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The impact of new Australian food composition data on national dietary references

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Until the late 1980s three food tables were in common use in Australia: an official limited publication compiled from foreign sources; the UK food tables; and the US food tables. The new tables *Composition of Foods, Australia* released from 1989 onwards comprise original analytical data for edible portion and a wide range of nutrients in a large number of Australian raw, processed and prepared foods. A series of studies have been carried out to assess the impact of these new Australian tables on Australia's major dietary references such as food availability statistics, food guides, dietary guidelines, and dietary goals and targets. These studies also included comparisons with the foreign tables often used in Australia. The results of these studies showed that a number of factors were responsible for the major impact of the new Australian data on the national dietary references, many of which had to be revised as a consequence. The factors included improved analytical methods, genuine changes in foods over the decades, natural differences between Australian and foreign primary produce, and particular food manufacturing and fortification practices used in Australia. The results provided a strong justification for Australia's ongoing food analytical programme. On the basis of the Australian experiences other countries are advised not to accept foreign data uncritically for application in their own national nutrition programmes.

INTRODUCTION

New Australian food composition tables, the series *Composition of Foods, Australia* began to be issued in 1989. These new tables comprise original analytical data for edible portion and a range of nutrients in a large number of Australian foods (Cashel *et al.*, 1989; English & Lewis, 1990; English *et al.*, 1990; Lewis & English, 1990*a*,*b*; Lewis *et al.*, 1992).

The previously used *Tables of Composition of Australian Foods* (Thomas & Corden, 1970, 1977) comprised mainly foreign data from the US and UK tables, with some adjustments for Australian conditions. However, the precise origins of the data are not known since the publication does not document sources. However, in the comparative studies we present below an assumption is made that the data are based on laboratory analyses and are indicative of the composition of foods in the late 1960s. The nutrients included in the old tables and the new tables are shown in Table 1.

COMPARISON OF THE OLD AND NEW TABLES

One of the most important nutrition references in Australia is the food balance sheets showing foods and nutrients available for consumption per capita of the population, and used to monitor trends in the food supply. The set selected for comparison of effects of the new tables with the old tables was for the year 1983–1984 (Australian Bureau of Statistics, 1985). In this study the effects of gross composition (e.g. proportions of muscle, bone and fat in meat) and nutrient composition were studied separately as well as together (Cashel & Greenfield, 1995*a*).

There appeared to be two main factors responsible for the results emanating from the comparison of the old and new tables; improved methods of analysis and genuine changes in the composition of foods.

Changes in foods

The extensive nature of the new analyses of meat had enabled carcase edible portion factors appropriate at retail level to be calculated for the first time in Australia (Cashel & Greenfield, 1994). The changes in the gross composition of meat resulted in a 16% fall in the estimate of edible meat available for consumption per capita. The impact on nutrients of all gross composition changes was to reduce the estimates of the following nutrients available for consumption: total fat (−7%), energy (−3%), iron (−5%), thiamin (−7%) and riboflavin (−2%).

Table 1. Comparison of old and new Australian food composition tables (per 100 g edible portion)

Parameter	Old tables[1]	New tables[2]
Number of foods	~800	~1700
Edible portion (%)	Yes	Yes
Common food measure (g)	Some	Yes (ml, metric cup)
Moisture (g)	Yes	Yes
Protein (g)	Yes	Yes
Amino acids (mg)	No	Yes (mg/g N)
Fat (g)	Yes	Yes
Energy (kJ)	Yes	Yes
Fatty acids (g)	Some	Yes (% total acids)
Cholesterol (mg)	Some	Yes
Carbohydrate (g)	Yes (total)	Yes
Starch (g)	No	Yes
Sugars (g)	No	Yes
Dietary fibre (g)	No	Yes
Organic acids (g)	No	Yes
Vitamin C (mg)	Yes	Yes
Retinol equivalents (μg)	No	Yes
Retinol (μg)	Yes	Yes
β-carotene equivalents (μg)	Yes	Yes
Individual carotenoids (μg)	No	Yes
Thiamin (mg)	Yes	Yes
Riboflavin (mg)	Yes	Yes
Niacin (mg)	Yes	Yes
Niacin equivalents (mg)	No	Yes
Sodium (mg)	Yes	Yes
Potassium (mg)	Yes	Yes
Calcium (mg)	Yes	Yes
Iron (mg)	Yes	Yes
Zinc (mg)	No	Yes
Magnesium (mg)	No	Yes
Copper (mg)	No	Yes
Manganese (mg)	No	Yes
Phosphorus (mg)	Yes	Yes

Old tables from Thomas & Corden (1970, 1977). New tables from Cashel *et al.* (1989), English *et al.* (1990), Lewis & English (1990*a*,*b*), English & Lewis (1990) and Lewis *et al.* (1992).
[1]Contained many gaps for vitamins and minerals.
[2]Includes additional modes of expression.

When gross and nutrient composition data were considered together, the effects were to lower the estimates of most nutrients available for consumption. Estimates of total fat decreased by 18%, with the ratio of vegetable to animal fat increasing from 0.55:1 to 0.74:1. Estimates of carbohydrates other than refined sugars, iron, thiamin and energy also decreased by 11, 17, 8 and 10%, respectively. By contrast, estimates of refined sugars did not change, and protein, vitamin C and retinol activity increased. The main reason for changed estimates of fat available for consumption in the period 1983–1984 was the changes in the gross and nutrient composition of meats. Thus, there was a reduction of available fat from 145 to 119 g per capita per day. Of the resultant 27.6 g decrease in fat from meats, changes to gross carcase composition were responsible for 10.1 g with the remaining 17.5 g being due to the fall in the total fat content of meats.

Beef, veal and pork had halved in fat content over time, and lamb had decreased in fat content by about 10%, whereas chicken had doubled in fat content [5.8 g fat/100 g edible portion (old tables) to 13.2 g fat/100 g edible portion (new tables)]. The changes in fat content of meats were probably due to the combined effects of agricultural and butchering practices in response to consumer demand; while changes in the fat content of chicken were probably due to changes in feeding and husbandry practices.

The changes in meat meant that perceptions of foods as sources of nutrients changed: an important point since dietary recommendations must be directed towards food sources of nutrients. The use of the old tables suggested that 39% of all dietary fat was contributed by the fats and oils group, similar to the meat and poultry group at 38%. The use of the new tables re-ordered this to the fats and oils group contributing 48% of fat, with the meats and poultry group much lower at 25%. This change clearly puts the spotlight on the fats and oils group as the primary target for consumer campaigns to reduce fat consumption (Cashel & Greenfield, 1995*a*).

Changes in analytical methods

The decreased estimates of carbohydrates available for consumption were undoubtedly due to the direct determination of starch (after hydrolysis) and sugars by HPLC in the new tables compared with the use of carbohydrate 'by difference' in the old tables (which would have meant fibre was included as carbohydrate). Vitamin C was measured by the indophenol or dye method in the old tables reflecting ascorbic acid alone, while the method used for the new tables was the microfluorometric method which measures ascorbic and dehydroascorbic acids together. This analytical change would have been responsible for the increase in estimated vitamin C available for consumption, from 94 to 108 mg per capita per day, a 15% increase.

Changes in foods and analytical methods

There were changes in estimates of iron available for consumption, down from 14.9 to 12.4 mg per capita per day. Most of this difference was due to a fall in the contributions made by meats and poultry. This could have been due to estimation of iron levels from protein content of animal foods in the data sources used for the old tables as well as genuine changes in foods such as slaughter of animals at a younger age, thus meaning that their iron stores would be lower. Iron levels in meats and poultry in the new tables had decreased by between 13 and 65% of the levels previously published in the old tables. These findings together with evidence about impaired iron status in girls and women reinforced the need for a new dietary guideline 'Eat foods containing iron. This particularly applies to girls, women, vegetarians and athletes' (National Health and Medical Research Council, 1992).

COMPARISON OF THE NEW TABLES WITH CONTEMPORARY FOREIGN TABLES

A peculiarly Australian tendency is to rely on scientific data from overseas, particular the UK and the USA. This remains true in the nutrition field, with some users preferring to continue using the US (US Department of Agriculture, 1976) and UK food composition tables (Paul & Southgate, 1978) instead of the new Australian tables. It was therefore decided to compare the foreign tables with the local tables using the 1990–1991 food availability statistics (Australian Bureau of Statistics, 1993).

This study found many differences between the three sets of tables in their rendering of the Australian food and nutrient availability figures. These differences were due to true differences in the foods in terms of their gross composition and nutrient composition. Nutrient composition varied due to different technological practices such as extraction of flour and fortification with particular nutrients; in addition different methods of analysis contributed to the outcomes.

Differences in foods

Gross composition differences for meats between the three sets of tables produced estimates of meat available for consumption that were 19% higher using UK and US tables; weights of vegetables available for consumption were 2% higher than the Australian calculations when UK data were used, and 6% lower when US data were used. Similarly fruits were 9 and 6% lower using UK and US data, respectively, compared to Australian data. When gross and nutrient composition data were considered together in the three-way comparisons, the trend was exacerbated with total fat available for consumption being 22% or 14% higher using UK data or US data, respectively, instead of Australian data. These results were due to the much leaner nature of Australian meats, probably mainly due to animal feeding practices (most livestock in Australia are range rather than lot fed).

Another difference was due to fortification of foods. The use of US data produced thiamin availability estimates 59% higher than those produced using Australian data, due to the fortification of wheat flour and rice with thiamin in the US. Similarly estimates of calcium available for consumption were 35% higher when UK data were used instead of Australian data, due to fortification of wheat flour with calcium in the UK. These results highlight the need for direct analysis of local foods, since although adjustments could be made for fortifying nutrients, the higher natural levels of thiamin in Australian flour due to higher flour extraction rates could only be determined experimentally.

Different methods of analysis and modes of expression

These were again responsible for different outcomes of the application of the three sets of tables. Estimates of carbohydrate available for consumption were 8% lower with the Australian than the UK or US tables. Carbohydrates were determined directly for the Australian and UK tables rather than 'by difference' as in the US tables (thus including fibre as carbohydrate); and carbohydrate was lower using Australian rather than UK tables because carbohydrates are expressed as monosaccharides in the UK tables. The picture is therefore very complex.

OTHER DIETARY REFERENCES

Unpublished analyses of Australia's dietary goals and targets have shown that the application of the new tables indicated not only that the goal for dietary fat (33% dietary energy) set for 2000 had already been met in 1983 (i.e. at the time it was set), but that refined sugars were originally 15.7% energy instead of 14.1% energy as estimated, thus placing the 2000 target of 12% energy even further from reach.

The availability of the new food composition data had a major impact on all new dietary references then in development. For example, a new set of core food groups was adopted officially in 1994 (Cashel & Jefferson, 1995) to aid nutrition education geared to dietary adequacy within a context of the dietary guidelines. Future publications will enable an evaluation of the role of the new food tables in the development of this important new nutrition education tool.

CONCLUSION

The decision to create entirely new indigenous Australian food tables comprising only original analytical data by means of an ongoing food analytical programme, employment of specialized personnel for data scrutiny and evaluation, and development of specific software for compilation and output in varied print and computer formats meant considerable investment of resources. This series of studies of the impact of the new tables provides a strong justification for the investment involved. The new data not only produced very different results for all major national dietary references than the old data or foreign data but have led to the development of new dietary guidelines and core food groups. While 'gold standard' studies still have to be carried out to validate the Australian tables using duplicate diets, the Australian experience does caution against uncritical use of old or foreign data in national nutrition programmes elsewhere. In countries outside of Australia the use of Australian food composition data is best restricted to those applying to imported Australian foods.

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