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A food insulin index: a physiological basis for predicting insulin demand evoked by composite meals

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Background – Postprandial hyperinsulinemia is relevant to the prevention and management of obesity and diabetes. A physiological basis for predicting insulin 'demand' may be a useful tool to aid further research.
Objectives – To assess the utility of a food insulin index (FII, white bread = 100) based on testing iso-energetic portions of single foods (1000 kJ) in predicting the insulin demand evoked by composite meals.
Design – Groups of 10 lean, healthy subjects consumed 13 different iso-energetic (2000 kJ) mixed meals of varying macronutrient content. Insulin demand as predicted by the FII of the component foods or calculated glycemic load (GL, the product of carbohydrate content and glycemic index) was compared with observed insulin responses.
Outcomes – Observed insulin responses (area under the curve relative to white bread) varied over a three-fold range (35 to 116) and were strongly correlated with insulin demand predicted by the FII of the component foods ($r = 0.78$, $P = 0.0016$). Calculated GL ($r = 0.68$, $p = 0.01$), but not carbohydrate content ($r = 0.52$, $P = 0.06$) also predicted insulin demand.
Conclusion – The relative insulin demand evoked by mixed meals is best predicted by an index based on insulin responses to iso-energetic portions of single foods. In the context of composite meals of similar energy value but varying macronutrient content, carbohydrate content has limited value.

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Development of a database of food insulin index values

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Background – Recent studies have shown that postprandial insulin responses are not always proportional to the carbohydrate content of foods. A wide range of dietary factors, including protein, fat, fibre and the glycaemic index of the carbohydrate, influence insulin secretion.
Objective – The food insulin index (FII) is a ranking of foods based on the average insulin response in young healthy subjects relative to a reference food (white bread = 100). A 1000 kJ portion is the basis of comparison and the insulin response is integrated as the incremental area under the curve. We systematically gathered available data to develop a FII database.
Design – Published and unpublished FII data were collected between 1997 and 2008. In total, there are 120 data entries, including values for most common sources of energy in western diets, all tested in at least 10 subjects. The foods were separated into nine food categories. Correlations between insulin responses and nutrient content were examined.
Outcomes – Significant differences in FII values were noted within and between food categories. Within food groups, insulin demand varied over a two-fold range among vegetable group and over a 20-fold range among fruits and fruit product group. Overall, available carbohydrate content was positively related to insulin responses ($r = 0.68$, $p < 0.01$, $n = 120$) whereas protein ($r = -0.26$, $p < 0.01$, $n = 120$) and fat ($r = -0.51$, $p < 0.01$, $n = 120$) were negatively related. There was no significant relationship between fibre content and insulin responses.
Conclusion – A FII integrates all dietary factors influencing insulin secretion into one result that is based on actual responses. Development of FII database may be helpful in exploring relationships between insulin demand and health.