

## Ramadan as a Model of Intermittent Fasting: Effects on Gut Hormones, Appetite and Body Composition in Diabetes vs. Controls

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**Abstract :** Fasting has been practiced for centuries and is incorporated into the practices of different religions including Islam, whose followers intermittently fast throughout the month of Ramadan. Thus, Ramadan presents a unique model of prolonged intermittent fasting (IF). Despite a growing body of evidence for a cardio-metabolic and endocrine benefit of IF, detailed studies of the effects of IF on these indices in type 2 diabetes are scarce. We studied 5 subjects with type 2 diabetes (T2DM) and 7 healthy controls (C) at baseline (pre), and in the last week of Ramadan (post). Fasting circulating levels of glucose, HbA1c and lipids, as well as body composition (with DXA) and resting energy expenditure (REE) were measured. Plasma gut hormone levels and appetite responses to a mixed meal were also studied. Data are means $\pm$ SEM. Ramadan decreased total fat mass ( $-907\pm 92$  g,  $p=0.001$ ) and trunk fat ( $-778\pm 190$  g,  $p=0.014$ ) in T2DM but not in controls, without any reductions in lean mass or REE. There was a trend towards a decline in plasma FFA in both groups. Ramadan had no effect on body weight, glycemia, blood pressure, or plasma lipids in either group. In T2DM only, the area under the curve for post-meal plasma ghrelin concentrations increased after Ramadan (pre:  $6632\pm 1737$  vs. post:  $9025\pm 2518$  pg/ml.min $^{-1}$ ,  $p=0.045$ ). Despite this increase in orexigenic ghrelin, subjective appetite scores were not altered by Ramadan. Meal-induced plasma concentrations of the satiety hormone pancreatic polypeptide did not change during Ramadan, but were higher in T2DM compared to controls (post: C:  $23486\pm 6677$  vs. T2DM:  $62193\pm 6880$  pg/ml.min $^{-1}$ ,  $p=0.003$ ). In conclusion, Ramadan, as a model for IF appears to have more favourable effects on body composition in T2DM, without adverse effects on metabolic control or subjective appetite. These data suggest that IF may be particularly beneficial in T2DM as a nutritional intervention. Larger studies are warranted.

**Keywords :** type 2 diabetes, obesity, intermittent fasting, appetite regulating hormones

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