




Abstract

Association between Physical Activity Energy Expenditure and Continuous Glucose Monitor-Derived Metrics: Data from the ZOE PREDICT 1 Study [†]

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Background and objectives: Physical activity can improve glucose variability (GV) and time in range (TIR) in people with impaired glucose tolerance/diabetes [1,2]. However, the effects of physical activity on these parameters in people within normo-glycaemic ranges are unclear. This study explores the associations between physical activity, GV, and TIR in normo-glycaemic individuals from the ZOE PREDICT 1 cohort. **Methods:** Free-living continuous interstitial glucose (using continuous glucose monitoring) and activity energy expenditure (AEE; mean of 14 days using a wrist-based accelerometer [ENMO]) were collected in the ZOE PREDICT 1 study (n = 1002). TIR was calculated using (1) the American Diabetes Association criteria (TIR 3.9–7.8 mmol·L⁻¹) and (2) a novel ‘stringent’ range (TIR 3.9–5.6 mmol·L⁻¹) [3]. The relationship between AEE and glycaemic outcomes (GV and TIR) was assessed using partial correlations (adjusted for age, sex, and BMI). **Results:** Data from 698 participants (186 M/512 F) were analysed (mean ± SD; age: 45 ± 12 y; body mass index (BMI): 25.4 ± 4.8 kg·m⁻²; and estimated basal metabolic rate (BMR; Harris–Benedict equation): 1456 ± 225 kcal·d⁻¹). The mean fasting glucose concentration was 4.93 ± 0.42 mmol·L⁻¹ (range: 3.58–6.07 mmol·L⁻¹), and the mean daily glucose concentration was 5.02 ± 0.54 mmol·L⁻¹ (range: 3.43–7.19 mmol·L⁻¹). The median GV was 16.1% (IQR: 13.1–18.5%), and the median proportion of time spent in TIR 3.9–5.6 was 72.4% (IQR: 62.0–80.7%) compared to 95.3% (IQR: 87.7–99.0%) in TIR ADA. AEE was inversely associated with TIR 3.9–5.6 (r = -0.09 p = 0.02), but not with TIR ADA (r = 0.03 p = 0.43), and positively associated with daily mean glucose concentration (r = 0.13, p < 0.001). **Discussion:** The data presented in this study suggest that, in normo-glycaemic individuals, higher activity energy expenditure is associated with a lower proportion of time spent within a novel ‘stringent’ range of interstitial glucose concentrations. However, the causality of this relationship is unclear, and future research should establish whether a higher physical activity level drives a higher glucose level, or vice versa.

Author Contributions: Study conceptualization and Methodology: H.A.S., K.M.B., A.M., J.T.G., S.E.B., T.D.S., J.W. Data Curation: S.E.B., J.W., T.D.S. Formal analysis, Validation and Visualisation: H.A.S., K.M.B.; Funding Acquisition: J.W., T.D.S. Study Investigation: S.E.B., J.W., T.D.S. Writing – Original Draft Preparation: H.A.S., K.M.B., A.M., J.T.G., S.E.B. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the London-Hampstead Research Ethics Committee (approval no. 18/LO/0663) and Integrated Research Application System (no. 236407) for studies involving humans.

Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: The data used for analysis in this study are held by the Department of Twin Research at King's College London and access can be requested from <https://twinsuk.ac.uk/resources-for-researchers/access-our-data/> (accessed on 10 November 2023) to allow for anonymisation and compliance with GDPR standards.

Conflicts of Interest: T.D.S. and J.W. are co-founders of Zoe Ltd. T.D.S. and S.E.B. are consultants to Zoe Ltd. K.M.B, H.A.S. are or have been employees of Zoe Ltd. H.A.S., A.M., J.W., T.D.S. and S.E.B. also receive options in ZOE Ltd. Other authors have no other conflicts of interest to declare.

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