

# The role of food analysis in national and international nutrition programmes

Shawn M Somerset<sup>1</sup> PhD and Ruth M English<sup>2</sup> AO, PhD

<sup>1</sup>Centre for Environmental Health Sciences, Queensland Health Scientific Services, Brisbane, Queensland, Australia

<sup>2</sup>Department of Social and Preventive Medicine, University of Queensland, Brisbane, Queensland, Australia

This paper outlines the importance of information on the composition of foods for a wide range of national and international activities at government, community and industry levels. Particular reference is made to the essential need for nutrient composition data of food supplied for the development of nutrition policy and programmes, for nutrition research and nutritional education to improve health status and reduce risk for disease. The regional activities of the International Network of Food Data Systems (INFOODS) and the Asia Pacific Food Analysis Network (APFAN) to promote the availability and quality of food composition data, are discussed. In particular, reference is made to the role of APFAN in promoting the use of consistent methodologies for food analysis by its member organizations.

**Key words:** food composition, nutrition programmes, nutrient analysis, INFOOD, APFAN.

## Introduction

Diet is a major determinant of health status and risk for disease. Knowledge of the composition of national food supplies, in terms of nutrients, additives and contaminants, is an essential database for the development and implementation of national and international policy and programmes in the nutrition and health sector, and also in a number of other areas, including agriculture, education, trade and social security.<sup>1</sup>

At a national level, Ministries of Health or Agriculture are usually responsible for the development of national databases on the nutrient composition of the food supply and associated food analysis programmes. These responsibilities are usually administered by food and nutrition units within these Ministries. Data on the composition of foods are essential for nearly all nutrition activities at a national level, as well as at a community and a household level. They are used for the development and evaluation of food and nutrition policies and programmes, for research into the association between diet and health and disease, and the development of therapeutic dietary regimes, and health promotion programmes. Government planning and policies in a number of other sectors, and food industry and trade decisions depend on having an accurate knowledge of the composition of foods, of both nutrient content and food contaminants. Availability of appropriate food composition data also has a positive impact on agricultural planning and programmes.

At an international level, food analytical data are essential for the growing inter-country trade and export of foods and to meet requirements for nutrition labelling of such foods. For health and nutrition, food composition databases are needed for international epidemiological studies, researching the associations between diet and disease. Within recent years the United Nations-sponsored International Network of Food Data Systems (INFOODS) has been active in facilitat-

ing the international exchange of food analytical data. At regional level, the Asia Pacific Food Analysis Network (APFAN) has been operating since 1989 to expand the usefulness of food composition data within the region, through the coordination of food analysis techniques. This paper details the need for and value of food analyses to promote the nutrition and health of populations and for economic development within the Asia Pacific region.

## Why analyse foods?

Activities at various levels depend on good quality food composition data.<sup>1-3</sup> At a national level, governments use food composition data:

- (i) to monitor the nutritional health of the population through, *inter alia*, assessment of the nutritional status of the populations through food consumption studies, which are converted into nutrient intakes for assessment of adequacy, using food composition tables;<sup>4</sup>
- (ii) to monitor the nutritional value and quality of the national food supply by analysing the nutrient content of 'apparent food consumption statistics', through the application of food composition tables;<sup>5</sup>
- (iii) to develop food standards to protect the nutritional quality of the food supply; and
- (iv) to ensure compliance standards for export foods are met.

Analysis and availability of appropriate nutrient data also generate positive impacts on agricultural development, facilitating the selection of varieties of crops with the best nutritional values, and assisting the promotion of wild and other

**Correspondence address:** Dr Shawn Somerset, Queensland Health Scientific Services, PO Box 594, Archerfield, Queensland 4108, Australia.

Tel: +61 7 3274 9012, Fax: +61 7 3274 9008

traditional foods for cultivation and development into cottage or export industries in less developed and developed countries in the Asia Pacific region.<sup>6</sup>

At a community and household level, the uses of food composition data include the following:

(i) researchers apply food composition data for epidemiological and clinical studies to determine the relationship between nutrient intake and risk for disease;

(ii) the education sector uses food composition data to teach people the fundamentals of healthy eating and how to plan and prepare nutritious meals;

(iii) schools, institutions, hospitals, etc., provide nutritionally adequate foods for people in their care through the calculation of the nutrient composition of diets and rations;

(iv) food industries use nutrient composition data to develop and modify food products, for nutrition labelling of foods and to provide specific composition data to consumers; and

(v) health professionals (dietitians, nutritionists, medical practitioners, nurses) use nutrient composition data to develop and apply appropriate therapeutic diets to prevent and control a range of disease conditions.

At an international level, the use of food analytical data include:

(i) the control and prevention of malnutrition, including micronutrient deficiency disease, through the use of food composition tables in the planning and implementation of global programmes;<sup>7</sup>

(ii) the distribution of food assistance programmes in response to needs for specific dietary components, such as energy, protein and particular micronutrients;

(iii) the development of international food standards through the Codex Alimentarius Commission of FAO and WHO, in conjunction with Member States;

(iv) correlation of patterns of disease with dietary components between countries to construct hypotheses of causality; and

(v) the facilitation of food trade between countries, that depend on the availability of food composition information.

Thus, food composition data provide a valuable resource for a variety of sectors including customs authorities (import/export), food production and manufacturing industries, food and nutrition researchers, consumers, regulators, public health surveillance agencies, public health planners and policy makers, and international agencies. Chemical analysis of food generates information on a variety of aspects of food composition, including ingredients, purity, nutrients, additives, contaminants, other bio-active components and on the bio-availability of nutrients and toxicants.<sup>8</sup>

Each sector determines the analytes most appropriate for meeting its own particular objectives. It is a sound strategy for the health and agriculture sectors to identify other sectors with an interest in food analysis data to develop collaborative partnerships between organizations requiring the same information on food composition. This is likely to reduce substantially the costs to the major authority of monitoring the nutrient and other components in the national food supply.

### **Importance of nutrition for improving population health**

A safe and adequate food supply is the cornerstone of maintaining optimal standards of population health.<sup>9</sup> Food directly

affects individuals by providing nutrients essential for maintaining good health and maximizing genetic potential. Food also can be a vehicle through which individuals are exposed to toxic compounds and pathogenic organisms. A safe and wholesome food supply delivers essential nutrients to the population in proportions appropriate for optimal health, growth and development, while minimizing the content of toxic and otherwise undesirable components. Data on the composition of foods are essential for the development of other nutrition assessment tools, such as recommended dietary allowances.

Food composition data also are useful as a basis for addressing situations where chronic degenerative diseases such as cancer, coronary heart disease, diabetes mellitus and stroke, and over-nutrition predominate. Examples of food components now being analysed more frequently include fatty acid profile, soluble and insoluble fibre (including resistant starch), polyphenolic compounds and other non-vitamin antioxidants.<sup>10</sup>

Geographical regions usually have their own specific food habits. Regional variations often are intensified by ethno-specific foods which are peculiar to a particular culture or region. The composition of foods also varies according to the geographical origin and the methods of preparation of the food in question. At this point in time, it may not be practical for some countries in the region to develop national nutrient composition databases. Regional compositional data then fulfil an important role, such as the Pacific Islands food composition tables, so that the nutritional value of unique foods and regional variations of common foods and their associations with local disease patterns are understood.<sup>11</sup>

### **Food analyses for a food and nutrition monitoring and surveillance system**

Monitoring in relation to a food supply is defined by the WHO as a system of repeated observation, measurement and evaluation for a defined purpose, carried out on samples representative of individual foods or the diet in a country or a given area within a country.<sup>12</sup>

The purpose of a monitoring system is to:

(i) ascertain whether over a long period changes occur to the content of desirable and undesirable substances in food;

(ii) combine such changes with changes to eating habits;

(iii) assess whether changes expose a population to nutritional or toxicological hazards to health;

(iv) generate background material and a basis for remedying health problems.

There are two basic levels to a monitoring system, involving food composition data:

(i) analysis of nutrients and contaminants in selected foods, and

(ii) determination of the composition of collective diets.

A recent Working Paper identified food and nutrition activities for national monitoring and surveillance in Australia.<sup>13</sup> As well as the nutrient composition of foods, this working paper recommended the following data sets as being important for monitoring the food supply: contents of food additives, levels of contaminants such as heavy metals and pesticide residues, and information on microbiological contamination. This information combined with food intake data determines levels of exposure of the population or specific

groups in the population, to noxious substances in the food supply.

An important food analysis question to answer is what analytes should be included in a monitoring system? The range of nutrients for which there are recommended dietary intakes forms the basis of food composition monitoring. Many countries have developed analytical programmes to address this basic range, providing a useful platform for inter-country comparisons.

In addition, individual countries may have specific health issues (e.g. excessive aflatoxin levels in foods) which require information on particular analytes which are not part of mainstream needs. In any case, from the health sector viewpoint, the most prudent approach is to conduct monitoring only to the level sufficient for important health decisions to be made.<sup>14</sup> The range of analytes can be expanded as new health issues emerge.

### **Food analysis and recommendations from the International Conference on Nutrition**

In December 1992, FAO and WHO held a joint International Conference on Nutrition (ICN) which sought to establish a global perspective on the state of food and nutrition in the world and develop a plan of action to ameliorate the current food- and nutrition-related problems of both developing and developed countries.<sup>9</sup> A variety of health, agricultural and other development policies and programmes were proposed as being the most effective way of improving the nutrition status of all people. There were nine specific themes endorsed by the 159 governments of member states represented at the Conference, to meet the goals of the World Declaration and implement the Plan of Action for Nutrition adopted at the ICN. Of these areas for action, three made specific recommendations concerning food analyses and food composition tables. They were:

- (i) protecting consumers through improved food quality and safety;
- (ii) preventing and controlling specific micronutrient deficiencies; and
- (iii) assessing, analysing and monitoring nutrition situations.

The Plan of Action for Nutrition states in the theme 'Protecting consumers through improved food quality and safety' that food quality encompasses the basic composition of foods and aspects concerning food safety. Better information on food analysis and food composition is needed for the development, implementation and monitoring of adequate food regulations and other measures to protect the consumer from unsafe, low quality, adulterated, misbranded or contaminated foods. In 'Preventing and controlling specific micronutrient deficiencies', it is recommended that research should be supported on the development of food composition tables of existing and potentially significant sources of micronutrients, including *inter alia*, green and yellow vegetables and fruits, palm oil, fish and other locally available food sources of micronutrients; and weaning foods. In the theme on 'Assessing, analysing and monitoring nutrition situations', special reference is made to the need for support and encouragement for the development and use of local food composition information.

Although no specific reference is made within their recommendations, the remaining six themes identified by the ICN also require input from food composition databases, for the successful implementation of the Plan of Action for Nutrition. They are:

- (i) incorporating nutritional objectives, considerations and components into developmental policies and programmes;
- (ii) improving food security;
- (iii) preventing and managing infectious diseases;
- (iv) promoting breastfeeding;
- (v) caring for the socio-economically deprived and nutritionally vulnerable; and
- (vi) promoting appropriate diets and healthy lifestyles.

### **The role of nutrition in the economic development of the Asia Pacific region**

Health is an important resource for any community, not only in terms of providing an effective and efficient workforce, but also as a valid, stand-alone indicator of the standard of living of a community. Unfortunately, the current trend in the corporate sector favours return on shareholder investment as the predominant performance indicator. Within this framework there are opportunities for nutrition to play a prominent role in international food trade. There is a trend for the USA nutrition labelling requirements to be used as a standard for the labelling of food destined for export from the region.<sup>15</sup> In particular, countries intending to export food to the USA need appropriate technologies in place to conform to US labelling requirements. It is anticipated that in some instances it will be the industrial sector that will fund the establishment and maintenance of this facility, whether within the industry or within an institution, such as a tertiary education centre. This represents an opportunity for the health sector, and nutritionists in particular, to benefit from this activity through indirect access to the resulting data and expertise generated by these emerging commercial and export requirements.

Cost-effective methods of evaluation are required to strengthen control measures for food quality and safety. Food analysis is an integral part of this process, as recommended in the ICN's National Plan of Action for Nutrition. An infrastructure comprising food inspection services, sampling programmes and analytical capabilities is required to ensure optimal food quality for local or export use.<sup>16</sup>

Since a large proportion of the responsibility for food production lies outside government, close ties with the food industry sector are essential. Food import standards of many countries necessitate effective monitoring of food quality. This is a very important economic consideration and there is a danger that with the emphasis on export food quality domestic food quality needs may be overshadowed. Through genuine intersectoral collaboration and cooperation, domestic food quality can be enhanced by export quality requirements.

### **Initiatives for the international coordination of food composition activities**

The International Network of Food Data Systems (INFOODS) was established in 1984 to improve the quality, quantity and accessibility of food composition data between

regions and countries. The lead agency within the United Nations for this network is the United Nations University (UNU). To progress the work of INFOODS, regional food composition groups such as EUROFOODS in Europe, NORFOODS in Scandinavia, NOAFOODS in North America, ASEANFOODS in the ASEAN countries, OCEANIAFOODS in the Pacific, AFRICAFOODS for the African continent, MENAFOODS in the Middle East and GULFOODS in the Gulf Arab States, have now been established. These initiatives have resulted in the compilation of inventories of regional resources of available manpower and data, and an exchange of information within and between geographical regions. The *Journal of Food Composition and Analysis*, first published in 1987 as a follow-up to the establishment of INFOODS, continues to publish scientific reports on the sampling, analysis, compilation and usage of food composition data. Of the groups in the Asia Pacific region, OCEANIAFOODS has been particularly active, organizing four regional conferences with published proceedings since its formation in 1986.<sup>17-21</sup> This group is now cooperating with a major research project on the 'Nutrient composition of some Pacific Island food crops and wild foods', being undertaken by the University of the South Pacific, in cooperation with the Australian Government Analytical Laboratories, and sponsored by the Australian Centre for International Agriculture Research.<sup>21</sup>

#### **The need for consistent methodologies for analysis**

Calculating the preventable proportions of disease and identifying environmental risk determinants require international comparisons.<sup>22</sup> It is essential that comparable methodologies are used in determining tools for risk evaluation. Food composition data are an essential database for international comparisons to determine the contributions that diet and specific nutrients make to health risk. Inter-country comparisons of disease rates and level of at-risk behaviours provide important insights into disease prevention. Using coronary heart disease (CHD) as an example, several important data sets are required to assign risk. Firstly, good data on morbidity and mortality based on common collection methodology are crucial. Once consistent methodology is verified, any differences in disease rates can then be attributed to risk factors.

Previous studies indicate that diet is a major determinant of CHD risk. In determining the role of specific nutrients, there is no certainty that a particular food eaten in one location delivers an equivalent nutrient load in the corresponding food, eaten in another region or country.<sup>23</sup> The composition of foods from both sources need to be compared and the methods used to assess composition need to be consistent. The facilitation of this consistency of methodology for food

analyses should be a focus for international and regional collaboration. FAO publishes data sheets on the apparent consumption levels of foodstuffs for many countries.<sup>24</sup> Again, ways in which these data are collected and collated need to be reasonably consistent for valid inter-country comparison.

The Asia Pacific Food Analysis Network (APFAN) has been established with the aim of facilitating the consistency and comparability of food analysis programmes in the region. The activities developed to achieve this aim include the conduct of regional conferences and seminars, the organization of 'hands-on' workshops, mainly held in Australia and the development of standard reference materials to validate analytical procedures in different laboratories.<sup>25,26</sup> The APFAN workshops have shown that not only do methodologies for specific analyses of various nutrients and toxicants need to be consistent, but also approaches to quality assurance and to laboratory management practices need to be consistent.

In addition, the ways in which analytical results are communicated, either as laboratory reports or in the scientific literature, also require a degree of consistency. The origin and context of food composition data need to be implicit in terms of issues such as sampling protocols, analytical methods and quality control practices. Communication of such information will ensure that food composition data are used appropriately. It is important that information on how composition data are to be used is communicated back to food analysts so that information is produced in its most relevant and efficient form. To facilitate such communication, it is advantageous to incorporate food analysts into the planning of food and nutrition monitoring and surveillance programmes at an early stage.

#### **Conclusion**

Thus, at country or at least regional level, food analysis activities should be a major component of public health monitoring and surveillance programmes, nutrition research, health promotion and regimes for the treatment and prevention of diet-associated disease. As well, food analyses can provide an important database for government policy and programmes in other areas, including agriculture and economic portfolios, such as trade and exports. A sound knowledge of the composition of foods (e.g. to meet national and international standards for nutrition labelling and maximum residue limits) is required also by the food industry. In this regard, liaison should be established on food analysis with the commercial sector, which may generate considerable food composition data, useful for health-related and other purposes, at no cost to the government sector.

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### 國家及國際的營養計劃中食物分析的作用

#### 摘 要

本文概括了國家及國際活動中，在政府，社會及工業水平上食物組成的重要資料。特別是提供了食物營養素的組成數據，營養政策和計劃，營養研究和營養教育等資料，以便改進健康狀況和減少疾病危害。本文討論了國際食物數據系統網絡（INFOODS）和亞太食物分析網絡（APFAN）的地區活動，加強了食物組成數據的有效價值及質量。特別是提供給 APFAN 會員組織有關應用統一的食物分析方法。

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