

Carbohydrate to protein ratio in food and cognitive performance in the morning

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The effect of different carbohydrate to protein ratios in food on cognitive functions and the relation between postprandial metabolic and cognitive changes were studied in fifteen healthy male students. Subjects were tested in three sessions, separated by one week, for short-term changes in mood states, objective cognitive functions, blood parameters, and indirect calorimetry using a repeated-measures, counterbalanced cross-over design. Measurements were made after an overnight fast before and hourly during 3.5 h after test meal ingestion. The isoenergetic (1670 kJ) test meals consisted of three carbohydrate to protein ratios, i.e. a carbohydrate-rich (CHO[4:1]), balanced (BAL[1:1]), and protein-rich (PRO[1:4]) meal, respectively. Overall accuracy in short-term memory was best after the PRO[1:4] meal concomitant to the least variation in glucose metabolism and glucagon to insulin ratio (GIR). Related to changes in glucose metabolism and/or in the ratios of large neutral amino acids (LNAA), respectively, attention and decision times were transiently improved within the first hour after the CHO[4:1] meal, whereas after the first hour the BAL[1:1] and PRO[1:4] meal resulted in improved performance. Overall reaction times of a central task were fastest after the BAL[1:1] meal concomitant to the highest overall tyrosine to LNAA ratio. Our findings suggest that the carbohydrate to protein ratio in food specifically influences higher cognitive functions in the morning. Except for a transient positive effect of rising blood glucose after a carbohydrate-rich meal, a protein-rich or balanced meal seems to result in better overall cognitive performance presumably because of less variation in glucose metabolism and/or higher modulation in LNAA ratios indicated by the overall GIR.