2018

Creation of a fibre categories database to quantify different dietary fibres

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Publication Details

Fuller, S., Tapsell, L. C. & Beck, E. J. (2018). Creation of a fibre categories database to quantify different dietary fibres. Journal of Food Composition and Analysis, 71 36-43.

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Foods rich in dietary fibre have long been consumed for their known health benefits. Fibre represents a complex group of substances, with diverse physicochemical properties and therefore varied physiological effects. To be able to fully understand the clinical benefit of consuming dietary fibre, it is important to look at the components and their physiological roles. Evidence suggests that soluble fibres contribute to health effects such as blood glucose attenuation and cholesterol lowering, while insoluble fibres play a role in health effects such as laxation. Most countries have a food composition database that includes dietary fibre, however further details on categories of fibre are not included. This lack of information is problematic for research, for example dietary effects may be attributed to total fibre, rather than the type of fibre. A Fibre Categories Database (FCD) was developed to include data on total, soluble and insoluble fibre from a range of common foods. Fibre data was collected from a variety of sources including the scientific literature, food industry and national databases and calculations from recipe files were used. The creation of the Fibre Categories Database provides a useful tool to analyse the intake of types of fibre and relate this to health outcomes in the context of a whole diet.

Disciplines
Medicine and Health Sciences

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Creation of a Fibre Categories Database to Quantify Different Dietary Fibres

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Original Research Article

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Abstract

Foods rich in dietary fibre have long been consumed for their known health benefits. Fibre represents a complex group of substances, with diverse physicochemical properties and therefore varied physiological effects. To be able to fully understand the clinical benefit of consuming dietary fibre, it is important to look at the components and their physiological roles. Evidence suggests that soluble fibres contribute to health effects such as blood glucose attenuation and cholesterol lowering, while insoluble fibres play a role in health effects such as laxation. Most countries have a food composition database that includes dietary fibre, however further details on categories of fibre are not included. This lack of information is problematic for research, for example dietary effects may be attributed to total fibre, rather than the type of fibre. A Fibre Categories Database (FCD) was developed to include data on total, soluble and insoluble fibre from a range of common foods. Fibre data was collected from a variety of sources including the scientific literature, food industry and national databases and calculations from recipe files were used. The creation of the Fibre Categories Database provides a useful tool to analyse the intake of types of fibre and relate this to health outcomes in the context of a whole diet.

Key words: “dietary fibre”, “fibre methods”, “soluble fibre”, “insoluble fibre”, “food composition”, “health benefits”, “food analysis”, “food composition database”

1. Introduction

Foods rich in dietary fibre have long been consumed for their known health benefits. While there is no universally accepted definition of dietary fibre, all existing definitions recognise dietary fibre to be a group of carbohydrate polymers or oligomers that escape digestion in the small intestine, passing into the large intestine, where they are either partially or completely fermented by gut microbiota. Many definitions also recognise the range of health benefits that can be attributed to dietary fibre including increased faecal bulk/ laxation; reduced total

and/or low density lipoprotein (LDL) serum cholesterol levels; and attenuation of postprandial glycaemia/insulinaemia (Jones, 2013; Mudgil and Barak, 2013). Dietary fibre has been extensively studied due to its beneficial physiological effects. Studies have shown that diets high in dietary fibre, especially fibre from cereal or vegetable sources, are significantly associated with lower risk of coronary heart disease and cardiovascular disease (Threapleton et al., 2013); and that cereal fibre, and to a lesser extent vegetable fibre, are significantly associated with lower total mortality (Kim and Je, 2014).

Evidence suggests that soluble fibres, such as β-glucan, play a role in certain health effects such as blood glucose attenuation and cholesterol lowering, while insoluble fibres play a role in health effects such as laxation (Fuller et al., 2016). The most widely accepted ways in which dietary fibres have been classified is to differentiate them based on (1) their solubility in a buffer at a defined pH, and/or (2) their fermentability in an *in vitro* system, using an aqueous enzyme solution representative of human alimentary enzymes (Tungland and Meyer, 2002). Since most fibre types are at least partially fermented, it may be appropriate to refer to fibre as partially or poorly fermented, and well fermented. Generally, well fermented fibres are soluble in water, while partially or poorly fermented fibres are insoluble. There are other classification systems such as those based on the role of fibre in the plant, the type of polysaccharide, the degree of simulated gastrointestinal fermentability, the site of digestion, and others based on products of digestion and physiological classification (Tungland and Meyer, 2002). Classification of dietary fibre based on molecular weight is also common (Westenbrink et al., 2013). For any classification system, it is important to understand that, as these are not mutually exclusive systems, fibre types may fit into more than one category. In addition, foods are likely to contain many different types of fibres, so individual foods that contain fibre will not fit into a single category, but rather be categorised into a group representing the predominant type of fibre in those foods. It is also important to recognise that

particular types of fibre belonging to a functional category (e.g. soluble fibre) may not attribute the same health benefits, and it is therefore essential to recognise which fibres possess specific health-promoting properties (McRorie and McKeown, 2017).

Current research has made it clear that dietary fibre represents a complex group of substances, with diverse physiological properties (McRorie and McKeown, 2017). To be able to fully understand the clinical benefit of dietary fibre, it is important to look at the individual components or properties and their physiological role, rather than considering dietary fibre as a single nutrient (Jew et al., 2015).

Most countries, including Australia, have a nutrient composition database that includes details for a range of nutrients, including dietary fibre (Food Standards Australia & New Zealand, 2014a). Food composition databases tend to only include details for total fibre in foods rather than specific types or categories. Further details on fibre types, including categorisation of fibre types as soluble and insoluble fibre, are not included. This lack of detailed information regarding fibre is problematic for research for example, attributing positive effects to total fibre, rather than type of fibre or even a broader group of fibre categories. However, sourcing information on different fibres is also difficult potentially requiring multiple approaches to analysis to determine fibre type. In addition there are limited publications providing useful reference data.

Being able to measure dietary fibre has important implications for research, regulation and labelling purposes. Quantification to determine health effects is particularly relevant, and although fibre labelling is not mandatory in Europe, it is required in countries such as Australia and the United States. As previously stated, the definition and analysis of dietary fibre components are intimately related. Both the definition of dietary fibre and the analytical methods used to measure dietary fibre have evolved over time (McCleary, 2007; Westenbrink

et al., 2013). Since dietary fibre is a multicomponent mixture, it is essential that there are methods that allow measurement of all known components.

Given that fibre is indigestible and there is chemical diversity of dietary fibre, a number of different methods have evolved to estimate the quantity of these materials in foods. All methods use a dried, defatted food sample, but they measure different chemical fractions (Lunn and Buttriss, 2007). Several methods are available for the measurement of dietary fibre in plant and food products. The Codex Alimentarius defines four types of methods for the measurement of dietary fibre; type I (defining methods), type II (reference methods), type III (alternative approved methods) and type IV (tentative methods), each with its own range of applicability. The Codex Committee on Methods of Analysis and Sampling have approved 14 methods for the measurement of dietary fibre: eight as type I methods, five as type II and one as type III (McCleary et al., 2013). A summary of these methods is given in Table 1.

Of these methods, the Association of Official Analytical Chemists (AOAC) methods 985.29 and AOAC 991.43 have been the main methods for dietary fibre analysis for many years. The AOAC 985.29 method measures the total high molecular weight dietary fibre (HMWDF) directly, while the AOAC 991.43 method distinguishes between insoluble and soluble HMWDF. The drawback of these methods is that they are inappropriate for the measurement of low molecular weight dietary fibre (LMWDF), such as inulin, fructo-oligosaccharides (FOS), galacto-oligosaccharides (GOS) and polydextrose, and they only measure RS3 category of resistant starch. Specific AOAC methods have therefore been developed to differentiate between different dietary fibre constituents. However, the large number of available methods makes it difficult to select an appropriate method for an unknown sample, and applying the broad classical and specific methods would be inappropriate since there is considerable overlap between these methods (Westenbrink et al., 2013). Table 1 shows the

components measured by various methods of dietary fibre analysis and highlights the significant crossover between methods which can be problematic.

As a result, in 2007, a new method for the integrated measurement of total HMWDF, LMWDF and resistant starch was described (McCleary, 2007). This method is known as the AOAC 2009.01 total DF method. This method has eliminated the need for both AOAC 985.29 for total dietary fibre and the specific methods for measuring LMWDF and RS1, 2 and 4 (Westenbrink et al., 2013). The AOAC 2011.25 method was developed as an extension of AOAC 2009.01 and enables differentiation between the soluble HMWDF and insoluble HMWDF part, of which the sum equals the HMWDF fraction as measured with the AOAC 2009.01 method (McCleary et al., 2012; Westenbrink et al., 2013). Therefore, of the approved methods, only AOAC Method 2009.01 and AOAC Method 2011.25 measures the total content of dietary fibre as defined by the Codex Alimentarius, with no double counting of any components (McCleary et al., 2013) (Figure 1). Further refinement of these latter methods is currently occurring in interlaboratory testing. The application of these methods has provided the dietary fibre databases available today.

Given the lack of information on the type of fibre in Australian Food Composition Databases (Food Standards Australia & New Zealand, 2014a), this project aimed to develop a database that included information for soluble fibre, insoluble fibre, and where possible resistant starch (RS), that could be applied to the analysis of dietary data. AUSNUT 2011-2013 Food Composition Database (Food Standards Australia & New Zealand, 2014a), which contains 5740 foods relevant to the Australian food supply, was used as a basis to establish a fibre categories database (FCD) thereby providing an expanded number of foods to potentially include.

2. Methods

2.1. Fibre Categories Database Creation

A Fibre Categories Database (FCD) was developed using data from a range of sources to include the total, soluble and insoluble fibre data, as well as RSA wide range of data was sourced, including most major food composition databases (from Australia, New Zealand, Europe, USA and Canada).The method (Figure 2) was adapted from previously published research involving whole grains (Dalton et al., 2014; Galea et al., 2016).

*2.2. Matching to AUSNUT 2011/13 Database*The starting point of the database comprised data for cereal foods provided by the Grains & Legumes Nutrition Council of Australia (GLNC) from the analysis of approximately 50 grain/legume foods by Grain Growers Ltd with support from Goodman Fielder Ltd and Ingredion ANZ Pty Ltd, using methods AOAC 2002.02 for resistant starch; AOAC 985.29 for total dietary fibre; and AOAC 991.42 for soluble and insoluble dietary fibre. The analysis produced data for 54 cereals, legumes and discretionary/non-core food items (higher fat, salt and sugar foodstuffs) (Food Standards Australia & New Zealand, 2014b).

The AUSNUT 2011/13 database (Food Standards Australia & New Zealand, 2014a) was sorted into major, sub-major and minor food groups, according to the Australian Health Survey classification system, and these food groups were used to guide the database matching process. These groupings are defined elsewhere (Food Standards Australia & New Zealand, 2014b), but in brief, this system assists in matching foods between different iterations of food databases. Firstly, foods were excluded if they were deemed to not contain fibre or have minimal fibre (<1g/100g AUSNUT dietary fibre), or make insignificant contributions to total dietary fibre by nature (e.g. meat, dairy) or were foods with insignificant consumption levels in the study population. Foods in the newly created FCD were matched against the AUSNUT

2011/13 database (5740 foods), to guide and extend development of the FCD by noting all foods that contained fibre in AUSNUT 2011/13 and searching for values for these foods.

A key task for database development was matching foods of similar type. For example, where a value existed for a slice of bread of a particular variety, this value could be used for the same type of bread if it was in a bread roll. In this way, foods were matched, and values provided for fibre containing foods in the AUSNUT database. After this initial matching, there was missing data for a number of foods or no appropriate match could be found. However, the amount of missing data was minimised through an iterative process of further searching.

After addition of definitive zero values and use of the GLNC data, further values were also obtained from the New Zealand FOODfiles 2014 Version 01 and Fineli- the Finnish Food Composition Database (National Institute for Health and Welfare, 2015; New Zealand Institute for Plant and Food Research Limited & The Ministry for Health New Zealand, 2014). The data obtained from these sources covered a range of additional foods. Foods that were not sourced from the GLNC dataset or the above-mentioned databases were sourced from original research studies that investigated fibre containing foods (Li et al., 2002; Marlett, 1992; Ramulu and Rao, 2003). Preference was given firstly to the GLNC data as this was attained using known analytical methods, and then to the NZ food files, followed by Fineli. If data had not been found in one of these sources, it was then sourced from one of the research studies referenced. Where foods were present in multiple sources, the data from the highest preference source was utilised for each food, namely direct analytical data or the best match to Australian foods. A small set of data was also obtained through industry partners who were able to provide data based on previous analysis of their products. Data was collated in an Excel spreadsheet, and included total fibre, soluble fibre, insoluble fibre and occasionally, RS. The source of the data and a description of the food product were also noted.

Two total fibre values for each food were derived in the process, - one from the original AUSNUT database and one from the new FCD. Differences in these 2 fibre values were observed, as expected, given the different data sources and methods used to measure dietary fibre.

2.2.1. Fibre calculations for cooked/raw & toasted/untoasted products

Due to lack of available data, the fibre values for some foods needed to be calculated from their cooked or raw versions. To do this, nutrient profile information (kJ) was utilised. The kJ difference between the two foods (e.g. cooked and raw) was calculated, and this ratio was then multiplied by the fibre value in the known food, which therefore allowed calculation of the amount of fibre that would be present in the unknown food on a weight basis. For toasted breads the calculation was also completed using the kJ method to account for moisture losses.

2.2.2. Mixed dish & recipe calculations

The fibre values in mixed dishes that contained a fibre source was calculated from the recipe information available in the AUSNUT 2011-13 recipe data file (Food Standards Australia & New Zealand, 2014a). The weight of each ingredient was calculated as a percentage, which was then multiplied by the fibre value of the food. This was repeated for all fibre containing foods in the recipe and the values were added together to give a total value for each dish. The calculation method for calculating fibre values from recipes is shown in Equation 1. Food sources contributing <1% to the total recipe were not included in the calculation, since these foods contributed insignificantly to the total fibre content of the recipe. For most recipes, these exclusions were limited to only singular foods, or foods that were not included in the FCD. This did not have a significant effect on the overall fibre values for those dishes affected.

3. Results

In total, 2624 foods were included in the FCD, while 3116 foods were excluded from the database (Table 2). Exclusions are shown in the database, with reasons for their exclusion noted. Data was unavailable for some foods, therefore a range of sources needed to be used in the creation of the database, introducing limitations which are discussed below. This lack of data also meant that exclusions were made for whole food groups as discussed above, but also for individual foods. Details of these exclusions can be seen in the database in the supplementary material.

The FCD dataset included 261 fibre containing foods for which analytical values for soluble and insoluble fibre were available. These foods mostly included those from the breads and cereals, fruits and vegetables, nuts and seeds and discretionary food groups.. These foods were matched to the AUSNUT 2011/13 Database to enable a fibre category profile for all relevant fibre containing foods in the AUSNUT database. This resulted in database of 2624 foods which could be used to calculate values for soluble and insoluble fibre. Food group categories that were included and excluded in the database are shown in Table 3. Data for resistant starch was so minimal that a full database was unable to be created. An example from the database is included in Table 4. This table demonstrates how individual foods were matched to a larger number of foods based on the referent food category. It also demonstrates some differences in the amount of fibre in the matched foods, however since it is the best available match it was utilised to obtain the soluble and insoluble fibre data for the purposes of this research.

4. Discussion

The creation of this fibre type's database will allow analysis of dietary intake data in relation to total fibre, soluble fibre and insoluble fibre. To date, this task has been relatively difficult with a lack of food composition data currently available which includes soluble and insoluble

data in food composition databases, values across a large range of sources and a limited range of foods with analysis. Australia, like most other nations, currently only includes total fibre in their food composition databases (Food Standards Australia & New Zealand, 2014a). To allow further study of the types of dietary fibre and their impact on human health, it is necessary to source the data for fibre types independently, which is a difficult process, limited by a lack of available data.

Current research suggests that the source and types of dietary fibre are important to human health (Fuller et al., 2016). Since most current food composition databases do not contain this information (Food Standards Australia & New Zealand, 2014a; Health Canada, 2015; Institute of Food Research, 2015; Nutrient Data Laboratory, 2015), it is difficult to conduct research in this area. Many studies into the health benefits of fibre types or categories are conducted by supplementing the diet of study participants (Brown et al., 1999; Othman et al., 2011; Whitehead et al., 2014), however since humans eat a varied diet, examining the health benefits of different dietary fibres in the context of the whole diet would make a useful contribution to current literature. The creation of this database represents one method to overcoming this obstacle, despite the limitations in its creation.

This study found data on dietary fibre was available from a range of sources, but there were limitations. The large variation in the fibre determination methods used by the different data sources was challenging. For example, the data obtained from the Grains & Legumes Nutrition Council (the analysis of approximately 50 grain/legume foods by Grain Growers Ltd with support from Goodman Fielder Ltd and Ingredion ANZ Pty Ltd) used methods AOAC 2002.02 for resistant starch; AOAC 985.29 for total dietary fibre; and AOAC 991.42 for soluble and insoluble dietary fibre, while the analysis conducted by Li et al. (2002) utilised method AOAC 991.43 to determine soluble and insoluble fibre (Li et al., 2002), the study by Ramulu & Rao (2003) utilised method AOAC 985.29 for total, soluble & insoluble

fibre (Ramulu and Rao, 2003) and the analysis by Marlett (1992) used a modification of the Theander method (Marlett, 1992). As discussed previously, the drawback of these methods is that they are inappropriate for the measurement of LMWDF, such as inulin, FOS, GOS and polydextrose, and they only measure RS3 category of resistant starch. Currently, of the approved methods, only AOAC method 2009.01 and AOAC method 2011.25 claim to measure the total content of DF as defined by the Codex Alimentarius Commission (CAC), with no double counting of any components (McCleary et al., 2013). Ideally any future analytical work examining dietary fibre would utilise these methods. The different methods utilised for the different data sources introduces variability into the database results, with some fibres being missed when older methods were utilised. The details of the fibre determination methods were not available for some sources, and therefore the methods used were not always clear, with this particularly true for the NZ Food Files Database (New Zealand Institute for Plant and Food Research Limited & The ministry for Health New Zealand, 2014). This is a major limitation of the study, and it is important to consider that while the data obtained may not be as accurate as if analytical methods were used for all determinations, in most cases this is the only data available. It is therefore the best available data. This limitation would have contributed to the fact that some foods showed a large difference between the FCD total fibre value compared to the AUSNUT total fibre value as shown in Table 3. The database is also limited in that seasonal or subtype/cultivar variation for dietary fibre is not taken into consideration. The subtypes of some foods (e.g. different lines of wheat or barley) may alter the fibre content (Andersson et al., 2013) and this variation is not accounted for in such a limited data set, limiting the accuracy. However, this is the first collection of dietary fibre categories listed in a single resource and provides a good starting point for additional work, particularly analytical determinations where data is particularly limited. Future work should include expansion of analytical work to more accurately reflect a

greater variety of foods and the impact seasonal variety has on nutrient content, including dietary fibre types.

Creation of the FCD and the process of matching this database to AUSNUT 2011-13 also had significant limitations. The lack of available data on soluble, insoluble and resistant starch is a major limitation. Worldwide, major food composition databases do not include data for soluble or insoluble fibre, or resistant starch (Health Canada, 2015; Institute of Food Research, 2015; Nutrient Data Laboratory, 2015), with the only known database to include soluble or insoluble fibre data, for some foods, being the Finnish Food Composition Database, known as Fineli. Since budget limitations prevented original analysis, data needed to be obtained elsewhere. This meant that data was unavailable for some foods, and that a range of sources needed to be used in the creation of the database. This also meant that data for resistant starch is incomplete in the database.

During database development, some foods, as well as whole food groups were excluded. Reasons for exclusions have been outlined above, and while the main reason for exclusions was based on a zero-fibre content, some foods were also excluded based on a lack of available data. However, most foods that were excluded due to lack of data contained smaller amounts of fibre (usually <1g/100g) and were also likely to have insignificant intakes in many study populations. For example, some tropical fruits which would have highly limited consumption in the Australian populations were excluded, for creation of this Australian food database. A limitation also exists for foods where the fibre value was obtained through a recipe calculation. The fibre value may be underreported due to the fact that ingredients contributing less than 1% to the recipe having been omitted. This may mean that some minor sources of dietary fibre have been excluded from the database, however, the impact of excluding these foods is likely to be minimal and this database provides the best possible estimate for soluble and insoluble fibre.

The foods with available data needed to be matched to all possible examples within the AUSNUT database; sometimes this meant that foods were matched to an appropriate representative food rather than an exact match, for example limes (AUSNUT) were matched to lemons (FCD). Professional judgement was used in this process and the Australian Health Survey (AHS) categorisations of foods were considered, with whole categories matched to their best available match (for example, all variations of fresh pears in the original AUSNUT database were matched to the single variety of fresh pear in the new FCD). In addition, this database, while aimed at use in Australia, needed to source international data. While this limits its precision in calculation of Australian values for soluble and insoluble fibre, it recognises that significantly more studies are required to produce this detailed information. Given similar limitations internationally, this database could be easily modified for use in other countries using the same food matching methodologies.

Despite the limitations outlined above, application of the newly created FCD allows for calculations of soluble and insoluble fibre present in a range of foods, and is particularly useful for examining the ratios of these fibre categories in foods. It should be noted that while the database provides two values for total dietary fibre, the value for AUSNUT fibre remains the more accurate value for total fibre and this should be considered in any application of the database. Most importantly, in any application of this database, it should be remembered that solubility is a continuum whereby fibres can be made more or less soluble under conditions of different pH (for example), and so these classifications are the traditional assignment of soluble and insoluble. Most critically, this does not mean that fibres classified as soluble are wholly fermentable in the large bowel and those classified as insoluble fibres undergo no fermentation. However, it represents one method of classification which tends to match a number of health effects, where, for example, insoluble fibre is typically associated with laxation and soluble fibre with cholesterol lowering or glucose attenuation. If we research

fibre in order to investigate health attributes, then utilising a system to categorise the fibres based on health effects is a reasonable choice.

5. Conclusions

The creation of the FCD provides a useful tool to analyse fibre type intake data and possible health outcomes in the context of a whole diet. Future work will include applying this database to the dietary data obtained from randomised controlled trials where participants have followed healthy eating guidelines and large population datasets to investigate any health effects or markers that may be associated not only with total dietary fibre intake, but types of fibre, namely soluble and insoluble fibre.

Conflict of Interest

EB is a member of the Code of Practice for Whole Grain Ingredient Content Claims Steering Committee for the not for profit Grains and Legumes Nutrition Council (GLNC).

Acknowledgements

This research has been conducted with the support of the Australian Government Research Training Program Scholarship. The authors acknowledge the support of the Grains and Legumes Nutrition Council (GLNC) in supply of data for some foods in the database.

Funding sources

This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

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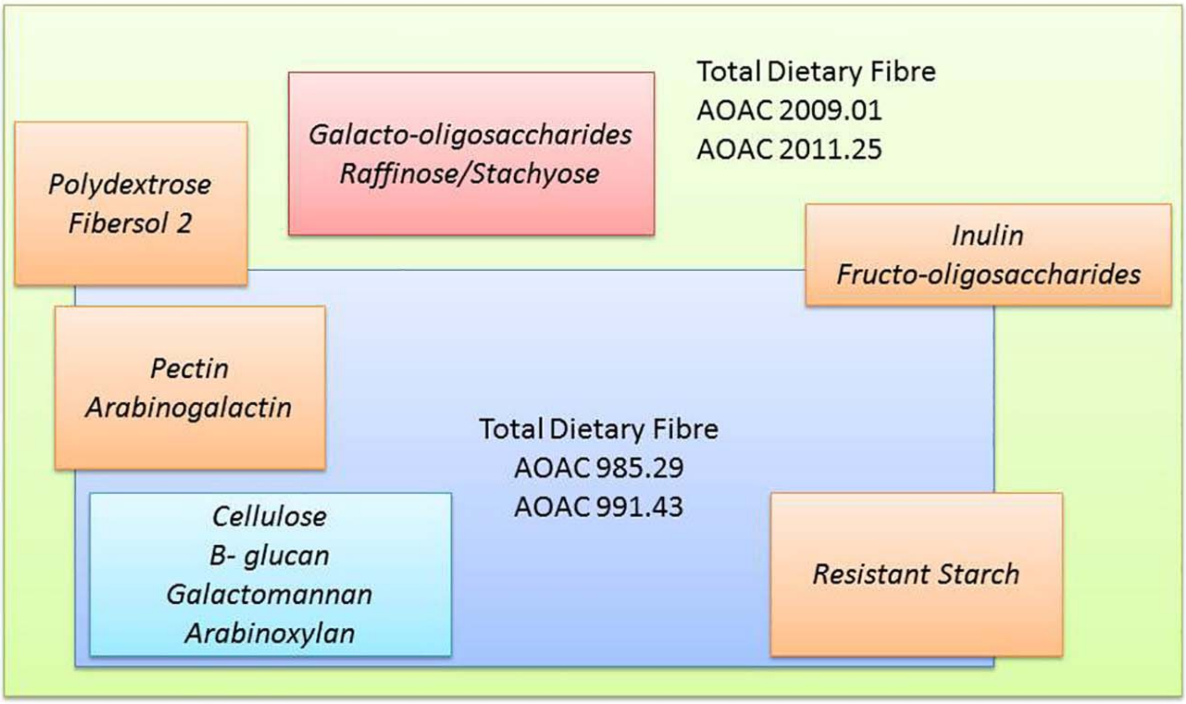
% of ingredient= (weight of ingredient (g)/ total weight of ingredients (g)) x 100

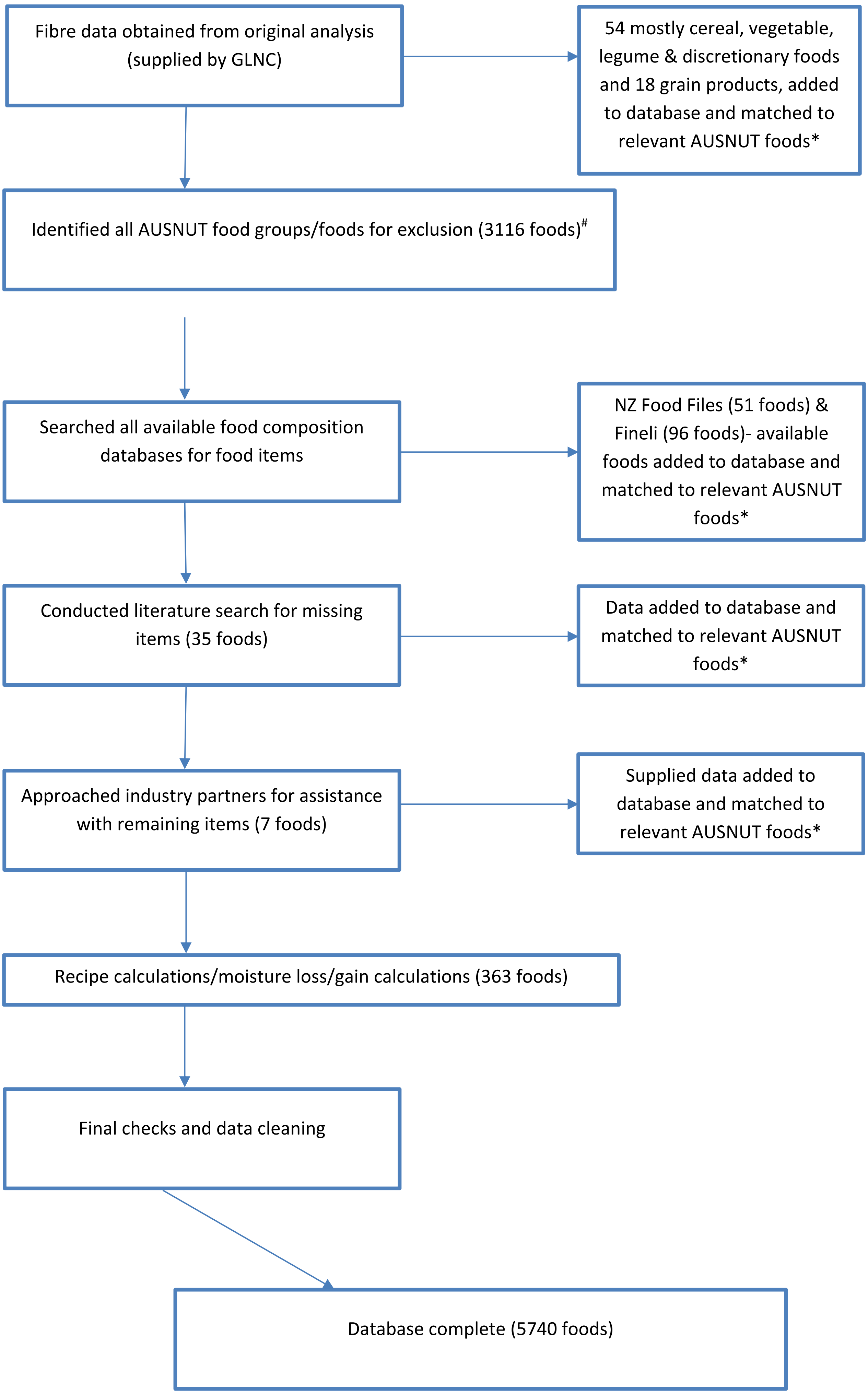
Fibre content = fibre content of ingredient X % of ingredient

Fibre content of recipe= sum of fibre content of all ingredients

Equation 1: Calculation method for calculating fibre value for recipes

FIGURE 1: Schematic showing issues with AOAC method 985.29 & 991.43. AOAC methods 2009.01 and 2011.25 measure all components shown, with no double counting. Adapted from McCleary et al. (2013).




Fibre data obtained from original analysis (supplied by GLNC)
54 mostly cereal, vegetable, legume & discretionary foods and 18 grain products, added to database and matched to relevant AUSNUT foods*
Identified all AUSNUT food groups/foods for exclusion (3116 foods)#
Searched all available food composition databases for food items
NZ Food Files (51 foods) & Fineli (96 foods)- available foods added to database and matched to relevant AUSNUT foods*
Conducted literature search for missing items (35 foods)
Data added to database and matched to relevant AUSNUT foods*
Approached industry partners for assistance with remaining items (7 foods)
Supplied data added to database and matched to relevant AUSNUT foods*
Recipe calculations/moisture loss/gain calculations (363 foods)
Final checks and data cleaning
Database complete (5740 foods)

Codex Alimentarius Method Type	AOAC Method	AACCI Method	Fibre fraction measured
I	985.29	32-05.01	Total HMWDF (IDF + HMWSDF)
I	991.42	32-20.01	IDF in foods
I	993.91	-	HMWSDF in foods
I	991.43	32-07.01	IDF and HMWSDF separately
I	994.13	32-25.01	Total HMWDF; provides sugar composition and Klason lignin
I	2001.03	32-41.01	HMWDF and LMWSDF in foods devoid of resistant starch
I	993.21	-	Total HMWDF in samples with >10% fibre and <2% starch
I	2009.01	32-45.01	HMWDF and LMWSDF in all foods
*	2011.25	32-50.01	IDF, HMWSDF, and LMWSDF in all foods
II	995.16	32-23.01	(1→3) (1→4)-**β**-Glucan in cereals, feeds, and foods
II	997.08	32-31.01	Fructans and FOS
III	999.03	32-32.01	Fructans and FOS (underestimates highly depolymerized FOS)
II	2000.11	32-28.01	Polydextrose
II	2001.02	32-33.01	Trans galacto-oligosaccharides
II	2002.02	32-40.01	Resistant starch (RS2 and RS3)

* No decision has yet been made by Codex concerning this method
(HMWDF = higher-molecular-weight DF; IDF = insoluble DF; HMWSDF = higher-molecular weight soluble DF; LMWSDF = lower-molecular-weight soluble DF; and FOS = fructooligosaccharides)

TABLE 1: Summary of Association of Official Analytical Chemists (AOAC) and American Association of Cereal Chemists International (AACCI) Approved Dietary Fibre Analysis Methods [1]

Included/Excluded Categories		No. of Foods
AUSNUT DATABASE		**5740**
EXCLUDED FOODS		**3116**
Excluded Category	Whole categories were excluded if they were likely an insignificant source of fibre in normally consumed quantities; OR they contained minimal or no fibre as a category AND data was unavailable	2972
Excluded- minimal or nil fibre	Food was excluded if it contained nil or minimal fibre (<1g/100g AUSNUT dietary fibre) AND data was unavailable	51
Excluded- insignificant fibre source	Food was excluded if it was likely an insignificant source of fibre (in population diet) AND data was unavailable	65
Excluded- nil data	Food was excluded if there was NO data	28
INCLUDED FOODS		**2624**
Matched to corresponding food	AUSNUT item was matched to a corresponding fibre containing food in the FCD	2261
Recipe calculation	Fibre value was calculated as outlined in methods section 2.2.2	336
kJ Calculation	Fibre value was calculated as outlined in methods section 2.2.1	27

TABLE 2: Number of foods in each category for excluded and included foods

Food Groups in the Fibre Categories Database			
Excluded Food Groups		**Included Food Groups**	
Code	**Food Group**	**Code**	**Food Group**
14	Fats and Oils	11	Non- Alcoholic beverages
15	Fish & Seafood	12	Cereals & cereal products
17	Egg products & dishes	13	Cereal based products & dishes
18	Meat, poultry & game products & dishes	16	Fruit products & dishes
19	Milk products & dishes	21	Soup
20	Dairy & Meat substitutes	22	Seed & nut products & dishes
27	Sugar products & dishes	23	Savoury sauces & condiments
29	Alcoholic beverages	24	Vegetable products & dishes
30	Special Dietary Foods	25	Legume & pulse products & dishes
32	Infant Formulae & Foods	26	Snack foods
33	Reptile, Amphibia & insects	28	Confectionary & cereal/fruit/nut/seed bars
		31	Miscellaneous

Table 3: Food group categories included or excluded in the fibre categories database

Sub-Sub Group Code	Sub-Sub Group Name	AUSNUT Code	Food Name (AUSNUT)	AUSNUT Total Dietary fibre (g)	Food Name (Database)	Data Source	Description	FCD Total Dietary Fibre (g/100g)	Insoluble Fibre (g/100g)	Soluble Fibre (g/100g)
12304	Savoury filled or topped breads & bread rolls	12304001	Bread or bread roll, topped/mixed with cheese	2.4	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304002	Bread or bread roll, topped/mixed with cheese & bacon	1.8	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304003	Bread or bread roll, topped/mixed with cheese & frankfurt	2.2	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304004	Bread or bread roll, topped/mixed with cheese, meat & vegetables	2.4	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304005	Bread or bread roll, topped/mixed with cheese & vegemite	2.6	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304006	Bread or bread roll, topped/mixed with cheese & vegetables	2.3	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304007	Bread or bread roll, topped/mixed with olives	2.9	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6
		12304008	Bread or bread roll, topped/mixed with spinach & fetta	3	Bread roll, white flour, cheese topped	GLNC	Bread roll, from white flour, topped with cheese and bacon- cheese and bacon roll	2.4	1.8	0.6

Table 4: Example of Fibre Types Database matched to AUSNUT 2011-13