

Letter to the Editor

Another approach to estimating the reliability of the glycaemic index: a different interpretation

(First published online 4 March 2010)

Williams *et al.*⁽¹⁾ contend that the usefulness of the glycaemic index (GI) depends on its reliability, which was estimated by the intra-class coefficient (ICC) defined as: $ICC = \sigma_B^2 / (\sigma_B^2 + \sigma_W^2)$, where σ_B^2 is between-person variance and σ_W^2 is within-person variance. They showed that the reliability of glycaemic responses, expressed as incremental area under the curve (iAUC), was moderate, while the reliability of GI was poor. It was concluded: (1) that the unpredictability of individual responses places limitations on the clinical usefulness of the GI; and (2) that if the very different GI of potato and chickpeas are estimates of an individual's every-day response to different foods, then the GI of foods may provide an indication of the GI of a long-term diet. I have a major problem with this, not because I disagree with the results, but because the conclusions are not supported by them.

ICC, as defined here and used by the authors, measures how well a single measure can distinguish between individuals. Thus, the fact that the reliability of GI is poor means that GI does not distinguish between individuals, i.e. the GI of one individual is not different from that of another. The authors interpret low reliability as supporting the conclusion that GI is not clinically useful, since the clinical utility of a measure depends on its reliability. However, if reliability means ICC, as defined here, then I would contend exactly the opposite. GI is intended to be a characteristic of a food, and in order to be clinically useful that characteristic has to be the same for nearly everyone. Since GI is not a reliable way to distinguish between individuals and since this is a desirable property for a food-based measure, the results of Williams *et al.*⁽¹⁾ support the clinical utility of GI.

It is concluded that GI has limited clinical utility because individual responses are unpredictable; however, this is not supported by the results. No data are presented to show whether individual responses are unpredictable. Glycaemic responses would be unpredictable if the probability that $iAUC = x$ is equal to the probability of it being any other value across the entire range of possible values. The distribution of unpredictable iAUC values within subjects would be flat – there would be an equal number of values within each range of iAUC (e.g. 0–49, 50–99, 100–149 ... etc). However, as for many other biological variables, iAUC values within subjects are normally distributed⁽²⁾, i.e. there is about 0.67 probability that any one value will be within 1 SD of the mean, about 0.27 probability that any one value will be between 1 and 2 SD from the mean and about 0.05 probability that any one value will be > 2 SD from the

mean. Thus, glycaemic responses are not unpredictable; they are predictable within confidence limits defined by mean, SD and n . Thus, variation in response from day-to-day within subjects does not limit the clinical utility of GI, because within-individual variation is not unpredictable.

The conclusion that 'if the very different GI of potato and chickpeas are estimates of an individual's every-day response to different foods, then the GI of foods may provide an indication of the GI of a long-term diet', implies that the authors do not know whether the GI of potato and chickpeas are estimates of an individual's every-day response to different foods. This is curious because Williams *et al.*⁽¹⁾ show data that can be used to address that question. The GI values of potatoes and chickpeas were not statistically compared by the authors, but are significantly different because the 95% CI of GI for potato (95% CI 76, 101) do not overlap with those for chickpeas (95% CI 22, 37). Also, the data were not used to see if the GI was a reliable way to distinguish between foods, which is, in fact, its purpose. For this purpose, presumably, $ICC = \sigma_F^2 / (\sigma_F^2 + \sigma_W^2)$, where σ_F^2 is between-food variance and σ_W^2 is within-person variance. I estimated the GI values of each individual for potato and chickpea from Figs. 2(B)⁽¹⁾ and 3(B)⁽¹⁾ and using repeated-measures ANOVA determined the between-food, between-person and within-person variance. This resulted in an ICC value of 0.97. Thus, GI highly reliably ($> 95\%$) predicts that potato will elicit a higher glycaemic response than chickpeas in an individual on any one occasion. Of course, the reliability of GI to distinguish between foods depends on the magnitude of between-food variance; reliability will be less good as the difference in GI between foods becomes smaller. We provided a method to estimate the probability of the GI distinguishing between foods (i.e. its reliability) over 20 years ago⁽³⁾.

Williams *et al.*⁽¹⁾ fail to provide an estimate of the reliability of GI which is relevant to its purpose; in addition, rather than place limitations on its utility, their results actually support the clinical utility of GI. I find it fascinating how different people can draw opposite conclusions from the same data. Does this limit the clinical utility of nutritional science?

Conflicts of interest

I am president of a contract research organisation, Glycemic Index Laboratories, Inc. (www.gilabs.com), which, among

other types of research services, conducts GI testing of foods. I am one of the originators and long-standing promoter of the scientific validity of the GI concept. However, my academic position and employment at the University of Toronto do not depend upon this issue.

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doi:10.1017/S0007114510000620

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