

Changes in Resting Metabolic Rate (RMR) and Body Composition: a UAE Ramadan Study

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Background Both eating and drinking is restricted during Ramadan fasting days (~30 days) marked by two main meals; one at sunset (*Iftar*) and one at dawn (*Suhour*). Our previous work indicated changes in feeding patterns [1], glucose variability [2] energy metabolism, expenditure and physical activity [3] during Ramadan.

Aim To investigate differences in resting metabolic rate (RMR) and various parameters of body composition via bioelectric impedance analysis (BIA) pre-, during and post-Ramadan.

Methods Healthy participants attended Imperial College London Diabetes Centre (ICLDC) were assessed for RMR (COSMED-Quark RMR indirect calorimetry machine) and BIA.(SECA mBCA machine) Of the 35 consented participants initially recruited who fasted Ramadan, 14 patients were included for data analysis. Strict exclusion criteria included full record of fasting days, no chronic or metabolic conditions and/or medication that may affect either measurements or the ability to fast. Changes in RMR, body mass index (BMI), weight (WT), fat free mass (FFM), fat free mass index (FFMI) and total body water (TBW) were assessed at: (1) Pre-Ramadan (Pre-R), (2) during Ramadan (R), (3) end of Ramadan (End-R) and (4) Post-Ramadan (Post-R). Data analysis was carried out using (STATA -v15.0). Repeated measures of ANOVA with Greenhouse-Geisser correction, was used with tukey post-hoc pairwise comparison with statistical significance at $P \geq 0.05$).

Results Of all the parameters measured at all the time points, statistically significant changes were observed between: (1) RMR: increased by 156.36 kcal/day between R and Post-R, (2) BMI: decreased by 0.37 kg/m² between Pre-R and End-R and (3) all the other parameters decreased between Pre-R and Post-R; weight (-0.98kg), fat free mass (-0.74 kg), fat free mass index (describing the amount of muscle mass in relation to height and weight) (-0.26 kg) and total body water (as a percentage of body weight) (-0.59 kg) (**Table1**).

Conclusions All parameters assessed were significantly modulated by Ramadan fasting. Our data e show that changes in RMR and BMI are not limited to decreases in fat mass and water (often associated with restricted eating and drinking during Ramadan fasting hours), but extend to changes in other parameters such as muscle mass. Moreover, the noted difference in timeline of these observed changes merits a closer look into the implicated physiology. Ongoing work is elucidating these changes and other related parameters in a larger cohort.

Parameter	Time Point 1	Point 1 Mean	Time Point 2	Point 2 Mean	Mean Difference	Std. Err.	P-value	ANOVA	G-G
RMR (Kcal/day)	R	1530.00	Post-R	1686.36	156.36	48.79	0.01	0.01	0.02
BMI (Kg/m ²)	Pre-R	26.03	End-R	25.66	-0.37	0.09	0.00	0.00	0.01
Weight (Kg)	Pre-R	74.04	Post-R	73.06	-0.98	0.27	0.01	0.01	0.02
Fat Free Mass (FFM) (Kg)	Pre-R	50.43	Post-R	49.69	-0.74	0.27	0.05	0.04	0.04
Fat Free Mass Index (FFMI)	Pre-R	17.64	Post-R	17.37	-0.26	0.09	0.03	0.01	0.01
Total Body Water (TBW)	Pre-R	36.76	Post-R	36.17	-0.59	0.20	0.03	0.02	0.03

Table 1. RMR and BIA changes pre-, during and post-Ramadan fast. Changes in various parameters were measured Pre-Ramadan (Pre-R), during Ramadan (R), end of Ramadan (End-R) and Post-Ramadan (Post-R) for fourteen healthy participants attending ICLDC health facility. Statistical significance ($p \leq 0.05$) was tested using repeated measures ANOVA on STATA (v15).

References

1. Lessan, N. and T. Ali, *Energy Metabolism and Intermittent Fasting: The Ramadan Perspective*. Nutrients, 2019. **11**(5).
2. Lessan, N., et al., *Glucose excursions and glycaemic control during Ramadan fasting in diabetic patients: insights from continuous glucose monitoring (CGM)*. Diabetes Metab, 2015. **41**(1): p. 28-36.
3. Lessan, N., et al., *The effects of Ramadan fasting on activity and energy expenditure*. Am J Clin Nutr, 2018. **107**(1): p. 54-61.