Glycaemic equivalents: exchanges based on both the glycaemic index and carbohydrate content of a food

S Colagiuri[1], JC Brand Miller[2], V. Swan[2], M. Colagiuri[2], P. Petocz[3]

[1]Department of Endocrinology, Prince of Wales Hospital, Randwick, NSW 2031, Human Nutrition Unit, Dept of Biochemistry, University of Sydney, NSW 2006, [3]School of Mathematical Sciences, University of Technology, Sydney, Broadway, NSW, 2007

Currently diabetic diets are based on carbohydrate (CHO) exchange lists which assume that 15 g CHO portions have the same glycaemic impact, irrespective of the type of food. This assumption has been shown to be incorrect by the 'glycaemic index' (GI), which ranks equal CHO portions of foods on the basis of their acute glycaemic impact. A true exchange system must therefore consider both the quantity and quality of the carbohydrate. We defined a 'glycaemic equivalent' (GE) as the amount of any particular food that will have the same glycaemic impact as one slice of white bread. The GE of a food can be theoretically predicted using both the published GI and CHO content (g/100g). In the present study we aimed to determine whether the theoretical GE was, in fact, equivalent to one slice of bread *in practice*. In addition, we sought to determine the 'dose-response' effect of consuming 2, 3, 4 or 6 GEs at one time.

Two groups of five foods were tested at each dose in random order after a 10 h overnight fast in groups of 10 healthy, non-diabetic subjects according to a 5 x 5 Latin square design. The GE of a food was calculated by the following equation: GE (g) = 1050/(GI x %CHO). The calculated GE of the foods was 30 g for white bread, 16 g for Calrose rice (raw weight), 33 g for spaghetti (raw weight), 15 g for cornflakes (with 100 mL milk), 155 g for fruit yogurt (sugar-sweetened), 85 g for banana, 217 mL for orange juice, 127 g for baked beans, and 14 g for jelly beans. Capillary blood was sampled at 0, 15, 30, 45, 60, 90 and 120 min and analysed for glucose and insulin.

The observed mean ± SE areas under the plasma glucose curve (AUC) for one GE are shown in the Figure. In both cases the foods were marginally different, but did not reach significance at the 5% level ($p = 0.062$ in the first group and $p = 0.051$ in the second group). The dose-response relationship, however, was highly significant ie as the number of GEs increased, the AUC increased linearly but not in direct proportion to dose, $p = 0.000$ in both groups).

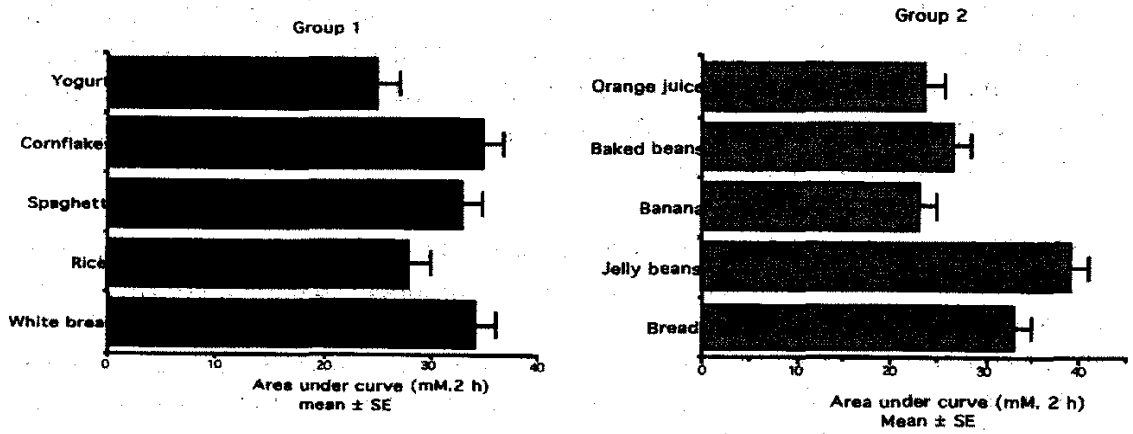

Figure. Observed mean ± SE area under plasma glucose curve for one GE of each food.

The marginal difference between foods indicates that some adjustment may need to be made to the theoretically calculated values for each GE. Based on this information, it will be possible to formulate a scientific and rational basis for dietary prescription in diabetes. The end product will be a validated exchange list of quantities of foods which are equivalent in their glycaemic impact. We recognise that macronutrient and energy differences will also need to be taken into account when formulating the new set of exchange lists.