Chapter 20 The Australian Experience in Total Diet Studies

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Introduction

The purpose of the Australian Total Diet Study (ATDS) is to estimate the dietary exposure (intake in the case of nutrients) for the Australian population to a range of chemicals that may be found in the food supply and determine whether there are any concerns for public health and safety. Australia has conducted a number of ATDS over the last 40 years and intends continuing this national survey in future years.

Traditionally, the ATDS has estimated dietary exposure for the Australian population to a range of pesticide residues and contaminants. In recent years, however, the scope of the ATDS has evolved with food chemicals of concern, such as additives and nutrients, which are now included.

History of the ATDS

In May 1969, at its Sixty-Eighth session, the Australian National Health and Medical Research Council (NHMRC) recognized the need for Australia to conduct a national "market basket' survey" to examine the levels of agricultural and veterinary chemical residues and contaminants in foods that constitute a significant part of the normal diet. The NHMRC recommended that the Commonwealth and State Departments of Health should cooperate in the organization and execution of the survey, with the Commonwealth assuming overall responsibility. This recommendation resulted in

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the first Australian market basket survey in 1970, conducted by the NHMRC. The NHMRC conducted a further 15 surveys before responsibility and oversight of the survey was passed to Food Standards Australia New Zealand (FSANZ), formerly known as the National Food Authority and Australia New Zealand Food Authority (ANZFA). This study, now more commonly referred to as the Australian Total Diet Study (ATDS), continues to be managed by FSANZ.

The ATDS: A Collaborative Approach to Food Regulation in Australia

FSANZ is one element of the Australian and New Zealand food regulatory system that has as its source of policy advice, the Council of Australian Governments Legislative and Governance Forum on Food Regulation (the Forum), formerly known as the Australia and New Zealand Food Regulation Ministerial Council, a body comprised of representatives from the Australian and New Zealand Governments and each of the Australian State and Territory Governments. A whole-of-government approach is taken in developing food standards, with health, agriculture, trade and other portfolios being consulted before policy advice is issued or decisions made. The Food Regulation Standing Committee (FRSC) is composed of the department heads of those portfolios represented on the Forum and supports the Forum by providing advice on policy development. FRSC's to implementation subcommittee on food regulation (ISFR) is responsible for the consistent implementation and enforcement of food standards within Australia and New Zealand (Fig. 20.1). A representative from the Australian local government authorities is an observer on the ISFR.

The ISFR Workplan is divided into eight components considered important in effective and consistent implementation in food regulation. As part of Component 1, '*Surveillance and Monitoring*', a 3-year forward 'Coordinated Food Survey Plan' (the Plan) was developed for Australian jurisdictions and New Zealand, with the aim being to develop efficiencies and enhance the quality of national or bi-national surveys through greater collaboration in the planning, implementation and consistent management of the outcomes. The 22nd ATDS commenced prior to the establishment of ISFR and was placed on the Plan while in progress. The 23rd ATDS is the first ATDS to go through the full cycle of planning and implementation through the ISFR process and continues to be a collaborative project with all Australian jurisdictions [1]. Almost 40 years since its inception, the ATDS continues to receive high-level support and commitment within the Australia New Zealand food regulatory system and is well recognized internationally. This high-level support for the ATDS was re-affirmed in 2008 with agreement to ensure full and timely national participation in all future ATDSs, including sufficient resourcing.

In addition to surveillance activities undertaken as part of the ISFR Plan, State and Territory health and agriculture authorities also conduct food surveys investigating a variety of food chemicals (e.g. pesticide residues, additives and contaminants). These surveys are usually targeted at specific food types or chemicals, and are used

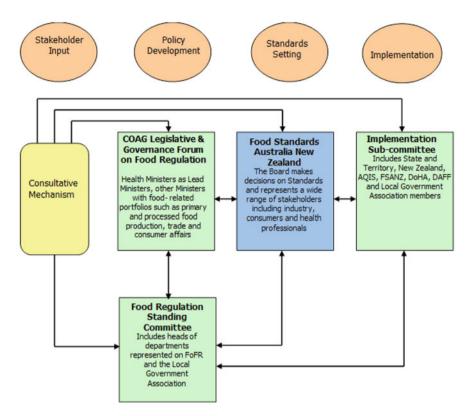


Fig. 20.1 Overview of the food regulatory framework in Australia and New Zealand

to assess compliance of primary producers and food manufacturers with relevant food regulations. The data generated from these surveys provide supplementary information on the chemical status of foods in Australia and serve as a valuable resource. The results of these surveys are shared with other State and Territory health and agricultural authorities through a Food Surveillance Network, a technical forum for collaboration on food surveillance issues in Australia and New Zealand, including the ISFR-related surveys, such as the ATDS. This network is chaired and managed by FSANZ.

Other Food Chemical Surveillance Activities in Australia

The Australian Government, through the Department of Agriculture, Fisheries and Forestry, conducts two ongoing surveillance programs that examine the level of specific chemicals in selected exported and imported foods, rather than investigate a whole of diet exposure to food chemicals. These programs are known as:

- The National Residue Survey, which focuses on foods exported from Australia.
- The Imported Food Program, which is conducted by the Department of Agriculture, Fisheries and Forestry (DAFF) Biosecurity to ensure compliance with the *Imported Food Control Act 1992* and the *Australia New Zealand Food Standards Code*.

Comparison of ATDS with Other Studies

The ATDS is the only national survey that monitors the level of food chemicals in the total diet to determine their significance in the overall Australian diet and any associated risks to human health. The ATDS is also the only comprehensive national survey that analyses representative food samples as they are consumed. This is in line with the TDS approach but in contrast to most other food analytical surveys conducted in Australia. All food samples in an ATDS are prepared to a 'ready to eat' state prior to laboratory analysis, that is, they are subjected to typical preparation or processing steps (e.g. peeling, frying, baking etc.) (see Chap. 9 - Food Sampling and Preparation in a Total Diet Study). The type of preparation or processing required varies with the type of food. For example, vegetables may be peeled if they are usually eaten without their skins, while chicken is grilled as this food is consumed after cooking in this manner. By analyzing foods that have been prepared as customary, factors such as storage and preparation that can affect the concentration of some food chemicals can be accounted for. This results in more accurate and representative estimations of dietary exposure to food chemicals or dietary intakes of nutrients for the Australian population.

The Focus of the Australian Total Diet Study

The focus of the ATDS was primarily to estimate dietary exposure to agricultural and veterinary residues and contaminants every 2 years up to and including the 20th ATDS [2]. In general, the results from these studies consistently showed that dietary exposure of Australians to residues from a range of agricultural and veterinary chemicals and contaminants were low, that is below relevant health-based guidance values (HBGV), and therefore did not represent a public health and safety risk.

In 2003 FSANZ and the State and Territory government food regulatory agencies, agreed to diversify the scope and format of the ATDS to include other food chemicals, such as additives and nutrients. Residues from a range of agricultural and veterinary chemicals and contaminants would still be investigated but less frequently. The diversification of the ATDS has enabled data to be collected for a wider

ATDS			Number	
number	Sampled	Published	of foods	Analytes
19th	1998	2001	69	Agricultural chemical residue screen: chlorinated organic pesticides, organo- phosphorus pesticides, synthetic pyrethroid, fungicides, selected carba- mates, piperonyl butoxide
				<i>Contaminants:</i> antimony, total arsenic, cadmium, copper, lead, mercury, selenium, tin, zinc, aflatoxins, polychlori- nated biphenyls
20th	2000/2001	2003	65	Agricultural chemical residue screen: chlorinated organic pesticides, organo- phosphorus pesticides, synthetic pyrethroids, carbamates & fungicides
				<i>Contaminants:</i> antimony, arsenic, cadmium, copper, lead, mercury, selenium, tin, zinc
				Natural toxicants: aflatoxins & ochratoxin Aª
				Inhibitory substances: penicillin G, streptomycin, oxytetracycline ^a
21st	2003	2005	60	Additives: sulphites, nitrates, nitrites, benzoates, sorbates
22nd	2004	2008	96	<i>Essential trace elements:</i> iodine, chromium, molybdenum, selenium and copper
				Additional survey activity on ATDS samples: e.g. polybrominated diphenyl ethers (PBDE) and polycyclic aromatic hydrocarbons (PAHs) ^a
23rd	2008	2011	93	Agricultural chemical residue screen
				Metals & other elements
				Natural toxicants

Table 20.1 Summary of the analytes included in 19th–23rd Australian total diet studies

Please refer to the reference list for the details of each published ATDS ^aCertain foods only

range of food chemicals. This has provided significant public health information about the Australian diet and allowed further investigation into concerns around some population groups exceeding (or not meeting in the case of nutrients) the required HBGV. The focus of the 21st and 22nd ATDSs reflected this change and evaluated food additives and nutrients (trace elements), respectively [3, 4]. The value of this new approach was demonstrated in relation to Australian's dietary exposure to sulphites (21st ATDS) and informing the status of dietary intake of iodine (22nd ATDS) in the Australian population. These findings prompted decisions to review relevant food regulations. A summary of the analytes examined in the more recent ATDS (19th–23rd ATDSs) is presented in Table 20.1.

How Is the ATDS Conducted?

The ATDS is managed by FSANZ in collaboration with all Australian States and Territories. The participation of all Australian States and Territories in the ATDS is necessary to ensure that high quality, nationally representative data are produced through the collection of representative national and regional samples. Sampling and analysis of food usually occurs over a 12 month period, for some foods up to four times a year to capture seasonal variation in the food supply. As the ATDS manager, FSANZ meets all costs associated with sample transport, preparation and analysis, with the States and Territories covering the cost of obtaining the samples. Food sample analysis is conducted by a commercial laboratory selected by an open and competitive tender process according to the Australian Government Procurement Guidelines (see Chap. 14 – Commercial Analytical Laboratories—Tendering, Selecting, Contracting and Managing Performance).

Following analysis, States and Territories receive the analytical data specific to their region. The ATDS is not undertaken for the purpose of assessing compliance with relevant food regulations, although cases of potential non-compliance are highlighted. From the concentration data obtained, FSANZ generates a dietary exposure estimate using DIAMOND (Dietary Modelling of Nutritional Data), a computer program developed by FSANZ to automate dietary exposure calculations (see Chap. 45 – Automated Programs for Calculating Dietary Exposure). DIAMOND combines food consumption data from the Australian 1995 National Nutrition Survey (NNS) [5] and more recently, the 2007 the Australian Children's Nutrition and Physical Activity Survey [6], also known as Kids Eats Kids Play (KEKP), with chemical concentration data to estimate the dietary exposure for that compound for a range of population groups. The 1995 NNS surveyed 13,858 Australians aged 2 years and above using a 24-h dietary recall survey. The KEKP surveyed 4,487 children aged 2-16 years also using a 24-h recall survey with a second 24-h survey on a non-consecutive day. As neither survey includes children less than 2 years of age, a theoretical diet was constructed for infants at 9 months of age. The theoretical infant diet is extrapolated from the diet of a child at 2 years for solid foods, with an adjustment for the proportion of the total diet made up of milk (e.g. breast milk or infant formula). While dietary modelling is a scientific systematic method for estimating the amounts of chemicals a person or population may be eating, the accuracy of these dietary exposures depend on the quality of the data used in the dietary models. These issues are addressed in the 22nd ATDS [4].

To assess whether the dietary exposure of each particular chemical from food is of concern to public health and safety, dietary exposure estimates are compared to the respective relevant HBGV and a risk characterization conducted. The outcomes of the survey and the final report are published in a hardcopy booklet, and in recent years, the reports have also been published on the FSANZ website (http://www.foodstandards.gov.au/monitoringandsurveillance/australiantotaldiets1914.cfm).

The Flexibility of ATDS Samples

While the ATDS is a resource intensive study, the value of the national samples, collected for this study is several fold. Over recent years, FSANZ has made a number of changes to the procedures, aimed at further minimizing the burden of sample preparation and collection, and maximizing the extent to which the samples are used. For example, ATDS samples collected from the States and Territories are stored for a period of time by the laboratory following the completion of the analytical component of the survey. These samples can then be used for additional analysis and the estimation of national dietary exposure to other chemicals. An example where this has been successfully used is with the samples collected for the 22nd ATDS, where the analysis of selected foods for polybrominated diphenyl ethers (PBDEs) [7] and polycyclic aromatic hydrocarbons (PAHs) [8] was undertaken in a subsequent survey activity (See Chap. 51 – Polybrominated Diphenyl Ethers in Food in Australia—An Additional Use of the Australian Total Diet Study).

Usefulness of Data Collected from the ATDS

It is essential to have a robust national total diet study that can produce the best scientific evidence available to inform the standards development process and other regulatory decisions. The ATDS provides quantitative information on concentrations of chemicals of interest in the food supply and estimates 'actual' dietary exposure.

Although there are recognized limitations of the sampling and methods of total diet studies, the ATDS produces a variety of useful and relevant data, which are often utilized internally by FSANZ for other purposes, including establishing priorities for further investigation, to identify or confirm potential areas of concern and contributing to FSANZ composition databases (Fig. 20.2). This information is used broadly in the work of FSANZ, providing information to fill data gaps in knowledge.

International Relevance of Information Collected from the ATDS

The ATDS is undertaken in accordance with international best practice for conducting total diet studies with the findings contributing to the international evidence base where possible. The ATDS generates data which are shared internationally via the World Health Organization (WHO) Global Environmental Monitoring System for food (GEMS/Food), which collects, compiles, and

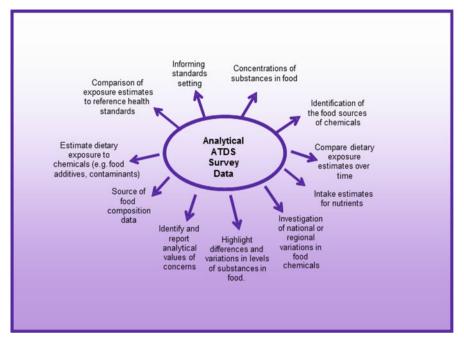


Fig. 20.2 Application of data collected for the Australian total diet study

disseminates food contamination data internationally, the Joint Food and Agriculture Organization (FAO)/WHO Expert Committee on Food Additives (JECFA), the Joint FAO/WHO Meetings on Pesticide Residues (JMPR), the relevant Codex Alimentarius Commission Committees, e.g. Codex Committees on Food Additives, Contaminants in Food and Pesticide Residues, and independent researchers in both government and non-government agencies.

Summary

Australia has considerable experience in conducting total diet studies, accumulated over a 40-year period. The ATDS is a unique study in Australia, being the only study to estimate the level of dietary exposure of the Australian population to a range of substances in food prepared as normally consumed over time. The study is a key element of the food regulatory system in Australia, and is an effective collaboration between food regulatory partners in State and Territory governments. The recent expansion of the scope of the ATDS to better inform potential developments in food regulation has proven successful in addressing key data gaps. Data collected as part of the ATDS are used in international food safety risk analysis and standards setting making regular and significant contributions to these processes.

References

- 1. FSANZ (2011) The 23rd Australian Total Diet Study. FSANZ, Canberra
- 2. Food Standards Australia New Zealand (FSANZ) (2003) The 20th Australian Total Diet Survey. FSANZ, Canberra
- 3. FSANZ (2005) The 21st Australian Total Diet Study. FSANZ, Canberra
- 4. FSANZ (2008) The 22nd Australian Total Diet Study. FSANZ, Canberra
- McLennan W, Podger A (1997) National nutrition survey selected highlights Australia. 1995, ABS Catalogue Number 4802.0. Commonwealth of Australia, Canberra
- Department of Health and Aging (DOHA) (2007) 2007 Australian National Children's Nutrition and Physical Activity Survey. Canberra. Also available from http://www.health.gov.au/internet/ main/publishing.nsf/Content/phd-nutrition-childrens-survey. Accessed 15 July 2013
- 7. FSANZ (2007) Polybrominated diphenyl ethers (PDBE) in food in Australia. FSANZ, Canberra
- 8. FSANZ (2010) Survey of Polycyclic aromatic hydrocarbons (PAHs) in Australian foods. FSANZ, Canberra