Food composition—essential data in epidemiological studies of food and health

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Introduction
Food composition data are an essential component of many food-health studies, including epidemiological studies. Food composition may change over time and so national food composition tables are updated periodically. The reasons for food composition variation described in this paper indicate that quantitative comparisons of nutrient intake over time, or between countries at one time, need to be made cautiously.

Food Standards Australia New Zealand (FSANZ) analyses foods for regulatory purposes, maintains Australian national food composition tables and has compiled food composition tables for national nutrition surveys (NNS). These tables and their underlying data have been released and are used by researchers, consumers, industry and others.  

Prior to the 1980s, Australian food composition tables were based largely on overseas data. Extensive analysis during the mid-1980s of a range of foods by university researchers and the Commonwealth of Australia lead to the Composition of Foods Australia and then to the first Australian electronic tables. These data formed the basis to analyse nutrient intakes for the 1995 Australian NNS. New composition data have been compiled from various surveys.

The Australian Total Diet Study
The Australian Total Diet Studies (ATDS) (previously called 'market basket' surveys) have been carried out in Australia since 1970. Initially, the dietary exposure to pesticide residues, additives and contaminants in food, including metal nutrients such as zinc, copper and selenium, were estimated. In 2003, the scope of the ATDS expanded and was included on the Implementation Sub-Committee’s Coordinated Food Survey Plan which was developed to enhance collaborations, efficiencies and quality of national or bi-national food surveys.

The foods sampled in an ATDS vary depending on the focus of the survey but are broadly representative of the major foods consumed in Australia. Samples are collected from all states and territories and are prepared to a ‘table-ready’ state before analysis. In the 22nd ATDS, for example, 740 composite samples of 96 types of food were analysed for iodine, selenium, chromium, molybdenum and nickel. The composition data were applied to the food intakes reported in the 1995 NNS to estimate both the mean and range of dietary intake of the minerals for various population groups.

The Key Foods Program
The 2007 Australian Children’s Nutrition and Physical Activity Survey was the first Australian NNS in 12 years and FSANZ was contracted to develop the food composition database to code the food intake data. Because food composition analysis is expensive and funding is limited, FSANZ modified the ‘Key Foods’ approach developed by the United States Department of Agriculture to prioritise analyses. The major food sources of various nutrients for Australian children aged 2–15 years were identified from the 1995 NNS and foods were ranked by their overall contribution to intake of all nutrients assessed. The top ranking foods were selected for analysis, with some moderation of foods to reflect any recent analyses or likely shifts in consumption since 1995 (for example, increasing consumption of reduced fat milk). The national sampling strategy included capital cities and some regional centres. Some food samples were analysed individually (where a food was a top tertile contributor to intake of a nutrient) and provide information on variation in nutrient levels. Sampling was conducted in 2006.

In 2008 FSANZ commissioned a second program, focussing on foods that contribute to nutrient intakes for Australians aged 16 years and over. Because a number of these foods had been analysed in 2006, not all top-ranked foods were analysed, thus allowing some resources to be devoted to new products, fortified foods and foods likely to have changed in composition. Samples were collected in both summer and winter.

Other food composition surveys
FSANZ sometimes conducts special purpose surveys, often in conjunction with other government agencies. For example, following a recent multi-agency survey of trans fatty acid levels in packaged and takeaway foods, FSANZ organised sodium and iodine analysis on the same foods. In 2005, FSANZ conducted surveys focussing on those foods that are major contributors to iodine and folic acid intake, to support consideration of the need for mandatory fortification with these nutrients.
Changing composition data
Food composition data can change over time because the methods of analysis or presentation format changes or because the foods themselves have changed. Consequently, caution is needed before adopting overseas food composition data into local tables.

Analytical improvements
As analytical methods develop, lower concentrations or a greater range of compounds might become detectable. Folic acid (Food Standards Code, Standard 2.4.2), almost all spreads now available contain 70% or less fat without being labelled as ‘reduced fat’. This has implications for assigning food codes to, for example, a food frequency questionnaire that might be administered several times during a cohort study. Replacement of data for margarine with data for spread might substantially alter estimated intake of unsaturated fat.

Variability and uncertainty in the composition of foods
Just as humans vary in height, weight and serum cholesterol levels, so too do foods vary in their composition. Variability in nutrient levels results from a number of factors including season, species, soil type, formulation (for processed foods) and food samples selected for analysis might not capture the overall variability in nutrient levels. Analytical methods also have associated uncertainty. Data reported in food composition tables are therefore ‘best estimates’ of nutrient levels and are only a representation of the ‘true’ nutrient value for that food.

Implications for researchers
In short-term studies, it is evident that the most current nutrient data should be used. When AUSNUT 2007 was released, FSANZ recognised that this was the first new compiled complete dataset in a decade and some researchers might have coded recent data using AUSNUT 1999. Therefore, a file matching the codes between the two databases was released to assist those wishing to update the coding in their studies. This is not a complete solution because researchers still need to consider how they have coded foods which might have changed over time. In randomised controlled trials, changing food composition might be unimportant if the sole purpose of describing nutrient intake is to show comparability between intervention and control groups. If the goal is to compare recent intake to biomarkers that respond quickly to dietary changes, the variation among samples of the same food might dilute the expected relationship so profoundly that researchers should be developing that sometimes have important nutritional differences (such as higher sugar levels or colour differences due to changing carotene levels). These changes affect not only the specific foods themselves, but also the ‘not further specified’ code that is used in surveys when respondents are unable to describe all aspects of the food eaten.

Table 1: Iodine and calcium values in full fat milk purchased in Australia in 2006 and 2008

<table>
<thead>
<tr>
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<th>Iodine (µg/kg)</th>
<th>Calcium (mg/kg)</th>
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<tbody>
<tr>
<td></td>
<td>Mean (range)</td>
<td>Mean (range)</td>
</tr>
<tr>
<td>2006 (n=20)</td>
<td>230 (150 – 310)</td>
<td>1030 (950 – 1200)</td>
</tr>
<tr>
<td>2008 (n=16)</td>
<td>230 (70 – 450)</td>
<td>1040 (790 – 1290)</td>
</tr>
</tbody>
</table>

n = number of purchases
The decision about whether to recode food intake data for longer term studies is complex, especially if food intake data has been collected several times. If compositional differences are due to better analysis, then one can argue that new data should be applied backwards in time. If technical improvements coincide with real change in the food supply then it is more difficult. It may be possible to identify indicator foods and conduct sensitivity or ‘bridging’ analyses to examine the impact of various assumptions on relative risk estimates. Similar considerations apply when doing sequential cross-sectional analyses of population intakes because failing to understand the composition data might lead to erroneous conclusions about trends.

Disclaimer
The views are those expressed by the authors and not necessarily those of Food Standards Australia New Zealand.

References


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