Introduction

- Behavioural studies have indicated that response times on complex reaction time tasks are faster if blood glucose concentrations (BGC) are elevated but within the normal BGC range (Owens & Benton, 1994).
- However, such tasks involve several cognitive processes, e.g. stimulus detection & identification, response selection & execution.
- In this study, we investigated which cognitive processes are affected by changes in BGC by using ERP markers.
- Using double-blind method, we administered 3 x 25 mg glucose and placebo (Saccharin) in drink format while participants performed an Eriksen flanker task (Eriksen & Eriksen, 1979).

Method

Participants

- N=12 (6 Females), Mean age 25.1 years (SD = 4.34), 11 right handed, 1 left handed.

Procedure

- Participants fasted overnight before testing.
- Participants were given a breakfast (1 bagel, 70g cream cheese, and 150g natural yoghurt) two hours before testing, in order to stabilise (BGC) prior to testing.
- A within participants double-blind design was employed where in one testing session participants were given 3 placebo drinks containing Saccharin, and in another session where 3 glucose drinks (25mg) were administered.
- Lemon juice (100ml) and water (100ml) was used to conceal the taste differences between placebo and glucose drinks.
- Blood glucose concentration (BGC) levels were measured throughout the study in 15 minute intervals.

EEG recording and analysis

- 32-electrode QuickAmp system, Sampling rate: 500Hz, Low-pass filter: 40 Hz; ERP amplitude analysis – see Fig. 3; LRP amplitude analyses – electrode pairs C3/4, CP1/2, C5/6; LRP latency analyses – Jack-knife analysis on electrode pair C3/4.

Results

Blood Glucose Concentration Levels

Mean BGC levels (mMol/litre) were similar before drink administration (glucose condition: 5.1, S.E. 0.75, placebo condition: 5.3, S.E. 0.53, p = 0.27) and during the task significantly higher in the glucose (6.9, S.E. 0.21) compared to the placebo condition (5.0, S.E. 0.56, p = 0.001).

Behavioural Results

- Behavioural results did not show any reaction time and error rate differences between the glucose and placebo conditions (RT: p=0.50, % errors (%): p = 0.85).
- A significant flanker effect was found where responses to congruent and neutral trials were faster and more accurate than responses to incongruent trials (RT: p=0.001, errors (%): p=0.001).

Conclusions

- The behavioural data show that glucose had no effect on reaction times or error rates. However, ERPs seem to be more sensitive to glucose effects. The N2 (170-200ms, O1, P07, Oz, P08, O2): A larger N2 amplitude was found for the glucose (-6.3 (0.90) µV), compared to the placebo condition (-5.4 (0.86) µV, p = 0.04).
- P2 (210-240ms, Fz, Cz): No effect of drink type was found for the P2 amplitude (p = 0.5). Though there was an effect of flanker congruency (p = 0.03). The neutral condition produced a significantly larger P2 (0.5 (0.76) µV) than congruent (-0.1 (0.83) µV) and incongruent condition (-0.2 (0.81), µV).
- P3 (300-450 ms, C1, P3, Pz, P4, C2): There was no effect of drink type (p = 0.47) or flanker congruency (p=0.27).
- ERPs comparing glucose & placebo

References


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