Review Paper

Health Implications of Ramadan Fasting in Healthy and Eligible Individuals: A Narrative Review

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ABSTRACT

Background: Ramadan fasting is obligatory for all healthy adult Muslims. During this period, eating and drinking are restricted from Suhoor (pre-dawn meal) to Iftar (breaking the fast at sunset). Given the large Muslim population and the growing integration of spirituality and religion into medical settings, robust scientific studies on the medical implications of religious practices are necessary. Considering the Islamic prohibition of fasting for the sick, this review aimed to examine the physiological effects and potential challenges of Ramadan fasting in healthy individuals, with a focus on various body systems.

Methods: This narrative review involved a qualitative analysis of studies retrieved from Web of Science, PubMed, Scopus, and Google Scholar. The included studies examined the effects of Islamic fasting on various body systems and their cellular mechanisms. Articles published between 2010 and 2024 were included in the search. A total of 299 articles were included in the study, and after appropriate screening and selecting those that met the inclusion criteria, 81 articles were finally analyzed. To avoid redundancy, only novel findings were emphasized, and the benefits and potential harms of Ramadan fasting in healthy individuals were summarized.

Results: The results of various studies show that Islamic fasting, a form of intermittent fasting, has beneficial effects on various body systems, improving cellular and tissue function. Although Islamic fasting can sometimes cause some temporary disturbances even in healthy people. To mitigate these potential disturbances, suggested strategies include balanced meals, adequate hydration, regular sleep, and lifestyle adjustments.

Conclusion: By evaluating the results of various studies, it can be safely said that healthy Muslims can use fasting not only for spiritual benefits but also to improve their physical health.

Keywords: Body organs, Islamic fasting, Healthy individuals, Ramadan, Cell

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Introduction

Fasting, a profound spiritual practice, holds a central place in Islamic jurisprudence as a mandatory duty for adult Muslims who meet specific criteria. Observed during the holy month of Ramadan, fasting involves abstaining from food and drink from dawn (Suhoor) to sunset (Iftar), representing a unique form of intermittent fasting (IF) within the broader spectrum of dietary regimens [1]. While fasting is practiced across various faiths and traditions, Islamic fasting is distinguished by its unique structure and cultural significance. These characteristics have sparked considerable scholarly and medical interest, prompting investigations into its potential health implications—both beneficial and adverse. The interplay between religious belief, cultural customs, and health outcomes positions Islamic fasting as a compelling subject of interdisciplinary research. In a modern contexts, where individuals increasingly seek empirical support for traditional practices, understanding the health effects of fasting becomes essential. Religion and spirituality, recognized as vital dimensions of human experience [2], are now being integrated into therapeutic contexts with growing emphasis [3]. The anthropometric and body composition changes observed during Ramadan are temporary, indicating the need for sustained lifestyle modifications to achieve long-term benefits in healthy adults [4]. The Holy Quran encourages critical thinking to strengthen conscious faith, distinguishing right from wrong, promoting intellectual and moral development, inviting questioning and dialogue, and encouraging responsibility and accountability. Previous research has explored the effects of Islamic fasting on various diseases, detailing both its benefits and harms [5-8]. Given this trend, exploring the health impacts of Islamic fasting aligns not only with its spiritual importance but also with the Quran's guidance that fasting is prescribed for those who are healthy and capable.

Unlike previous reviews that focused on specific systems or general effects, our study provides a comprehensive overview of Ramadan fasting's impact on multiple body systems and cellular functions in healthy individuals. The main highlights of this review include its exclusive focus on healthy adults, its integration of both physiological and cellular outcomes, and its emphasis on Islamic fasting as a unique model of IF with practical health implications. By shedding light on these outcomes, we aim to provide a clearer understanding of fasting's role in enhancing overall well-being for Muslims and non-Muslims alike.

Methods

Review of the literature

This narrative review summarizes the available evidence on the effects of Ramadan fasting on different body systems and cellular functions in healthy individuals. A comprehensive search was conducted in PubMed, Scopus, Web of Science, and Google Scholar. Keywords included "Ramadan," "Islamic fasting," "health," "body systems," and "cells" and combinations of these keywords and Boolean operators, such as "Ramadan" AND "Islamic" AND ("health" OR "physiology" OR "body systems" OR "cells"). Databases were searched for studies published between 2010 and 2024. The inclusion criteria were as follows: original studies and reviews in English on the physiological and systemic effects of Islamic fasting in healthy participants. Studies focusing on acute and chronic diseases, specific conditions, such as pregnancy and lactation, and other types of fasting were excluded, unless deemed necessary to complete the discussion. The EndNote software was used to organize records and identify duplicates. Initially, 299 articles were selected for review. After screening the title and abstract, 93 studies were excluded due to their inconsistency with the research objectives or because they examined fasting types other than Islamic fasting. In addition, 129 duplicate records—mostly older or low-citation publications—were excluded. Reference lists of included studies were screened for additional eligible articles, and 37 more were identified through manual searching. A total of 117 articles were excluded from the full text due to unclear demographic criteria, focus on disease states, examination of fasting in pregnant or lactating women, or investigations conducted under poor socioeconomic conditions. Finally, 81 articles were included for the final text of the present study. Two investigators independently reviewed and extracted data, with a third consulted in cases of disagreement.

Due to the narrative nature of the review, no formal tools were used to assess the risk of bias. Efforts were made to include studies with specific methods, appropriate statistical analysis, and sufficient sample size. Findings were summarized by body system, focusing on both beneficial and adverse effects, with redundant results being excluded.

Effects of Islamic fasting on various organs and systems of the body

Ramadan fasting and cardiovascular system

Ramadan fasting is associated with significant improvements in lipid profiles—reductions in total cholesterol, low-density lipoprotein (LDL), triglycerides, as well as increases in high-density lipoprotein (HDL)—along with improved blood pressure and heart rate [9, 10]. Studies also suggest increased parasympathetic activity during fasting, supporting relaxation and vital organ health, including the heart and brain [11]. Research by Badlzadeh et al. links Ramadan fasting to reduced oxidative stress, improved vascular function, and favorable lipid profile changes [12]. Furthermore, fasting enhances endothelial function and reduces cardiac stress in hypertensive patients, even when used alongside medication [13, 14]. Sutton et al. noted that time-restricted feeding benefits metabolism independently of weight loss, underscoring its broader physiological advantages [15].

Ramadan fasting and endocrine gland function

Fasting influences hormonal balance. In men, fasting increases anabolic hormones, such as testosterone and GH, supporting fat metabolism and muscle maintenance [16]. Time-restricted feeding improves insulin sensitivity and β-cell function in the pancreas, as Sutton et al. reported [15]. Altered circadian rhythms during fasting elevate cortisol levels throughout Ramadan, and this requires metabolic and endocrine adjustments to maintain energy balance [17].

Different studies reported that thyroid hormones remain stable overall during Ramadan, despite a decrease in T3 levels and a slight increase in T4 late in Ramadan, and these changes do not significantly affect reproductive or thyroid metabolic functions [18, 19]. Glucose homeostasis is maintained through pre-dawn meals and liver glycogen reserves, while lipid fluctuations depend on diet and weight changes [20]. Fasting shifts cortisol and testosterone secretion, increases nocturnal prolactin peaks. It minimally affects follicle-stimulating hormone (FSH) and growth hormone (GH) rhythms, and attenuates serum thyroid-stimulating hormone (TSH) rhythms (Boroumand et al.) [21]. Melatonin levels follow circadian patterns but decline significantly compared to baseline during Ramadan [22]. However, another study showed fasting increases serotonin levels without changing melatonin and cortisol levels [23].

Fasting also induces modest liver function improvements, with changes in enzymes, such as aspartate transaminase, alkaline phosphatase, bilirubin, and gamma-glutamyl transferase, suggesting transient protective effects against fatty liver disease [24].

Ramadan fasting and neurological system

Fasting enhances neurochemical activity by increasing serotonin, brain-derived neurotrophic factor (BDNF), and nerve growth factor (NGF) [25]. It does not raise the risk of cerebrovascular events, such as stroke or CVST [26].

Fasting seems to support brain health without affecting cortical thickness. A study linked the left amygdala to spatial memory strategies and found a connection between fat intake and brain volume distribution, with improved cognitive function and task performance after fasting [27]. IF shows promise for neurological disorders, such as better seizure control in epilepsy, cognitive improvement in Alzheimer's disease, reduced disability in multiple sclerosis, and enhanced mood and anxiety regulation [28].

Studies on adolescents (11–15 years) revealed no significant effects on decision-making, reaction times, or information processing during Ramadan fasting [29]. A randomized trial showed that ischemic pain tolerance decreased early in Ramadan but improved over time, indicating adaptive pain response mechanisms [30]. Headaches related to dehydration during fasting are common but typically resolve with fluid intake [31]. However, a review noted increased migraine frequency during Ramadan compared to the following month [32].

Ramadan fasting and mental health outcomes

Research suggests that fasting and prayer positively impact mental health and emotional regulation. Fakhrari and Naghizadeh found that students who practiced fasting and prayer had higher mental health scores, indicating better psychological well-being [33]. However, the effects on sleep are mixed. A meta-analysis of 103 studies showed delayed sleep-wake cycles, reduced deep sleep, and lower daytime alertness due to fasting-related factors [34]. Other studies report improvements in anxiety, depression, and body mass index (BMI) among those fasting during Ramadan [35, 36], with Nasiri and Lotfi linking fasting to better mental health and aggression management [37].

Fasting has been associated with stress reduction, as shown by a significant decrease in stress levels among pre-clinical medical students during Ramadan [38]. Furthermore, fasting was associated with improved mood and reduced fatigue, though it did not significantly influence sleepiness, physical exercise, or calorie intake [39]. Molavi et al. found that fasting enhanced emotional processing, with quicker reactions to happy stimuli and increased mood levels [40].

Ramadan fasting and immunological system

Fasting modulates immune responses by enhancing leukocyte migration, prolonging monocyte survival, and promoting immune homeostasis [41]. It upregulates autophagy, reduces apoptosis-related gene expression, and boosts neutrophil activity, including degranulation and cytokine secretion [42].

Solimani-Far et al. found decreased serum immunoglobulin (Ig)A and interleukins (IL)-17 during Ramadan, while mucosal immunity remained stable [43]. Develioglu et al. observed reduced IgG and salivary IgA, unchanged IgM, and increased lymphocyte counts without direct correlation to immunoglobulin levels [44]. Other studies noted minor cytokine shifts, such as slight increases in IL-1α, IL-2, IL-8, and a reduction in IL-6, indicating subtle immune modulation [45].

Nasiri et al. reported minor decreases in white blood cell and lymphocyte counts, alongside a lower percentage of neutrophils after Ramadan [46]. Fasting also alters macrophage regulation, enhancing their functionality, reducing oxidative stress, and modulating inflammation [47].

Ramadan fasting and digestive system

Ramadan fasting generally has a minimal impact on gastrointestinal health. While Sadeghpour et al. reported rare cases of complications, such as peptic ulcers or bleeding, serious GI events are uncommon in healthy individuals [48]. Other studies found no major worsening of digestive symptoms during fasting, though constipation may increase with prolonged fasting beyond two weeks [49].

Combined with acid blockers, fasting can help reduce gastric ulcer risks [50]. In obese and sedentary men, fasting has been shown to regulate appetite-related hormones, leading to improved body composition and reduced obesity [51]. A review also suggested that fasting promotes gut health by fostering beneficial bacteria, such as *Akkermansia muciniphila* and *Bacteroides* [52], with several studies supporting its positive impact on the gut microbiome [53].

Furthermore, Abdullah et al. demonstrated that IF during Ramadan reduces visceral fat and enhances gastrointestinal motility [54]. Some increase in *Helicobacter pylori* growth is reported due to reduced acid secretion, though clinical significance remains unclear [55].

Ramadan fasting and respiratory system

Fasting may improve nasal airflow and mucociliary function [56]. Most studies on chronic obstructive pulmonary disease (COPD) show stable lung function during Ramadan [57-59], while others report enhanced pulmonary performance [60]. A literature review also suggested that fasting may benefit asthma patients by reducing high sensitivity c-reactive protein (hs-CRP) concentrations and alleviating symptoms like wheezing [61]. It also serves as a catalyst for smoking cessation [62].

Ramadan fasting and the skin

Increases in sebum production may occur due to hormonal and circadian shifts [63]. Several studies have demonstrated the potential benefits of IF for skin conditions, particularly psoriasis, and for improving treatment outcomes [64]. A multicenter study by Damiani et al. showed that fasting during Ramadan reduced the PASI score in patients with moderate to severe psoriasis [65]. It reduces oxidative stress, enhances hydration and barrier integrity, and supports skin rejuvenation [66, 67].

Ramadan fasting and the urinary system

Research on Ramadan fasting and kidney function shows largely neutral or mixed effects. Tarabeih et al. and Jaleel et al. found no significant changes in serum creatinine, urea, or nocturnal urine output, highlighting the body's ability to conserve water during fasting and the importance of proper hydration during non-fasting hours [68, 69]. Hejaili et al. also reported no adverse effects on kidney transplant function over two consecutive Ramadan periods [70].

While a retrospective study of 237 patients in Riyadh found no overall increased risk of kidney stones, it noted a higher incidence of ureteral stones during summer fasting compared to winter [71]. Miladipour et al. observed reductions in urinary calcium, phosphate, and magnesium, but increases in concentrations of uric acid and other solutes, indicating altered stone formation risk during fasting [72].

Ramadan fasting and eye health

Studies on the ocular effects of Ramadan fasting show varied but generally modest outcomes. Overall, fasting does not significantly affect refractive errors or visual acuity in healthy individuals. Some research suggests minor changes in intraocular pressure (IOP) and ocular surface parameters. Hassan et al. observed a significant reduction in IOP among healthy African-Black participants during Ramadan [73, 74]. Armstrong et al. reported alterations in tear break-up time and increased ocular surface inflammation measured by InflammaDry, suggesting potential but limited impact on tear film stability [75]. Beyoğlu et al. investigated anterior segment structures and found that while fasting did not alter lens density or central corneal thickness, it led to slight decreases in anterior chamber depth and volume, along with a significant reduction in corneal density and IOP [76]. Regarding retinal structure, Gokmen noted an increase in subfoveal retinal thickness, though no significant differences were seen in foveal thickness or retinal vascular networks [77]. Ettehad et al. found a significant reduction in inner retinal thickness in both the parafoveal and foveal regions and a decrease in central retinal artery flow in the evening during fasting, indicating potential alterations in retinal circulation and structure [78]. Tear production may decrease, but not enough to significantly affect ocular health [79].

Cellular and tissue mechanisms affected by fasting

IF, including Ramadan fasting, modulates key signaling pathways, such as AMP-activated protein kinase (AMPK), mTOR, sirtuins, and FOXO, contributing to improved metabolic regulation, enhanced autophagy, reduced oxidative stress, and delayed aging phenotypes [80-82]. Studies suggest that IF can reduce oxidative damage, inflammation, and optimize energy metabolism, contributing to lifespan extension, disease prevention, and reduced cancer risk [83, 84]. It reduces oxidative stress, supports DNA repair, and boosts mitochondrial health [83, 84]. Ramadan fasting shares these mechanisms, promoting metabolic flexibility and toxin clearance [85]. Additionally, fasting increases mitochondrial health, promotes DNA repair, and influences white adipose tissue remodeling via vascular endothelial growth factorA (VEGF-A) and fibroblast growth factor21 (FGF21) [81, 82, 86]. Studies have shown that IF reduces inflammation, improves glucose and lipid metabolism, and enhances insulin sensitivity, making it a promising strategy for managing lifestyle-related conditions such as diabetes, cardiovascular disease, and obesity [87-89]. It may also reduce cancer risk and chemotherapy toxicity, though more clinical trials are needed before its routine use in cancer patients can be recommended [90].

In animal models, IF and calorie restriction lower β-amyloid accumulation, improve hippocampal function, and support vascular health [91]. These shifts influence fat storage, immune function, and cellular resilience to stress [92]. Fasting-induced metabolic shifts from glycogen to fatty acids and ketones are driven by hormonal regulators, such as peroxisome proliferatoractivated receptoralpha (PPARα) and cyclic AMP–responsive element–binding protein 3-like 3 (CREB3L3) [93, 94]. Short-term fasting enhances intestinal stem cell protection during chemotherapy by boosting autophagy, reducing apoptosis, and maintaining barrier integrity [95, 96].

Fasting also leads to a reduction in intracellular water, suggesting alterations in membrane function [85], and may slow age-related epigenetic changes, contributing to longevity [82]. Additionally, IF promotes neuroprotection by enhancing synaptic plasticity and neurogenesis, and potentially suppressing cancer cell proliferation [88].

Results

Figure 1 shows a flow diagram outlining the literature search and selection process, including the number of records identified, screened, excluded, and ultimately included in the final review.

The effects of Islamic fasting on vital systems of the body

In the present study, we evaluated findings from various studies on the effect of Islamic fasting on the vital organs of the body, including the cardiovascular, urinary, nervous, and respiratory systems. The findings indicate substantial beneficial effects of this dietary pattern on these systems, with no serious adverse effects reported after fasting. Fasting has been associated with several positive effects on cardiovascular health [9-15]. These findings highlight fasting's potential neuroprotective and adaptive benefits while acknowledging challenges, such as hydration-related headaches [25-32]. The results suggest that while Ramadan fasting may have varied impacts on respiratory health, it holds promise for improving lung function in certain individuals and offering support for smoking cessation (56-62). While Ramadan fasting appears to have little effect on kidney function in most individuals, it may have varying impacts depending on environmental factors, such as fasting during

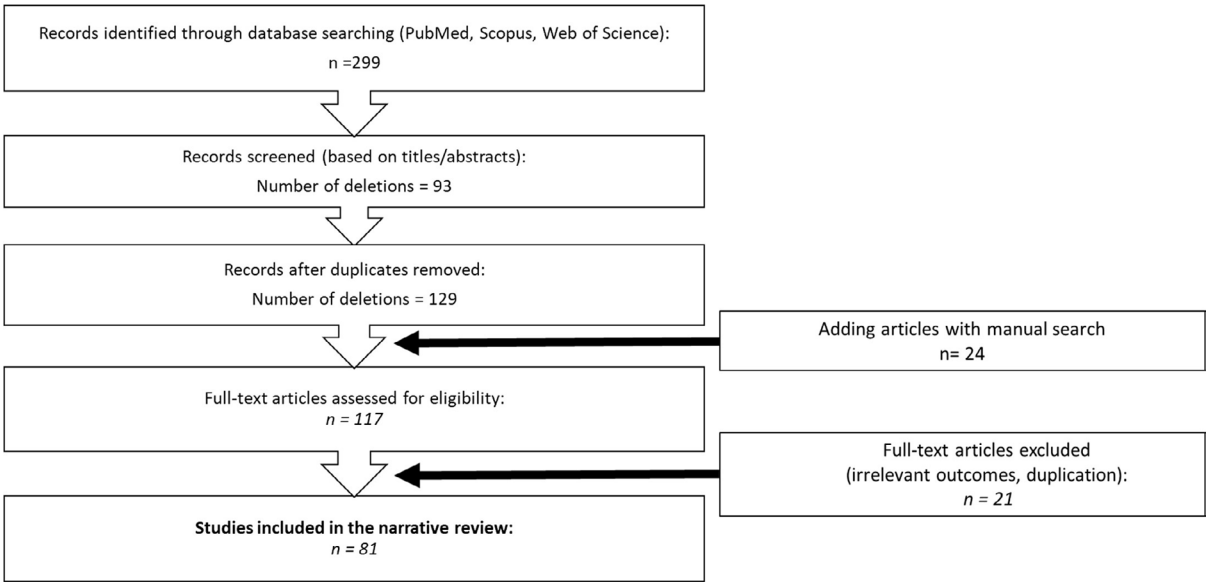

Figure 1. Number of records identified, screened, excluded, and included in the final review

summer versus winter, and the presence of underlying kidney conditions [67-71]. Table 1 presents the summarized effect of Islamic fasting on vital organs.

The effect of fasting on other body systems

In the current study, the effects of Islamic fasting on other organs and body systems were also evaluated. The results showed that Islamic fasting positively influences these structures, yielding beneficial effects. Islamic fasting induces hormonal changes and affects endocrine gland function, thereby enhancing the activities of various body systems [15-24]. Despite the possibility of sleep disorders, it has been observed that most fasting Muslims experience better mental and emotional conditions [33-40]. Fasting can enhance specific immune re-

Table 1. Effects of Islamic fasting on vital systems of the body, indicating the overall positive outcomes

Target Organ	Advantages	Disadvantages	Ref.
Cardiovascular system	Improved metabolic homeostasis; enhanced heart rate metrics; increased parasympathetic system activity; reduced vascular damage; lower triglyceride-to-HDL cholesterol ratios; improvements in blood pressure and oxidative stress levels.		[9-15]
Neurological system	Boost brain health by increasing levels of serotonin, BDNF, and NGF; increase cognitive function; improve seizure control in epilepsy; support cognitive function in Alzheimer's disease; help the gut microbiome in multiple sclerosis and reduce disability caused by the disease; reduce mood and anxiety symptoms Increase pain threshold at the end of Ramadan	Effects on neurotrophin and neurotransmitter synthesis as well as oxygen radical metabolism Increased risk of cerebral and sinus vein thrombosis, dehydration headaches, and recurrent migraine attacks	[25-32]
Respiratory system	Improved nasal breathing; reduced hs-CRP levels; reduced asthma severity including wheezing; no significant effect on spirometric measures such as forced vital capacity or peak expiratory flow; supports Smoking Cessation	Weakening of the nasal airway defense system	[56-62]
Urinary system	No permanent increase in creatinine; no negative effect on kidney function in healthy individuals; no effect on nocturnal urine volume or osmolality; maintains overall body hydration; no increase in risk of urinary stones; decreases urinary calcium concentration and increases urinary uric acid, citrate, phosphate, sodium, and potassium levels; insufficient evidence for harmful effects of fasting in people with kidney disease or kidney transplants	Increased risk of ureteral stones in hot seasons	[67-71]

HDL: High-density lipoprotein; hs CRP: Hig hsensitivity c-reactive protein.

Table 2. Beneficial effects of Islamic fasting on various body systems

Target Organ	Advantages	Disadvantages	Ref.
Endocrine gland system	Increased testosterone, growth hormone and adrenaline levels in men; maintaining glucose homeostasis; reducing biochemical parameters, especially blood sugar; increased cortisol and T4 concentrations; no effect on reproductive function, hypothalamic-pituitary-thyroid axis; change in the timing of cortisol and testosterone secretion; increased nocturnal prolactin peak; significant improvement in liver function tests	Changes in serum lipids depend on the quality and quantity of food consumption and weight changes; lack of effect of rhythmic FSH and GH hormones; fading of serum TSH rhythm; A decrease in melatonin hormone levels from baseline. Reduced or delayed nocturnal melatonin peak	[15-24]
Mental health outcomes	Reduces levels of anxiety, depression and stress; increases positive affect, mood control and aggression; useful for managing fatigue; increases arousal; stabilizes BMI; no significant effect on sleepiness, physical exercise or calorie consumption; improves mental health in students and people completing their fasts	Delay in the sleep-wake cycle Reduced deep sleep and lack of awareness during the day.	[33-40]
Immunological system	Increase the lifespan of monocytes; enhance their rapid return to the bone marrow; enhance autophagy and macrophage activity; increase immune function; regulation of inflammatory responses by Increase the secretion of interleukin-1α, interleukin-2 and interleukin-8 and decreased concentration of serum immunoglobulin G, salivary immunoglobulin A, interleukin-6, interleukin-17; increase the survival of leukocytes and number neutrophils and lymphocytes; reduce the expression of genes related to apoptosis and oxidative stress in macrophages	Reduction of Na^+ and Cl^- electrolyte levels	[41-47]
Digestive system	Reduces gastric and duodenal ulcers; improves lipid profile; positive effect on appetite-regulating hormones; beneficial for intestinal bacteria such as Akkermansia muciniphila and Bacteroidetes; reduces visceral fat; improves digestive motility; no association with increased risk of gastric ulcers caused by Helicobacter pylori	Constipation may become more frequent and severe in those fasting for 2 weeks or more	[48-55]
Skin	Increased sebum production in the skin; significant reduction of psoriasis and improvement of the treatment process; reducing the rate of cell proliferation; improving skin health		[63-66]
Eyes	Reduced IOP; Improved TBUT; Reduced ocular surface inflammation; significant increase in submacular choroidal thickness without affecting foveal thickness or capillary networks; improved ocular topography	Decreased inner retinal thickness in the parafoveal and foveal areas; decreased central choroidal flow; decreased tear production; increased tear osmolarity	[72-78]

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Abbreviations: FSH: Follicle-stimulating hormone; GH: Growth hormone; Na^+: Sodium; Cl^-: Chloride; TSH: Thyroid-stimulating hormone; TBUT: Tear break-up time.

sponses, balance inflammatory processes, and improve cellular resilience [41-47]. These findings illustrate that Ramadan fasting can have both beneficial and potentially harmful effects on gastrointestinal health, depending on individual factors and fasting duration [48-55]. These findings suggest that while Ramadan fasting may cause some temporary changes in ocular health, such as reduced tear production, increased inflammation, or shifts in IOP and retinal thickness, these effects are generally not severe in healthy individuals [72-78]. Furthermore, improved skin health has been noted as another benefit of this type of fasting [63-66]. Table 2 presents the summarized results of the effect of Islamic fasting on these systems.

The effect of fasting on cellular systems

The results show that the body's cells exhibit increased activity following this dietary regimen, initiating cellular repair processes. Islamic fasting is associated with improved function of organelles and intracellular structures and increases the lifespan of the cell [84]. IF, including practices such as Ramadan fasting, has been shown to modulate various metabolic and cellular pathways that contribute to improved health outcomes [80, 89]. These pathways involve key signaling mechanisms, such as AMP-activated protein kinase (AMPK), sirtuins, and mechanistic target of rapamycin (mTOR), which promote metabolic regulation, autophagy, and reduced inflammation, while also influencing aging and disease prevention [84]. Fasting enhances mitochondrial health, improves lipid and glucose metabolism, and increases insulin sensitivity [87]. IF triggers molecular and cellular changes—such as increased levels of ketone bodies, BDNF, and gut microbiota shifts—that improve neuronal stress resistance, plasticity, and neurogenesis [82]. It has demonstrated neuroprotective effects, promoting cognitive function, reducing oxidative stress, and safeguarding against neurodegeneration [90]. Additionally, fasting may improve water balance and aid in toxin elimination, contributing to overall cellular health [85]. While the benefits of fasting are extensive, further research is needed to fully understand the long-term effects on human health, especially in relation to aging, disease prevention, and cognitive function [90, 91]. Table 3 presents the results of Islamic fasting on these cells.

Discussion

The Quran, in Surah Baqarah (2:183), [97] mandates fasting for Muslims and links it to the pursuit of righteousness. It also underscores divine wisdom in human creation and provision. Fasting, prescribed for earlier nations, is intended to foster self-control and awareness of both physical and spiritual needs. While the Quran encourages reflection and critical thinking, it invites exploration into the effects of fasting, which has been studied in various scientific contexts. This review study

Table 3. Cellular and tissue mechanisms affected by fasting in different studies

Author(s), Year	Type of Study	Target Population	Key Results
Yuliyanasari et al. 2024 [80] & Brocchi et al. 2022 [82]	Review article	Human	Activation of some cellular-molecular mechanisms in people's bodies Activation of signaling pathways that reduce aging phenotypes associated with obesity
Strilbytska et al. 2024 [84] & Clifton et al. 2021 [90]	Review article	Human	Increase lifespan, prevent diseases, and reduce inflammation and cancer risk
Najafi et al. 2023 [85]	Healthy individuals	Human	The cause of changing the integrity of the cell membrane and the exit of water from the cell
Reinisch et al. 2024 [87] & Ahmed et al. 2018 [89]	Review article	Human	Improves glucose and lipid metabolism Increases fat metabolism Improves insulin sensitivity Reduce inflammation, stress, autophagy problems and endothelial dysfunction
Padinjakara et al. 2023 [91]	Review article	Human	It has reduced β-amyloid accumulation and improved cognitive function through synaptic adaptations in the hippocampus and promoted vascular health
He et al. 2023 [92]	Review article	Human	Reducing oxidative stress through hormone secretion. Effect on oxidative gene expression Treatment of anxiety and cognitive disorders
Ruppert et al. 2024 [94]	Review article	Human	Creating significant metabolic changes in the liver, including increased fatty acid oxidation and ketogenesis

demonstrates that IF during Ramadan generally poses no serious risks to healthy individuals and can even promote improved health. These benefits may include improvements in physiological parameters related to cardiovascular health, metabolic function, and immune system function. Variability in study findings may be due to the cultural dietary differences, fasting duration affected by geographic and seasonal factors, age, gender, socioeconomic status, and other individual health and lifestyle factors [98]. Fasting during Ramadan may help eliminate intracellular toxins, and any potential adverse health effects from negative water balance are generally avoided. Lifestyle modifications, particularly sleep regulation, are essential for maintaining health. Fragmented or insufficient sleep may lead to gut dysbiosis and metabolic disorders, potentially due to hypothalamic-pituitary-adrenal axis activation. Probiotic supplements can improve sleep quality and help manage these effects [99]. Exercise during fasting can enhance physical fitness and cardiovascular autonomic balance [100], but it requires appropriate planning and management.

Healthcare professionals can utilize the insights from this study to provide evidence-based advice to healthy individuals fasting during Ramadan. Clinicians can advise patients on safely maintaining hydration, nutritional balance, and overall health throughout the fasting period. While the findings presented in this review provide compelling evidence of the health benefits of Ramadan fasting, several areas remain underexplored and warrant further investigation. Longitudinal, controlled clinical trials are needed to assess the long-term effects of fasting on health outcomes, particularly with regard to cellular aging, neuroplasticity, and organ function. Public health policies could also encourage flexible work hours and school schedules during Ramadan, allowing individuals to manage the demands of fasting without compromising their health or productivity. By promoting lifestyle modifications, such as sleep optimization, exercise, and probiotic supplements, public health authorities, can help mitigate potential negative impacts on gastrointestinal health and metabolic function.

Given that religious studies can be subject to bias from both proponents and opponents, it is advisable for research to be conducted by neutral individuals or mixed-group teams to ensure more reliable results. The Quran emphasizes the importance of fasting in a gentle and comforting tone. Islamic scholars have provided guidance on proper fasting etiquette, such as breaking the fast with warm water and a sweet food item. Like any other activity, fasting can have both benefits and drawbacks. According to the Qur'an: "Fasting is better for you if you only knew." [97] By understanding the different aspects of fasting and managing them through appropriate nutrition, hydration, sleep regulation, and overall lifestyle adjustments, individuals can maximize its benefits.

Conclusion

The evaluation of various studies shows that a healthy Muslim can fast in Ramadan without any problems, provided proper management and planning and lifestyle modification are implemented.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Ethics Committee of Mazandaran University of Medical Sciences, Ramsar Campus, Ramsar, Iran (Code: IR.MAZUMS.RIB.REC.1403.072).

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Authors' contributions

Conceptualization, methodology, supervision, project administration and funding acquisition: Samaneh Farrokhfar; Investigation, data collection, analysis, and Writing: All authors.

Conflict of interest

The authors declared no conflict of interest.

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