



Ramadan Fasting with Insulin-Treated Diabetes: A Narrative Review of Structured Pre-Ramadan Assessment and Reported Outcomes

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Abstract

Religious exemption from fasting exists for people with diabetes and is widely not taken: epidemiological survey found 42.8 per cent of those with type 1 diabetes and 78.7 per cent with type 2 diabetes fasted for at least fifteen days. The clinical question is therefore not whether to permit fasting but how to support it. Older observational data recorded a significant excess of severe hypoglycaemia during Ramadan, particularly in those treated with insulin or sulfonylureas, with reported hypoglycaemia incidence of 13.8 per cent in one cohort and 11.7 per cent in another. More recent work points the other way. In a study of stable, uncomplicated type 1 diabetes managed with structured education and advanced glucose monitoring, hypoglycaemia fell during Ramadan relative to before it, at 0.53 against 0.81 episodes per day, with no severe hypoglycaemia or ketoacidosis. Time above 10 mmol/L rose significantly over the same period, so the improvement was a trade rather than a net gain.

Keywords: Ramadan; Insulin therapy; Hypoglycaemia; Risk stratification; Structured education

Introduction

During Ramadan, observant Muslims abstain from food and drink between dawn and sunset, taking two meals: one before dawn and one after sunset [1,2]. Islamic law exempts people with illness, including diabetes, from the obligation [3].

The exemption is widely not used. Epidemiological survey found that 42.8 per cent of participants with type 1 diabetes and 78.7 per cent with type 2 diabetes fasted for at least fifteen days, and a later multinational study reported 63.6 per cent of those with type 2 diabetes observing the fast [4,5]. Fasting is a matter of personal and religious significance and many people fast irrespective of medical advice [6,7,21]. Systematic overviews of the published studies exist [21], as do national guidelines written for particular communities [33].

This review examines what has been reported about outcomes during Ramadan in insulin-treated diabetes, what structured pre-Ramadan assessment involves, and how reliable the risk-stratification tools are. It concerns the published

evidence and not the management of any individual.

Material and Methods

Search strategy: PubMed and the archives of the major diabetes and endocrine journals were searched for studies of diabetes management during Ramadan. Search terms combined Ramadan and fasting with diabetes, insulin, hypoglycaemia, risk stratification and structured education. Reference lists of the practical guidelines [1] and the principal epidemiological reports [4,5] were screened by hand for primary sources.

Eligibility: Studies were included if they reported glycaemic or clinical outcomes in people with diabetes fasting during Ramadan, evaluated a structured intervention, or assessed a risk-stratification instrument. Guideline documents are cited for their content and are identified as such.

Data extraction and handling: Design, population, diabetes type, treatment and the reported outcome were extracted as published. Whether a cohort was selected for stability and

absence of complications is stated in each case, because the recent favourable results come from such cohorts and the older unfavourable ones do not. This review reports published findings and the content of guidance. It does not advise on whether any individual should fast, nor on the adjustment of insulin or other medication, both of which are matters for the treating clinician and the person concerned. No pooling or re-analysis was performed. Figures 1 to 6 and Tables 1 to 3 reproduce published values only. This is a narrative synthesis and was not registered as a systematic review.

Results

How many fast: A large multinational epidemiological study reported that 42.8 per cent of participants with type 1 diabetes and 78.7 per cent of those with type 2 diabetes fasted for at least fifteen days during Ramadan (Figure 1) [4]. A subsequent study reported 63.6 per cent of those with type 2 diabetes observing the fast [5].

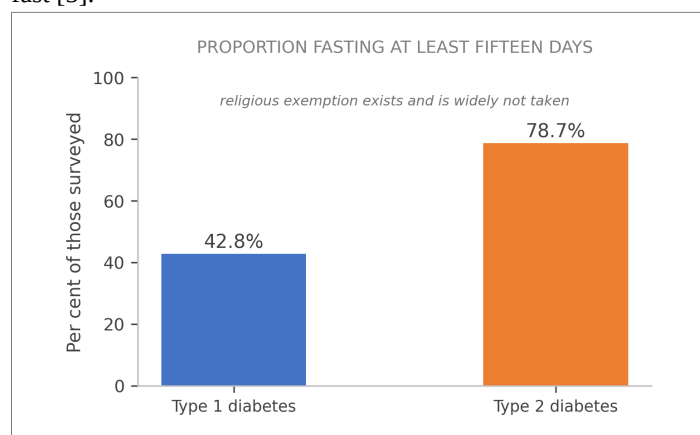


Figure 1: Proportion fasting for at least fifteen days [4]

What the older data recorded: The same epidemiological study reported a significant increase in severe hypoglycaemic episodes during Ramadan compared with other months, particularly among those treated with insulin or sulfonylureas, together with a severe hyperglycaemic event rate of 4 per cent [4,8,31]. Ketoacidosis during Ramadan has been examined separately and its risk critically reappraised [3,24]. The later multinational study recorded a hypoglycaemia incidence of 13.8 per cent, and a primary care validation cohort reported hypoglycaemic episodes in 46 of its participants, or 11.7 per cent (Figure 4) [5,9].

Table 2: Summary of reported findings by element

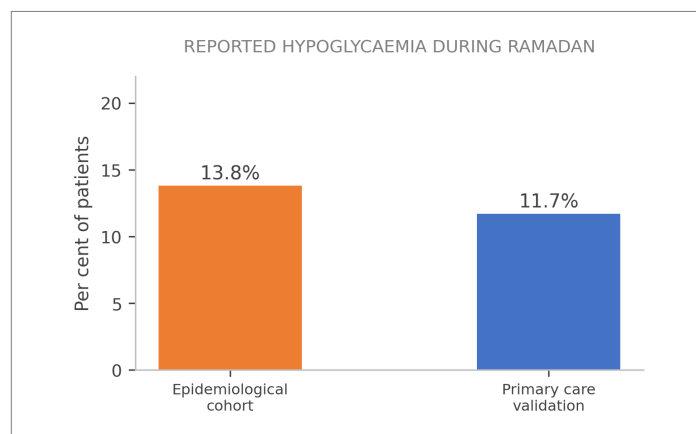


Figure 4: Reported hypoglycaemia during Ramadan in observational cohorts [5,9]

What structured management achieved: A study recruited people with stable and uncomplicated type 1 diabetes, treated by multiple daily injections or continuous subcutaneous infusion, who had chosen to fast. Participants attended structured education, basal insulin was reduced in a controlled fashion, and each was assigned either a sensor-augmented pump or flash glucose monitoring. Rates of hypoglycaemia were significantly lower during Ramadan than before it, at 0.53 plus or minus 0.49 against 0.81 plus or minus 0.69 episodes per day ($p = 0.0015$), and no episodes of severe hypoglycaemia, ketoacidosis, acute kidney injury or hospitalisation occurred (Figure 2) [10].

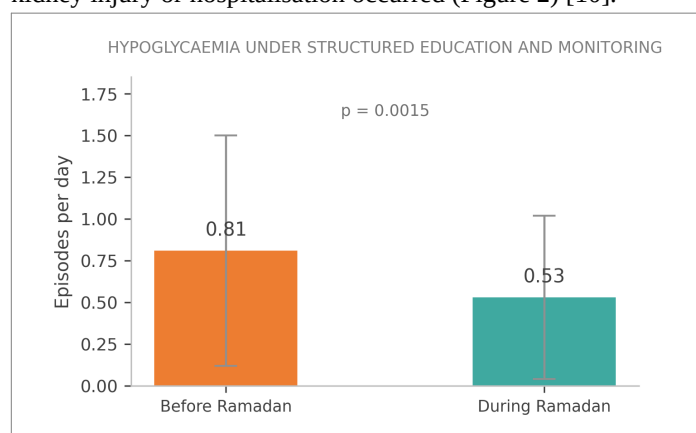


Figure 2: Hypoglycaemia under structured education and advanced monitoring [10]

What was traded for it: In the same cohort, time spent above 10 mmol/L rose significantly, from 42.5 plus or minus 16.4 per cent to 46.7 plus or minus 17.7 per cent ($p = 0.03$). Time in the 4 to 10 mmol/L range fell from 50.9 to 48.8 per cent and time below 4 mmol/L fell from 5.7 to 4.7 per cent, neither difference reaching significance (Figure 3) [10].

Table 1: Outcomes in stable uncomplicated type 1 diabetes with structured education and advanced monitoring [10]

Table 3: Why the two bodies of evidence point in different directions [4,10]

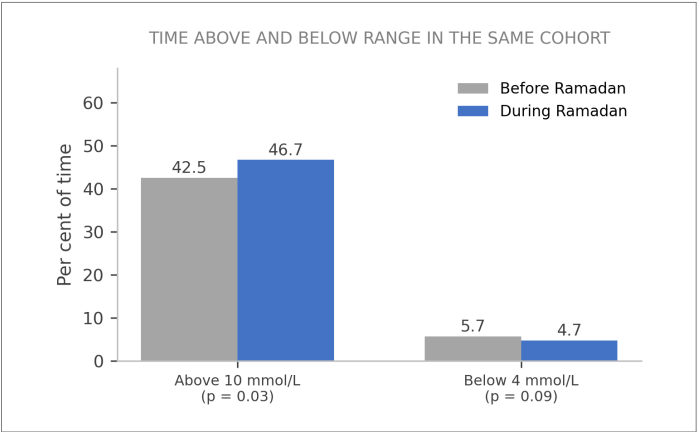


Figure 3: Time above and below range in the same cohort [10]

Outcome	Before Ramadan	During Ramadan
Hypoglycaemia episodes per day	0.81	0.53 (p = 0.0015)
Time above 10 mmol/L	42.5%	46.7% (p = 0.03)
Time in 4 to 10 mmol/L	50.9%	48.8% (p = 0.13)
Time below 4 mmol/L	5.7%	4.7% (p = 0.09)
Severe hypoglycaemia or ketoacidosis	—	None recorded

Insulin dose reduction: A systematic review of insulin dosing in insulin-requiring type 2 diabetes examined which approaches reduce hypoglycaemia. It reported that reducing the pre-Ramadan total daily dose did not subsequently increase rates of hyperglycaemia, ketoacidosis or glycated haemoglobin, and noted a severe hyperglycaemic event rate of 3 per cent in one intervention group against 4 per cent in the earlier epidemiological data [8,11].

Structured assessment: Practical guidelines set out components including risk stratification before the month, structured patient education, individualised medication adjustment, arrangements for glucose monitoring, guidance on recognising when to break the fast, and review afterwards (Figure 5) [1,12]. A risk-categorisation tool was introduced in 2021 to support decisions about fasting [1,13,30]. Earlier iterations of the recommendations date from 2010 and 2020 [12,15], and a prospective study examined the combined effect of dose alteration, monitoring and education [6].

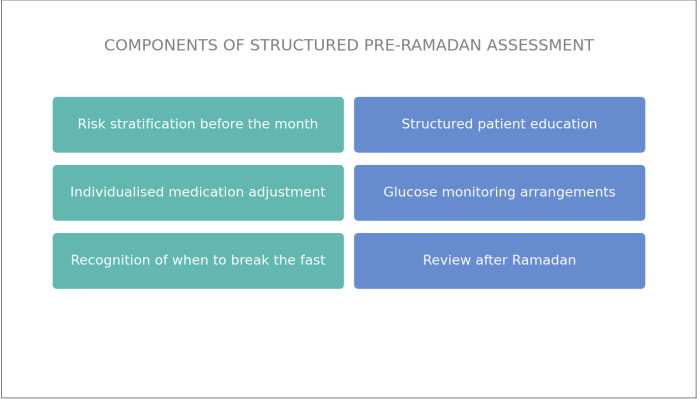


Figure 5: Components of structured pre-Ramadan assessment described in guidance [1,12]

How well the tool performs: A prospective observational study at two centres evaluated the tool in 303 patients, of whom 163 (53.5 per cent) were female, mean age 50.49 plus or minus 17.91 years; 217 (71.6 per cent) had type 2 diabetes and 231 (76.2 per cent) had diabetes for more than ten years (Figure 6). The investigators concluded that further validation is necessary to enhance its predictive accuracy [13]. A separate primary care validation compared outcomes after Ramadan against the pre-Ramadan risk score, and among those reporting hypoglycaemia, ten were in the high-risk group [9].

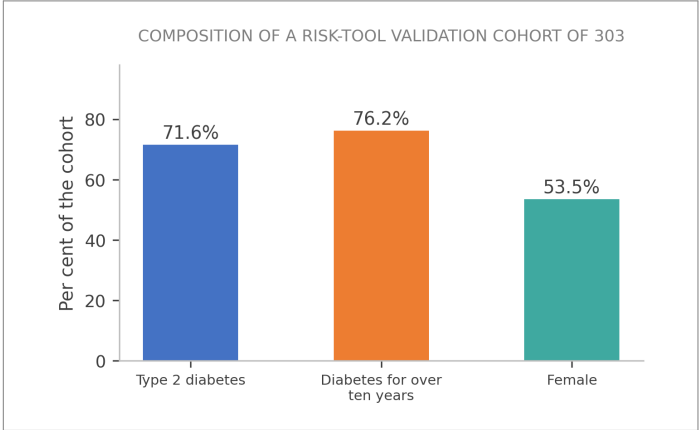


Figure 6: Composition of a risk-tool validation cohort of 303 [13]

Element	What has been reported
Proportion fasting	42.8% type 1, 78.7% type 2 [4]
Severe hypoglycaemia, older data	Significant excess during Ramadan [4]
Hypoglycaemia with structured care	Lower than before Ramadan [10]
Dose reduction	No excess hyperglycaemia or ketoacidosis [8,11]
Risk tool	Requires further validation [13]

Study feature	Older epidemiology	Recent structured-care study
Design	Observational survey	Prospective, single group
Population	Unselected, multinational	Stable, uncomplicated type 1
Monitoring	Routine	Sensor-augmented or flash
Education	Not standardised	Structured programme
Direction of hypoglycaemia	Increased	Decreased

Discussion

The premise of this literature is worth stating first. A religious exemption exists and most people do not use it, with 42.8 per cent of those with type 1 diabetes and 78.7 per cent of those with type 2 fasting at least half the month [4]. Advice framed around whether to fast therefore addresses a decision that has usually already been made, and the useful clinical question is how the month is prepared for.

The two bodies of evidence point in opposite directions, and the difference is explicable. The older epidemiological data found a significant excess of severe hypoglycaemia during

Ramadan in unselected populations receiving routine care [4]. The recent study found hypoglycaemia falling, in people with stable uncomplicated type 1 diabetes who attended structured education, had insulin adjusted in advance and wore continuous or flash monitoring throughout [10]. Those are not the same populations receiving the same care, and the contrast is more plausibly about preparation than about fasting itself [16,22]. Education programmes designed for this purpose have been evaluated and improve knowledge and outcomes [16,22].

The result should still not be over-read, for two reasons the paper itself supplies. Time above 10 mmol/L rose significantly over the same period [10]. Hypoglycaemia was exchanged for hyperglycaemia rather than eliminated, which is what one would expect from controlled reduction of basal insulin, and over a single month the hyperglycaemic cost is modest while over years it would not be. And the cohort was selected for stability and absence of complications, which excludes those at highest risk and therefore the people about whom the question is most pressing.

The risk-stratification tool occupies an awkward position. It is recommended, it is in use, and its own validation study concluded that further work is needed to improve its predictive accuracy [13]. In the primary care validation, hypoglycaemia occurred across risk categories rather than concentrating in the high-risk group [9]. A tool that guides a consequential decision and has not yet demonstrated discrimination should be described that way, and its output treated as a prompt for discussion rather than a determination.

A more general observation concerns where the evidence comes from. Almost all of it is observational, single-arm or before-and-after, because randomising people to fast or not fast is neither feasible nor appropriate [1,10,14]. That constraint is permanent, and it means this field will continue to rely on cohorts and registries. Recognising that argues for better observational infrastructure [23,34], particularly recording of who fasted, what preparation they received and what happened, rather than for waiting on trial evidence that will not arrive.

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Study limitations

The limitations belong to the underlying literature. The principal favourable study is single-arm, compares the fasting month against the preceding period rather than against a control group, and recruited people with stable uncomplicated type 1 diabetes, so it cannot describe outcomes in those with complications or unstable control [10]. The principal unfavourable data are more than twenty years old, precede continuous glucose monitoring and current insulin analogues, and reflect care as delivered at that time [4,8]. Hypoglycaemia is variously self-reported, sensor-detected and clinically confirmed across studies, which affects comparability [5,9,10]. The risk tool has been validated in a limited number of settings and its own investigators call for more [13]. Ramadan falls at different seasons over a cycle of years, so fasting hours differ substantially between studies conducted in different years and latitudes [1,12]. Populations studied are drawn disproportionately from a small number of countries [5,13]. And the reviewed studies report short-term glycaemic outcomes rather than the longer-term consequences of an annual month of altered management [11,14,32]. Trials comparing specific agents or insulin preparations during Ramadan exist but are few and small [17,18]. Evidence in young people, adolescents and pregnancy is more limited still [25,26,29], and metabolic responses to intermittent fasting have been described separately [20]. Continuous monitoring in adolescents shows fluctuation patterns that periodic testing does not capture [19,27,28].

Conclusion

Most people with insulin-treated diabetes who could claim exemption from fasting do not claim it, so the relevant clinical work is preparation rather than permission. Older observational data recorded a clear excess of severe hypoglycaemia during Ramadan in unselected populations, and a recent study in stable uncomplicated type 1 diabetes with structured education and continuous monitoring found hypoglycaemia falling rather than rising. The difference is most plausibly the preparation rather than the fast. Two qualifications hold: time above range rose in that study, so hypoglycaemia was traded for hyperglycaemia, and the cohort excluded the patients at highest risk. The risk-stratification tool now in use has not yet demonstrated the predictive accuracy its own validators sought, and should be read as a prompt for a conversation rather than as an answer.

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Conflict of Interest

The authors declare no competing interests.

Ethics Statement

This article reviews previously published studies only. No new patient data were collected and no participants were recruited, so ethical approval was not required.

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