

Lifestyle Medicine During Ramadan Fasting: Evidence from Clinical Trials and a Framework for Comprehensive Cardiometabolic Care

Almoutaz Alkhier Ahmed *

A/Professor - Family Medicine- MBRU, SSR family medicine -Nad Alhamar Health Center. DAHC

FRCGP [int], MSc Diabetes, MSc endocrinology, Senior fellow of IDF, MPH, FESC, FASLM, Dip IBLM, ELMC, Pg Cer medical education.

Abstract

Introduction: Although Ramadan fasting is often regarded as a dietary intervention, it also affects meal timing, hydration, physical activity, sleep, circadian rhythms, psychosocial well-being, substance use, and social behaviour. Consequently, Ramadan represents a religious and culturally embedded example of multidimensional lifestyle modification.

Objective: To critically analyse Ramadan fasting from the perspective of lifestyle medicine and evaluate its potential as a structured intervention for reducing cardiometabolic risk and facilitating sustainable behavioural change.

Methods: Evidence from clinical trials, systematic reviews, meta-analyses, and clinical guidelines was synthesized narratively across key lifestyle domains, including nutrition, physical activity, sleep, mental health, social connection, and avoidance of toxic substances.

Results: Ramadan fasting is associated with modest improvements in weight, waist circumference, blood pressure, blood glucose, and lipid parameters in certain populations, although individual responses vary. Fasting alone does not determine health outcomes. Factors such as food quality and quantity, hydration, physical activity, sleep, smoking, medication management, and behaviours during non-fasting periods influence the overall benefits. Integrating balanced nutrition, individualized exercise, optimized sleep, adequate nighttime hydration, smoking cessation, and behavioural support can transform Ramadan from a fasting practice into a comprehensive lifestyle medicine intervention. Individuals with chronic diseases require risk assessment prior to Ramadan, tailored treatment adjustments, education, and ongoing monitoring.

Conclusion: Ramadan encompasses more than food restriction; it involves a comprehensive reorganization of lifestyle factors that influence health. An evidence-based lifestyle medicine approach can utilize Ramadan as a 'teachable month' to improve cardiometabolic health and promote sustained healthy behaviours.

Keywords: Ramadan; fasting; lifestyle medicine; cardiometabolic health; behaviour.

Introduction

Ramadan fasting is one of the most popular forms of fasting for religious reasons. When the lunar month of Ramadan rolls around, healthy adult Muslims stop eating or drinking anything from sunrise to sunset. What's interesting is that this type of fasting is different from other kinds of intermittent fasting that are popular these days [1]. For one, Ramadan fasting does not allow any fluids, and it's tied to the body's natural rhythms and the timing of the sun. It is also closely linked to a person's faith, behaviour, and social life [1]. So, when we are trying to understand what happens to our bodies during Ramadan fasting, we cannot just look at how many hours we are not eating, there are a lot of other factors at play [1]. Ramadan completely flips our daily routine on its head. We start eating at night instead of during the day, our sleep gets all messed up, and we must be very careful about staying hydrated when the sun is out [1]. Our workout schedules get turned upside down, and we tend to hang out with family and friends a lot more often. Plus, some people even need to adjust when they take their medication. So, Ramadan is like a big experiment in changing our whole lifestyle all at once [1]. This viewpoint is especially important when it comes to lifestyle medicine, which focuses on changing behaviours that we can control, like what we eat, how much we exercise, getting enough sleep, managing stress, spending time with others, and avoiding things that can harm us. All these areas can be affected by Ramadan at the same time. Research has shown that fasting during Ramadan can have some positive effects on our heart health and metabolism, but the results can be different from one study to another. A recent systematic review

[2] found that people who fasted during Ramadan tended to lose weight, have a smaller waist size, lower blood pressure, and better blood sugar and cholesterol levels. However, the quality of the studies that were reviewed was not very strong, which makes it hard to draw firm conclusions.

This review aimed to answer the following questions:

What are the actual health effects of fasting during Ramadan?

How can we make sure people are doing it safely?

How can lifestyle behaviours during Ramadan be optimized to enhance health benefits while minimizing risk?

Ramadan as a Lifestyle Medicine Intervention

Figure 1 describe a useful conceptual model. This framework proposes that the health effects of Ramadan should not be attributed to fasting alone. Rather, clinical outcomes reflect the combined and interacting influences of fasting duration and timing, dietary quality, physical activity, sleep and circadian changes, hydration practices, psychological well-being, social context, and the management of established cardiometabolic risk factors.

This approach understands that fasting is just one part of what people go through during Ramadan. Two people can fast for the same amount of time, but their bodies might react in completely different ways. This is because what they eat and how they live their lives can have a big impact on their health. For example, one person might eat lots of vegetables, whole grains, and foods that aren't processed too

*Corresponding Author: *Almoutaz Alkhier Ahmed, A/Professor -MBRU, SSR family medicine -Nad Alhamar Health Center. DAHC

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much. They might also stay active, drink plenty of water, get enough sleep, and not smoke. On the other hand, another person might eat a lot of fried foods, sweets, and drinks with added sugar does not sleep well, and smoke a lot after they break their fast.

These different choices can lead to very different effects on their metabolism, which is how their body uses energy. The time you spend

fasting is about the same, but the way you live your life when you're not fasting is different. So, Ramadan is a chance to shift our focus from just fasting to a more overall healthy lifestyle.

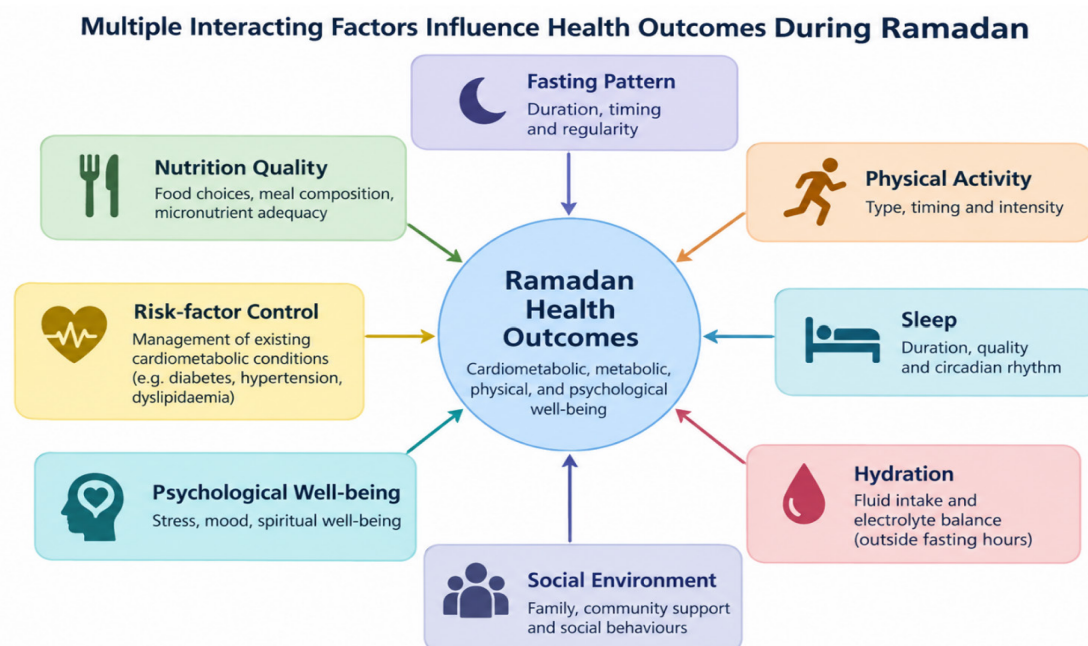


Figure 1: Ramadan as a Lifestyle Medicine Intervention framework.

Nutrition

From Feast–Fast Cycling to Nutritional Quality, nutrition is perhaps the most visible lifestyle change during Ramadan. Food intake becomes concentrated predominantly between Iftar and Suhoor. This temporal restriction may reduce overall energy intake in some individuals, but fasting does not automatically produce caloric restriction. Traditional Ramadan meals vary enormously between cultures. Potential metabolic benefits may be lost when fasting is followed by excessive consumption of refined carbohydrates, sweets, fried foods, saturated fats and sugar-sweetened beverages [3].

A lifestyle-medicine approach should therefore emphasize food quality rather than fasting duration alone (Figure 2). When you break your fast, your meal should help you get back the water and nutrients your body needs, without overeating. A good way to plan your meal is to focus on vegetables, beans, whole grains, fruits, nuts, and healthy oils, as well as protein sources that are good for fasting persons (4). Try to limit foods that are highly processed and have a lot of added sugar. Eating a good suhoor is just as important. Things like oats, whole grains, legumes, yoghurt, eggs, vegetables, nuts, and seeds are all great options and a person can pick the ones that suit his/her taste and culture [4]. When you eat foods that are high in fibre and rich in carbs, protein, and healthy fats, you will feel satisfy for longer and won't get too hungry later [5].

For persons with diabetes, it's important to plan meals carefully. Eating big meals with lots of carbs in the evening can cause blood sugar levels to spike. To manage this, the recommendation [4] stated that people with diabetes should get personalized advice on what to eat and drink. They should also try to eat more fibre and replace sugary foods with more complex carbs [4]. This can help keep their blood sugar levels under control. It's all about finding the right balance and making healthy choices to manage your diabetes.

When it comes to managing blood sugar levels, it's not just about keeping track of your average glucose levels or HbA1c. You also need to consider how much your glucose levels are fluctuating over time, known as glycaemic variability (GV). Two people can have the same HbA1c values, but their glucose profiles can be quite different. If your glucose levels are relatively stable, with fewer big swings into low or high blood sugar, that's considered low GV. On the other hand, high GV means you're experiencing a lot of ups and downs in your glucose levels. Thanks to continuous glucose monitoring (CGM), we can now measure GV using things like the glucose coefficient of variation (%CV). Experts agree that a CV of 36% or less is a good target for stable blood sugar levels. But if your CV is higher than that, it means you're experiencing too much variability, which can lead to more episodes of low blood sugar, especially if you're taking insulin [6,7]. This is important to keep in mind, as it can help you better manage your condition and reduce the risk of complications.

High GV may have clinical consequences beyond HbA1c. Observational evidence associates greater glucose variability with cardiovascular disease, renal disease, neuropathy and mortality, although causality has not been definitively established [8]. Proposed mechanisms include increased oxidative stress, inflammation, endothelial dysfunction and cellular injury induced by recurrent glucose excursions [9,10]. Therefore, contemporary diabetes management should aim not only to reduce HbA1c but also to increase time in range, minimize hypoglycaemia and hyperglycaemia, and reduce excessive glucose fluctuations, producing a more stable glycaemic profile. Thus, Ramadan nutrition should follow a simple principle: Do not compensate for daytime fasting with nighttime overnutrition (Figure 2).



Figure 2: Nutrition during Ramadan.

Weight and Metabolic Health

Ramadan is often perceived as an opportunity for weight loss. However, weight responses are inconsistent because fasting duration does not determine total energy intake (Figure 3). Research shows that there are some benefits to this approach. A recent systematic review study [2] found that people who followed this method lost weight and waist circumference. The study also showed improvements in markers like blood pressure and cholesterol levels, which are all important for staying healthy. A meta-analysis [2] examining metabolic syndrome also demonstrated improvements in fasting glucose, waist circumference and blood pressure, with an overall improvement in metabolic-syndrome severity. These findings are clinically relevant but should not lead to the assumption that Ramadan fasting itself is a weight-loss therapy. Weight reduction depends on the interaction between energy intake, food quality, physical activity, sleep and behavioural compensation.

From a lifestyle medicine perspective, Ramadan may instead function as a behavioural reset period. Patients seeking weight reduction

could establish three simple objectives: eliminate sugar-sweetened drinks, control Iftar portions, and maintain daily physical activity [11].

Losing weight during Ramadan is great, but it's not just about the month of fasting [11]. The real goal is to keep consistency of changes through the year. When a person lose weight while fasting, but then put it all back on afterwards, it does not do much for overall health in the long run. What Ramadan should really do is help you start new habits that you can keep up for the rest of the year [11].

Energy expenditure during Ramadan is influenced by changes in physical activity, sleep, meal timing and circadian rhythms. Although fasting does not inherently reduce basal metabolic requirements, daytime activity may decline because of fatigue, altered work schedules or avoidance of exercise, potentially lowering total daily energy expenditure [44] (Figure 4). Conversely, increased nocturnal activity, including social activities and Taraweeh prayers, may partly compensate for reduced daytime movement. Exercise energy expenditure also varies according to training intensity and timing relative to Iftar. Consequently, Ramadan-associated weight change reflects the balance between energy intake and expenditure rather than fasting alone, emphasizing the importance of maintaining regular physical activity throughout Ramadan.

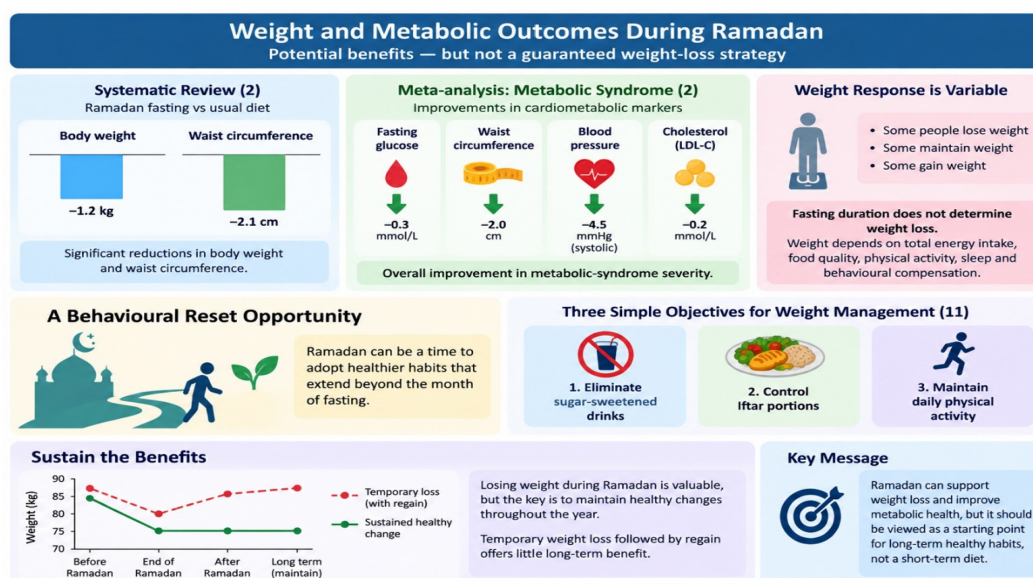


Figure 3: weight management during Ramadan.

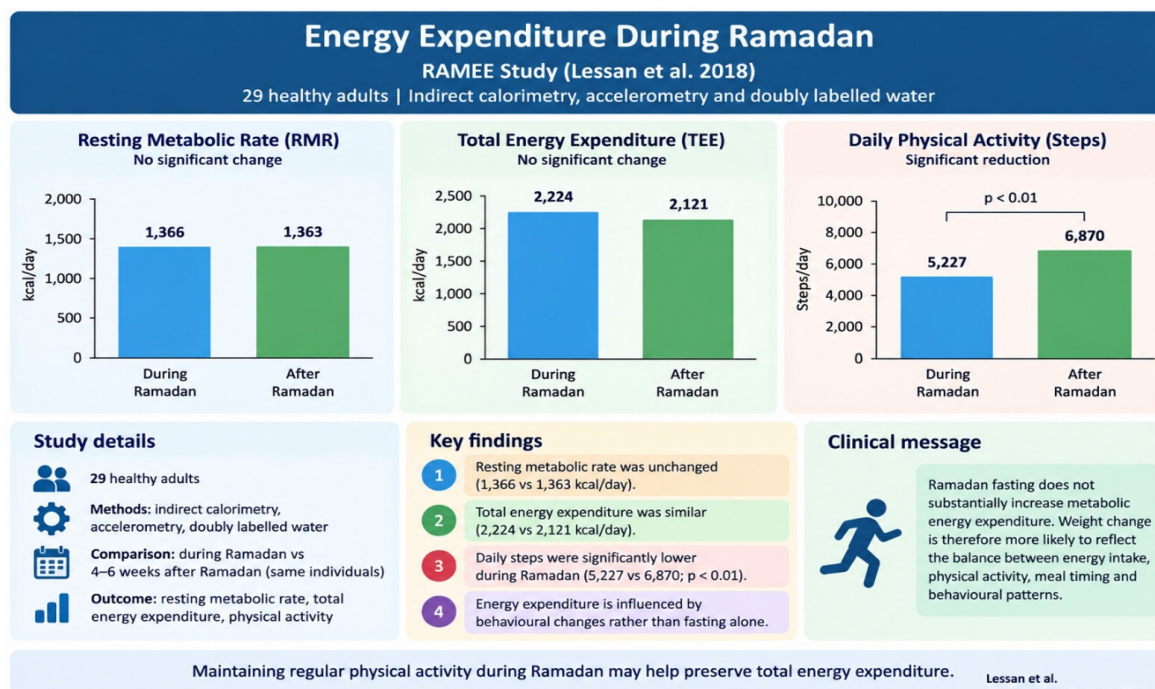


Figure 4: Energy expenditure during Ramadan.

Physical Activity

A lot of people think that when they are fasting, they should avoid exercise altogether, but that is not entirely true, while it is probably not a good idea to overexert our bodies, especially on long or hot days when we are not eating or drinking. Most healthy adults do not need to be completely inactive. In fact, some physical activity can be beneficial, as long as persons not pushing them self too hard. It is all about finding a balance that works for you and your body (Figure 5). The principal challenge is exercise timing. When person is fasting, it's usually accepted to do some light exercise, like going for a walk. But if you are going to do something more intense, it's probably better to wait until after you have eaten and had something to drink, like after

Iftar [12]. One thing that works well is walking after Iftar, because it gets you moving and can also help your body handle the food you just ate [12]. This could be the wisdom for keeping Taraweeh pray after iftar.

If Ramadan is accompanied by weight loss and inadequate protein intake, loss of lean mass may occur alongside fat loss [13], Resistance exercise deserves greater attention [14]. Resistance training combined with adequate protein intake may help preserve muscle mass, particularly in older adults [14]. When you have diabetes, you need to be careful when you are active near the end of a fasting period. This is because there is a risk of hypoglycaemia [4]. It's a good idea to think about what you are going to do and when, so you can stay safe and healthy.

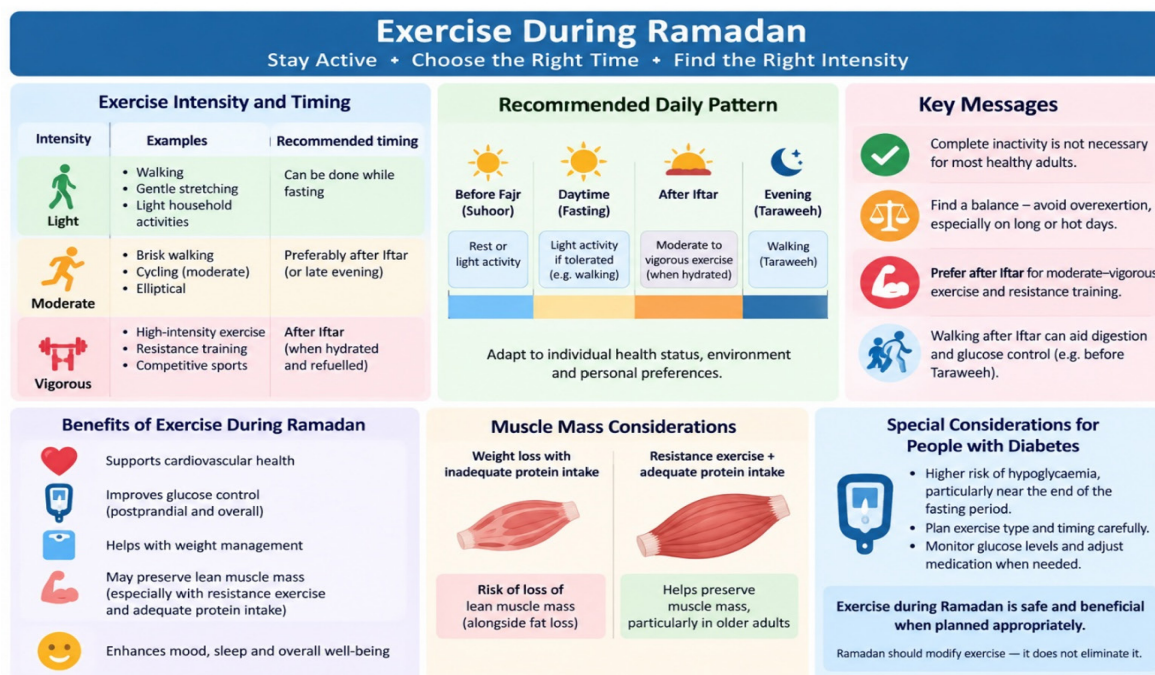


Figure 5: Physical activity management during Ramadan.

Exercise Timing During Ramadan

Exercise is a crucial part of a healthy lifestyle, but when it comes to Ramadan, we don't really know the best time to do it (Figure 6). Despite being so important, there hasn't been much research on this topic. Researchers, led by Trabelsi et al. [35], looked at how aerobic exercise affects the body when done on an empty stomach versus after eating. They studied 19 physically active men during the month of Ramadan, dividing them into two groups: one that exercised while fasting and another that exercised after eating. When people exercised on an empty stomach, they lost about 1.9% of their body weight. On the other hand, those who ate before working out lost around 2.6% of their body weight. What's interesting is that the people who exercised while fasting saw a significant drop in body fat - about 6.2%. However, exercising on an empty stomach also had some other effects on the body. For example, it changed some markers related to how well the body is hydrated and how the kidneys are working. This included increases urine concentration, urea, creatinine, and uric acid levels.

Exercise during Ramadan needs to be balanced. When you exercise while fasting, it can help some healthy people lose body fat, but there's a risk of dehydration, especially in hot weather or when fasting for a long time. This is important to consider when making exercise plans for Ramadan [36,37]. Consequently, exercise timing should be individualized according to age, fitness, comorbidities,

fasting duration, environmental temperature and exercise intensity. New studies have taken a closer look at when we exercise, using the latest tools to track glucose levels. A randomized crossover study in Kuwait [38] investigated 32 adults with type 1 diabetes performing remotely supervised combined aerobic and resistance exercise three times weekly, either during the afternoon before Iftar or during the evening after breaking the fast. Regular exercise can help keep your blood sugar levels in check. When people exercised, their glucose levels were lower on those days, and even the next day, if they worked out in the evening. This is a big deal because it means that exercise can be a safe and helpful way to manage blood sugar, even when done from home with some guidance. Plus, exercising in the evening might have extra benefits for your glucose levels. This research is important for lifestyle medicine because it brings together three new approaches: physical activity + digital supervision + continuous physiological monitoring. It also supports a move away from generic advice such as "avoid exercise while fasting" toward personalized exercise prescriptions.

For many people, doing light exercise is okay when they're fasting, but it's better to do more intense workouts or strength training after eating and had something to drink, like after Iftar. This way, they can make sure they are hydrated and have the energy they need.

The clinical message is Ramadan should modify exercise and does not eliminate it.

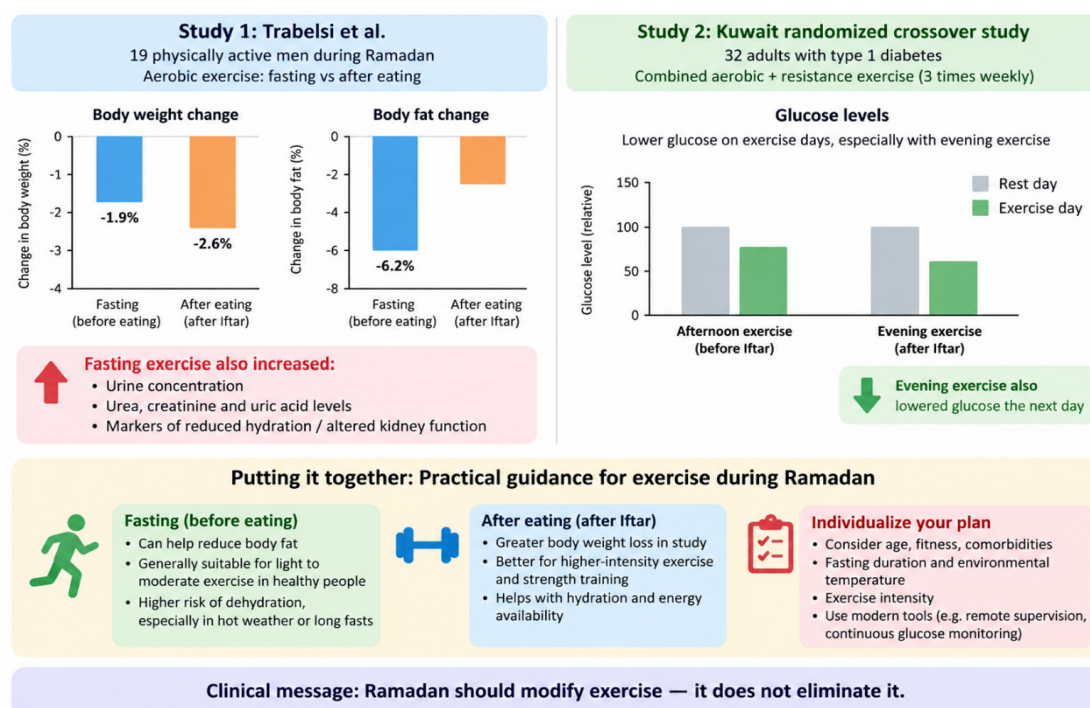


Figure 6: Effect of exercise timing.

Sleep and Circadian Health

The Forgotten Ramadan Pillar Sleep is often overlooked as a crucial part of staying healthy during Ramadan. Late-night social activities, delayed meals, early Suhoor, morning responsibilities and altered working schedules may reduce total sleep duration and fragment sleep architecture [15]. These changes can influence appetite regulation, insulin sensitivity, blood pressure, mood, cognitive performance and daytime energy [15]. Ramadan therefore presents a paradox: dietary timing may potentially improve metabolic health while sleep disruption may counteract some of these benefits [15]. To live a healthy life, it is important to get healthy sleep, so, when people get advice on how to live better, they should also get a plan for sleeping well [15]. This plan should help them get enough sleep

over the whole day, try to go to bed and wake up at the same time every day, not use screens like phones or computers too much before bedtime, and not drink too much caffeine before sleeping. By following Sleep hygiene (Figure 7), people can help their bodies get the rest they need to stay healthy and feel good. Sleep should not be treated as the residual time remaining after Iftar, social activities and Suhoor, Instead Sleep protection should be prescribed as deliberately as nutritional advice. Now more than ever, it is obvious that making healthy lifestyle choices during Ramadan is crucial for health. What we eat, how much we move, and how well we sleep are all connected and play a big role in how our bodies work. Just changing what we eat isn't enough, we need to think about all these things together.



Figure 7: Sleep hygiene.

Hydration

Ramadan is different from other types of intermittent fasting, mainly because fasting persons not just skipping food during the day, but also not drinking any fluids. It is not a good idea to drink a lot of water right before dawn. A better approach is to drink smaller amounts over a longer period to spread out from Iftar to Suhoor. This way can help person to stay hydrated without feeling overwhelmed [1]. Hydration requirements vary according to environmental temperature, fasting duration, physical activity, occupation, age and medical conditions [1]. This is especially relevant in hot climates and among individuals undertaking outdoor physical work. Water is usually the best choice for drinking and sugary drinks add a lot of calories but do not really help with hydration [16]. Tarabeih et al. [16] looked at how drinking more water at night during Ramadan affects the kidneys. They found that people who drank 2-3 liters of water between Iftar and Suhoor had healthier kidney signs, like lower serum creatinine and urea and higher eGFR. This suggests that drinking enough water at night might help keep kidneys working well during Ramadan fasting. Excessive caffeine intake during Ramadan, particularly during the evening, may contribute to sleep disturbance in susceptible individuals and may also increase urinary frequency, potentially complicating overnight hydration [45]. Patients with heart failure, advanced kidney disease or other conditions requiring individualized fluid management should not be given generic hydration targets; advice should be individualized clinically [17-20].

Psychological Well-being

Mindfulness and Stress in Ramadan is about more than just what we eat. It is also a time for thinking deeply, being patient, controlling our desires, feeling thankful, and coming together with others. These traits could lead to a significant chance to improve health through behavioural changes. Eating can be a personal thing, and there are different ways to think about it. Some people talk about "mindful eating" and "intuitive eating" - these are two ideas that are related, but not the same [21]. Mindful eating is all about paying attention to your food, noticing how hungry or full you are, and tasting the Flavors. It's like being present in the moment, while you are eating, and not getting distracted by other things. On the other hand, intuitive eating is a bigger idea that is not just about how you eat, but also about why

and what you eat. It's about listening to your body, and eating when you are hungry, stopping when you're full. It's also about not being too hard on yourself and allowing yourself to enjoy all kinds of food. Both ways of thinking can help people develop healthier relationships with food and get away from strict diet rules. But while mindful eating is more about the actual act of eating, intuitive eating is a whole philosophy that guides your choices around food. It's about respecting your body and finding a balance that works for you [22]. Eating mindfully can be a great way to stay healthy during Ramadan. When person is fasting, it can be tempting to eat too much or too quickly when you finally get to eat (23). But mindful eating can help to slow down and make better choices [23]. This means paying attention to how hungry or full you are, eating slowly, and not getting too distracted by everything else going on around you. It is also important to remember that just because you are fasting during the day, it doesn't mean you need to eat a huge meal at night.

The World Health Organization has some great tips for eating during Ramadan, like eating slowly, not overeating, and focusing on healthy foods like vegetables, whole grains, and lean proteins [24]. Mindful eating can help you follow these tips and develop a healthier relationship with food [23]. One of the benefits of mindful eating is that it can help you tune in to your body's hunger and fullness cues, so you can stop eating when you're satisfied, rather than stuffed. It is worth noting that while intuitive eating - which is all about listening to your body's hunger and fullness cues - can be helpful for developing a healthy relationship with food, mindful eating might be more useful during Ramadan. This is because Ramadan has a set schedule for eating, which can make it easier to plan out your meals and snacks. Overall, eating mindfully during Ramadan can be a great way to take care of your physical and mental health (24). By slowing down, paying attention to your body, and making healthy choices, you can navigate the challenges of fasting and feasting with more ease.

Ramadan can be a great time to set goals. Instead of trying to make lots of big changes, health care providers might ask patients to pick just one or two things they really want to work on. This could be something like taking a walk every day, cutting out sugary drinks, sleeping better, quitting smoking, or eating less processed food. By focusing on just a few things, people can make real progress and build healthy habits that last. It is a good way to make small changes

that can add up to make a big difference. The spiritual emphasis on self-discipline may reinforce motivation when lifestyle advice is delivered respectfully and in a culturally congruent manner.

Social Connection: Ramadan is a special time that helps people connect with their families and communities in a strong way, and this kind of social connection is a big part of living a healthy lifestyle [25]. Shared Iftar, charitable activities and family gatherings may strengthen social relationships and reduce isolation. These benefits should be recognized as genuine components of health [25]. But at

Table 1: Comparison between mindful and intuitive eating.

Domain	Mindful Eating	Intuitive Eating
Core concept	Conscious, non-judgmental awareness of eating	Eating guided primarily by internal body cues
Main- focus	How a person eats	Why, when, and what a person eats
Hunger awareness	Recognizes hunger without requiring immediate eating	Encourages responding to physiological hunger
Satiety	Encourages slow eating and recognition of fullness	Uses fullness as a major guide for stopping eating
Meal timing in Ramadan	Easily adapted to fixed Iftar–Suhoor schedule	Less directly applicable because eating times are externally determined
Iftar application	Helps reduce rapid eating and compensatory overeating	May help recognize fullness, but hunger can be intense after fasting
Food choice	Encourages deliberate awareness of food quality and portions	Rejects rigid food rules while emphasizing body responsiveness
Emotional/social eating	Promotes awareness of emotional and environmental triggers	Encourages distinction between physical and emotional hunger
Potential Ramadan benefit	Portion control, slower eating, improved eating awareness	Healthier long-term relationship with food
Evidence	General evidence supports improved eating behaviours; Ramadan-specific trials limited	Evidence supports eating-related psychological outcomes; Ramadan-specific evidence limited
Ramadan suitability	High—particularly practical at Iftar and Suhoor	Moderate—useful as a complementary approach
Lifestyle-medicine role	Practical behavioural tool during Ramadan	Broader long-term eating philosophy

Tobacco and Harmful Substance Avoidance

Ramadan provides a particularly powerful opportunity for tobacco cessation because individuals who smoke already demonstrate an ability to abstain for prolonged periods during daylight hours [26]. Clinicians can reframe this experience constructively: If abstinence is achievable during fasting hours, can it be extended beyond Iftar and ultimately beyond Ramadan? Instead of just telling smokers to stop, health care providers can use Ramadan as a chance to offer proven methods to help them quit, like counselling and medicine, if it's right for the patient. The month may therefore function as a culturally meaningful cessation window, converting temporary abstinence into permanent behavioural change [27].

the same time, getting together with people can also lead to having big meals, lots of desserts, and eating late into the night. The goal should therefore not be to discourage Ramadan social traditions but to make the healthy choice the socially normal choice. Families can serve smaller portions, provide water instead of sweet beverages, increase vegetables and fruit, reduce fried foods and incorporate family walks after Iftar [24]. This changes the way we think about lifestyle interventions, moving away from just being something each person is responsible for, and towards an approach that involves the whole family and community.

Ramadan and Cardiovascular Health: Changes in body weight, blood pressure, glucose and lipid metabolism have generated substantial interest in Ramadan fasting as a potential cardiometabolic intervention. A large systematic review and meta-analysis [2] involving 91 studies and 4,431 adults reported modest favourable changes in several cardiovascular risk markers, including HDL cholesterol and LDL cholesterol. New research also shows that there are positive changes in many areas related to metabolic syndrome. It is worth noting that previous studies did not show a big increase in heart problems during Ramadan, compared to when people did not fast [28]. However, each person's risk is different and can vary a lot.

These results don't mean that fasting is good for everyone's heart. Some people, like those with serious heart problems, many health is-

sues, or complicated medication schedules, need to be evaluated on a case-by-case basis. It is important to know that lifestyle medicine should work together with the right medical treatment, not replace it.

Diabetes: From Glucose Management to Whole-Person Care, diabetes is a big deal when it comes to chronic diseases that people must deal with during Ramadan. Managing diabetes during Ramadan is not just about dealing with low or high blood sugar and adjusting medication. While these things are still important, looking at the bigger picture can be helpful. This means thinking about the kind of food you eat, when you eat it, how much you move around, how much water you drink, how well you sleep, your weight, how you're feeling mentally, and keeping track of your condition. By considering all these factors, patients can take a more holistic approach to managing their diabetes during Ramadan. Persons with diabetes need to be checked before Ramadan and make an individual plan. The American Diabetes Association has some specific tips for people who fast for religious reasons, including checking health carefully before you start fasting [29]. Some other guidelines, like the IDF-DAR [4], also showed that persons should figure out how risky fasting might be for them, learn about how to stay healthy, and get a personalized plan. This way, persons with diabetes can fast safely and stay healthy [4]. People who are at high risk should be told not to fast if it's likely to cause health hazard to them [4]. If someone can fast safely, they should get proper guidance before Ramadan starts, not after something goes wrong [4]. This way, they can be prepared and avoid any health hazards. It is better to be safe than sorry, so it's crucial to talk to these patients beforehand and make sure they know what to do.

A Proposed Lifestyle Medicine - Ramadan Clinical Pathway (Almoutaz Model)

Taking care of people during Ramadan is an ongoing process that focuses on the individual's needs. It starts before Ramadan, and continues after, to help people maintain healthy habits (Figure 8). A helpful approach is to break it down into steps. First, we identify any health risks related to fasting, such as diabetes or heart problems. Then, we tailor our advice to each person's specific needs, considering their

health conditions, treatments, and personal goals. Next, we prepare them for fasting by educating them on healthy eating, exercise, and sleep habits, and by adjusting their medication if needed. When Ramadan starts, we emphasize the importance of healthy nutrition, staying hydrated, being physically active, getting enough sleep, and recognizing warning signs of potential health problems. We also closely monitor how people are doing during fasting, checking on their health and behaviour. Additionally, we provide ongoing support from healthcare professionals, family, and community to help people stay on track. Finally, after Ramadan, we work to help people keep up the healthy habits they developed during the fasting period. This approach helps to move Ramadan care away from just giving advice on fasting and towards a more structured and ongoing management of lifestyle and health. By doing so, we can better support people in maintaining healthy behaviours throughout the year.

Assess: Evaluate cardiometabolic disease, medications, nutritional status, physical activity, sleep, hydration requirements and relevant fasting risks.

Personalise: Understand the patient's health priorities, cultural practices, work schedule and previous Ramadan experience.

Prepare: Establish nutrition, exercise, hydration, sleep and medication plans before Ramadan.

Fast safely: Encourage healthy Iftar and Suhoor patterns, appropriate physical activity, adequate overnight hydration and symptom awareness.

Monitor: Keep an eye on your weight, blood pressure, and glucose levels when necessary. Also, pay attention to any symptoms you're experiencing, and track your physical activity and sleep patterns.

Support: Use family involvement, healthcare teams, digital monitoring and behavioural coaching.

Sustain: Convert successful Ramadan behaviours into long-term habits after Eid. This last part is crucial.

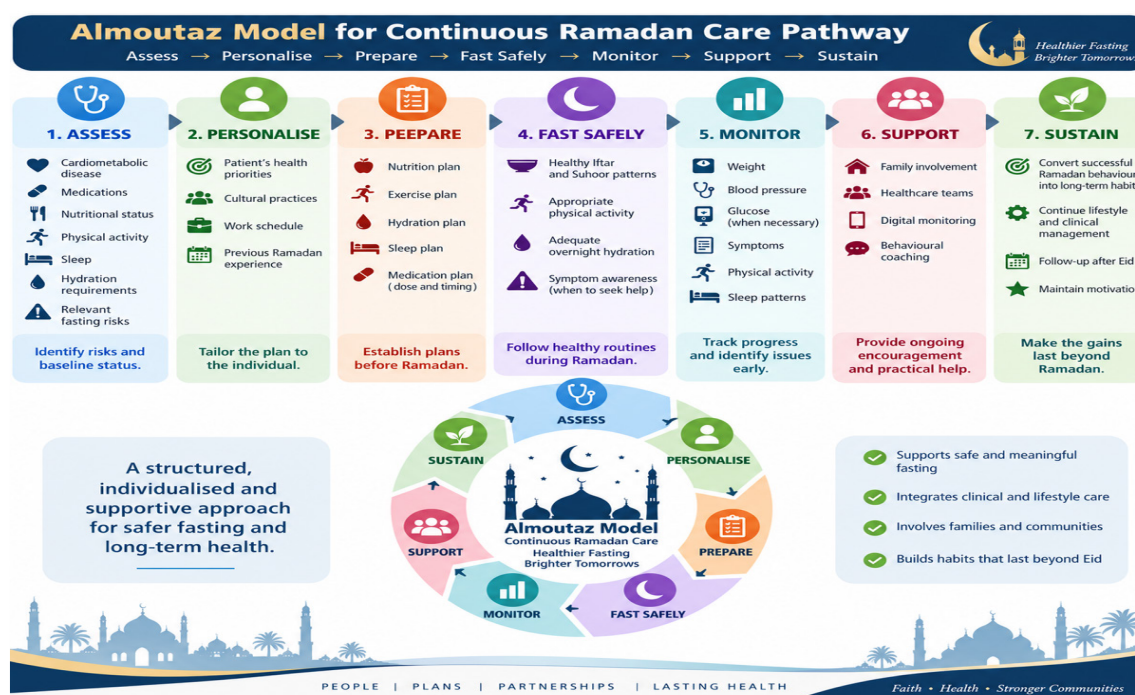


Figure 8: Almoutaz Model for continuous Ramadan care pathway.

The biggest benefit of lifestyle medicine might not be what happens while changing habits, but what sticks after that. It is all about creating new habits that last, even when the initial change is over.

Clinical Opportunities Before, During and After Ramadan

The pre-Ramadan consultation should ideally occur several weeks before fasting begins and should assess chronic disease stability, medications, previous fasting experiences, dietary patterns, activity, sleep and individualized risks [4]. During Ramadan, healthcare contact should focus on adherence, symptoms, hydration, glucose where appropriate, physical activity, sleep and practical barriers. The post-Ramadan consultation is equally important but frequently neglected [3]. It provides an opportunity to evaluate changes in weight, blood pressure, glucose, dietary behaviour and physical activity and to identify behaviours worth maintaining [4,30]. Evidence From Clinical and Randomized Trials Although much of the Ramadan literature is observational, an expanding body of interventional evidence demonstrates that the health effects of Ramadan are modifiable. Importantly, these studies suggest that outcomes are determined not simply by fasting itself but by the accompanying behaviours; including nutrition, physical activity, education, self-monitoring, and treatment adjustment. This concept strongly supports viewing Ramadan through a lifestyle medicine framework. So, the clinical message is taking care of health during Ramadan should be a three-part process: getting ready, getting support, and keeping it up.

Ramadan Focused Education and Lifestyle Intervention (Figure 9)

One of the most reliable studies on this topic was a large-scale international trial conducted by Ibrahim et al. [31]. In this study, researchers wanted to find out if giving people with type 2 diabetes special guidance and support before Ramadan would help them manage their condition better. The study involved 506 patients with diabetes who were randomly assigned to either receive special Ramadan-focused education and personalized adjustments to their medication, or to continue with their usual care. The patients in the first group got a thorough check-up before Ramadan, as well as advice on what to eat and how to stay active during the fasting period. They also learned how to monitor their blood sugar levels, recognize the signs of low blood sugar, and adjust their treatment plan as needed. When it comes to severe hypoglycaemia, the group that received special care during Ramadan had a much lower risk - about 80% lower - compared to those who received the usual care. Both groups saw an improvement in their HbA1c levels, but the group with structured Ramadan care had a significantly bigger improvement. The people in this group also lost weight and had higher levels of good cholesterol, although these differences weren't quite big enough to be considered statistically significant. Overall, it seems that getting special care during Ramadan can make a big difference in managing blood sugar levels and staying healthy. This study is an important study because it did not just focus on changing patients' medication. Instead, it took a more holistic approach by combining education, healthy eating habits, regular physical activity, monitoring, and personalized treatment. This shows that looking at the big picture and making lifestyle changes can be beneficial. By taking a comprehensive approach, we can see the potential benefits of treating the whole person, not just their symptoms. This kind of integrated approach can be a corner stone in the field of lifestyle medicine.

fast, people should get ready and learn about a few key things. This includes what to eat, how to check blood sugar levels, when to take medicine, and how to stay active. It's also crucial to know the signs of low blood sugar and when it's necessary to stop fasting. By teaching people these things before Ramadan, we can help them have a safer and healthier experience while fasting. This way, they can make informed decisions about their health and well-being during this special time.

These results have a bigger impact that goes beyond just diabetes. They show that Ramadan is a time of year when people's behaviour changes in a predictable way, which means it is a chance for people to make healthy lifestyle changes before problems start, rather than just treating health issues after they happen. Focused Pre-Ramadan Education Trial [33] is another controlled intervention involving 320 people with type 2 diabetes compared standard care with focused individualized education before Ramadan. Among the 120 participants receiving focused education, hypoglycaemia during fasting occurred in only 4.1%, compared with 19.5% among 200 participants receiving standard care. It's also worth noting that the number of people in the intervention group who got their HbA1c levels under 7% increased dramatically, from 20.8% before Ramadan to 55.8% after. Additionally, their LDL cholesterol levels went down significantly. On the other hand, body weight remained relatively stable in both groups, with no major changes observed.

This study illustrates an important principle: successful Ramadan lifestyle medicine should not be judged exclusively by weight reduction. Improvements in glucose control, hypoglycaemia prevention, dietary behaviour, patient knowledge, self-efficacy and cardiovascular risk factors may occur independently of major changes in body weight. Digital health may further strengthen lifestyle support during Ramadan. In a pilot randomized controlled trial involving 37 people with type 2 diabetes, participants received either Ramadan-focused education alone or education supplemented by telemonitoring, individualized goal setting and personalized feedback [34]. Participants receiving telemonitoring were substantially less likely to experience hypoglycaemia, with an odds ratio of approximately 0.13 compared with the education-only group. This small study brings up a big idea for taking care of people during Ramadan; helping them make good choices all the time.

Regular healthcare check-ups might only happen once before Ramadan, but people with health conditions must make choices about what they eat, how much they exercise, and when they take their meds every single day during Ramadan. Luckily, there are some tools that can help fill in the gaps like remote monitoring, health apps on your phone, special devices that track your glucose levels, messaging systems, and even virtual coaches who can give you advice on how to live a healthy lifestyle.

The future Ramadan lifestyle clinic

The future Ramadan lifestyle medicine clinic (Figure 10) could provide a structured continuum of care extending beyond conventional pre-fasting advice. A comprehensive pre-Ramadan assessment would identify cardiometabolic, nutritional, physical activity, sleep, hydration and medication-related risks, followed by an individualised lifestyle prescription aligned with patient priorities and fasting practices. During Ramadan, digital monitoring of relevant clinical and behavioural outcomes could enable timely personalised feedback and facilitate behavioural adaptation. Healthcare professionals, family support and digital technologies could reinforce adherence and fasting safety. Importantly, post-Ramadan maintenance would identify successful behaviours worth sustaining, transforming Ramadan from

Nassar et al. [32] conducted a large study in Egypt examining structured Ramadan education in people with diabetes. The study included more than 900 participants, with 407 receiving structured diabetes education and 494 receiving standard education. Learning about safe fasting during Ramadan is important. Before starting to

a temporary fasting period into an opportunity for long-term lifestyle improvement.

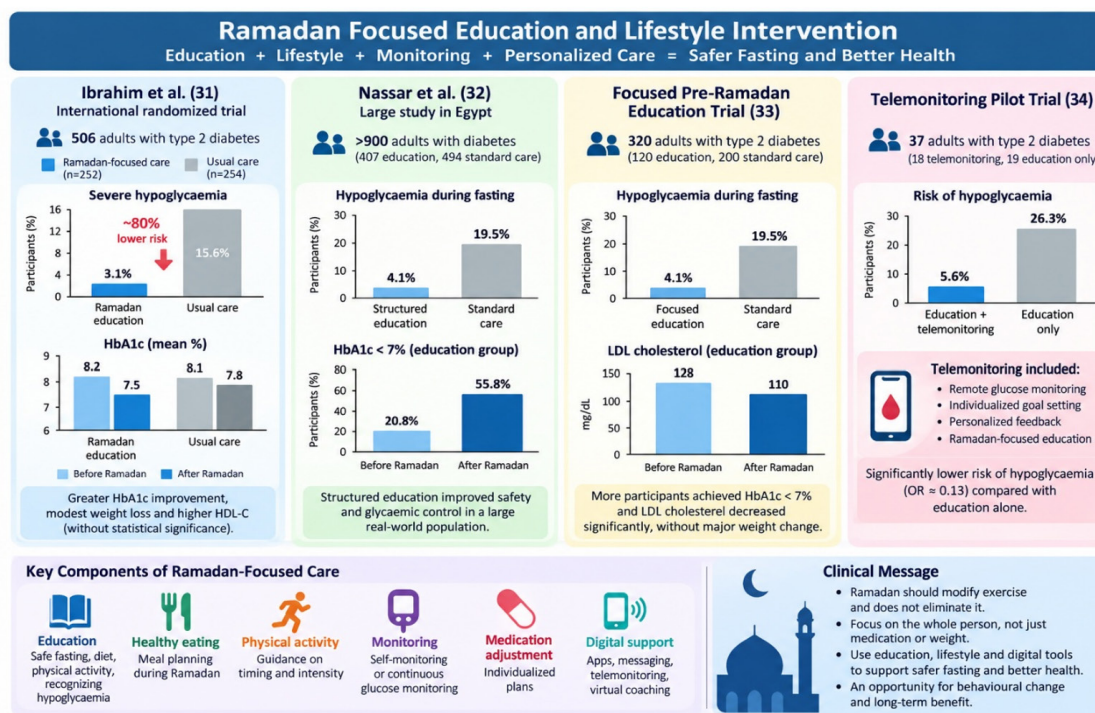


Figure 9: Ramadan Focused Education and Lifestyle Intervention.

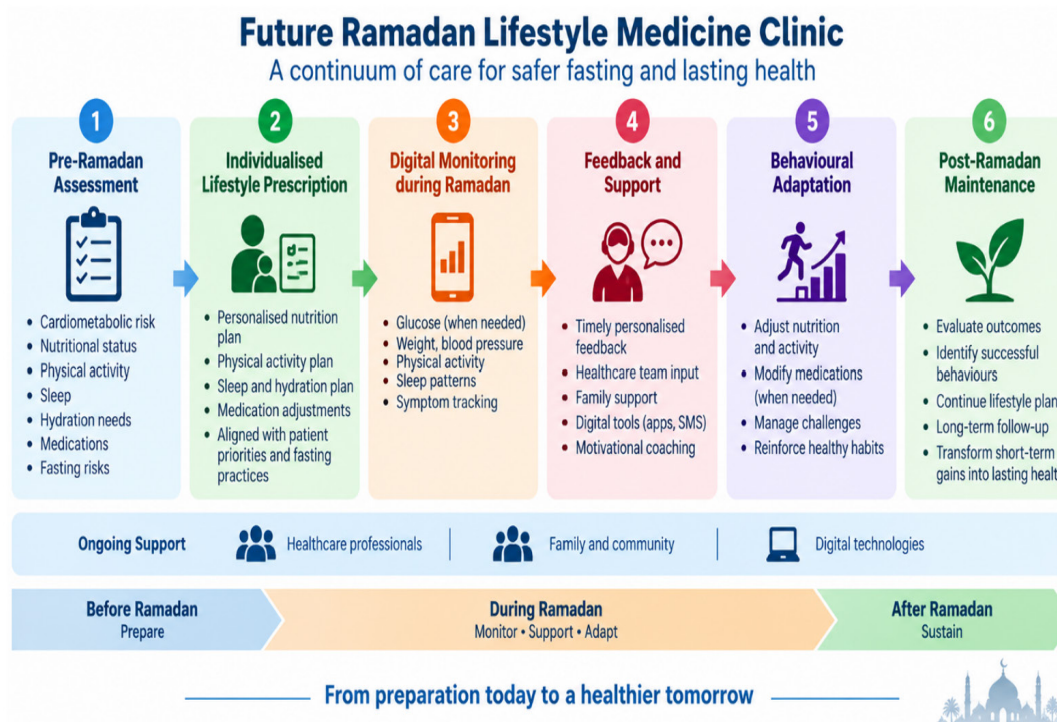


Figure 10: Future Ramadan lifestyle clinic.

Lifestyle Intervention in Emirati Adults with Metabolic Syndrome

Lifestyle Intervention in Emirati Adults with Metabolic Syndrome Research from the United Arab Emirates offers more information about how Ramadan can affect our daily habits and overall way of life. A prospective study in Emiratis from Ajman [39] with metabolic syndrome evaluated metabolic markers, dietary intake and body composition during Ramadan while encouraging healthy lifestyle changes. There was a notable decrease in body weight, from around 103.9 kg to 102.1 kg, and a reduction in waist circumference, from approximately 123 cm to 119 cm. Interestingly, about 40% of the participants became more physically active, which can be partly attributed to their increased engagement in prayer-related activities.

However, despite these positive changes, the overall energy intake didn't decrease significantly. In fact, fat consumption increased by around 23%, which is a concern. Furthermore, both fasting glucose and HbA1c levels showed a modest increase, suggesting that there is still room for improvement in terms of overall health and wellness. This study demonstrates the complexity of Ramadan metabolism. Improvements in body weight and central adiposity do not necessarily translate into simultaneous improvement in every metabolic parameter. It also emphasizes an important lifestyle medicine message: Fasting cannot compensate completely for poor dietary quality. The finding that dietary fat intake increased despite reduced meal frequency illustrates why Ramadan counselling should address what patients eat rather than focusing solely on when they eat.

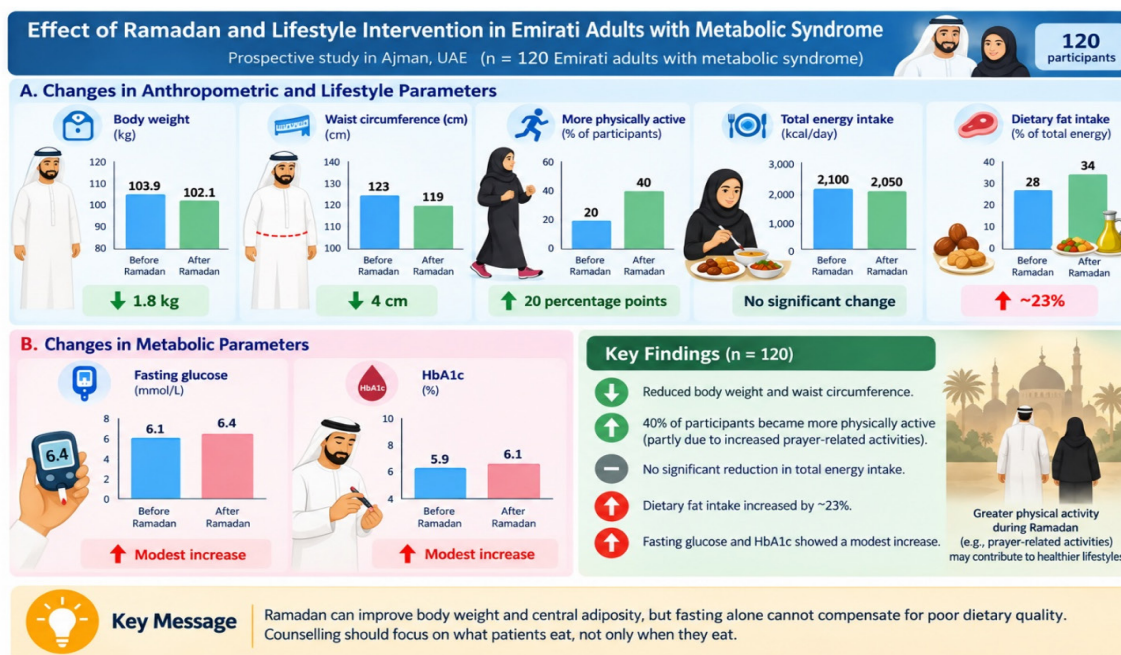


Figure 11: Lifestyle Intervention in Emirati Adults with Metabolic Syndrome study.

The optimum Care and Continuous Glucose Monitoring study (40) investigated a special plan to help people with high-risk diabetes who still wanted to fast during Ramadan. This plan included teaching people about how to manage their diabetes during Ramadan, using a device to constantly check their blood sugar levels, adjusting their

medication before Ramadan, and giving them access to expert medical help. This research is especially important because it shows a shift from only focusing on health during Ramadan to managing health risks all the time.

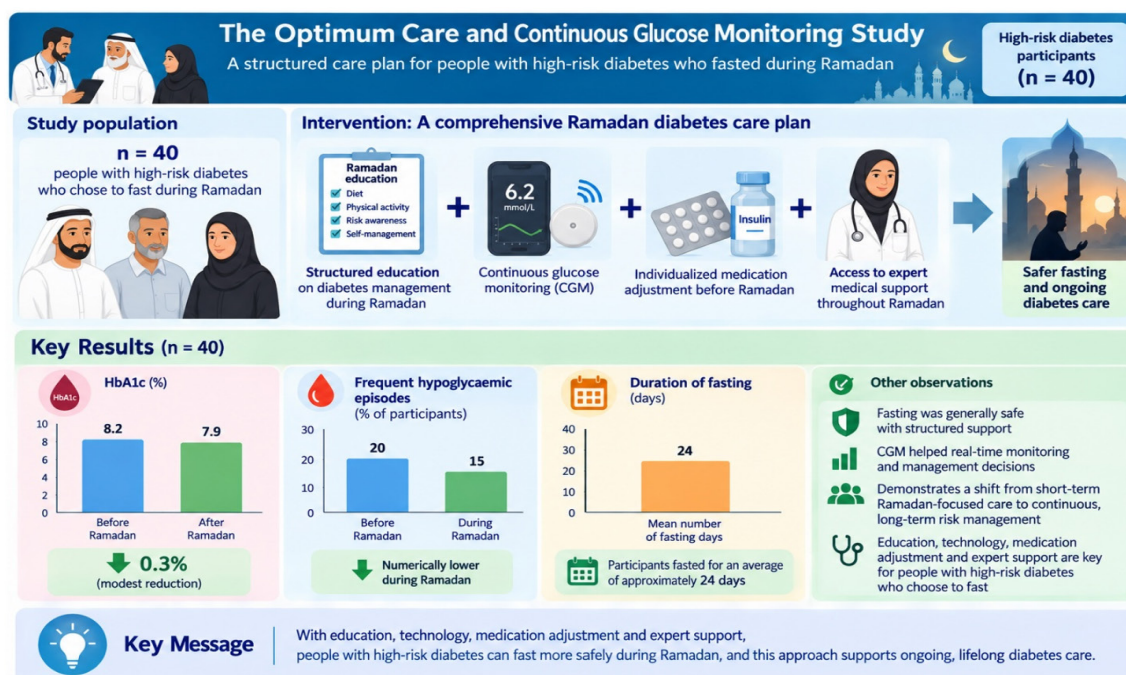


Figure 12: The optimum Care and Continuous Glucose Monitoring study.

A similar study among people with type 1 diabetes combined Ramadan-focused education, dietary advice, insulin adjustment and flash glucose monitoring. Participants fasted for an average of approximately 24 days. HbA1c decreased from 8.2% before Ramadan to 7.9% afterward, while the proportion experiencing frequent hypoglycaemic episodes was numerically lower during Ramadan than before it. So, just because some people with health risks can fast without

issues, it doesn't mean everyone can do it safely. What these findings really show is that if people with higher risks still want to fast, they need to be careful and get proper guidance from medical professionals to minimize potential harm. This includes getting educated on the risks, being closely monitored, and having a personalized plan in place.

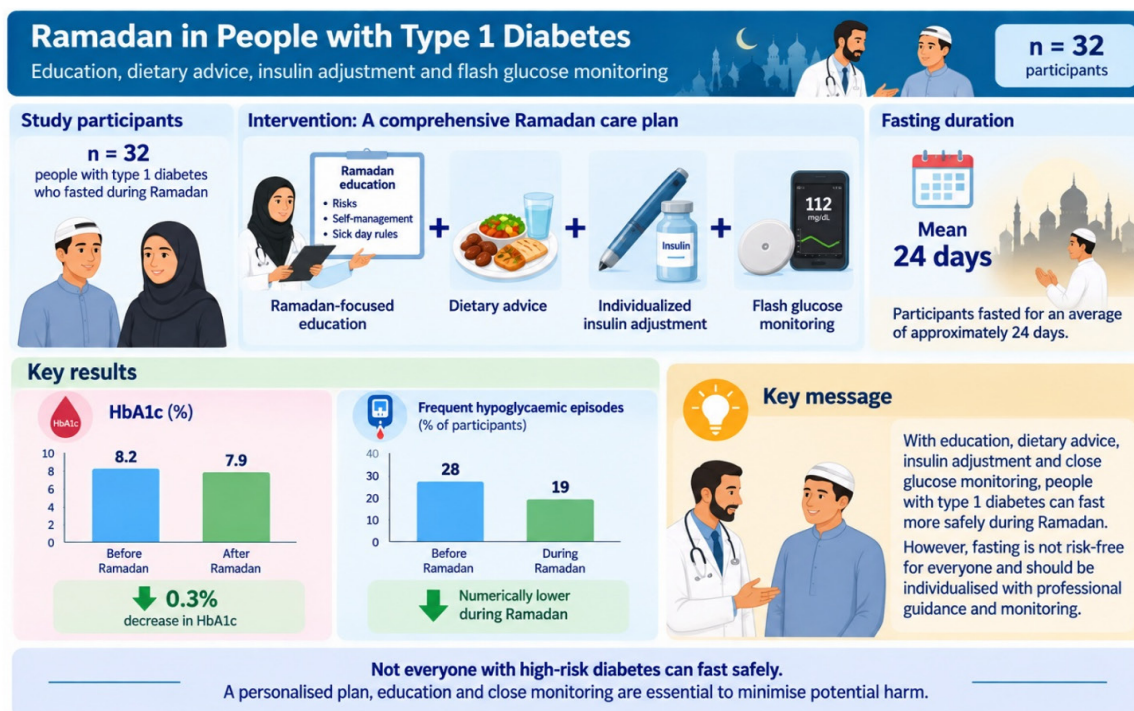


Figure 13: Type 1 diabetes combined Ramadan-focused education study.

What Do the Trials Collectively Show?

It's clear that Ramadan fasting is more complex than just one simple action. What really matters is how fasting interacts with other things

Table 2: Studies on lifestyle medicine during Ramadan.

we can control in our daily lives, like our overall lifestyle choices. The results of studies show that it's this combination that affects our health outcomes (table 2).

Study	Population	Intervention	Major finding	Lifestyle medicine relevance
Ibrahim et al. study [31]	506 adults with T2D	Ramadan education + individualized treatment adjustment	Severe hypoglycaemia substantially reduced; HbA1c improved	Supports integrated pre-Ramadan care
Nassar et al. study [32]	>900 people with diabetes	Structured Ramadan education	Improved safety and glycaemic management	Education and self-management
Focused education study [33]	320 adults with T2D	Individualized pre-Ramadan education	Hypoglycaemia 4.1% vs 19.5%	Behavioural preparation reduces risk
Telemonitoring RCT study [34]	37 adults with T2D	Education + telemonitoring and feedback	Hypoglycaemia risk reduced	Digital lifestyle support
Trabelsi et al. study [35]	19 active men	Fasted vs fed aerobic exercise	Weight decreased in both; fat percentage decreased with fasted training	Exercise timing matters
Ramadan exercise crossover trial [38]	32 adults with T1D	Pre- vs post-Iftar supervised exercise	Glucose improved with exercise; evening activity showed prolonged benefit	Personalized exercise prescription
Ajman UAE study [39]	19 adults with metabolic syndrome	Ramadan fasting + healthy lifestyle advice	Weight and waist decreased; dietary quality remained important	Demonstrates multidomain effects
Optimum diabetes care study [40]	High-risk diabetes	Education + glucose monitoring + treatment adjustment	Improved ability to manage fasting risk	Continuous monitoring model

Interpretation of the Trial Evidence

These studies support five major conclusions. Firstly, education plays a big role in how our bodies react to fasting. Secondly, exercise is still important when you are fasting during Ramadan, but you need to think about when and how hard you work out and make sure you are drinking enough water. Third, digital monitoring can transform Ramadan management from episodic care into continuous care. Fourth, metabolic outcomes are multidimensional. Weight loss may coexist with deterioration in dietary quality or individual biochemical parameters; consequently, weight alone is an inadequate measure of successful Ramadan lifestyle intervention. Finally, the strongest interventions combine several components rather than addressing one lifestyle behaviour in isolation.

Critical Appraisal of Current Ramadan Lifestyle-Medicine Trials

The available clinical trials suggest that structured preparation, education, glucose monitoring, telemedicine and appropriately timed exercise can improve selected outcomes during Ramadan (table). Nevertheless, the evidence should be interpreted cautiously. The literature remains dominated by relatively small studies, short-term endpoints and interventions focused primarily on diabetes. Few trials have tested Ramadan as a genuinely multidomain lifestyle-medicine intervention incorporating nutrition, physical activity, sleep, stress, social connection and avoidance of harmful substances simultaneously.

Current clinical trials generally support structured lifestyle and diabetes-management interventions during Ramadan; however, the strength of evidence varies considerably across interventions and populations. The most convincing evidence relates to pre-Ramadan education, individualized treatment adjustment, glucose monitoring, and continued clinical support, whereas evidence regarding specific lifestyle components such as exercise timing remains limited. A recent study on type 2 diabetes, by Ibrahim et al. [31] and is one of the most notable ones out there. They looked at 506 adults with type 2 diabetes from five countries where most people are Muslims. What they found was that teaching people about Ramadan and adjusting their treatment plans individually made a big difference. It lowered the risk of severe hypoglycaemia by about 80% and improved blood sugar control. This study is strong because it was done in many countries and was very practical, which makes the results more reliable and applicable to real life. However, some participant did not want to be part of the study, and some dropped out, which could affect the results. Also, the study had many variables; like education, behaviour changes, medication adjustments, and more doctor visits, so it's hard to say which part made the biggest difference.

Large educational studies provide broadly consistent findings. Nassar et al. [32] studied 901 people with diabetes and demonstrated benefits from structured Ramadan education addressing diet, physical activity, glucose monitoring and fasting safety. Nevertheless, incomplete methodological information, the open-label behavioural design, potential Hawthorne effects and recruitment from a geographically concentrated Egyptian population reduce causal precision and international generalisability. Similarly, a controlled study [33] involving 320 adults reported markedly less hypoglycaemia with individualized education (4.1% versus 19.5%), but its non-randomized design leaves substantial potential for selection bias and residual confounding. McEwen et al. [41] extended these findings across Egypt, Iran, Jordan and Saudi Arabia. Among 774 adults with type 2 diabetes, individualized education was associated with improvements in BMI and HbA1c and fewer severe hypoglycaemic episodes. Its multicounty setting improves generalisability, although the non-randomized design limits causal inference. Increased reporting of mild-to-moderate hypogly-

caemia among educated participants may reflect greater recognition rather than increased physiological events.

When it comes to managing health, technology can be a corner stone. Some small studies have shown that using digital tools can make a big difference. For example, one study [34] with 37 people found that using a special monitoring system, along with education, helped reduce low blood sugar levels more than education alone. Another study [42] with 85 people found similar results, with people who used remote glucose monitoring having fewer episodes of low blood sugar and better control of their condition. These studies are promising, but we need to do more research to see if these results will hold up in larger groups of people. We need to know if using digital monitoring is feasible, if people will use it, and if it's cost-effective. If it is, it could completely change the way we care for people during Ramadan, shifting from occasional check-ins with a doctor to continuous, responsive support.

Evidence regarding physical activity is substantially weaker. Trabelsi et al. [35] studied only 19 physically active men and suggested greater body-fat reduction with fasted exercise; however, the very small, highly selected population and potential hydration-related changes preclude recommending fasted exercise routinely. A randomized crossover trial of 32 adults with type 1 diabetes provided more rigorous physiological evidence, demonstrating favourable glucose responses to supervised exercise, particularly after Iftar [38]. Nevertheless, its small, young and selected population limits applicability to older and higher-risk patients. Overall, the evidence supports Ramadan as an opportunity for structured, individualized and supported cardiometabolic care rather than fasting as an isolated intervention. Important limitations remain, including small samples, non-randomized designs, short follow-up, heterogeneous interventions and underrepresentation of women, older adults and high-risk populations. Future multicentre trials should isolate individual lifestyle components, incorporate continuous glucose monitoring and patient-reported outcomes, and determine whether benefits persist beyond Ramadan.

Overall Methodological Quality of Current Evidence Research on Ramadan and healthcare shows that people who get special care, like education on managing their condition, monitoring their glucose levels, and adjusting their treatment, tend to do better. A study that looked at 17 different projects on Ramadan and education found that people who got this kind of education were about 81% less likely to have low blood sugar [43]. However, only a few of these studies were similar enough to be compared directly, and they used different methods to collect data [43]. This heterogeneity substantially reduces certainty.

Studies limitations: (Table 3)

One major limitation is that current research does not fully capture the complete picture of how Ramadan affects our overall lifestyle and health. Most have tested: education + medication adjustment + glucose monitoring rather than: nutrition + exercise + sleep + hydration + behavioural health + social connection + tobacco cessation + medical optimization. So, even though we have strong evidence that planning before Ramadan is helpful for people with diabetes, we don't have as much direct evidence to support a comprehensive lifestyle program that includes the six pillars of lifestyle medicine. Most studies focus on short-term results like blood sugar levels, weight, and cholesterol numbers. But they often overlook the important things, like heart problems, hospital stays, kidney damage, and how well people can physically function. One big problem is that there's no long-term follow-up after Ramadan. A lifestyle change should re-

ally stick with you even after Ramadan is over. But most studies stop right after the fasting period, or soon after, so we don't know if the changes people made last. So, the big question isn't about whether people can make healthy changes for a short time, like during Ramadan, but whether those changes can stick and lead to a lasting impact on their lifestyle for the rest of the year.

Can Ramadan be the starting point for people to make real, long-term changes that improve their overall health and wellbeing?

Overall Conclusion of the Critical Appraisal Current trials provide convincing evidence that Ramadan outcomes are modifiable rather than inevitable. Structured education, individualized clinical planning and digital monitoring appear capable of making fasting safer, particularly for people with diabetes. However, the evidence base remains considerably stronger for diabetes safety than for lifestyle medicine itself. The field now requires a transition from studies asking: "Can patients fast safely?" toward trials asking: "Can Ramadan be used as a structured, culturally embedded lifestyle intervention capable of producing sustained cardiometabolic and behavioural improvement?" That transition would move Ramadan research from short-term fasting safety toward comprehensive preventive and lifestyle medicine.

Table 3: The major methodological weaknesses across the literature.

Limitation	Effect on interpretation
Small sample sizes	Imprecise estimates and increased risk of chance findings
Few large multicentre RCTs	Limited high-certainty evidence
Open-label behavioural interventions	Performance and reporting bias
Non-randomized designs	Confounding and selection bias
Heterogeneous populations	Difficult direct comparison between trials
Different fasting durations and climates	Reduced geographical generalizability
Multicomponent interventions	Cannot identify the effective component
Heavy diabetes focus	Limited evidence for broader lifestyle medicine
Short follow-up	Sustainability after Ramadan unknown
Self-reported diet/activity	Recall and social-desirability bias
Limited objective sleep assessment	Major lifestyle pillar insufficiently studied
Rare hard clinical endpoints	Evidence predominantly based on surrogate outcomes

Conclusion

Fasting during Ramadan is a special time when faith, culture, and healthy living come together. It is not just about not eating, because Ramadan also changes how we eat, move, sleep, drink, interact with others, think, and avoid bad habits. All these things combined have an impact on our health. Evidence suggests modest favourable effects on several cardiometabolic outcomes, including body weight, waist circumference, blood pressure, glucose and lipid parameters, but these effects are heterogeneous and strongly influenced by behaviour. The clinical objective should therefore shift from simply helping patients "get through the fast" toward helping them use Ramadan as an opportunity for sustainable health improvement. A comprehensive lifestyle medicine strategy should integrate healthy Iftar and Suhoor patterns, appropriate physical activity, muscle preservation, adequate hydration outside fasting hours, restorative sleep, psychological well-being, social support and tobacco cessation. Patients with diabetes and other chronic diseases require additional risk stratification and individualized medical supervision. Ramadan can be seen as a special time of the year that helps people make healthy changes to their lifestyle. With the right medical check-ups and advice on behaviour, this month of fasting can be more than just a temporary change - it can be a chance to start new, healthier habits that last all year round.

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