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The Impact of Ramadan Fasting on the Cardiovascular System with Particular Emphasis on Myocardial Infarction Risk

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Abstract

Introduction

Cardiovascular diseases (CVD) are the leading cause of death worldwide, with prevalence rising in aging populations. Ramadan fasting, practiced by over a billion Muslims annually, may influence cardiovascular health through changes in metabolism and lifestyle.

Aim of the Study

This study aims to assess the effects of Ramadan fasting on the cardiovascular system, with emphasis on the risk of myocardial infarction.

Materials and Methods

This is a narrative literature review of current studies examining the impact of Ramadan fasting on cardiovascular parameters such as glucose metabolism, lipid profile, blood pressure, and incidence of cardiovascular events.

Results

Most studies suggest that Ramadan fasting leads to favorable changes: improved lipid profile, lower blood pressure, and reduced inflammation. Fasting appears safe for individuals with stable cardiovascular disease under medical supervision. However, a slight increase in myocardial infarction cases has been noted after Ramadan in some subgroups, especially older adults and those with comorbidities like diabetes or hypertension.

Conclusion

Ramadan fasting may benefit cardiovascular health, but safety depends on individual risk factors. It should be avoided by patients with unstable heart conditions. Personalized assessment and increased awareness are key to safe fasting practices.

Keywords: Ramadan fasting, cardiovascular diseases, myocardial infarction, cardiovascular risk factors, cardiovascular incidents

1. Introduction

Cardiovascular diseases (CVD), particularly ischaemic heart disease (IHD) and stroke, remain the leading causes of mortality worldwide and are among the main contributors to long-term disability. The scale of the issue is alarming: the number of prevalent CVD cases has nearly doubled, from 271 million in 1990 to 523 million in 2019. Over the same period, the number of deaths from CVD increased from 12.1 million to 18.6 million **[1]**. This means that approximately 1 in 15 people globally suffers from some form of cardiovascular disease, and projections suggest that CVD-related mortality will continue to rise.

According to the study by Bryan Chong et al., the global age-standardized prevalence of CVD is expected to remain relatively constant in the coming decades, which suggests that the net effect of current preventative efforts may not significantly change. However, age-standardized cardiovascular mortality is projected to decline by 30.5% between 2025 and 2050, reflecting improvements in post-diagnosis care and treatment. Despite this, **crude** (i.e. unadjusted) cardiovascular mortality is expected to increase sharply—by as much as 73.4%—primarily driven by the ageing global population. This demographic shift is anticipated to place increasing pressure on healthcare systems worldwide **[2]**.

In this context, understanding the impact of Ramadan fasting on cardiovascular health becomes particularly relevant. Fasting during Ramadan is observed by the majority of the 1.8 billion Muslims worldwide, representing a significant portion of the global population. Despite this, there is still a lack of comprehensive studies evaluating the effects of fasting on patients with cardiovascular conditions.

As highlighted in the work by Akhtar AM et al. (2022), Ramadan fasting can have clinically significant implications for patients with CVD. For individuals with well-controlled hypertension or stable coronary artery disease, fasting may be considered safe. However, for those with a recent myocardial infarction, decompensated heart failure, or unstable angina, fasting is generally not recommended. Therefore, individual risk assessment and consultation with a healthcare provider are essential. Given the increasing burden of CVD among Muslim populations, this topic warrants greater attention and further research **[3]**.

2. Characteristics of fasting in Ramadan

In Islam, Ramadan is the holy month of fasting, falling on the ninth month of the lunar calendar, with its exact timing changing from year to year. It is one of the five pillars of Islam and is obligatory for all healthy, adult Muslims **[4]**. Fasting during Ramadan involves complete abstinence from food, beverages (including water), medications, and any form of nutrition—including percutaneous feeding, such as via a percutaneous endoscopic gastrostomy tube—from dawn until sunset.

Ramadan fasting is considered a form of intermittent fasting, as its duration can range from 10 to as many as 21 hours per day, depending on geographical location and season. This practice

is observed daily for 29 to 30 consecutive days. Those who fast typically consume two main meals: **Suhoor** (pre-dawn meal) and **Iftar** (post-sunset meal), and refrain from all intake between those times **[5]**.

Muslims currently make up nearly one-quarter of the world's population. In 2010, the global Muslim population was estimated at approximately 1.6 billion. The highest concentrations of Muslims are found in the Middle East and North Africa (93% of the population), Central Asia (83%), Southeast Asia (42%), and Sub-Saharan Africa (29–31%). In other regions, such as Oceania, Europe, and the Americas, the Muslim population is estimated to represent 5% or less of the total population **[4]**.

Given both the substantial size of this global community and the rising prevalence of cardiovascular diseases in Muslim-majority countries, healthcare professionals are increasingly confronted with questions from patients seeking medical advice on whether it is safe for them to observe fasting during Ramadan **[3]**.

Physicians should therefore be equipped with knowledge about the potential impact of Ramadan fasting on patients with cardiovascular diseases (CVD), as they are increasingly called upon to provide guidance on this issue. Conditions such as hypertension, ischaemic heart disease, and heart failure are highly variable in nature—making it essential to base fasting recommendations on an individualized assessment of the patient's clinical status.

In light of the increasing burden of CVD in Muslim populations, this issue is gaining growing importance. A study conducted in Tunisia found that before Ramadan in 2022, only 40.9% of patients with diabetes consulted a physician regarding disease management during fasting, and just 12.1% received any formal education on the topic. These findings underscore the urgent need for greater awareness and education among both healthcare providers and patients regarding the safe observance of Ramadan fasting in the context of chronic diseases **[6]**.

Therefore, it is essential for clinicians to have adequate knowledge of the effects of Ramadan fasting on patients with cardiovascular and other chronic conditions, in order to offer evidence-based advice and ensure safe and individualized care during this significant period.

3. Physiological and Metabolic Changes During Ramadan Fasting: Implications for Cardiovascular Risk

Ramadan fasting, characterized by daily abstention from food and drink from dawn until sunset **[7-9]**, induces a series of physiological and metabolic adaptations that may influence cardiovascular health, particularly concerning risk of myocardial infarction **[8]**.

Glucose Metabolism

During the fasting hours of Ramadan, the body undergoes a shift in energy utilization, transitioning from glucose to fat as a primary energy source **[10].** This metabolic switch can lead to alterations in insulin sensitivity – some studies proved that adipokines, such as adiponectin, which improves insulin sensitivity, may interfere with glucagon-like-peptide-1 (GLP-1) leading to improved glucose control **[11]**. Some studies have reported improved insulin sensitivity during Ramadan fasting, suggesting a potential benefit in glucose metabolism **[12]**. However, other research indicates that fasting blood glucose levels may remain unchanged or even increase, possibly due to factors such as meal composition during non-fasting hours and individual variations in metabolic responses **[7]**. The risk of hypoglycemia is generally low in healthy individuals but may be a concern for those with diabetes or on glucose-lowering medications. Studies showed that taking the newest generations of glucose-lowering medications makes a small risk for hypoglycemia occurrence during fast. Low incidence was reported due to taking medications such as insulin, sulfonylureas and metformin **[11]**.

Lipid Profile

Ramadan fasting has been associated with favorable changes in lipid profiles. Several studies have documented significant reduction in total cholesterol, low-density lipoprotein cholesterol (LDL-C) and triglyceride level, along with an increase in high-density lipoprotein cholesterol (HDL-C) during the fasting period. These changes are thought to result from alterations in dietary intake, meal timing and increased physical activity during Ramadan. The improvement in lipid parameters may contribute to a reduced risk of atherosclerosis and subsequent cardiovascular events **[8]**.

Blood Pressure, Heart Rate and Hydration

The impact of Ramadan fasting on blood pressure and heart rate varies among individuals. Some studies have observed reductions in systolic and diastolic blood pressure, potentially due to decreased caloric intake, weight loss and improved autonomic function **[9, 11]**. Heart rate variability may also improve, indicating enhanced cardiovascular adaptability **[7]**. However, the risk of dehydration, especially in hot climates or among individuals with limited fluid intake during non-fasting hours, can counteract these benefits and may lead to hypotension or other cardiovascular stress **[15]**.

Oxidative Stress and Inflammation

Fasting during Ramadan may exert antioxidant and anti-inflammatory effects. Research has shown reductions in markers of oxidative stress and inflammatory cytokines during the fasting period. These changes may be attributed to decreased oxidative metabolism, improved lipid profiles and enhanced cellular repair mechanisms. The reduction in oxidative stress and inflammation is beneficial for endothelial function and may lower the risk of plaque formation and rapture, key events in the pathogenesis of myocardial infarction **[13]**.

Adaptive Responses

The human body exhibits remarkable adaptability during Ramadan fasting. Hormonal adjustments, such as increased secretion of growth hormone and decreased insulin levels, facilitate the mobilization of energy store and promote metabolic flexibility. These adaptations support the maintenance of energy balance and physiological functions during prolonged periods without food and water intake **[13, 14]**.

In summary, Ramadan fasting induces a complex interplay of metabolic and physiological changes that can positively influence cardiovascular health. Improvements in lipid profiles, blood pressure regulation and reductions in oxidative stress and inflammation may collectively contribute to a decreased risk of myocardial infarction. However, individual responses to fasting vary and factors such as age, health status and lifestyle should be considered when evaluating the cardiovascular implications of Ramadan fasting **[13, 15]**.

4. Myocardial Infarction – Risk Factors and Pathophysiology

Myocardial infarction (MI) occurs due to a reduction or complete cessation of blood flow and oxygen supply to a region of the heart muscle. The vast majority of MI cases are caused by coronary artery disease, primarily resulting from atherosclerosis. This leads to narrowing or occlusion of the coronary arteries. The extent of the infarction depends on the location of the embolism, the size of the ischemic area, the duration of artery occlusion, the presence of collateral circulation, the pre-existing condition of the heart and individual patient factors **[16,18]**.

A number of modifiable risk factors for myocardial infarction have been identified by the INTERHEART study, including:

- Smoking
- Abnormal lipid profile/apolipoproteins
- Hypertension
- Diabetes mellitus
- Abdominal obesity
- Psychosocial factors (e.g., depression, loss of control, overall stress, financial stress, and life events such as marital separation, job loss, or family conflicts)
- Lack of daily fruit and vegetable intake
- Physical inactivity
- Alcohol consumption (weaker association) **[16]**.

Non-modifiable risk factors for myocardial infarction include:

- Advanced age
- Male sex
- Genetic predisposition (increased risk if a first-degree relative experienced a cardiovascular event before the age of 50) **[16]**.

The most effective method for preventing heart disease, including myocardial infarction, is lifestyle modification and proper management of risk factors. Regular physical activity, adequate sleep hygiene, healthy dietary habits, weight management and smoking cessation significantly reduce the risk of cardiovascular disease (CVD) **[16,17]**.

Pathophysiology of Myocardial Infarction

The most common underlying cause of coronary artery disease leading to myocardial infarction is atherosclerosis.

Formation and progression of atherosclerotic plaques – Atherogenesis

Atherosclerotic plaques accumulate within the coronary artery walls, progressively narrowing the vascular lumen and restricting blood flow.

Plaque rupture

Unstable plaques may rupture under the influence of triggers such as heightened stress, inflammation, or elevated blood pressure.

Activation of the coagulation system

Exposure of the plaque's interior activates the coagulation cascade and platelet aggregation.

Thrombus formation and vessel occlusion

The resulting thrombus, composed of platelets and fibrin, may partially or completely occlude the coronary artery.

Myocardial ischemia and necrosis

Cardiomyocytes are highly sensitive to oxygen deprivation. Without timely reperfusion, ischemic myocardial infarction leads to irreversible cellular injury **[16,19,20]**.

Sleep and Cardiovascular Diseases

Sleep plays a critical role in overall health. Short sleep duration is associated with a wide range of adverse health outcomes and increased risk of premature death. Poor sleep quality and insufficient sleep are strongly correlated with an increased risk of cardiovascular disease. It is recommended that adults sleep 7–9 hours per night, at consistent times, during nighttime hours, and without frequent interruptions **[21,22]**.

How does poor sleep hygiene affect the heart?

Inflammation:

Sleep deprivation triggers the release of inflammatory markers such as interleukin-6 and C-reactive protein (CRP), which are associated with an increased risk of CVD. During healthy sleep, blood pressure decreases and blood vessels relax. Chronic sleep deficits can lead to sustained high blood pressure, contributing to vascular damage **[21]**.

Appetite:

Lack of sleep is linked to increased appetite and consequently a higher risk of obesity. Individuals who sleep less tend to have elevated BMI, lower leptin levels and higher ghrelin levels. Obesity is a well-known risk factor for cardiovascular disease **[21,22]**.

Hormones:

Sleep restriction and circadian rhythm disruption reduce insulin sensitivity, increase the risk of type 2 diabetes and contribute to arterial damage. Additionally, obstructive sleep apnea has been shown to increase levels of hormones involved in the renin-angiotensin-aldosterone system (RAAS), leading to elevated blood pressure **[21,22]**.

Recent studies indicate that the impact of Ramadan fasting on the incidence of acute myocardial infarction (AMI) hospitalizations varies and is influenced by factors such as age, gender, lifestyle, and season. A retrospective population-based study conducted in Israel found no significant change in AMI hospitalizations among Muslims during Ramadan; however, a slight but statistically significant increase was observed in the months following Ramadan, particularly among middle-aged men **[23]**. Conversely, a study in Iraq reported no significant differences in the frequency of hospitalizations for acute coronary syndromes during Ramadan compared to other months, suggesting that fasting does not increase the risk of AMI in this population **[24]**.

5. Effect of Ramadan on the incidence of cardiovascular incidents

Research involving the Saudi population revealed that individuals with pre-existing cardiovascular diseases who adhered to medical recommendations and modified their lifestyle did not experience increased cardiovascular complications during Ramadan **[25]**. It is important to highlight that lifestyle factors such as dietary habits, physical activity levels, and smoking

can significantly influence cardiovascular risk during this period. Additionally, the season in which Ramadan occurs plays a crucial role — fasting during summer months involves longer durations without fluid intake, which can adversely affect cardiovascular health, especially in elderly patients or those with chronic illnesses **[26]**. According to study, Ramadan fasting was associated with a marked reduction in estimated 10-year coronary artery disease (CAD) risk, as assessed by the Framingham risk score. Improvements were noted across several key cardiovascular parameters, including increased HDL-C levels, decreased LDL-C, lower systolic blood pressure, reduced body mass index, and a smaller waist circumference. Collectively, these changes suggest a potentially protective effect of fasting on overall cardiovascular health.Studies found no association between Ramadan fasting and the incidence of stroke, myocardial infarction, angina, heart failure, or valvular disease in patients with stable cardiac conditions. Overall, Ramadan fasting appears to be safe for most patients with stable cardiovascular disease, provided that they are appropriately monitored and managed **[27,28,29]**. Contrastingly, studies by Betesh-Abay et at. indicates that the incidence of acute myocardial infarction (AMI) among the Muslim participants did not differ during Ramadan compared to the preceding month. Interestingly, the highest occurrence of AMI was observed in the month following the end of Ramadan. An increased association between Ramadan and AMI mortality was observed particularly in selected subpopulations, including older adults (≥65 years), females, non-smokers, and patients with comorbid diabetes or hypertension **[30]**.

6. Conclusion

Cardiovascular diseases remain one of the leading causes of death and disability worldwide, and their increasing prevalence demands effective preventive and therapeutic measures. In the context of demographic changes, including population aging, this issue becomes even more significant, especially among Muslim communities, where Ramadan fasting is observed by over a billion people globally.

Fasting during Ramadan induces a range of beneficial metabolic and physiological changes, such as improved lipid profiles, lowered blood pressure, reduced inflammation, and favorable effects on glucose metabolism, which may contribute to a decreased risk of myocardial infarction. However, these effects are individual and depend on the health status and lifestyle of the fasting person.

For patients with well-controlled cardiovascular diseases, Ramadan fasting can be safe, provided that appropriate medical supervision and treatment adjustments are in place. Conversely, individuals with unstable cardiac conditions should avoid fasting or follow their healthcare provider's recommendations. Special attention should be given to elderly patients and those with comorbidities, who may be at higher risk of complications, particularly in the period immediately following Ramadan.

In conclusion, Ramadan fasting is an important cultural and religious practice whose impact on cardiovascular health requires further research and personalized clinical management. Increasing awareness and education among both patients and healthcare professionals is essential to ensure safety and optimal care during this significant period.

Disclosure Author's contribution

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