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Effects of normal meals rich in carbohydrates or proteins on plasma tryptophan and tyrosine ratios.

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BACKGROUND: The delivery of circulating tryptophan to the brain and its conversion to serotonin vary directly with plasma concentrations of tryptophan and inversely with those of other large neutral amino acids (LNAAs). Although carbohydrate-rich, protein-free formula diets have been shown to elevate, and high-protein diets to depress, the tryptophan-LNAA ratio, few data are available about this ratio's responses to actual meals.

OBJECTIVE: We determined whether carbohydrate-rich or protein-rich breakfasts, such as those Americans normally eat, produce substantial differences in the plasma tryptophan-LNAA ratio and in the corresponding ratio for tyrosine, the precursor of brain dopamine and norepinephrine.

DESIGN: Nine overnight-fasted subjects consumed, 3-7 days apart, a carbohydrate-rich (69.9 g carbohydrate and 5.2 g protein) and a protein-rich (15.4 g carbohydrate and 46.8 g protein) breakfast. Blood samples collected at baseline and after 40, 80, 120, and 240 min were assayed for tryptophan, tyrosine, the 5 other LNAAs, and insulin.

RESULTS: The carbohydrate-rich and protein-rich breakfasts had significantly different effects on both the plasma tryptophan-LNAA and tyrosine-LNAA ratios (each $P < 0.01$). Among the 8 subjects who consumed both breakfasts, the median difference for tryptophan:LNAA was 54% (range: 36-88%) and for tyrosine:LNAA was 28% (range: 10-64%). Insulin concentrations rose significantly after the carbohydrate but not after the protein meal.

CONCLUSIONS: High-carbohydrate and high-protein breakfasts similar to those Americans normally eat can cause substantial differences in the plasma tryptophan ratio and thus, probably, in brain tryptophan concentrations and serotonin synthesis. Such meals also change the plasma tyrosine ratio and may thereby modify catecholamine synthesis.

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