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DO DIFFERENT SOURCES OF MUSCLE PROTEIN AFFECT SATIETY DIFFERENTLY?

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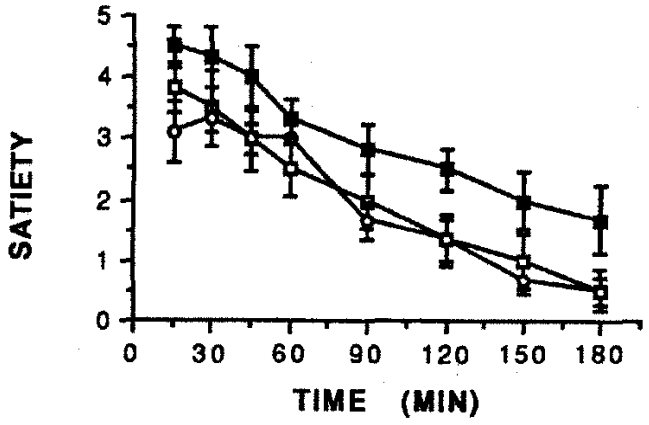
It is widely believed that different types of meat, particularly red and white meat, affect satiety to varying degrees. Satiety signals may include the neurotransmitters serotonin and catecholamines, the synthesis of which are dependent on the levels of their precursors, tryptophan and tyrosine respectively, in the brain. A measure of the level of these neurotransmitters is the ratio of the precursor amino acid to the sum of the large neutral amino acids (LNAA) because of competition between these amino acids for the LNAA carrier across the blood brain barrier (Li et al.1983).

In the present study we recruited six lean male subjects and after an overnight fast, fed them one of three randomly allocated protein meals consisting of 50 g of protein in the form of: lean beef, lean chicken or fish (flake). Subjects reported their appetite/satiety on a 7 point scale at 10 time points over a 3 hr period. Blood samples were taken to coincide with these time points. Plasma samples were stored at -70°C prior to measurement of: amino acid profile by HPLC with pre-column derivatization with OPA, glucose by glucose oxidase, and insulin by RIA. Samples of each dietary protein were also hydrolysed and the amino acid composition determined.

The amino acid profiles after the three meals were similar for most amino acids, peaking 120-150 min after the meal. There were strong correlations between the concentrations of a number of dietary amino acids and their corresponding postprandial plasma levels. Valine, leucine, isoleucine, histidine, phenylalanine, tyrosine, threonine and alanine showed good correlations while tryptophan, lysine, aspartic acid/asparagine and glutamic acid/glutamine did not. Glucose levels declined slightly following all meals and insulin showed a corresponding small peak.



Satiety following a 50 g protein meal of fish (■), beef (□) or chicken (○)

Satiety produced by fish was significantly greater than after a beef or chicken meal ($P < 0.01$, fig). The tryptophan to LNAA ratio declined more slowly in the fish than in beef or chicken (a decline in this ratio can be correlated with a decline in serotonin synthesis and the satiety response it causes) which is consistent with satiety reported by subjects. The delta tryptophan to LNAA ratio for fish had a significantly higher value than beef or chicken meals after 45 min (+0.0073 vs -0.0247 and -0.0223). There were no significant differences in glucose, insulin or tyrosine to LNAA ratios between the three meals.

Lean red meat does not affect satiety differently from chicken. However fish had an increased effect on satiety compared to both red meat and chicken. This difference may in part be due to the differences in the tryptophan to LNAA ratio response to the fish meal.

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