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Update of a database for estimation of whole grain content of foods in Australia

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ABSTRACT

Food composition data is essential for calculating consumption based on reported dietary intake. Inclusion of the whole grain content of foods in food composition databases is limited. In Australia, quantification of whole grain composition does not include all foods within the current survey database, AUSNUT (Australian Food, Supplement and Nutrient) 2011–13. This study aimed to update an existing Australian whole grain database to include all foods and food products within AUSNUT 2011–13 (n = 5741). Whole grain content (g) per 100 g was calculated using a systematic recipe-based approach, and input from industry stakeholders, product packaging, and ingredient lists. Overall 590 foods were identified as containing whole grain. Cereals and cereal products formed the majority (43%) of the database. Foods with whole grain content 100.0 g/100 g were raw or puffed whole grains, whole grain flours, and ready to eat cereals made from 100% whole grains. Considerable variation in whole grain content exists between and within food groups. The updated database may be a useful tool for assessing whole grain content of Australian food intake data. Application will allow estimation of whole grain intake in highly varied Australian population groups.

1. Introduction

Recommendations within the Australian Dietary Guidelines (ADG) encourage consumption of mostly whole grain and/or high cereal fibre varieties of core grain (cereal) foods (National Health and Medical Research Council, 2013). This recommendation has been quantified, with the Grains and Legumes Nutrition Council (GLNC), a not for profit organisation promoting grain and legume nutrition in Australia, supporting a 48 g whole grain Daily Target Intake (DTI) (Griffiths and Nestel, 2006). Whole grains are defined by Food Standards Australia New Zealand (FSANZ) as "the intact grain or the dehulled, ground, milled, cracked or flaked grain where the constituents- endosperm, germ and bran- are present in such proportions that represent the typical ratio of those fractions occurring in the whole cereal, and includes wholemeal" (FSANZ, 2011a). Despite these recommendations, no current, nationally representative data exist to quantify whole grain intake in the Australian population. Nationally representative data exist for the US and UK, indicating current whole grain intake amongst adults appears to be less than one 16 g serving per day, below the recommended three servings per day (Cleveland et al., 2000; Lang et al., 2003; Mann et al., 2015b; O'Neil et al., 2010).

There is no analytical method for measuring whole grain in foods, and there are currently no recognised, validated biomarkers of whole grain intake. The use of plasma alkylresorcinols (or their metabolites) is promising, as they are found only in the outer layers of wheat and rye, remain stable during food processing, and are well absorbed by humans (Ross et al., 2015). However, inter-individual variation is high, and alkylresorcinols are not accurate biomarkers from intake of all commonly consumed whole grains such as rice and oats. Therefore, in order to allow quantification of whole grain intake, an up to date whole grain database, matched to

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the food supply is essential to be used together with current dietary intake data.

The 2011–13 Australian Health Survey (AHS) provides the most recent national survey data within Australia, collecting information on dietary intake, physical activity, and biochemical markers (FSANZ, 2013a). Each food reported within the survey was categorised within the related Australian survey database, AUSNUT 2011–13 Food, Supplement and Nutrient Database (FSANZ, 2013a), to allow calculation of nutrients from 24-h recall data obtained in the survey. Each food within the AUSNUT database has a name and an eight digit identification code. These codes are grouped into broader food groups using a hierarchical nested coding system. For example, within the major (two digit) food group *Cereals and cereal products*, sub-major (three digit) food group classifications include "*Breakfast cereals, ready to eat*" and "*Breakfast cereals, hot porridge style*." Minor (five digit) food groups categorise foods based on fortification, whether they have saturated fat or sugar content above or below a certain value, and production or processing considerations. For example, "*Breakfast cereal, wheat based, fortified, sugars >20 g/100 g*" and "*Porridge style, other cereals*."

A recent whole grain database developed by Dalton et al. (2014) represents a significant advance in the ability to quantify whole grain intake within Australia. The database provides compositional data related to manufactured and packaged food products available on the Australian market in 2011. Whole grains are most often consumed as an ingredient within products or mixed dishes, such as breads and breakfast cereals. They may make up a proportion of the food, but in many cases, not one hundred percent of the weight of the total food. Hence it is of great importance to adjust for the proportion of whole grains contained in whole grain products, as the assumption that the weight of whole grains consumed is the same as the weight of the food product itself could result in dramatic overestimations of whole grain consumption. With additional work relating to mixed dishes, and coding for foods to match the AUSNUT 2011–13 database (FSANZ, 2013a), the existing whole grain database by Dalton et al., 2014 can be updated.The aim of the present study was to update the existing whole grain database, to include all foods and food products included within the most recent Australian survey database, AUSNUT 2011–13. Challenges encountered during the multi-step process are described. This database can be used in future studies to quantify whole grain intake of the Australian population using data from the most recent population survey, the 2011–13 AHS, along with application in other dietary studies.

2. Material and methods

This update of a whole grain database has adapted methods described elsewhere (Dalton et al., 2014), applied to the most recent Australian food composition survey database, AUSNUT 2011–13. The update involved input from GLNC, food manufacturers, product packaging and whole grain content claims, ingredient lists, and a recipe-based approach informed by previous research (Dalton et al., 2014; Franz and Sampson, 2006; Kyrø et al., 2012). In summary, the process included the identification of foods in the AUSNUT database containing whole grains, calculating the whole grain content from cooked and mixed dishes by considering final weight and weight change, calculating the whole grain content of cooked grains using a weight change factor and applying professional judgement to assign values from similar foods in the absence of the above data.

2.1. Data extraction and management

Product data were collated and managed in a Microsoft Excel spreadsheet (Version 14.0.0, 2011, Microsoft Corporation, North Ryde, NSW, Australia). Foods within AUSNUT 2011–13 were categorised according to the AUSNUT 2011–13 food coding system at the major, sub-major, and minor food group levels (FSANZ, 2015).

2.2. Development of a framework to update foods and food products containing whole grain ingredients

For the purpose of this research, cereal grains and ingredients were classified in accordance with the FSANZ (Australian regulatory organisation) definition of whole grains (FSANZ, 2011a). This included buckwheat, buckwheat flour, BarleyMax™, millet, rolled oats, rice (brown, wild, black, red), rye, rye flour, sorghum, triticale, wheat and wholemeal wheat flour (including burghul, faro, einkorn, freekeh, kamut spelt, teff), and sprouted whole grains. For this research, pseudo grains (amaranth, buckwheat, and quinoa) were also considered as whole grains due to their similar macronutrient profile.

In order to add whole grain values to the existing whole grain database, all foods containing whole grains were identified within the AUSNUT 2011–13 Database (FSANZ, 2013a) and Food Recipe File (FSANZ, 2013b). No limits were set on the minimum whole grain content to be contained in a product, allowing reporting of total grams of whole grain content as suggested by Ross et al. (2015).

2.3. Whole grain content calculations

An overview of the systematic method for calculating whole grain content is provided in Fig. 1. Adapted from Dalton et al. (2014), the whole grain content of cooked grains and mixed dishes composed of more than one ingredient, such as brown rice salad or porridge, involved disaggregating mixed foods to their individual ingredient levels using the AUSNUT Food Recipe File (FSANZ, 2013b). In this recipe-based approach, grams of ingoing whole grain (ingredients) were divided by the final weight of the product, after applying a total weight change percentage factor (FSANZ, 2011b) to account for moisture losses during processing as shown in Eq. (1):

$$\text{Whole grain content}(\text{g}/100\text{g}) = \frac{\text{ingoing whole grain weight}(\text{g})}{\text{final weight of product}(\text{g})} \times 100 \quad (1)$$

Where

$$\text{final weight of product}(\text{g}) = \text{sum of ingoing ingredients}(\text{g}) \times \left(\frac{100+\text{weight change factor}}{100}\right)$$

Eq. (1): calculation of whole grain content using a recipe-based approach.

This approach was also adopted for cooked grains containing a recipe within the FSANZ Food Recipe File for AUSNUT 2011–13, and for toasted products, as shown in Table 1.

Whole grain content of foods that did not contain recipes within the FSANZ Food Recipe File involved data transferred by an author from an existing whole grain product database, calculated using methods described for the previous version of the database (Dalton et al., 2014). Cooked grains that did not have an associated recipe in