals.<sup>[16,17]</sup>

The available evidence suggests that fasting during Ramadan does not increase cardiac events and may even be beneficial to cardiac health. Saleh *et al.*<sup>[18]</sup> reported that the model of Ramadan fasting could be used as a program to control cardiac events. However, further prospective studies are required to test this contention.

It should be noted that all of the cited studies were conducted in traditionally Muslim nations, which present a unique cultural context. Of note, our findings may not be applicable to the Muslim populations living in western countries. For instance, smoking has been found to be higher among Muslims living in Muslim countries as compared with those living in western nations.<sup>[19]</sup>

### Impact on Diet

Foods consumed during Ramadan tend to be high in fat, carbohydrates and sugar which differ significantly from typical foods consumed during the rest of the year.<sup>[8]</sup> Meals, therefore, tend to have a high caloric value, in contrast to the healthy low fat and low calorie diet recommended to cardiac patients.<sup>[20]</sup> It has also been suggested that individuals overeat at sundown, having abstained from food all day.<sup>[21]</sup> In individuals with diabetes, this may cause post-prandial hyperglycemia, known to increase the risk of fatal cardiovascular disease.<sup>[22]</sup> Poor dietary habits during Ramadan may, therefore, be expected to increase the risk of cardiovascular disease as well as raising cholesterol, blood pressure, heart rate, risk of diabetes and obesity. Abstaining from food may also lead to further negative effects on the cardiovascular system, resulting in a fall in blood pressure, heart rate and cardiac output.<sup>[23]</sup> These recommendations may, however, be disregarded by practicing Muslims due to their religious faiths and degree of observances.<sup>[24,25]</sup>

Karaagaoglu and Yucecan<sup>[24]</sup> have reported that out of 187 Muslims that had health problems, 37% of them

needed to be on a special diet due to their illnesses, but 18% of them ignored dietary advice during Ramadan. Similar levels of compliance were found by Al Suwaidi *et al.*<sup>[25]</sup>, who noted that 31% of Muslims with heart disease were non-adherent to their doctor's instructions, consequently 19 out of the 465 patients in their study were hospitalized.

Interestingly, Al-Suwaidi *et al.*<sup>[26]</sup> have reported that exogenous factors, such as changes in eating patterns during Ramadan are significant features in the circadian pattern of cardiac events and, therefore, play an important role in the timing of such events. However, these studies were conducted in the Persian Gulf region, making it difficult to generalize to other Muslim populations living in the US and Western Europe, considering the differences in behaviours noted among Muslims living in these societies.<sup>[26]</sup>

Conversely, another report suggests that fasting during Ramadan can be beneficial for cardiac patients as they improve coronary disease profiles.<sup>[15]</sup> Reportedly, fasting can be an effective, non-pharmacological method to increase the high-density lipoprotein (HDL) cholesterol levels (i.e., good cholesterol) and to decrease low-density lipoprotein (LDL) cholesterol levels (i.e., bad cholesterol) in the blood<sup>[28,29]</sup> These changes could be beneficial to the cardiovascular system since HDL-cholesterol is protective against the development of coronary heart disease.

Ibrahim *et al.*<sup>[30]</sup> evaluated the effects of fasting during Ramadan on cardiovascular bio-markers of 76 high risk patients. They found increases in HDL, decreases in LDL levels and a significant reduction in body weight and blood pressure of the patients. The findings suggest that Ramadan fasting might be cardio-protective in individuals with multiple cardiovascular risk factors. However, it has been noted that fasting only provided short-term benefits, i.e., the body weight, BMI, blood pressure, HDL and LDL cholesterol levels may return to baseline levels within 30 days after Ramadan.<sup>[31]</sup> Similarly, Norasyikin *et al.*<sup>[9]</sup> have reported beneficial increases in HDL cholesterol and a reduction in body weight during Ramadan. However this effect was not maintained for long-term after Ramadan. Likewise, Hajek *et al.*<sup>[32]</sup> reported that those who fasted throughout Ramadan lost significantly more body weight than those who did not; however, the weight loss was not maintained longer than one month.

### Impact on Physical Activity, Sleep and Metabolism

Few studies considered changes in physical activity during Ramadan and how this might affect cardiac patients. Evidence suggests a reduction in physical activity during Ramadan can have detrimental effects on an individual's health. Decrease in physical activity can reduce levels of HDL cholesterol, which subsequently increases the risk of plaque formations in large blood vessels, leading to adverse cardiovascular events.

Decreases in physical exercise may also be attributed to dehydration, which may increase the risk of clots formation in the vasculature. Further, reduced food intake can affect the individual's energy levels and the sleep-wake cycle.<sup>[33]</sup> Typical sleep patterns may also be affected during Ramadan due to late night festivities.

Increased amounts of daytime sleep may be taken to compensate for nightly festivities, which again reduce the overall physical activity of the individual. Karaagaoglu and Yucesan<sup>[24]</sup> reported that 34.4% of participants had behavioural disturbances during Ramadan, such as feeling tired and being unable to work, thereby justifying the reduced physical activity level.

A more recent study<sup>[34]</sup> has reported that fasting activates cellular stress response, improves autophagy, modifies apoptosis and alters hormonal balance. These are important constitutional and metabolic changes supportive of overall health. Intermittent fasting has been found to be better tolerated than everyday fasting, and provides both somatic and psychological benefits to the patients' sustained health.

#### **Impact on Taking Prescribed Medications**

Patients may stop taking their prescribed medications regularly during Ramadan due to strong religious conviction. However, the interruption may prove to be harmful since the medications are essential for controlling the patients' cardiac conditions.<sup>[7,35]</sup> Many patients with cardiovascular disease are not necessarily aware of the importance of taking their medications regularly and as prescribed. They may stop completely or reduce the dosage and/or frequency during Ramadan without consulting their healthcare providers. This can have serious repercussions, particularly in patients with multiple risk factors for heart disease.<sup>[9]</sup> Poor or lack of adherence to taking prescribed medications can result in many complications for these patients, including uncontrolled blood pressure, pathologic changes and signs and symptoms of worsening cardiac function, hospitalization, and even death.<sup>[36]</sup> Karaagaoglu and Yucesan<sup>[24]</sup> have suggested that out of 187 patients 60% were normally taking prescribed medication, 10% stopped taking their prescribed medication during Ramadan. In a subsequent study, Al-Suwaidi *et al.*<sup>[25]</sup> reported that 17% of cardiac patients were non-adherent to their medication during Ramadan. This suggests that fasting does interrupt the patients' prescribed schedule to take medications.

#### **Impact on Cardiac Rehabilitation Programs**

During Ramadan Muslim patients are less inclined to seek the help of a healthcare professional or to attend cardiac rehabilitation programs.<sup>[37]</sup> Consequently, there needs to be emphasis on developing more focussed ways to engage them to follow a healthy lifestyle. For instance, British Heart Foundation<sup>[38]</sup> developed a Ramadan campaign, during which Imams were trained in basic lifestyle advice with a focus on diet, smoking, exercise,

and were taught to deliver this information in their mosques. Evaluation of this campaign indicated that attendees at the mosques had a better understanding of the link between smoking and heart disease, and services available to support lifestyle changes. Furthermore, since smoking is not allowed during the fasting hours, there can be an increase in the number of people who may quit smoking permanently. This clearly suggests that Imams can help promote health, as well as engaging the hard-to-reach Muslims in a community setting during Ramadan and other religious observances. This approach may have a positive effect on Muslims attending cardiac rehabilitation programs, as messages may become more credible if delivered in a sacred place by Imams with training in basic health concepts.

Alternative cardiac rehabilitation programs such as those that are based in home or community could also be used as a way of continuing cardiac rehabilitation. This would enable patients to incorporate exercise and health education in the Ramadan festivities. For instance, Houle *et al.*<sup>[39]</sup> demonstrated increased physical activity and a decrease in waist circumference, using a pedometer-based program at home with 65 patients following an acute coronary event. More innovatively, Varnfield *et al.*<sup>[40]</sup> designed an internet and mobile phone program which contained all of the core components of a cardiac rehabilitation program, linked up to a central database, where nurses could monitor patients progress and provide feedback. Preliminary results showed a high usage rate as well as reports that the program was practical and easy to follow. Patients appreciated being able to fit the activities around the demands of daily life and not having to travel back and forth to the programs. Such novel approaches to cardiac rehabilitation could potentially increase adherence of patients to medical advice and promote a healthy lifestyle during Ramadan.

#### **Recommendations for Healthcare Practitioners**

Muslim patients intending to fast during the Ramadan should be examined by their doctors or healthcare providers to assess their suitability on an individual basis, and be reviewed periodically during Ramadan, so as to identify any significant health changes and to avoid undesirable outcomes. For this reason, it is important that patients attend regular check-ups before, during and after Ramadan. It is also imperative that patients are aware of the risk factors associated with fasting and the adverse effects it may have on their health. However, this may be difficult to achieve as Muslims intending to fast may be less able to seek professional help for fear of being given advice against their strong religious conviction.

During Ramadan, adherence to taking medication may decrease, thereby affecting treatment outcomes.<sup>[41]</sup> Alternative medication regimes should be made explicit to patients. For instance, timing of single daily medication doses could be altered so that they are taken during the evening after sunset. Doses that are taken twice a day could be altered so that the first dose is taken

before sunrise and the second after sunset. Drugs that require multiple doses could be replaced by other drugs of the same therapeutic class but with a more suitable schedule for fasting patients. However, caution must be taken when altering the dosing time and the time-span between the doses, as this could affect the drug's plasma concentration profile and therefore, its efficacy and tolerance.<sup>[42]</sup>

Many public health authorities have encouraged their patients to stop smoking at the beginning of Ramadan.<sup>[19]</sup> Enforced abstinence from smoking during the day in Ramadan may prompt withdrawal for many regular smokers.<sup>[43]</sup> To achieve a sustained withdrawal, smoking cessation nurses could help individuals set targets and goals to adhere to the new healthy habit after Ramadan.

In summary, the expert opinion of cardiologists holds that people with the following conditions must be cautious about fasting, since it may adversely affect their health:

- Being obese or extremely underweight.
- Having hypertension.
- Having fasting blood glucose level of 150 mg/dL or higher.
- Experiencing chest pain during the fasting period.
- Having a high level of uric acid in the blood.
- Having a highly stressful occupation or life style.
- Having a high LDL or low HDL level in the blood.

Interestingly, expert cardiologists believe that fasting does not necessarily cause low blood pressure and/or heart rate (bradycardia). In general, medical experts recommend fasting for healthy people and warn against it for patients, especially those with cardiovascular disease. Further, Islamic authorities have emphasized that if fasting during Ramadan seriously aggravates a person's illness or health condition, then it is forbidden for that person.

#### KEY POINTS

- The Muslim populations have higher incidences of cardiovascular disease.
- Fasting in Ramadan may have a positive effect on the incidence of cardiac events.
- Fasting has potential to impact diet; physical activity; sleep and adherence to taking prescribed medications.
- During Ramadan, Muslim patients may be less able to attend a cardiac rehabilitation programs due to religious observances and restrictions. Therefore, there needs to be more emphasis on developing innovative ways of engaging this population to follow a healthy lifestyle.
- Patients who intend to observe fasting during the Ramadan should be medically examined in order to assess their suitability on an individual basis and be encouraged to attend regular medical check-ups.

- To achieve safe fasting, medical and healthcare practitioners should make their patients aware of the alternative methods of taking their medications during Ramadan.

#### CONCLUSIONS

The available evidence suggests that certain lifestyle changes during Ramadan can have beneficial effects on factors such as blood cholesterol levels, body weight and to a lesser extent, blood pressure. However, the benefits, particularly the decline on blood pressure, tend to be short lived and are rarely sustained beyond the months following Ramadan. Overall, the weight of evidence suggests that behavioural changes during Ramadan (such as non-adherence to medication, diet or exercise regimens, etc.) lead to poorer outcomes for patients. Consequently healthcare professionals are urged to find innovative ways to engage fasting patients during Ramadan in healthy lifestyle choices.

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