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## Does how we eat affect how much we eat? Associations between covertly measured eating behaviours and food intake over 24 hours in a controlled residential setting

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Obesity is a complex condition which is significantly impacted by an individual's biology, environment and behavioural factors. Excess energy dense (ED)(kJ/g) food intake (1), higher eating rate (2), increased eating frequency (3) and eating later in the day (4) have all been linked with obesity, but findings are mixed and require clarification using robust and objective measures of food intake behaviour. The aim of this research was to investigate associations between these eating behaviours and energy intake (EI) within a controlled residential setting in 65 participants (BMI 36.4 ± 11.0 (range 17.6-65.2); 9 optimal weight, 15 overweight and 41 with obesity/severe obesity; age 44.3 ± 12.7 years (range 18.6-67.6 years), 44F,21M).

As part of baseline measurements for a larger study (5) participants were assessed for 36hrs (twonights) within the Human Intervention Studies Unit at Ulster University, UK, and had ad lib access to a personalised menu (n 54 foods) representing a range of low/high fat macronutrient mix food groups with varying carbohydrate and protein content (6). Food intake and eating behaviour were measured covertly and validated by CCTV. Study outcomes were 24-hour EI (MJ), ED (kJ/g), % nutrient contribution to total EI, as well as parameters of eating including: size (g, kJ) speed (g/min; kJ/min;), number (n) and duration (mins) of eating occasions (defined as consumption of at least 210kJ separated by ≥5 minutes) and the timing of eating (epochs: 7-11am, 11:01-3pm, 3:01-7pm, 7:01-11pm). On the final morning, blood samples were collected before and 90mins after a standardised breakfast for the analysis of glicentin, a proglucagon-derived peptide. Associations between total EI and measures of eating behaviour were assessed using Spearman's Rank

Correlation analysis showed weak positive associations between total EI and fasting glicentin ( $r = 0.296$ ,  $p = 0.024$ ), ED ( $r = 0.364$ ,  $p = 0.004$ ), and moderate associations with number ( $r = 0.419$ ,  $p = 0.001$ ) and size of eating occasions ( $r = 0.415$ ,  $p = 0.005$ ) as well as total weight of food consumed ( $r = 0.634$ ,  $p < 0.001$ ). Of note, there was also a positive association between EI/eating occasion and a faster eating rate as expressed by [kJ/min ( $r = 0.519$ ;  $p < 0.001$ )] but not g/min ( $r = 0.276$ ,  $p = 0.07$ ). There was also a stronger relationship between EI and lean mass ( $r = 0.450$ ,  $p < 0.001$ ) than bodyweight ( $r = 0.291$ ,  $p = 0.023$ ).

These findings suggest that food portion size and increased eating frequency may be a more important drivers of EI than dietary ED, and that the rate of eating higher ED foods may be linked to consuming a higher energy meal. These findings are skewed towards individuals with obesity but if confirmed highlight a need for weight management programmes to strengthen strategies to improve portion control and to limit grazing behaviours. There is also a need for robust randomised controlled trials to determine if eating slower reduces overall EI.

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