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Abstract

Meal Glycemic Load, Meal Frequency, and Alertness: Mediation Effect of Glucose Concentration †

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Abstract: Background and objectives: Night shift workers experience circadian disruption that may manifest in poor alertness. This study aimed to explain the mediation by acute glucose concentration resulting from the assignment of meals varying in glycemic load (high and low) and meal frequency (1 and 3) on alertness parameters, including the number of lapses, reaction time median (RTMed), and variability (RTVar). Methods: A two-arm randomized cross-over trial was conducted on female nurses working night shifts. In each of the study arms, the 1-MEAL and 3-MEAL arms, the participants followed three intervention periods consisting of the provision of high glycemic load (GL) or low GL meals in the form of yogurts with either dextrose added or the combination of lactose and fructose or fasting (no meal) during three consecutive night shifts with a 2-week washout period. In the 1-MEAL arm, the participants were provided with one meal (1-high GL or 1-low GL), while three meals were provided in the 3-MEAL arm (3-high GL or 3-low GL). Twenty-four-hour interstitial glucose concentrations were measured using continuous glucose monitors during the interventions. The participants performed brief psychomotor vigilance tasks (PVT-B) at 04:00 h. Mediation analysis was performed to determine whether the meal glycemic load effect on the number of lapses, RTMed, and RTVar was explained by the mean glucose concentration 120 min prior to performing the PVT. Result: A mediation effect of mean glucose concentrations on RTVar was observed, for instance, in 1-high GL (βind = 16.23 mmol/L, 95%CI: 1.62, 33.89) and 3-high GL (βind = 8.85 mmol/L, 95%CI: 0.90, 19.33) compared to no meal. Significant mediation effects of mean glucose concentrations on RTVar were also detected between 3-high vs. 1-high GL, 1-high GL vs. 1-low GL, and 3-high GL vs. 3-low GL. However, no mediation effect was observed on the number of lapses or RTMed. Discussion: In summary, mediation analysis suggests that an elevated mean glucose concentration 120 min prior to performing the PVT increased the reaction time variability, indicating difficulties in maintaining attention.

Keywords: alertness; glycemic load; meal frequency; glucose; night shift

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