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Methodology for assigning appropriate glycaemic index values to an Australian food composition database

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ABSTRACT

We aimed to produce an updated Australian glycaemic index (GI) database based on a systematic method. GI values were assigned to the 3871 unique foods in an Australian food composition database. Following the method, 1124 (29%) foods had less than 2.5 g of available carbohydrates per 100 g and were assigned a GI of 0, and 416 (11%) foods had a direct match in one of the three data tables used. The GI value of a 'closely related' food was assigned to 1793 (46%) foods; 135 foods (3%) had their GI values calculated using the weighted average GI method; 391 (10%) foods were assigned the median GI of their corresponding food subgroup, and 12 (<1%) foods were assigned a GI of 0 because they were not significant sources of carbohydrates in a typical diet. For the 3634 foods which received a GI value in the 2009 assignment, 1954 (53.8%) had an updated GI value, and the mean $\pm$ SD difference between the 2009 and current assigned values was +3.0 $\pm$ 16.0 units (paired sample *t*-test $p < 0.001$). Acknowledging some limitations, this database will enhance the utility of the GI concept in research and clinical settings in Australia (199 words).

1. Introduction

The glycaemic index (GI) is a measure of the quality of dietary carbohydrates, where a low GI indicates that the carbohydrates in the food are either digested and absorbed slowly, or contain monosaccharides that are inherently less glycaemic (Brand-Miller et al., 2009). The GI of a food is the mean ratio between the area under the postprandial glycaemic response curve of a serving of that food which provides 50 g available carbohydrate, and that of a reference food, usually 50 g of glucose, and is therefore dimensionless in nature. As the amount of carbohydrate consumed is also a key factor in determining postprandial glycaemic response, the GI was often criticized for not taking the quantity of carbohydrate into account. To address this, the glycaemic load (GL) concept was developed (Salmeron et al., 1997; Salmerón et al., 1997). GL is given by the product of GI (as %) and amount of carbohydrate in the food, and therefore the unit is grams.

The consumption of low GI meals results in lower fluctuations in postprandial blood glucose levels compared with high GI meals with the same amount of available carbohydrate (Solomon et al., 2010). Since chronic postprandial hyperglycaemia and the associated hyperinsulinaemia have been associated with increased risk of several chronic diseases (Ludwig, 2002), a low GI eating pattern is hypothesized to be protective. In recent years, research around the world has provided evidence for the benefits of following a low GI diet. A meta-analysis by Barclay et al. (2008) concluded that a low GI diet was associated with reduced risks of type 2 diabetes, coronary heart disease, gall bladder disease and breast cancer. Recent meta-analyses (Fleming and Godwin, 2013; Greenwood et al., 2013; Livesey et al., 2013; Mirrahimi et al., 2012; Rouhani et al., 2013; Schwingshackl and Hoffmann, 2013) on the

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topic have reached similar conclusions that a low GI/GL eating pattern is beneficial.

Accurate assignment of GI values to food items is crucial to the validity of the observed relationship between dietary GI and/or GL and health outcomes in observational studies, as well as accurate design and delivery of a low GI/GL diet in intervention studies.

Previously researchers are required to develop their own method of assigning GI values to foods, or adopt methods developed by other researchers which often require slight modification to suit their own purpose. This makes comparison between studies difficult due to different methods used to assign GI values. Because of the subjective nature, the accuracy of the assigned values has also been criticized (Flood et al., 2006; Jenab and Boffetta, 2010).

This issue may be addressed by developing and applying robust methodology to assign GI values to foods in standard/national food composition databases, which can then be utilized by researchers. Although there could still be differences in the methods used between countries, it could at least ensure standardization within countries. The cross-country differences could also be justified due to the differences in food composition and food supply, similar to the differences seen for other nutrients. Research groups in the US (Martin et al., 2008; Schakel et al., 2008), UK (Levis et al., 2011), Malaysia (Shyam et al., 2012), and Finland (Kaartinen et al., 2010) have produced food composition databases completed with GI values.

In addition to the benefits to the research community, producing a standard GI database could also assist health professionals to put the GI concept in practice by allowing easy assessment of the dietary GI of their clients/patients. A nutrition analysis package commonly used by dietitians in Australia, FoodWorks (Xyris Software, Spring Hill, QLD, Australia), has an inbuilt function to analyse dietary GI when appropriate data are available.

Despite the benefits, a food composition database with complete GI data is not available in Australia. We therefore aimed to document the methods we used to assign GI values to food items in an Australian national food composition database, AUSNUT2007 (Food Standards Australia New Zealand, 2008); and provide the resultant database for use by other researchers and health professionals.

2. Materials and method

2.1. Assignment and update of GI values

The current work was largely based on our previous work on the secondary analysis of the 2007 Australian National Children Nutrition and Physical Activity Survey, completed in 2009 (Louie et al., 2011a), where we have assigned GI values to the majority of foods included in AUSNUT2007 (n = 3634, 94% of all foods in AUSNUT2007). Since then new analytical values have become available, and a dietitian experienced in the GI assignment process (JCYL) has therefore updated the database with the new values and assigned GI values to the remaining foods without a GI. Based on a modified version of a method previously described by us (Fig. 1) (Louie et al., 2011b), we assigned GI values to all of the 3871 foods included in AUSNUT2007 (Food Standards Australia New Zealand, 2008). AUSNUT2007 is a food composition database compiled by FSANZ for the analysis of the 2007 Australian National Children's Nutrition and Physical Activity Survey (Commonwealth, 2008). It contains complete data for 37 common nutrients for 3874 foods, as well as pre-defined linkages of branded items with generic items. Foods in AUSNUT2007 were classified into 23 broad food categories (University of South Australia, 2009a). Percentage change in weight due to cooking is also provided. Nutrient data of 1233 (32%) foods in AUSNUT2007 were based on data from NUTTAB2006 (Food Standards Australia New Zealand, 2006), a food composition database with mainly chemically analysed data. Data for the remaining 2641 foods were derived using a 'recipe approach' based on standard recipes (n = 2153); from food labels (n = 236); calculated or imputed (n = 105); borrowed from the 1995 National Nutrition Survey database (n = 81) or similar items in overseas food composition databases (n = 61); or obtained from

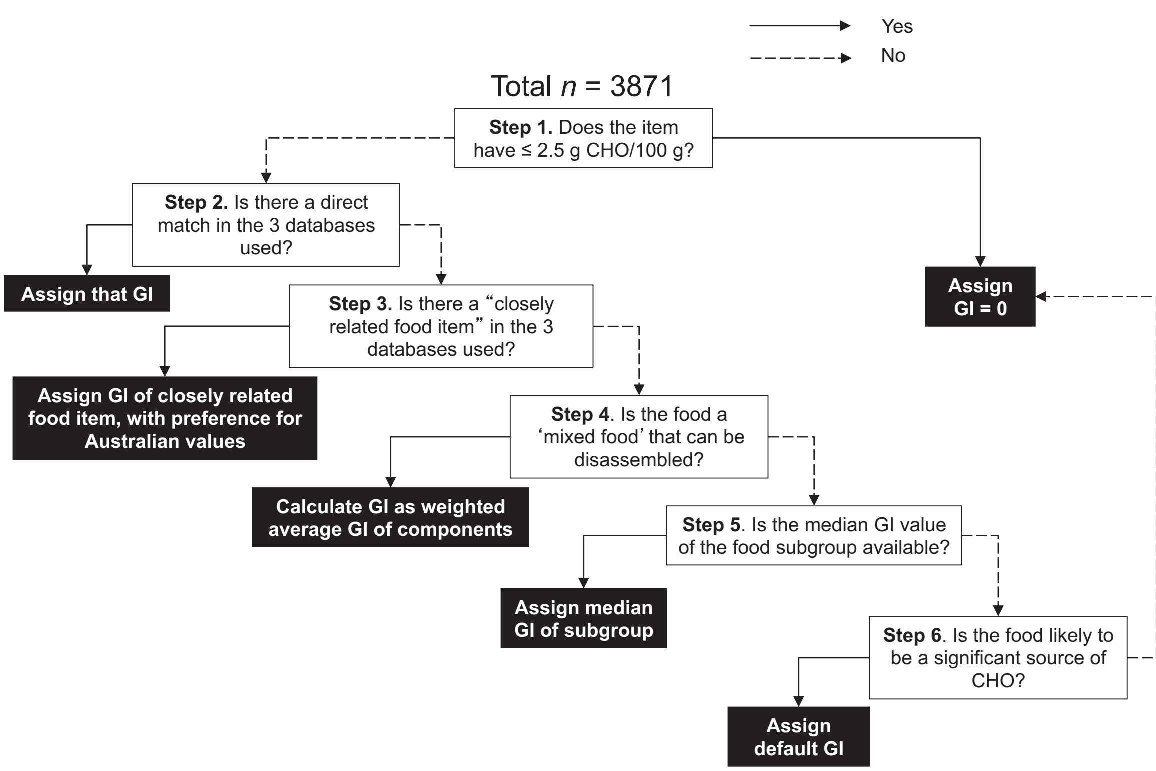

Fig. 1. Decision algorithm for GI value assignment. Boxes in black indicate decision end points. Modified from Fig. 2 in Louie et al. (2011b).