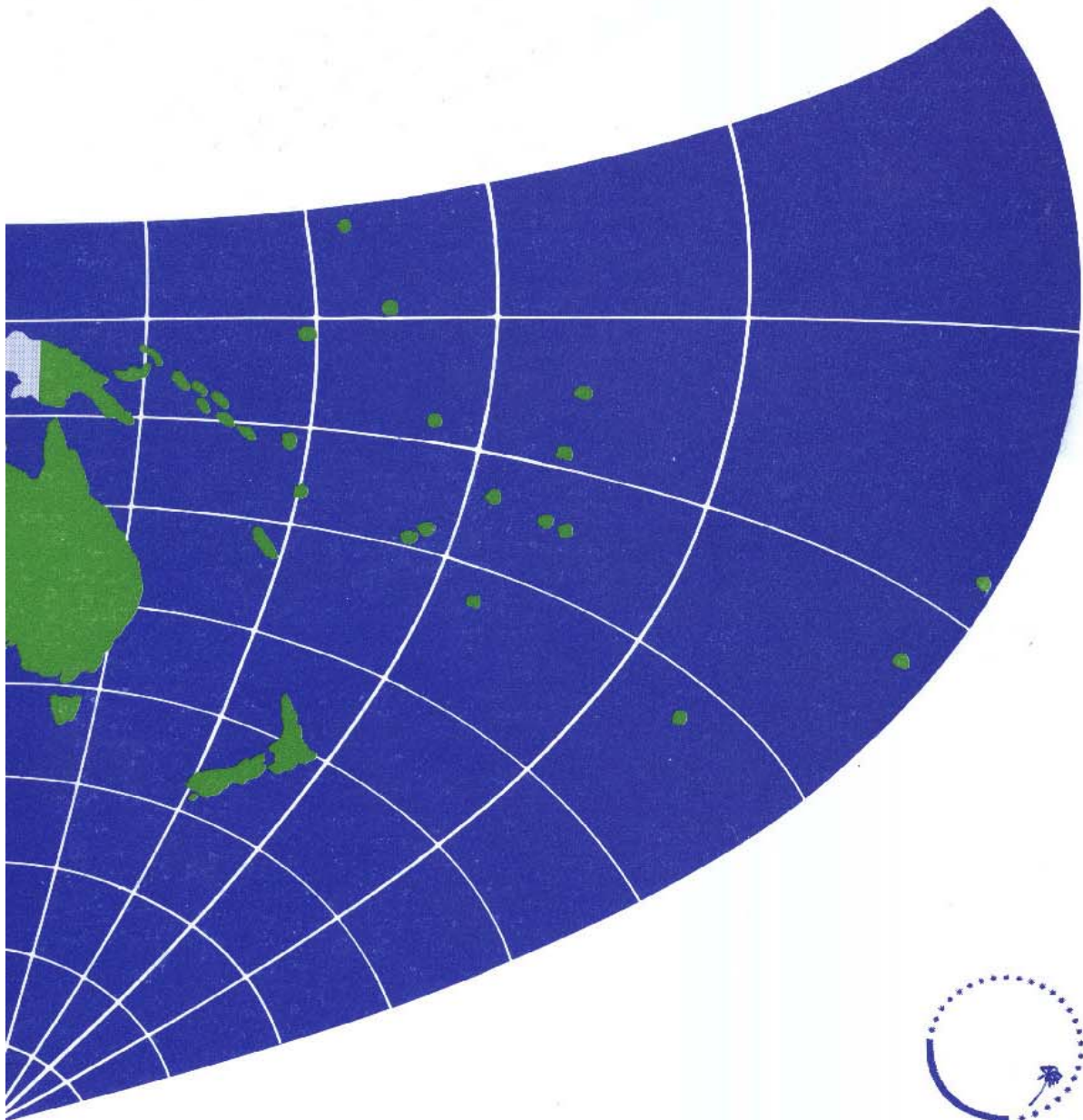




# Proceedings of the **sixth** **OCEANIAFOODS** Conference



**Food Standards Australia New Zealand**

# **Proceedings of the sixth OCEANIAFOODS Conference**

**Brisbane, Australia  
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Food and Agriculture Organisation of the United Nations (FAO).

Assistance with the organization of the conference was kindly provided by Dr Pieter Scheelings of Queensland Health Scientific Services (QHSS).

## FOREWORD

OCEANIAFOODS is a regional group of the International Network of Food Data Systems (INFOODS), working to facilitate interaction and collaboration amongst the three regional member food composition programs that are Australia, New Zealand and the South Pacific. Conferences are held every two to four years.

OCEANIAFOODS conferences have been held in a number of locations in the Oceania region since the first conference was held in Canberra, Australia in May 1987. The second conference was held in Suva, Fiji, in November 1989 and the third, organised by the Department of Scientific and Industrial Research (Crop Research Division), in Auckland, New Zealand. The fourth conference saw a return of delegates to Suva, while the fifth conference was held in Noumea, New Caledonia in May 1998. This sixth meeting was held in Brisbane, Australia, in conjunction with the Second International Total Diet Workshop, convened by the World Health Organisation (WHO). The next OCEANIAFOODS meeting, the seventh, will be held in New Zealand.

In these proceedings you will find reports of the presentations made as well as a set of recommendations and resolutions of the meeting. A précis of the meeting is also presented.

Please note that Food Standards Australia New Zealand (FSANZ) was known as the Australia New Zealand Food Authority (ANZFA) until July 2002 and prior to that, as the National Food Authority until the 1996 implementation of a joint food standards agency with New Zealand. Each of these names may be used in these proceedings depending on the context of use.

You should be aware that the opinions expressed in these proceedings are those of the authors of the included papers and do not necessarily reflect the views of the sponsoring organizations.

Judy Cunningham and Luisa Trevisan  
EDITORS

February 2004

## Meeting précis

The sixth meeting of OCEANIAFOODS was held in conjunction with the Second International Total Diet Workshop, recognising that, in the Oceania region, those working in the area of the nutrient composition of food are often also involved in many other aspects of the composition of foods, including studies on contaminants.

The meeting opened with a thought provoking presentation from Dr Heather Greenfield on the difficulties that continue to face food composition workers in this region. Dr Greenfield stressed the need for better training of food composition data users and for continued ready access to data unhindered by commercialisation considerations. She identified reluctance of laboratories to publish details of methods of analysis, the proliferation of data of uncertain origin on the internet and uncertainties about enforcement of nutrition labelling as challenges for the future of food composition work.

Country reports were presented for Fiji, New Zealand, Australia and the Federated States of Micronesia (FSM), and Dr Barbara Burlingame outlined the activities of INFOODS since the last meeting. Each country demonstrated substantial progress in generating new and relevant food composition data for their countries, with the extent of progress heavily dependent on available funds. Fiji, New Zealand, Australia have each released new food composition publications since the last OCEANIAFOODS meeting. In FSM there has been some important research to identify indigenous foods that are sources of carotenoids, in an effort to combat the growing prevalence of vitamin A deficiency in this country. The challenges of conducting an analytical program in FSM were very different to those experienced in, for example, Australia and New Zealand, reflecting the diversity of conditions and resources in countries in Oceania. However the achievements of the FSM project demonstrated what is possible when researchers in different parts of the region work together. Delegates noted with regret the absence of representatives from Papua New Guinea at this meeting.

A session was devoted to the uses of food composition data worldwide and within the Oceania region. Dr Burlingame stressed the central role of food composition data for planning international food policies. While there has been great progress internationally in generation of relevant regional data, there is still much work to be done in encouraging regional programs to work together. Delegates from New Zealand and Australia outlined how they had used food composition data in projects to assist different groups of data users – policy researchers conducting a New Zealand Children’s Nutrition Survey, and industry users in both countries requiring information to assist them to comply with nutrition labelling requirements. Each of these projects required data producers to address the very different needs of the intended user groups.

Developments in nutrient analysis were discussed in another conference session. The activities of the Asia Pacific Food Analysis Network were outlined and one of the major projects of this network, a regional training workshop in niacin analysis, was described in detail. Regional researchers have also participated in a collaborative trial for folate analysis. Improved methods for the analysis of fat soluble vitamins were described. The final paper in this session was a report on the generation of nutrient retention factors for foods cooked using a traditional Pacific cooking method – earth oven (or lovo) cooking.

The second volume of *Pacific Island Foods* was launched at the meeting and delegates congratulated those involved in developing this important resource.

The meeting produced 28 recommendations and resolutions and there was strong support for a continued role of OCEANIAFOODS and for strengthening links with other regional food composition programs such as ASEANFOODS. Key recommendations of the meeting included that there be ongoing support for analysis of regional foods, particularly those that contribute to intake of key nutrients of concern in the Oceania region, and for reporting of results for these foods on the basis of variety. There was also agreement that additional training in food composition activities should be held within the region.



Photo 1. Delegates to the 6<sup>th</sup> meeting of OCEANIAFOODS, Brisbane, Australia, February 2002



Photo 2. Launch of Volume 2 of *Pacific Island Foods*, with three of the books authors, Praveen Ravi, William Aalbersberg and Ruth English together with Pieter Scheelings who was a co-author of Volume 1 of *Pacific Island Foods*.

## SUMMARY OF RECOMMENDATIONS AND RESOLUTIONS FROM THE SIXTH OCEANIAFOODS CONFERENCE

Adherence of OCEANIAFOODS members to the guiding principles of OCEANIAFOODS shall be regularly reviewed.

### Administration

1. New Zealand will be appointed as Convener of OCEANIAFOODS until the seventh OCEANIAFOODS Conference.

*Action: Convener*

2. The seventh OCEANIAFOODS Conference will be held in New Zealand in 2004.

*Action: Convener*

3. Articles in the Proceedings of the sixth OCEANIAFOODS Conference will be submitted to CAB Abstracts and Reviews and to appropriate newsletters. Authors to provide abstracts of their presentations to Judy Cunningham, the Convener of the sixth conference.

*Action: Judy Cunningham, authors*

4. The Proceedings of the sixth conference will be submitted to the *Journal of Food Composition and Analysis* for review as a book review along with a précis of the proceedings. Authors to provide full text versions of their presentations in a format suitable for publication.

*Action: Judy Cunningham, authors*

5. FAO to elaborate its existing OCEANIAFOODS webpage and link it to appropriate sites of member countries and of the Secretariat of the Pacific Community. Members to provide information on appropriate links to Barbara Burlingame.

*Action: Barbara Burlingame, all members*

6. OCEANIAFOODS members should subscribe to the INFOODS list serve via the FAO website, and should advise INFOODS of relevant publications and activities.

*Action: All members*

7. FAO to investigate holding a post-graduate three-week course in food composition in the Oceania region, possibly in 2003.

*Action: FAO*

## General resolutions

8. OCEANIAFOODS recognises the University of the South Pacific (USP) laboratory as a regional centre of excellence for Pacific Island food composition analysis and strongly recommends continued support for it from FAO and other development partners in its continued analysis of priority Pacific foods and, further, to assist other Pacific island countries to set up and undertake food composition analysis.
9. OCEANIAFOODS supports ongoing efforts to facilitate the involvement of the University of Technology in Papua New Guinea in food composition activities, including participation in future OCEANIAFOODS meetings.
10. New Zealand and Australia, wherever possible, will continue to facilitate the provision of assistance for food composition analysis to Pacific island countries.
11. OCEANIAFOODS strongly supports the continuation of the beneficial collaboration with ASEANFOODS.
12. OCEANIAFOODS members should continue to explore collaboration with the University of Hawaii and with other groups in the Pacific region.
13. OCEANIAFOODS recognises that many traditional Pacific island food crops are important sources of key nutrients. Promotion/production of these foods should be supported in preference to imported products.
14. OCEANIAFOODS should liaise with UN agencies and regional organisations to encourage the consideration of food composition in relevant national projects and programs in the Pacific region, such as supply of agricultural statistics to FAO, food balance sheets, agriculture research and extension, nutrition programs and food legislation.
15. Members of OCEANIAFOODS should be supported in efforts to attend the fifth International Food Data Systems meeting to be held in Washington DC in 2003 in conjunction with the National Nutrient Data Bank Conference.
16. FAO should facilitate provision of relevant Codex documents to OCEANIAFOODS members.
17. OCEANIAFOODS appreciates the attendance of UN agencies at this meeting and strongly supports their continued involvement in OCEANIAFOODS.

## Technical issues

18. Information on forthcoming meetings and on sources of expertise for food analysis and training should be referred to INFOODS for inclusion on the INFOODS website. This information should also be shared directly among OCEANIAFOODS members.

*Action: All members to share relevant information as appropriate. Jayashree Arcot to assist with holding relevant information.*

19. OCEANIAFOODS laboratories developing new analyses are encouraged to facilitate testing of these methods by other laboratories.
20. In-house standards, and any listings of available reference materials, should be shared among the three analysis programs and ASEANFOODS for analysis and comparison. The AOAC Technical Committee on reference materials is doing relevant work in this area. (Further to this resolution, Dr Scheelings has subsequently requested delegates to provide information to him on reference materials used in their laboratories.)
21. OCEANIAFOODS members should explore a common description for indicators of quality for food composition data.

### **Food composition tables issues**

22. The Secretariat of the Pacific Community should coordinate a study of the current use of the Pacific Island Food Composition Tables (PIFCT) in the Pacific and an analysis of future needs in this area, and to seek funding for a regional follow-up to the 1994 launch of the PIFCTs.
23. The second edition of the PIFCTs should be prepared and include a review of niacin values.
24. OCEANIAFOODS members should explore effective ways to make existing food composition data more accessible to the general public (e.g. bar graphs by nutrient in relation to certain diseases).
25. OCEANIAFOODS recognises the importance of education about the use of food composition tables, for example to assist with labelling of packaged foods.
26. OCEANIAFOODS recognises the wide variety of cultivars of traditional Pacific island food crops, including fruits, root crops and starchy staples, and the wide variation that is found in important nutrients. This should be reflected in food composition tables (e.g. by reference to degree of orange/yellow coloration) and in education programs.
27. OCEANIAFOODS members should investigate the possibility and necessary harmonisation of combining the three major OCEANIAFOODS food tables and software, recognizing that work in this area has already taken place between the PIFCTs and the New Zealand tables.
28. All food composition-related publications by OCEANIAFOODS members should be shared with other appropriate OCEANIAFOODS members.

## **OPENING ADDRESS AND WELCOME TO DELEGATES**

*Dr Judy Cunningham  
Food Standards Australia New Zealand  
Canberra, Australia  
Convenor, Sixth OCEANIAFOODS Conference*

Ladies and Gentlemen, I am delighted to welcome you all here today to the sixth OCEANIAFOODS conference. I would particularly like to welcome those of you who have travelled to Brisbane from outside Australia.

I know that some of you have been in Brisbane throughout this week, attending the Second International Total Diet Workshop and I commend your stamina in volunteering to attend another day and a half of discussions. I trust that you'll find your participation this weekend has been worthwhile.

This meeting has been co-sponsored by my employer, Food Standards Australia New Zealand (FSANZ) and the Food and Agriculture Organisation of the United Nations (FAO). I would like to thank both organisations for their generous support, without which this meeting would not have gone ahead.

This meeting may be a little different to previous OCEANIAFOODS meetings. Certainly it will be shorter than most previous meetings, as we have fitted it between the two weeks of the Total Diet Workshop in order to make the most of the shared interests and audience. Given this limited time, we have deliberately developed an informal meeting, with what I hope will be adequate time set aside for discussion of key issues that face our group over the next two or three years.

We have organised the presentations into three different themes – the first, this afternoon, includes the keynote address and reports from delegates from different countries in the Oceania region.

Tomorrow morning we'll be looking at some of the uses of food composition data within the region. Later tomorrow we have a large session focussing on some important analytical and nutrient issues. We will conclude with a discussion session on issues facing our region in relation to food composition work.

Finally, it will be our task to make a number of resolutions to carry forward our work until the next OCEANIAFOODS meeting. In your meeting papers you will find a list of the resolutions and recommendations from the 5th OCEANIAFOODS meeting, together with an outline of progress on these matters. Our last task of the meeting will be to appoint a convenor for the next meeting.

Looking back over the previous meetings of OCEANIAFOODS, there have been a number of themes that have emerged. At the first meeting, it is not surprising that discussion focussed on introductory issues such as the reasons why a network like OCEANIAFOODS was set up and on matters related to "getting started" in food composition work. The second meeting focussed on data handling, description and dissemination, as well as on sampling. At the third meeting there was a focus on food composition database applications and implications, and

on the requirements for data exchange. The fourth meeting looked at national food and nutrition policies, nutrition labelling and uses of food composition data. Finally at the last meeting, in Noumea in 1998, there were sessions on analytical issues and on some of the micronutrient issues facing Pacific nations.

I am sure that we will revisit most of these matters during the course of this meeting. I suspect that another issue that will be identified again and again at this meeting is the lack of resources to pursue food composition issues.

For example, how do we balance the need to generate the best quality analytical data with the high cost of many nutrient analyses? How do we match the need for data that represents the foods available in our region with the pressing need of researchers and industry for almost any sort of nutrient data regardless of its origin? How do we prioritise the foods and nutrients we are going to analyse when resources are tight?

Another issue that we are likely to want to discuss is how best to present our data to users in the era of the Internet. Tomorrow one of my colleagues, Luisa Trevisan, will be showcasing FSANZ's recently released Internet program for food labelling purposes. I think our experiences provide some interesting lessons for other organisations exploring this publishing option.

The third issue I think we need to bear in mind during this meeting is about the achievements and the future of OCEANIAFOODS. Is our current set up serving us well? Does this group continue to have a role?

It is now my great pleasure to welcome our keynote speaker, Dr Heather Greenfield. Heather is one of the pioneers of food composition work in the Oceania region. Together with her co-workers at the University of New South Wales, she has published over 40 papers presenting original analytical data on the composition of Australian foods.

She established the food composition program at the South Pacific Commission and, together with David Southgate of the UK Food Research Institute, authored one of the key works on food composition *Food Composition Data: Production, Management and Use* (Greenfield & Southgate, 1992).

It is hard for me to believe that it's almost 25 years since Heather initiated her work in food composition. It certainly only seems like the other day that she suggested to me that I conduct my Honours research on the nutrient composition of Australian meat pies, a favourite Australian fast food, but in fact it was in 1980.

Since supposedly retiring a few years ago, Heather has continued to pursue her interest in food composition, particularly in the phytoestrogens content of foods, but has also conducted some important research on adolescent bone health, including a study recently published in the *American Journal of Clinical Nutrition* on vitamin D status in adolescent girls in Beijing (Du *et al* 2001).

I have great pleasure in welcoming Heather and I am sure that she will provide us with some very thought-provoking observations that will stimulate discussion and get our meeting off to a flying start.

## References

Du X.Q., Greenfield, H., Fraser, D.R., Ge, K.Y., Trube, A., Wang, Y. (2001). Vitamin D deficiency and associated factors in adolescent girls in Beijing. *Am. J. Clin. Nutr.* 74(4), 494-500

Greenfield, H., Southgate, D.A.T. (1992). *Food Composition Data Production, Management and Use*. Elsevier Applied Science, London.

## KEYNOTE ADDRESS

### **A quarter century of food composition work in Australia: lessons learned, future directions**

*Honorary Associate Professor Heather Greenfield  
Faculty of Veterinary Science  
University of Sydney, Australia*

#### **Abstract**

This presentation will focus on the importance of food composition in the education and training of professionals who use food composition data in their work. Analysts, dietitians, nutritionists, food scientists and technologists, food service personnel, food regulators and others all use food composition data in the course of their work. However, despite great improvements in the availability of published literature and training materials in the last 25 years, students apparently still receive inadequate training in the principles of food composition data production, management and use, including in Australia.

In Australia the situation has been particularly exacerbated by the downturn in university funding, which has seen many courses cut, and the move towards privatisation and commercialisation of knowledge, which inhibits access. The global trends in information technology should ideally improve access to knowledge, but in many instances, have resulted in quality and reliability being erroneously conferred on data simply by virtue of their electronic format.

The role of the professional and educational organisations in leading the way to improvement in the future will be discussed.

#### **Introduction**

This is a fitting moment to review the recent history of food composition work in Australia, as the current program probably commenced about 25 years ago in the late 1970s when I arrived to work in Australia and discovered that the food composition tables in the country were a rather slim booklet of data with many gaps (Thomas & Corden, 1970). A group of Sydney dietitians quickly informed me of their concerns about the tables, and the Greenfield and Wills team was formed at Food Science and Technology at the University of New South Wales (UNSW) and made the decision to find funds to carry out new analyses of Australian foods at the University (Anon, 1981).

The decision proved to be timely since moves were already afoot in other centres in the industrialized world to revisit the issue of food composition. So the year the UNSW finally obtained funding (1978) was the year the 5<sup>th</sup> edition of the UK food tables was published (Paul & Southgate, 1978) and the US established its new Nutrient Composition Laboratory (Greenfield & Wills, 1979). The UNSW produced its first food composition data paper in 1980 (Wills & Greenfield 1980) and also hosted a national meeting of interested persons (Greenfield & Wills, 1981). The Australian national food composition programme was established in 1980. The currents swirling simultaneously worldwide led to the holding of a special international meeting in Bellagio, Italy (Rand & Young, 1983), leading to the

establishment of INFOODS and the *Journal of Food Composition and Analysis*. The UNSW team was thrilled to have produced the first paper to receive official acceptance into the new journal (Makinson et al., 1987). Judy Makinson (now Cunningham) was the first PhD student to graduate from UNSW in this 'new' field, and her thesis was instrumental in acceptance in Australia of food composition work as a 'real' topic for research (Makinson, 1985). Around this time the decision was made to 'mainstream' food composition analytical work within the funding of the Department of Health. The Australian Government Analytical Laboratories (AGAL) became the main laboratory carrying out contract analyses for the Department's food composition programme. Throughout the whole protracted and difficult birthing process of 'new' food composition work, important midwives were the Australian food industry and not least, *Food Technology in Australia* (now *Food Australia*) and its then editor F.H. Reuter who seized the opportunity to break the whole series of papers produced and thus apparently boosting sales of the journal at the same time!

## **Look back in analysis 2002**

### *Leaps forward...*

Food composition became, for a time, recognized in Australia as a trendy subject for research, particularly for small laboratory-based projects. All who became involved quickly realized that far from being "routine laboratory work", food composition work drew together many specialist skills in sampling, chemical analysis, laboratory quality control, statistics, dietary issues such as food description, and arcane matters such as portion size, edible portion and food preparation methods. Meanwhile we were all coming to grips with computers and tabulation software, as well as the inky business of printers.

Despite these teething problems, the ready access to information brought about an ability to find, process and disseminate information very quickly, making a world of difference to the working lives of nutritionists, dietitians and other health professionals throughout Australia.

Other nutritional agendas were also taking off in Australia, notably the rush towards nutritional epidemiology which makes great demands on local food composition data, though not all were sufficiently knowledgeable, especially those who bought up packages based on US data.

Another positive development was the move towards nutrition labelling, first for those foods making claims, and recently for all foods. While some of us would prefer to see the information on labels traceable back to a laboratory analysis, at least the labelling requirements are a step towards informing consumers, industry and others about food components and the need for data about them.

### *Running on the spot*

The fact that Australia was in the first wave of nations to embark on or revamp their national food composition activities seems to have led to an element of complacency, a feeling that we can rest on our laurels. Thus the concise Australian tables (English & Lewis, 1991) have never been brought up to date since the original publication although they have been reprinted with corrections from time to time. The most recent computerized format of the true food composition data base was *NUTTAB95* (Lewis et al., 1995). In addition a new product,

*AUSNUT*, was produced for the analysis of the 1995 National Nutrition Survey, and has been made available for public use.

By contrast the New Zealand programme produces an annual update of the electronic database (Anon., 2001) and biennial updates of the Concise Tables (Athar et al., 2001).

We also seem to have lost the imagination to develop our tables (or licence others to develop our tables) into the myriad of multimedia products for which such projects have potential.

Another example of “running on the spot” is the reluctance to innovate locally. It seems to me that we tend to look elsewhere for ideas, and even then are slow to adopt those innovations. Further, health professionals, in my view, have been too reluctant to complain about the stasis in the local food composition program for fear of rocking the boat, and thus the status quo.

### *Steps backward*

The biggest step backwards in Australia in recent years has been the huge cuts to educational funding. At UNSW we were running the first and only food composition course which gave theoretical and practical training in food composition work. That had to be axed due to the pressures to run only classes with very large enrolments. Further, lack of funds has cut the practical component of many science courses generally. It remains to be seen how this will impact on the quality of science in Australia in the future.

Commercialisation or privatization of information is, in my view, also not helpful in relation to food composition work. In the vigorous environment of “user pays”, many laboratories are now keeping their analytical methods confidential. Perhaps there are good reasons for this, but in the area of food composition, analytical data that cannot be validated are, in my opinion, invalid. Clearly the person or organization commissioning analytical work must have access to details of the method of analysis and its operating features such as accuracy, precision and so on. It would seem advisable in these cases for the contracts to specify that details of the method will be provided to clients and this could be part of a confidentiality agreement.

Another step backwards has been that the wonderful world of information technology has sometimes turned into a nightmare for food composition. All kinds of data are being put on the Internet, and who can possibly know the quality of the data, or the origins of the data? Chat lines seem to be a source of all kinds of misinformation, for example, an enquirer looking for food composition data on zinc in foods for a study of zinc deficiency in Mali, was advised by another list subscriber to use the American food composition data for zinc, easily available on the Internet, and free too!

Food labels and health claims are in my view another step backwards because the specifications are too loose. Some food packages are now covered with all kinds of data and claims. Yet it is understood that there is no requirement for these claims to be monitored under the new regulations. Further, even with respect to straightforward nutrient data, monitoring, if it were to occur, would be meaningless in my opinion, since the tolerance levels for listed data have been removed from the regulations (Australia New Zealand Food Standards Code, 2002) and no clarification is available as to how close the analytical value for a nutrient has to be to the claimed value.

## Look forward in analysis 2002

On a global level, food composition work has now acquired a veneer of respectability. Whereas ten years ago the high-ranking *American Journal of Clinical Nutrition* rejected, if I recall correctly, the opportunity to review the book we had written on the subject under the auspices of INFOODS (Greenfield & Southgate, 1992) so it was exciting to see the recent publication in the journal of an editorial and an original article highlighting work on phytochemical data bases (Ziegler, 2001; Normen et al., 2001). Further INFOODS work is conducted through the *Journal of Food Composition and Analysis*, and by ensuring that the international food data base conferences continue on a biennial basis (e.g. FAO, 2001).

Food composition work is dynamic and ever-expanding, fuelled by basic science (e.g., the effects of micronutrient deficiencies on DNA damage (Ames, 1999). While these moves have fuelled an ever-increasing demand for food composition information, they have not necessarily motivated much data generation and collation. There is still the view that someone else should be doing the food composition work, while the real excitement in the research is using the data to study outcomes. Nevertheless, those mainly government organizations charged with the responsibility of carrying out food composition work usually have other priorities for their funds – basic nutrients rather than ‘new’ or ‘re-discovered’ nutrients.

What can be done? We probably feel powerless in the face of a huge literature, daunting legislation and government departments forced to make compromises in the face of cost-cutting. There are still things we can do, however.

The professional organizations could well look at their criteria for training programs, related to the competencies that their members should have. The Dietitians’ Association of Australia (DAA) lists the following under Section 6, Core fields of study to assist curriculum development, Part 2, Knowledge and skill at professional level, in its course accreditation guidelines, for food composition data analysis:

- *to determine, for clients, nutrient content of diets*
- *to determine nutrient content of recipes, meal plans and menus*
- *to develop food guidance systems and ready reckoners*
- *to develop an awareness of the limitations of food composition analysis.*

(Noel Roberts, DAA, personal communication, 7 February 2002).

Many dietitians find themselves working on a food composition data base program, or compiling tables, or recommending methods of analysis for nutrients in foods to an employer in industry, or having to interpret food composition data for food industries or commodity boards, but if these study guidelines are to be followed to the letter, all that they would have been required to learn in the curricula about the data themselves is that they have limitations. The competency standards available publicly on the Internet (DAA, 1993) do not offer much further enlightenment.

In relation to the food composition tables in the region, it would be great to see the main professional organizations having special interest groups on food composition, and certainly nominating representatives to steering committees. New Zealand has had a Steering

Committee for its food composition programme since 1984 (Harris, 1987), but Australia does not have one, and the situation in the Pacific Islands is not known.

### **A continuing role for OCEANIAFOODS**

Aalbersberg (1999) wrote an excellent foreword to the proceedings of the last OCEANIAFOODS conference noting “OCEANIAFOODS is a regional group of INFOODS, working to facilitate interaction and collaboration amongst the three regional member food composition programmes which are Australia, New Zealand and the South Pacific”. I would like to add the word “educate” here to those three little words, facilitate, interact, collaborate. There is much that OCEANIAFOODS could do in education and training.

While training courses for trainers are carried out under the auspices of INFOODS and its regional groups ([www.fao.org/INFOODS](http://www.fao.org/INFOODS)), there do not seem to be any short training courses available at an intermediate level. There is clearly room for regular food composition conferences in the Oceania region, similar to those run annually in the USA (<http://www.nal.usda.gov/fnic/foodcomp/conf/PastConf.htm>) and also short courses such as those run on analysis of folate in foods by Dr Jayashree Arcot at the University of New South Wales (<http://www.foodscience.unsw.edu.au/news/folate.htm>). Running national conferences proved popular in Australia when the food composition programme was getting started (Greenfield & Wills, 1981) and again when the new food composition tables were launched in the late 1980s (Greenfield, 1990). Perhaps the OCEANIAFOODS meetings in future could be organized in such a way as to open them up to a wider participation than the mostly government-based meetings that have occurred up to date, and attract more submissions of original research papers and posters. Sessions could be held at meetings of the local nutrition societies, dietitians’ associations, and food industry groups in Oceania. Such developments would seem to be very timely. Already Australia and New Zealand have formed a joint food standards agency and adopted a joint Food Standards Code. There may be scope for greater collaboration and exchange in the food data area among the countries in Oceania.

It is rewarding to note that this part of the world has been active in the ‘new wave’ of food composition work since the 1970s and noteworthy that the leader of the New Zealand program from 1987 to 1998, Dr Barbara Burlingame, became the Global Coordinator of INFOODS in 1994 first while still based in New Zealand, and subsequently when INFOODS moved into FAO. It is good to note that the close connections between the region and the international network still continue today; these conferences are certainly an excellent way for workers in the area to re-connect with each other and re-affirm their commitment to the objectives of the organization.

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## COUNTRY REPORTS

### INFOODS ACTIVITIES INCLUDING A REPORT OF THE FOURTH INTERNATIONAL FOOD DATABASE CONFERENCE, AUGUST 2001

*Dr Barbara Burlingame  
Food and Agriculture Organisation of the United Nations (FAO)*

The International Network of Food Data Systems (INFOODS) was established in 1984 on the basis of the recommendations of an international group convened under the auspices of the United Nations University (UNU). Its goal was to stimulate and coordinate efforts to improve the quality and availability of food analysis data worldwide and to ensure that anyone anywhere would be able to obtain adequate and reliable food composition data. In furtherance of these purposes INFOODS has provided leadership and administrative framework for the development of standards and guidelines for collection, compilation, and reporting of food component data. It is establishing and coordinating a global network of regional data centers directed toward the generation, compilation and dissemination of accurate and complete data on food composition. It is also the generator and repository of special international data bases and serves as a general and specific resource for persons and organizations interested in food composition data on a worldwide basis. Its Secretariat has developed the necessary software for the electronic storage of food composition data and its interchange among data bases. The INFOODS effort is intrinsically interdisciplinary, depending on the efforts of food scientists, analytical chemists, and nutritionists working together with computer and information scientists.

Dr Burlingame outlined the status of INFOODS within FAO and the Codex Alimentarius Commission; INFOODS has observer status at the Commission.

FAO, through INFOODS, is sponsoring a new edition of *Food Composition Data Production, Management and Use*, by Drs Greenfield and Southgate, which it is hoped will be released in 2003.

The 4<sup>th</sup> International Food Data Base Conference was held in Bratislava, Slovak Republic, in August 2001, as a satellite conference to the 17<sup>th</sup> International Congress of Nutrition. This conference was organised and convened by the Food Research Institute (FRI) in cooperation with the FAO and the International Union of Nutritional Sciences (IUNS). The theme of the conference was 'New trends in the management and uses of food databases'. In 2002 there will be a special edition of the *Journal of Food Composition and Analysis* devoted to a report from this conference. An expert consultation is to be held on food classification systems.

The 5<sup>th</sup> International Food Database Conference is to be held in Washington DC in 2003 with the 6<sup>th</sup> Conference to be held in Pretoria, South Africa, in 2005. A report of the 3<sup>rd</sup> Conference, held in Rome in 1999 has been published by FAO's Food and Nutrition Division under the title *Back to Basics*.

Dr Burlingame reminded delegates that they are able to subscribe to the INFOODS list server through the INFOODS website ([www.fao.org/infoods](http://www.fao.org/infoods)). It is also proposed that there will be links to taxonomic databases from this site.

## COUNTRY REPORT: FIJI

*Dr W Aalbersberg, Mr S Kumar, Mr P Ravi*  
*University of the South Pacific*  
*Suva, Fiji*

Analyses for the Pacific Islands Food Composition Program have been performed since its inception in the early 1990s at the Institute of Applied Sciences (IAS) at the University of the South Pacific. The most active period was from 1994-1997 supported by a grant from the Australian Centre for International Agricultural Research (ACIAR). The data from this work have been published in *Pacific Island Foods*, Volume 1 (Aalbersberg et al., 1996). Previous to this, collaborative work within OCEANIAFOODS coordinated by the Secretariat for the Pacific Community (then the South Pacific Commission) had resulted in the publication in 1994 of the *Pacific Island Food Composition Tables* (PIFCT). This is a compilation of available food data for about 900 foods. Some data for Pacific green leafy vegetables that had been generated at the University of the South Pacific were included in these food tables but not for many indigenous fruits, nuts, root crops and seafoods. These latter foods were the focus of the 1994-1997 analytical programme.

Since the end of the ACIAR projects the work of the Food Unit has been mainly of a commercial or research nature. Students have completed Masters theses in the analysis of carbohydrates, fatty acids and cholesterol and the effects on nutrient content of foods cooked in the traditional Pacific earth oven (see later paper in these proceedings).

Commercial requests have come mainly from exporters desiring data for food nutrient labels and food processors seeking data on raw materials to guide product development. Analyses have also been performed for national nutrition departments which needed data to complete nutrition studies. Much of the data from these analyses have been compiled in *Pacific Island Foods*, Volume II (Kumar et al., 2001)

Data for the following foods have been determined:

- The first list contains foods analysed as part of a study on nutrient retention on cooking in a traditional Pacific earth oven, called "lovo" in Fijian. "Palusami" is a traditional Polynesian mixed dish based on taro leaves and coconut cream, usually with onions and sometimes meat (corned mutton in our example).

Corned mutton, canned  
Chicken, whole, raw  
Chicken, whole, 'lovo'  
Chicken, whole, microwave  
Chicken, whole, roast  
Chicken, raw, lean-only  
Chicken, lovo, lean-only  
Chicken, microwave, lean-only  
Chicken, roast, lean-only  
Chicken, raw, skin-only  
Chicken, lovo, skin-only

Chicken, microwave, skin-only  
Chicken, roast, skin-only  
Lamb chops, whole, raw  
Lamb chops, whole, lovo  
Lamb chops, whole, microwave  
Lamb chops, whole, roasted  
Lamb chops, raw, lean-only  
Lamb chops, lovo, lean-only  
Lamb chops, microwave, lean-only  
Lamb chops, roast, lean-only  
Lamb chops, raw, fat-only

Lamb chops, lovo, fat-only	Cassava, boiled
Lamb chops, microwave, fat-only	Taro, raw
Lamb chops, roast, fat-only	Taro, lovo
Reef fish, raw	Taro, boiled
Reef fish, lovo	Palusami, raw
Reef fish, microwave	Palusami, lovo
Cassava, raw	Palusami, steamed
Cassava, lovo	Onion, raw

- The foods below were requested by national food and nutrition committees:

Cocoa, prepared Samoa-style	"Dawa", <i>Pometia pinnata</i> (Pacific lychee)
Pandanus, fine scrapping	Mutton pieces, raw
Pandanus, flake sheets	Sea cucumber, raw
Banana, <i>Musa troglodytarum</i>	Sea urchin, raw

- Three analyses were performed on commercial products:

Banana chips	Taro chips, Tausala brand
Taro chips, Leilei brand	

From the last two lists above, only sea cucumber presently appears in the PIFCT. Whole chicken is also absent from the tables, even though this is the common mode of consumption in the Pacific. The attachments to this paper compare some of the new values with those in the PIFCT, which are mainly derived from Australian food tables. In the tables "na" means not analysed; a dash means data not in tables.

The Food Unit has also applied the high precision liquid chromatography (HPLC) techniques used in vitamin analysis to develop other methods. The most commonly performed ones are for kava lactones (a measure of the strength and quality of the kava plant, a major Pacific export) and histamine, especially in tuna. IAS has completed several hundred of these analyses in the past year as part of a PhD project to study conditions that minimise histamine development in fish caught by artisanal fishermen. IAS is also performing analyses for carotenes and retinol as part of a PhD study on Vitamin A equivalent content in foods in the Federated States of Micronesia. (A paper on this work will also be presented at this meeting).

### Using the Data

PIFCT and *Pacific Island Foods*, Volume 1, are being widely used in the Pacific and elsewhere for a variety of nutrition research studies. Fiji has been able for the first time to complete a National Nutrition Survey and Food Balance Sheets. Studies have also been carried out to develop low-cost diets that supply full nutrient requirements. The data were also used to assess the metabolism of food by Pacific islanders.

### The Future

At the end of the ACIAR project, it was agreed that a further need of the IAS laboratory was to develop their food contaminant capability to the same level as for nutrients. Heavy metal analysis has long been performed at IAS and is in some ways an extension of mineral nutrient analysis. Pesticide analysis had been developed by an MSc student in the early 1990s and has

been redeveloped in the past year. A proposal has been submitted to the Technical Cooperation for Developing Countries Unit of FAO to help support further development of food contaminant work at IAS. This project would also assist to update the Pacific Island Food Tables with new data.

### **Quality Assurance**

IAS has continued to participate in the United Kingdom FAPAS proficiency testing scheme for check sample quality assurance for food nutrients and also one distributed by the ASEAN Program. Both standard and in-house reference materials are also regularly analysed with each batch of samples. Each method has also been written up as a standard operating procedure in anticipation of application for an initial audit.

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**Comparison of nutrient values reported in the Pacific Island Food Composition Tables with those recently determined in Fiji (Kumar et al., 2001)**

*Cassava (Manihot esculenta)*, peeled

<b>PROXIMATES (g)</b>	<b>Raw</b>	<b>Boil</b>	<b>`Lovo'</b>	<b>Raw*</b>	<b>Boiled*</b>	<b>Baked*</b>
Water	60.4	67.5	58.9	63	65	56.5
Protein	0.7	0.6	0.8	0.5	0.5	1.7
Fat	0.5	0.4	0.5	0.2	0.2	0.4
Carbohydrate, Total	35.7	28.9	37.8	33.5	33.5	41.4
Sugars, Total	1.2	0.8	0.9	-	-	-
Starch	33.0	26.7	34.1	-	-	-
Total Dietary Fibre	1.5	1.4	2.8	1.5	1.5	1.4
Ash	0.6	0.5	0.7	-	-	-
<b>MINERALS (mg)</b>						
Sodium	26	22	21	7	7	7
Potassium	331	217	326	302	289	365
Calcium	11	10	11	20	20	33
Magnesium	27	22	29	30	30	35
Iron	0.2	0.2	0.2	0.2	0.2	2.1
Zinc	0.4	0.3	0.4	0.5	0.5	-
Copper	0.1	0.1	0.1	-	-	-
<b>VITAMINS</b>						
Retinol Equivalent (µg)	0	na	na	<5	<5	<5
Retinol (µg)	na	na	na	0	0	0
β-Carotene Eq. (µg)	0	na	na	<5	<5	<5
Thiamin (mg)	0.04	0.02	0.00	0.06	0.04	0.01
Riboflavin (mg)	0.02	<0.02	0.00	0.02	0.02	0.04
Niacin (mg)	0.4	0.3	0.4	1	Trace	1
Vitamin C (mg)	36	15	31	14.9	18.6	50

\*PIFCT

'Palusami', prepared

<b>PROXIMATES (g)</b>	<b>Raw</b>	<b>`Lovo'</b>	<b>Steam</b>	<b>PIFCT*</b>
Water	75.3	70.5	68.3	66
Protein	7.4	10.4	11.0	9.9
Fat	12.1	11.2	14.4	12.9
Carbohydrate, Total	3.5	4.8	3.6	6.4
Sugars	2.0	1.4	1.6	2.0
Starch	0.0	0.0	0.0	0.0
TDF	1.5	3.4	2.0	4.4
Ash	1.5	1.4	1.5	-
<b>MINERALS (mg)</b>				
Sodium	399	252	333	263
Potassium	291	302	298	658
Calcium	64	65	57	166
Magnesium	22	20	25	146
Iron	2.1	3.0	3.0	3.5
Zinc	1.4	2.0	2.0	1
Copper	0.4	0.3	0.4	-
<b>VITAMINS</b>				
Retinol Equivalent (µg)	212	389	340	555
Retinol (µg)	0	0	0	0
β-Carotene Eq. (µg)	1275	2336	2038	3320
Thiamin (mg)	0.04	0.03	0.02	0.12
Riboflavin (mg)	0.07	0.04	0.03	0.35
Niacin (mg)	1.5	1.6	1.4	2
Vitamin C (mg)	5	5	0	67

\* "mixed cooked dish"

Taro (*Colocasia esculenta*), peeled

<b>PROXIMATES (g)</b>	<b>Raw</b>	<b>Boil</b>	<b>`Lovo'</b>	<b>Raw*</b>	<b>Boiled*</b>	<b>Baked*</b>
Water	65.7	73.4	66.0	69.0	75	60
Protein	1.1	0.9	1.1	1.1	0.9	1.4
Fat	0.4	0.3	0.4	0.1	0.6	0.2
Carbohydrate, Total	30.0	22.5	30.4	27.5	22.8	38.5
Sugars, Total	0.6	0.5	0.7	-	-	-
Starch	27.4	19.8	26.8	-	-	-
Total Dietary Fibre	2.1	2.2	2.9	1.5	0.8	2.5
Ash	1.1	0.8	1.2	-	-	-
<b>MINERALS (mg)</b>						
Sodium	25	19	25	2	1	2
Potassium	487	329	521	448	264	421
Calcium	16	12	19	32	34	54
Magnesium	35	28	37	115	114	115
Iron	0.5	0.3	0.6	0.5	1.0	1.6
Zinc	1.5	0.8	1.2	0.5	-	-
Copper	0.2	0.2	0.3	-	-	-
<b>VITAMINS</b>						
Retinol Equivalent (µg)	0	na	na	7	6	7
Retinol (µg)	na	na	na	0	0	0
β-Carotene Eq. (µg)	0	na	na	42	38	42
Thiamin (mg)	0.11	0.07	0.07	0.03	0.08	0.13
Riboflavin (mg)	0.02	<0.02	0.00	0.03	0.03	0.04
Niacin (mg)	1.3	0.9	1.3	1	1	1
Vitamin C (mg)	0	na	na	15	5	8

(\* = PIFCT data)

Lamb, chump chops, lean and fat

PROXIMATES (g)	AUST	RAW	'LOVO'	M/WAVE	O/ROAST	PIFCT*
Water	51.5	59.7	34.5	39.7	46.5	50
Protein	15.1	16.2	25.5	19.6	22.5	29.6
Fat	32.7	23.5	38.6	39.7	30.5	18.4
Carbohydrate, Total	0.0	na	na	na	na	0
Ash	0.9	0.6	0.7	0.6	0.7	-
<b>MINERALS (mg)</b>						
Sodium	68	76	72	78	89	72
Potassium	221	186	218	193	194	370
Calcium	14	13	14	13	9	20
Magnesium	19	21	24	22	21	27
Iron	1.9	1.8	2.3	2.0	2.1	3.2
Zinc	2.8	3.5	4.4	3.7	4.6	4.3
Copper	na	0.4	0.5	0.4	0.4	-
<b>VITAMINS</b>						
Retinol Equivalent (µg)	7	12	15	12	7	6
Retinol (µg)	7	12	15	12	7	6
β-Carotene Eq. (µg)	0	na	na	na	na	0
Thiamin (mg)	0.06	0.14	0.03	0.08	0.00	0.05
Riboflavin (mg)	0.16	0.05	0.05	0.06	0.03	0.27
Niacin (mg)	3.3	3.6	4.2	3.7	3.8	5
Vitamin C (mg)	0	na	na	na	na	0

\*grilled

Fish (*Lethrinus xanthophilus*), unspecified cut, skinned

PROXIMATES (g)	USDA <sup>1</sup>	RAW	'LOVO'	M/WAVE	PIFCT*	PIFCT*
Water	81.3	77.7	69.1	71.0	76	72
Protein	17.9	21.3	29.1	27.3	19.5	24.1
Fat	0.6	2.0	2.4	0.8	3.3	3.4
Carbohydrate, Total	0.0	na	na	na	0	0
Ash	1.2	1.3	1.4	1.5	-	-
<b>MINERALS (mg)</b>						
Sodium	71	74	51	87	73	85
Potassium	403	346	415	420	370	411
Calcium	7	5	6	14	19	24
Magnesium	24	27	36	33	-	-
Iron	0.3	1.2	0.5	0.8	0.7	0.7
Zinc	0.4	0.4	0.5	0.5	-	-
Copper	0.3	0.4	0.4	0.3	-	-
<b>VITAMINS</b>						
Retinol Equivalent (µg)	8	0	na	na	31	17
Retinol (µg)	8	0	na	na	31	17
β-Carotene Eq. (µg)	0	na	na	na	0	0
Thiamin (mg)	0.02	0.02	0.00	0.02	0.06	0.08
Riboflavin (mg)	0.04	<0.02	0.00	<0.02	0.07	0.11
Niacin (mg)	2.0	4.5	5.8	4.8	3	4
Vitamin C (mg)	0	na	na	na	0.7	1.3

\*Composite reef fish, first raw and then baked

<sup>1</sup>Pacific cod

Sea cucumber, *Stichopus sp*, raw

<b>PROXIMATES (g)</b>	<b>RAW</b>	<b>PIFCT</b>
Water	93.8	76
Protein	2.2	22
Fat	0.5	0.1
Carbohydrate, Total	0	0
Ash	3.2	-
<b>MINERALS (mg)</b>		
Sodium	775	-
Potassium	173	-
Calcium	65	120
Magnesium	120	-
Iron	0.9	1.4
Zinc	0.2	-
Copper	0.5	-
<b>VITAMINS</b>		
Retinol Equivalent (µg)	<5	-
Retinol (µg)	<5	0
β-Carotene Eq. (µg)	20	-
Thiamin (mg)	<0.02	-
Riboflavin (mg)	0.13	-
Niacin (mg)	0.9	-
Vitamin C (mg)	<1	-

## COUNTRY REPORT: AUSTRALIA

*Mr Gregory Milligan  
Food Standards Australia New Zealand*

### Introduction

Since the last meeting of OCEANIAFOODS in 1998, Australia has released four food composition publications, conducted further development of its supporting database, and commissioned a considerable amount of nutrient analyses. This paper briefly outlines the work undertaken in these areas.

### Publications

#### *Supplement to NUTTAB95 (released in January 1999)*

The *Supplement to NUTTAB95* (Australia New Zealand Food Authority, 1999) was the first product that FSANZ released after NUTTAB95 (National Food Authority, 1995) and was also the first product produced from the new Australian Nutrient Databank (ANDB) system. *NUTTAB95* was an electronic product of the main tables in the paper publication *Composition of Foods Australia* (COFA) (National Food Authority, 1989-95). *Supplement to NUTTAB95* is an electronic format of the information that was originally presented in the appendices of COFA. This publication includes two files on fatty acids, expressed as grams fatty acid per 100g total fatty acids (gfa/100 g TFA) and as grams fatty acid per 100 g edible portion of the food (gfa/100g EP). It also includes two files on amino acids (mg amino acid/g nitrogen and mg amino acids/100g EP), two files on available carbohydrates (g/100 ml or g/100 g EP), and one file on organic acids (g/100 ml or g/100g EP). The final product was released on CD-ROM and provided numerical and descriptive data for between 800 and 1116 foods, depending on the nutrients in question. One of the major improvements for this particular publication was correcting fatty acid values (g/100g) for meat (lean and fat) records compared to those reported in COFA.

#### *AUSNUT (released in November 1999)*

In early 1997, the technical files developed to support the 1995 Australian National Nutrition Survey (NNS) were completed. The range and names of foods in the technical file were designed for estimation of dietary nutrient intake and their nutrient composition was representative of the foods available in Australia in 1995. It was decided to commercialise the technical files and, in the following two years, these files were updated to make them more applicable to end-users of the product. The updates included a second estimation of energy content from dietary fibre and nutrient changes due to vitamin and mineral fortification of some key foods.

The final product, *AUSNUT* (Australia New Zealand Food Authority, 1999), provided numerical and descriptive data on over 4500 foods and consisted of seven inter-related data files released on CD-ROM. These seven files were:

Food file	contains details on NNS record numbers, descriptions and food names
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Nutrient file	presents the numerical values for 126 000 nutrients (28 nutrient values for each of the food records)
Food measure file	contains details on about 22 000 common standard measures (e.g. description and mass of 1 cup of wheat flour)
Recipe file	contains details on approximate percentages of ingredients in recipes, changes in weight during cooking and the nutrient retention factors used for each of the ingredients
Nutrient retention factor file	contains 330 sets of values that are applied to ingredients to account for losses or gains of nutrients during cooking
Nutrient definition file	gives analytical information on each of the 28 nutrients
Explanatory Notes	provides details on the 6 other files, production of the NNS 1995 technical files and references.

The nutrient values in *AUSNUT* came from four data sources:

- Australian analytical data (approximately 50%) - most of the analytical values were obtained from *NUTTAB95*, with the remainder of the values coming from unpublished results.
- Australian calculated data (approximately 46%)
- UK values (30 records)
- UK folate values (98% of folate values) – at this time, data were not available for folate in Australian foods.

A substantial amount of work was undertaken to obtain information on:

- the approximate percentage of ingredients in recipes
- assigning appropriate proportions of separate meat lean and fat values to represent the gross composition of meat cuts as sold to consumers
- frying of foods, and
- the type of records that would be classed as ‘not further specified’ foods.

*AUSNUT Special Edition and the Nutrition Panel Calculator (released in November 2001)*

In 2000, FSANZ released new food standards requiring that most packaged foods be labelled with a nutrition information panel containing information on at least seven nutrients. To assist manufacturers with calculating these nutrient values FSANZ has, over the last two years, developed a nutrition labelling tool called the Nutrition Panel Calculator (NPC) and a supporting database called *AUSNUT Special Edition* (Australia New Zealand Food Authority, 2002; see later paper for further details on development of the NPC). *AUSNUT Special Edition* contains information on the energy, protein, fat, saturated fat, available carbohydrate, sugars and sodium content of approximately 4000 foods.

The foods included in *AUSNUT Special Edition* mainly came from *AUSNUT*. *AUSNUT* contains information on foods that are available in supermarkets and then prepared for consumption (e.g. raw and cooked). After discussion with FSANZ food technologists,

twenty food industry ingredients and fourteen food additives were selected for inclusion in *AUSNUT Special Edition*. A factor that was considered when including food additives and ingredients was the likely levels at which they would be used in products. Where additives or ingredients are present at less than 2% of the finished food, they may not make a significant contribution to the nutrients that must be declared in labels, or may only contribute significantly to one of these nutrients. Common sodium-containing food additives were included in *AUSNUT Special Edition* since they could contribute substantial amounts of sodium to the final food product despite being used at low levels in the final food. Another factor that was considered when including other food industry ingredients was the likely range and number of foods they would be used in. Additional care had to be taken with the food names since there may be many different names for the same ingredient.

FSANZ hopes to add to the list of food industry ingredients and food additives, particularly to food ingredients such as modified starches. As the NPC is used more extensively, FSANZ hopes to gain a greater insight into the other ingredients and food additives that are used.

#### *AUSNUT Sodium values (released in February 2002)*

The original *AUSNUT* publication did not include values for sodium as sodium intake was not estimated in the 1995 NNS. In contrast, all previous FSANZ food composition publications have included sodium values. After many requests for information on sodium, we are now producing a supplementary *AUSNUT* product that presents sodium values only (Australia New Zealand Food Authority, 2002).

#### **Database work 1998-2002**

A new unpublished database based on the 4500 foods included in *AUSNUT* was developed for up to 50 individual fatty acids, particularly the omega-3 and omega-6 polyunsaturated fatty acids (PUFA). The sources and dietary intake of individual fatty acids were not estimated in the 1995 NNS and therefore values for these individual acids were not included in the original *AUSNUT*. *AUSNUT* only included total saturated, monounsaturated and polyunsaturated fatty acid levels. In 2000, FSANZ undertook a collaborative project with the University of Wollongong (NSW, Australia) on this subject. A fatty acid database was created, with each of the 4500 *AUSNUT* foods having up to 50 fatty acid values presented. Fatty acid values from the two fatty acid files of *Supplement to NUTTAB95* (on a g/100g tfa or a g/100g food basis) or more recent Australian data for fish and meat were adjusted to the three fatty acid subtotals presented in *AUSNUT*.

#### **Analytical programs**

Over the last four years, FSANZ has been able to produce four large food composition publications through the maintenance of high standards in both the quality of the analytical program and the compilation of the food records. For the two major analytical projects conducted during 1998-2001, a substantial amount of time was involved in planning the sampling and analytical procedures (e.g. getting representative samples, appropriate choices of raw food samples and nutrients, methods of cooking and selecting appropriate methods of nutrient analyses).

### *Completed analytical programs (1998 - 2001)*

The priorities of FSANZ for food composition work between 1998 and 2002 were:

- nutrients of interest to other areas of FSANZ activity, e.g. vitamin D, trans fatty acids and iodine
- nutrients where there was external academic interest and where the analytical methods had recently improved so that analysis was now a feasible option, e.g. vitamin D, trans fatty acids
- obtaining Australian analytical values for foods where the quality of calculated data was poor, e.g. soup powders.

Between 1998 and 2001, FSANZ conducted one large analytical program. Eight major food groups, encompassing 109 foods and up to 19 nutrients (particularly minerals, fatty acids and vitamins) were included in the analyses. Once the nutrients of interest were selected, the foods for analysis were chosen on the basis of the consumption of different foods and their anticipated contribution to nutrient intake.

On occasions, analyses were performed to replace overseas data (e.g. folate). Since the last OCEANIAFOODS meeting, the folate values in 80 foods were analysed and quality ratings assigned to the results received.

### *Analytical programs planned over for 2002-2003*

Mayer (1997) suggested that the mineral content in fruits and vegetables available in the United Kingdom has declined over time. Consequently, FSANZ has decided to reanalyse mineral content in 51 fruit and vegetable samples that were originally analysed in Australia during 1981-85.

Currently, FSANZ is assisting Meat and Livestock Australia (MLA) to plan a new analytical project on the nutrient composition of Australian beef, lamb, mutton and veal. When the results of this project become available, the Authority will be updating existing records for these foods in our food composition publications.

### **Information technology**

Development work on the current Australian Nutrient Databank (ANDB) system finished in early 1998 and, for the last four years, we have undertaken two projects relating to the ANDB:

- uploading of the technical files from the NNS 1995 (4500 food records) and 704 unpublished analytical records into ANDB, and
- manipulation of records to generate food lines for publications.

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## COUNTRY REPORT: FEDERATED STATES OF MICRONESIA

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### **Food composition work**

Few foods of the Federated States of Micronesia (FSM) had been analysed for their nutrient content prior to the year 2000. Those foods that had been analysed, as well as others more recently analysed, are briefly discussed below.

#### Giant swamp taro (*Cyrtosperma chamissonis*)

Analysis for a range of nutrients (Bradbury and Holloway 1988)

In this food composition work, Pohnpei agriculture officers had sent samples of giant swamp taro cultivars from the main island of Pohnpei and from one Pohnpei outer island Ngatik for analysis of a range of nutrients. This was carried out as part of a wider study organised from outside the country. The results were documented in a book along with results of analyses of other taro and root crops throughout the Pacific. Information on the study was obtained through a request to the Pacific Rootcrops Net e-mail network, asking if any members knew of any analyses for nutrient content of giant swamp taro. One member provided information on Dr Bradbury's work in this area, and Dr Bradbury was contacted. He later kindly provided a copy of the book. It appeared that no information on the study was any longer available at the Pohnpei Agricultural Office, pointing out the difficulties in FSM of maintaining information of this sort.

#### Karat banana (*Musa troglodytarum*) and giant swamp taro (*Cyrtosperma chamissonis*)

Analysis for alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin.  
(Englberger 1999, 2000, 2001; Englberger and Elymore 1999)

This study was initiated as a part of the FSM National Vitamin A Program. Efforts were made to identify local foods that could contribute to vitamin A status and which could be promoted to alleviate the serious problem of vitamin A deficiency in the country. Unstructured interviews and informal focus group discussions were carried out in Pohnpei discussing foods that might have potential in containing high levels of provitamin A carotenoids, based on the deep yellow coloration in the foods. Several people mentioned that *Karat* is known to be very yellow. Due to its rarity, it was difficult at first to find the banana to examine it and to get samples.

*Karat* was previously the traditional weaning food in Pohnpei, but it became rare due to neglect. A frozen sample of peeled ripe *Karat* was sent to the Cancer Research Center of Hawaii and was analysed there for alpha-carotene, beta-carotene, and beta-cryptoxanthin (these three carotenoids have provitamin A activity), and also lutein/zeaxanthin. Following the finding in late 1998 of the high level of provitamin A in *Karat*, an active campaign was carried out to promote it and other vitamin A-rich foods, as an interdepartmental, community-

based project. The campaign was quite successful. Prior to the campaign, the banana was not sold in the markets. Since the promotion, there has been an increase in production, which also has led to the banana appearing regularly for sale in the local produce markets. Interviews with local market people revealed that people knew about the campaign and that the banana had been found to be rich in vitamins. However, one ad hoc interview also indicated that some people had not been convinced, showing the need for continued promotion. One of the education officers who had been involved in the 1999 campaign also indicated his belief that a further campaign on *Karat* is needed.

An unspecified cultivar of Yap giant swamp taro “lak” was investigated during the Vitamin A Study in Yap in the year 2000. At that time, arrangements were made for the analysis in Honolulu, at the Cancer Research Center of Hawaii. Subsequently, a cooked sample of the taro was analysed by HPLC and found to have high carotenoid content.

*Karat (Musa troglodytarum), Mangat, Inasio and Uht en Ruk banana (Musa spp), pele (Hibiscus manihot), chaya (Cnidocolus chayamansa), noni (Morinda citrifolia), and pandanus fruit (Pandanus tectorius)*

Analysis for a range of nutrients (Shovic 2001)

This study involved the analysis of eight foods for a range of nutrients, carried out by the Covance Laboratory, Madison, Wisconsin in a project of the University of Hawaii.

Cultivars of banana, breadfruit, giant swamp taro, pandanus, papaya, fern (*Asplenium nidus*), false durian (*Pangium edule*), and yellow and white cassava

Analysis for alpha-carotene, beta-carotene, lutein, zeaxanthin, total carotenoids, and nine minerals (Analysis nearing completion)

These analyses were carried out as part of the lead author’s PhD thesis titled *A Laboratory and Community-based Assessment of Vitamin A-rich Foods of the Federated States of Micronesia*. Samples were analysed at the Institute of Applied Sciences, University of the South Pacific, Suva, Fiji, and at Roche Vitamins Ltd, Basel, Switzerland. A small set of samples of two banana cultivars and two giant swamp taro cultivars were analysed at the Atlanta Center of Nutrient Analysis, Food and Drug Administration, Atlanta, Georgia; this was for analysis of nine minerals: iron, zinc, calcium, phosphorus, sodium, potassium, magnesium, copper, and potassium. Also, a set of two banana cultivars and two giant swamp taro cultivars were analysed for carotenoids at the USDA Food Composition Laboratory, Beltsville Human Nutrition Research Center, Beltsville, Maryland. Analyses for these are in the process of being completed, and the first sets of results processed and submitted for publication. All samples were labelled by name of food, cultivar, maturity, type of cooking or raw, date of freezing, and source of sample (island), and all samples were delivered to the laboratories in the frozen state.

Fish liver (skipjack tuna, yellowfin tuna, and parrotfish), fish egg and heart (skipjack tuna), canned mackerel (4 brands) and canned sardine (1 brand)

Analysis is underway for retinol, and analysis for mercury for the fish liver samples.

## Plans for food composition work

No analytical work is now done in the country as there are no laboratories with the capacity. However, there is great interest in food composition work on local foods. The FSM National Government provided funds for one set of analyses carried out by USP, and they also included funds for future food analysis work in the 2002 FSM budget.

Many government officers in FSM as well as people in the community in the different islands of Pohnpei, Kosrae, Chuuk, and Yap, showed great interest in the results of the analyses of the different banana, taro, breadfruit, and pandanus cultivars. People expressed strongly that they liked very much this kind of research in which their own local foods were analysed.

A senior officer of the Pohnpei Department of Agriculture had made a request for the analysis of the bird's nest fern, as he had been informed by the nutrition educator of a family eating it, and as it hadn't been eaten in Pohnpei before. One Pohnpei mother had started cooking it as a result of the campaign for cooking and eating green leaves. Also, interest was expressed in the analysis of a further particular food from the Mortlock Islands, the *afuch*.

Funding is limited for food analysis, and there is a lack of skills on sample preparation, coordination of sample analysis, and interpretation of results. The national nutritionist post is now unfilled, limiting national coordination of nutrition work. There are difficulties in getting samples to the laboratory, including quarantine restrictions, though through careful arrangements, these difficulties can be overcome.

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## **Editors' note**

The results of this work have now been published in the following three articles:

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## COUNTRY REPORT: NEW ZEALAND

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In February 1989, the Department of Scientific and Industrial Research (DSIR), formerly known as DSIR Crop Research Division, released the first edition of the New Zealand Food Composition Database (NZFCDB) in the form of printed tables and data files. The first database product contained 1122 records of which only 23% were sourced from New Zealand. To date, the NZFCDB contains information on 2665 foods. In total, there are 236,326 component values. Of these, 112006 (47%) are from New Zealand sources and the other 124,320 (53%) are from overseas, calculated and presumed values.

A complete presentation of 48 nutrient components for more than 2500 foods is available from the computer product FOODfiles 2001, which is accompanied by a user manual. Included with this product are sampling and analytical details (including the number of samples), standard deviation and standard errors. FOODfiles 2001 also includes ingredient information for 279 commonly used recipes, information on fortified foods and vitamin and mineral information on more than 700 dietary supplements.

Approximately 60 new foods, which is equivalent to 2900 New Zealand source values, are added annually. The selection of food for the analyses is based on users' demand, market share, food industry practice, requests from public health organisations, food related legislation and public health significance.

Research methodologies for some of the food components are available in-house such as water, nitrogen, ash, fat, fatty acids, cholesterol, starch, fibre (Englyst) and carotenoids. At present, quality control mechanisms include checking of samples, interlaboratory trials and integrity tests. In the future, these mechanisms will be extended to include reference materials and proficiency testing.

Once the new data have passed the quality checks, they are made available to users via computer products such as the FOODfiles disk, as mentioned above, and printed products such as the Concise New Zealand Food Composition Tables. This publication presents nutritional information for 28 nutrients in approximately 900 foods. Nutrient information is based on both a 100 g edible portion and a common serving. It is revised and updated every two years.

Nutrition Information Panel Data Files (NIPD) are also available. These comprise a subset of the New Zealand food composition tables, including nutrient data for the seven nutrients that must be declared on a nutrition information panel (energy, protein, fat, saturated fat, carbohydrates, total sugars and sodium).

There are several commercially produced dietary software packages (on diskette) that include New Zealand food composition data. These are:

*FoodWorks*    [www.xyris.com.au](http://www.xyris.com.au)

The packages are fully compatible Windows applications and provide a nutritional analysis of food, recipes and food intakes in both numeric and graphical forms. Using these packages it is possible to export nutritional information to common work processor files, spreadsheets and other databases.

Other publications containing New Zealand food composition data include:

*The Pacific Islands Food Composition Tables*  
*Fats and fatty acids in New Zealand foods*  
*Sugars, starch and fibre in New Zealand foods*  
*Characteristics of fruits and vegetables*  
*Export fruits and vegetables*  
*Dairy products*  
*Poultry*  
*Bread and flour*  
*Pork*

New Zealand food composition data have been stored using an Advanced Revelation Database Management System (a client based system) for the past 11 years. The system has outlived its use in recent years: it is somewhat inefficient and lacks flexibility, for example, the report formatting is all pre-set.

A review of the system has been undertaken. As a first step, we visited the USA and Europe to become informed about new developments in the field. A project manager has been appointed to oversee the development of the new database, which will be conducted in three phases as follows:

Phase 1 – scoping of the development project

Phase 2 – obtaining a quotation on the technical description from software developers

Phase 3 – commencing the development work (from March 2002)

It is envisaged that the old system will be replaced with a web-enabled, relational database management system that would offer more flexibility, usability and functionality. This would provide on-line access to the information on a user-pays basis.

Future developments with respect to New Zealand food composition data include:

- Reporting of fortified nutrient values from naturally occurring sources;
- Reporting of dietary folate equivalents; and
- Changing the conversion factor for retinol equivalents.

**Three major financial providers for the New Zealand Food Composition Database work are: the Ministry of Health (MOH), Crop & Food Research (CFR) and the Foundation for Research, Science and Technology (FfRST).**

# FOOD COMPOSITION DATA

## USE OF FOOD COMPOSITION DATA IN DEVELOPING COUNTRIES

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Reliable data on the nutrient composition of foods consumed by people are critical in many areas - health assessment, the formulation of appropriate institutional and therapeutic diets, nutrition education, food and nutrition training, epidemiological research on relationships between diet and disease, plant breeding, nutrition labelling, food regulations, consumer protection, and agricultural goods and products, as well as for a variety of applications in trade, research, development, and assistance.

In March 1994, FAO and the United Nations University (UNU) organized an international discussion on "Food Composition for Developing Countries" in Tunis, Tunisia. At this meeting, FAO's commitment to improving the quality and availability of food composition data in developing countries was renewed after an interval of many years.

As part of this new effort, FAO joined UNU in the promotion of the INFOODS project. Priority is currently given to mobilizing resources for improving the quality, quantity and accessibility of food composition data in the developing world. Whereas in 1949 there was a single FAO food composition table for use throughout the world, there are now regional data bases and developing countries are able to interchange data with each other. INFOODS has helped to advance the harmonization of food composition data in several fields: analytical methods, nutrient nomenclature, definitions and mode of expression, food nomenclature, description, terminology and classification, and database management and interchange.

However there remains divergence in these databases leading to incompatible data at the international level, including in food identification and naming systems, units for expressing nutrients, methods of analysis, statistical treatment of data, source of data and common measures and serving sizes. FAO therefore convenes expert consultations to critically review the work that has been undertaken, to provide advice on how to complete and improve the work and to make the scientific information available to potential users, as it becomes available.

International food composition databases also need to include information on antinutrients in foods, not only nutrients.

FAO has a number of statistical databases that present data on foods available for human consumption. National supplies are expressed as amounts of foods (kg per caput/year), and as Dietary Energy Supply (kcal per caput/day), Dietary Protein and Dietary Fat Supply (g per caput/day). These databases draw on food composition data and are used to estimate the prevalence of undernourishment, and the trends in prevalence, but they also provide valuable information on food patterns and trends, and on diet diversification.

There has been progress in reducing the numbers of malnourished people worldwide and it is aimed to halve these numbers by 2015 to 400 million.

## USES OF FOOD COMPOSITION DATA IN NEW ZEALAND

*Dr Nelofar Athar  
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Crop & Food Research's vision for information on the composition of New Zealand foods contained in the database is to improve the health of New Zealanders by providing accurate and relevant information for:

- users including public health professionals, educators, researchers, food industry and the general public
- nutrition surveys and
- public health policy development.

Not only is the demand for food composition data rising significantly, but users are asking for custom-made, quality information on the nutrient composition of foods. Hence, a very systematic approach has been adopted to enable these needs to be met. Examples of quality information used to construct the database are previous editions of the Concise Tables, the Child Nutrition Survey (CNS) database, and data that can be used to construct nutrition information panels.

The demand for the Concise Tables has been very high since its first release in 1991. It is updated every two years. The fifth edition of these tables was published in 2001. To maintain the value of the concise tables, an official user forum was established in 1999 to guide the selection of foods for inclusion. The 2001 edition contain information on 28 nutrients for 900 foods. The nutrient values are reported on a per 100 g and per common measure basis. Information on fortified foods is also available in the publication.

To help decide which foods are relevant for inclusion in the concise tables, a group of 12 dietitians from both regions are randomly selected. The dietitians are provided with the complete list of foods and asked to select those that they feel should be included. A final shortlist of foods is prepared including only those that were selected by 75% of the participants.

Outcomes include:

- the inclusion of many ready to consume foods;
- a good reflection of changes in the food industry; and
- positive feedback from the users.

The CNS database has three components: the nutrient composition of foods, information on fortified foods, and information on dietary supplements. Our objective is to work with the CNS project team to provide food composition data for the calculation of nutrient intake in children aged between 5 years and 14 years and 11 months.

Nutrition Information Panel Data Files (NIPD) are also available. These are designed specifically for food manufacturers. They facilitate food manufacturers to prepare a nutrition information panel as required under Standard 1.2.8 - Nutrition Information Requirements, of

Volume 2 of the Food Standards Code. The NIPD files contain nutrient values for the seven nutrients that must be declared on a nutrition information panel (protein, energy (kJ), carbohydrate, sugar, fat, saturated fat, sodium) for 2550 foods. Web access to these files has been proposed.

In conclusion, the uses of food composition data are increasing. As such, it is crucial to understand the needs of those using the database, produce the highest quality data that most accurately reflects the New Zealand food supply, and disseminate the information in the most effective way.

# USES OF FOOD COMPOSITION DATA IN AUSTRALIA – THE ON-LINE NUTRITION PANEL CALCULATOR

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## **Introduction**

The Nutrition Panel Calculator (NPC), released by Food Standards Australia New Zealand (FSANZ) in November 2001, is a web-based, online nutrition labelling tool, freely available via FSANZ's website [www.foodstandards.gov.au](http://www.foodstandards.gov.au).

In December 2002, a new Food Standards Code ('the Code') for Australia and New Zealand will, after a two-year transition period, become the sole Code for both countries. By that time, Australia and New Zealand will require the display of nutrition information panels on the labels of almost all packaged foods, as set out under Standard 1.2.8 – Nutrition Information Requirements, of Volume 2 of the Food Standards Code. The NPC was designed to assist food manufacturers and retailers compile these nutrition information panels.

## **The requirement for a nutrition labelling tool**

The new joint Code was developed following a comprehensive review of all of the food standards including the nutrition labelling standard. In drafting the new nutrition labelling standard, it was recognised that the food label is the most direct mechanism to provide consumers with nutritional information to enable them to compare products and to assist them to choose an appropriate and healthy selection of food, leading to better health outcomes.

The new nutrition labelling standard requires that most packaged foods display a nutrition information panel irrespective of whether a nutrition claim is made or not. Information on seven 'core' nutrients must be presented. These are: energy, fat, total saturated fat, carbohydrates, total sugars, protein and sodium. These nutrients were selected on the basis of the available scientific information about their health impacts and contribution to the daily diet.

The NPC was one of the primary measures implemented by FSANZ to assist the food industry, particularly small business, make a smooth transition to the requirements of the new Code. Other measures included a hotline, small business seminars and training packages.

## **Development of the tool**

Development of the NPC began in about November 2000. Initially, there were no firm ideas about the form that the product would take. A number of important options and issues had to be considered before any final decisions were made. To assist us to work through all of the relevant issues, a Food Industry Reference Group was convened. The group was consulted on several occasions throughout the development process.

The main issues requiring careful consideration are discussed in further detail below.

## 1. Data source

FSANZ's food composition program has produced several food composition databases, including *NUTTAB95* (National Food Authority, 1995) and *AUSNUT* (Australia New Zealand Food Authority, 1999), from which the food composition data could be sourced. Ultimately, it was decided that the data should be sourced from the *AUSNUT* database.

*AUSNUT* is a food and nutrient database, which contains data on 4,500 foods, released in November 1999 on CD ROM. It is based on the technical support files used to code and analyse the 1995 Australian National Nutrition Survey (NNS) food intake data.

*AUSNUT* was selected because it contained the most up-to date and extensive data set. However, there are limitations to its use and an extensive revision of the data was required. The result was the development of a modified version of *AUSNUT* called *AUSNUT Special Edition*, which, although based on *AUSNUT*, was developed specifically for use with the NPC.

A brief discussion of some of the major limitations follows. Firstly, *AUSNUT* data relate mainly to foods ready for human consumption (i.e. cooked and processed). As such, there are data gaps relating to some raw and unprocessed items such as raw kidney beans and raw meat cuts devoid of separable fat, and food industry ingredients and food additives, such as maltodextrin and monosodium glutamate. To overcome this problem, it was necessary to include data for some raw and unprocessed foods from the *NUTTAB95* database and other available sources.

Secondly, although some new data had to be added, a small number of foods had to be omitted from the modified version. A number of data lines in *AUSNUT* are identified by the terms 'Not specified as to...' or 'Not further specified' e.g. 'Lamb chops not further specified'. Although appropriate for NNS data files, it was decided that these foods were inappropriate for labelling purposes.

Thirdly, *AUSNUT* lacks data on sodium. This again is because it was based on the 1995 NNS technical support files. Due to the difficulty in measuring discretionary salt use, an analysis of sodium intake was not undertaken as part of the NNS. To overcome this problem it was necessary to derive sodium data from very early versions of the 1995 NNS technical support files and other sources.

Fourthly, carbohydrate values and energy values in *AUSNUT* 1999 are not consistent with the requirements of the Code. These had to be revised to account for differing components and energy factors.

Lastly, *AUSNUT* contains nutrient values for 28 nutrients (not including sodium). As only seven core nutrients need to be included on a standard panel, it was decided to limit *AUSNUT* Special Edition to these seven only; all of other nutrients were omitted.

The resultant *AUSNUT* Special Edition database comprises three data files containing nutrient data and associated information for more than 4000 foods. It is freely available, separate to the NPC, via CD ROM or email by contacting [npc@foodstandards.gov.au](mailto:npc@foodstandards.gov.au).

## 2. *Format*

Numerous formatting options for providing the AUSNUT Special Edition data files were considered including:

- A hard copy publication including food tables and guidelines for calculating recipes;
- Data files in ASCII format, guidelines, and a spreadsheet recipe calculator provided on either diskette, CD Rom or as downloadable files from our website; and
- A web based, on-line recipe calculation program, supported by the AUSNUT Special Edition data files.

Initially, it was decided to proceed with a CD ROM comprising *AUSNUT Special Edition* data files in ASCII format for upload into database management or spreadsheet applications. The CD ROM would also include a simple recipe calculator running on a Microsoft™ Excel spreadsheet.

A prototype of this CD ROM package was released to a limited audience, seeking their comments on its overall usefulness. The general feedback was not very positive; something simpler and more user-friendly was required. In light of these comments, the web-based, on-line format currently available was developed.

## 3. *Charging Policy*

Careful consideration had to be given as to whether or not a charge should be imposed. On one hand, if a charge were imposed, this could be seen as a conflict of interest whereby FSANZ could be seen to be making a financial gain through Industry's requirement to comply with legislation. On the other hand, if no charge was imposed, this would contrast with FSANZ's standard pricing policy for all of its earlier food composition products, leaving FSANZ vulnerable to accusations of bias towards industry.

Ultimately, it was agreed that the product be provided free of charge to assist food manufacturers, and particularly small business, comply with the new Code requirements with minimal difficulties and financial burden.

## 4. *Accessibility*

To comply with the Australian Government Online requirements for Website accessibility, two different formats of the NPC have been developed. One was developed using Omnis technology, providing a dynamic graphical user interface. However, this version does not comply with Government requirements. The second was developed using Cold Fusion software, which is functionally similar to the Omnis version however it complies with Government requirements.

### **Appearance and functionality of the NPC**

The NPC can be accessed from the FSANZ home page by clicking on the selection 'Nutrition Panel Calculator' displayed on the left hand side of the page.

Users enter the NPC via some introductory screens and a set of comprehensive Explanatory Notes. A client feedback form is also provided. The user then enters the calculator itself. It

comprises four screens that can be accessed by clicking on the tabs at the top left hand corner underneath the FSANZ logo. The four screens are:

- Search for an ingredient
- Enter custom ingredient
- FAQ – Includes frequently asked questions and answers and
- About – Details regarding the version and software.

Each section is clearly labelled in the sample screen below (Accessibility version shown).

The screenshot shows the ANZFA Nutrition Panel Calculator interface. At the top, there is a navigation bar with tabs for 'Search for an Ingredient', 'Enter Custom Ingredient', 'FAQ', 'Feedback', 'About', and 'Leave NPC'. Below the navigation bar is a search bar with the text 'Search for an Ingredient' and a 'Search' button. To the right of the search bar is a 'Recipe Name' input field. Below the search bar is an 'Ingredient List' table with columns for 'Ingredient List' and 'Ingredient Weight (g)'. The table is currently empty, with the text 'No ingredients selected.' displayed. To the right of the ingredient list is a 'Weights and servings' section with input fields for 'Initial Weight: 0.00', 'Final Weight: 0.00 g', 'Serve Size: 0.00', 'Specific Gravity: 0.00', and 'Serves Per Package: 0.00'. There is also a 'Weight Change: 0.00 %' field and a 'Grams' dropdown menu. Below the weights and servings section is a 'Nutrition information panel data' table with columns for 'Nutrient', 'Qty per Serve', and 'Qty per 100g'. The table contains the following data:

Nutrient	Qty per Serve	Qty per 100g
Energy (kJ)	0.00	0.00
Protein (g)	0.00	0.00
Fat, Total (g)	0.00	0.00
Fat, Saturated (g)	0.00	0.00
Carbohydrate (g)	0.00	0.00
Sugars (g)	0.00	0.00
Sodium (mg)	0.00	0.00

At the bottom of the interface, there is a copyright notice: 'Copyright © 2001-2002 - Australia New Zealand Food Authority - All Rights Reserved.'

Firstly, users must search the database for each of the ingredients that are used in their recipe and add it, one by one, to an ingredient list. Searching is done by entering all or part of the ingredient name in the 'Search for an ingredient' box. Users must specify the quantity of each ingredient required to make up their recipe. Both weights and, for some liquid ingredients, volumes can be entered. The NPC will automatically convert the volume of a liquid ingredient into a mass, based on an in-built specific gravity data file (by multiplying the volume by the specific gravity of the food).

Once all of the ingredients have been added, the user may need to make adjustments to the recipe's raw weight to account for weight changes in cooking. This is because the cooking process can change the recipe's raw weight, due to gains and/or losses in both water and/or fat. This may be done by either inserting the cooked weight of the recipe, if known, or an appropriate weight change factor in the boxes provided. Weight change factors for a range of foods can be found in Appendix 5 of the Explanatory Notes that accompany the NPC.

To complete the calculations, the user must nominate a serving size and servings per package. No further data input is required. The NPC will automatically calculate the nutrient composition per 100 g of the finished product, adjusting for weight changes on cooking and

for serving quantities. A paper copy of the results can be obtained by clicking on the button 'Print results'.

The second screen, the 'Enter custom ingredient' screen has been set up to allow the user to add customised nutrient data for their own unique ingredient or for ingredients that are missing from the NPC database.

This facility has built in safeguards whereby logic dictates that it will only accept:

- a saturated fat content that is less than or equal to the total fat content and
- a sugars content that is less than or equal to the carbohydrate content.

## **Limitations**

The NPC is a useful tool for deriving average nutrient values for nutrition labelling as permitted under the Code. However, there are limitations to its use. Firstly, it does not have the capacity to adjust for the effect of processing on nutrients. Secondly, it has a limited capacity to deal with foods that require either boiling or frying, where the water or oil is not completely absorbed by the food. The Explanatory Notes address these issues in great detail.

## **Conclusion**

The NPC was designed to assist food manufacturers and retailers compile nutrition information panels for the labels of their packaged foods. Under the new Food Standards Code for Australia and New Zealand, it is a requirement that most packaged foods display a nutrition information panel on their label.

While a number of formatting options were considered for the NPC, it was ultimately decided that a web-based online tool, supported by the *AUSNUT Special Edition* database, would be the most user-friendly option.

The NPC comprises two main screens that allow the user to search for an ingredient from the *AUSNUT Special Edition* database, add it to an ingredient list, make adjustments for weight changes that may occur on cooking, specify serving sizes and the number of servings per pack, and print off the information in a format which complies with the requirements of the new Code.

There are several limitations with using the NPC as it does not have the capacity to adjust for the effect of processing on nutrients and it has a limited capacity to deal with foods that require either boiling or frying, where the water or oil is not completely absorbed by the food.

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# **NUTRIENT AND ANALYTICAL ISSUES**

## **ASIA PACIFIC FOOD ANALYSIS NETWORK**

*Dr Pieter Scheelings*  
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Dr Scheelings presented an overview of the work of the Asia Pacific Food Analysis Network (APFAN), of which he is currently the coordinator.

APFAN is a special project of the Federation of Asian Chemical Societies and links food analysts and scientists operating in the Australasian, Oceania and ASEAN regions.

One of APFAN's recent projects was the training exercise on analysis of niacin, described elsewhere in these proceedings, initiated at the 6<sup>th</sup> APFAN meeting held in Brisbane, Australia, in May 1999.

# ANALYSES FOR PROVITAMIN A CAROTENOIDS IN THE PACIFIC REGION: BANANA, TARO, BREADFRUIT, AND PANDANUS

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## **Introduction**

The work presented here is one part of the PhD research project of the lead author. The overall aim for that study was to gain insight into factors affecting production, acquisition, and consumption of vitamin A-rich foods in the Federated States of Micronesia (FSM), and to identify foods that could be promoted to alleviate vitamin A deficiency in the FSM. The country is made up of four states, Pohnpei, Kosrae, Chuuk, and Yap, and has 607 islands spread out over a million square miles of water (Federated States of Micronesia, 1996).

## **Background on FSM**

In order to understand the food and nutrition situation of the FSM, it is important to understand some of its background. The islands first came into contact with Europeans in the mid-1800s, along with traders, whalers, and missionaries. The country was then colonized by three foreign powers, Spain, Germany, and Japan. At the end of World War 2, the islands came under United States (US) administration, as part of the Trust Territories of the Pacific Islands. In 1986, the country gained its independence, along with a Compact of Free Association with the US, which has had tremendous impact on the country. The population as counted in the year 2000 census stood at around 107,000 (preliminary data, FSM Department of Economic Affairs, 2002).

## **Diet of FSM**

The diet of the country is in a stage of transition. The local foods including breadfruit, banana, taro, some other root crops, coconut, fresh fish and seafood, other meats, fruits and vegetables, are increasingly being replaced by imported foods. They include rice, wheat products, sweet and refined foods, and canned fish and meat. The reasons for the transition include changing lifestyles, convenience factors, tastes, family structure, the change from a subsistence to a market economy, government policies which have often been inconsistent, and food aid programs. One might ask why would a change from local foods to imported foods lead to vitamin A deficiency? One reason is... rice. It is the food in the diet that has had the biggest change, and has become a staple in the diet. It contains no provitamin A carotenoids and is replacing traditional staple foods which were providing the provitamin A carotenoids in the past.

## **Vitamin A deficiency in FSM**

There is a serious problem of vitamin A deficiency (VAD) in FSM. The prevalence rates of vitamin A deficiency in Chuuk have been considered to be among the most serious in the world. High rates of clinical vitamin A deficiency were detected in Chuuk in the late 1980s, this including symptoms of night blindness and Bitot's spots, blindness, and death. Then, a series of surveys were carried out to determine the prevalence of subclinical vitamin A deficiency, determined by examination of the blood for serum retinol. These surveys carried out from 1992 to the year 2000 showed that 76%, 63% and 51% of the preschool children (respectively for Chuuk, Kosrae, and Pohnpei), were vitamin A deficient, as determined by low serum retinol (Lloyd-Puryear et al., 1989, Lloyd-Puryear et al., 1991, Auerbach, 1994, Centers for Disease Control and Prevention, 2001). The problem in Yap was less, at 38%, but this was also a problem of public health significance (Centers for Disease Control and Prevention, 2001).

It is noted that the problem of vitamin A deficiency is thought to be an emerging problem, as well as chronic diseases. As to clinical vitamin A deficiency, there is no word in the language for night blindness, whereas in countries where there has been a problem of VAD for many years, there is usually such a local term. Also, older people in the community have not known of night blindness in the past.

Chronic disease is also a growing problem in FSM (Coyne, 2000). Carotenoids are now thought to have a protective effect against chronic disease (World Cancer Research Fund/American Institute for Cancer Research, 1997). Foods high in carotenoid appear to decrease the risk for particular chronic diseases.

### **Role of vitamin A**

What is the role of vitamin A? Previously, it was thought that vitamin A was mainly for vision and eye health. However, recent studies have shown that if vitamin A status is improved in deficient populations, the overall all-cause mortality of under five year old children can be decreased by about 23% (Beaton et al., 1993).

Thus, the role of vitamin A also involves morbidity, mortality, the immune system, and anemia, as well as vision, and eye health.

### **Sources of vitamin A in the FSM**

The animal sources of vitamin A in the FSM include liver of fish and meat, some seafood, eggs, milk, and butter, and some fortified foods as some ramen noodles, and margarine. The plant sources include ripe papaya, mango, pandanus fruit, and dark green leafy vegetables (Dignan et al., 1994).

The animal sources have a greater bioavailability, yet they are more expensive and often difficult to obtain. There are also problems with the plant sources of vitamin A. Papaya and mango are often eaten green, at which time there is little carotenoid content. Edible pandanus fruit is not grown on all islands. Dark green leafy vegetables were reported to not be eaten in the past on most of the islands, and are disliked by most people. They are considered to be foods for animals such as pigs.

Thus, one comes to ask, what were the foods in the past that protected the people of FSM against vitamin A deficiency? Banana, taro, and breadfruit were main staple foods of the FSM, and in some areas, pandanus was also an important food. Previously, banana, taro, and breadfruit were not considered as vitamin A sources. However most cultivars had not been analysed, although many cultivars had a yellow-orange colouring indicating the presence of carotenoids.

### **Aim of this study**

The aim of this study was to identify potential local foods that may be promoted in a sustainable food-based VAD prevention strategy for FSM, and to gain insight into the factors affecting production, acquisition, acceptability, and consumption of vitamin A-rich foods in FSM.

### **Research methods**

The research methods included both qualitative and quantitative methods. As to qualitative methods, an ethnographic approach was used to select the samples for analysis, and to study food practices and beliefs. This included key informant interviews, informal focus group discussions, and photography of the foods. The quantitative methods included analysis of the sample by high performance liquid chromatography (HPLC); 63 samples were sent to Roche Vitamins Ltd, Basel, Switzerland, and 41 samples were sent to the Institute of Applied Science, University of the South Pacific (USP), Suva, Fiji. Most of these food cultivars had not been analysed previously. Both raw and cooked samples were analysed, and the sample was prepared as ready to eat, without the skin or peelings in most cases, except for one breadfruit cultivar that is eaten with the skin.

#### Banana (*Musa troglodytarum*)

*Karat* banana *Musa troglodytarum* was found to contain significant levels of  $\beta$ -carotene, over 20 times the levels of  $\beta$ -carotene found in common bananas (Dignan et al., 1994). This appears to be the first banana in the world found to be high in provitamin A-rich carotenoids (Englberger, 2001). The *Karat* banana of Pohnpei was the traditional weaning food for infants. It fruits by the bunch growing directly up into the air. The ripe finger has a reddish-colored skin and a fat shape, and the edible flesh is deep yellow in color.

The strengths of the *Karat* include: high provitamin A content, bioavailability should be high (being an orange fruit), good acceptability as it originally was the traditional weaning food, and resistance to leaf streak disease. The limitations include rarity and seasonality, lack of planting material, some sensitivity to strong sunlight and poor soils, and vulnerability of the young sucker to pigs. A campaign in 1999 (Englberger, 1999) to promote *Karat* in Pohnpei proved to be very successful, as seen by the regular appearance of *Karat* in the markets from the year 2000 up to the time of writing of this paper. The banana had not been sold in the markets previously.

The results of the carotenoid analyses show a great range of values of carotenoids. The export *Uht en Manila* cultivar contained 30  $\mu\text{g}$   $\beta$ -carotene/100g sample, whereas the *Uht en Yap* contained 6110  $\mu\text{g}$ /100g. The *Lakatan* banana, which appears to be close to the bottom of the list, still contained 10 times the level of  $\beta$ -carotene as the *Uht en Manila*. The *Uht en Manila* banana was not thought to contain high levels of carotenoids, because the color of the edible

flesh was very light-colored, but it was analysed for purposes of comparison, and because it was a common banana. The carotenoid content was similar to that for common cultivars of bananas (Dignan et al., 1994). There was a considerable difference between the results of laboratories for the *Uht en Yap* banana; this may be accounted for by sample inhomogeneity, and differences in sample history such as transport and storage, in addition to any inter-laboratory differences. On most samples there was a good agreement between the laboratories. The results of both laboratories indicated that there was a greater yellow coloration of edible portion, along with a greater content of carotenoids.

It is emphasized that the carotenoid analyses indicate that a number of bananas contain high carotenoid levels, the *Usr Lakatan*, *Usr Taiwang*, *Uht Ipali*, *Uht en Yap*, in addition to *Karat*. All banana samples were frozen as raw, or they were prepared by a particular cooking method and then frozen, which was documented on the label and sample list (see Table 1 below).

Table 1. Carotenoids content in bananas, determined by HPLC analysis

Cultivar	$\beta$ -carotene $\mu\text{g}/100\text{g}$	$\alpha$ -carotene $\mu\text{g}/100\text{g}$	Total carotenoids $\mu\text{g}/100\text{g}$
<i>Uht en Yap</i> , baked*	6110	1209	na
<i>Uht en Yap</i> , raw**	2780	830	5370
<i>Uht en Yap</i> , baked**	1250	400	3130
<i>Usr Wac</i> , boiled**	2300	950	3740
<i>Ipali</i> , boiled**	940	610	1770
<i>Karat</i> , steamed**	710	100	1140
<i>Usr Taiwang</i> , raw**	400	180	630
<i>Usr Lakatan</i> , raw**	330	280	900
<i>Uht en Manila</i> , boiled**	30	20	290

\* USP Nov 2000, \*\* Roche March 2001      na- not available

#### Giant swamp taro (*Cyrtosperma chamissonis*)

The giant swamp taro *Cyrtosperma chamissonis* is a special food crop. It is a very large plant, and has a large corm. It is very specially suited to the atoll islands, as the plant can withstand more saline soils, and as it can be stored in the soil (on the plant) for 10 to 20 years, and remain very edible. Thus, it provides important food security to the people in times of hurricanes and drought, and between breadfruit seasons.

The results of the carotenoid analyses also presented a range of values, from 50  $\mu\text{g}$   $\beta$ -carotene/100g sample in the *Pasruk Ebon* to 2040  $\mu\text{g}/100\text{g}$  in the *Mweshei*. The *Pasruk Ebon* was not thought to contain high levels of carotenoids, because the color of the edible corm was very light-colored, but it was analysed for purposes of comparison, and because it was a common taro (see Table 2).

Table 2. Carotenoids content in giant swamp taro, determined by HPLC analysis

<b>Cultivar</b>	<b><math>\beta</math>-carotene <math>\mu\text{g}/100\text{g}</math></b>	<b><math>\alpha</math>-carotene <math>\mu\text{g}/100\text{g}</math></b>	<b>Total carotenoids <math>\mu\text{g}/100\text{g}</math></b>
<i>Mweshei</i> , raw**	2040	830	3290
<i>6-moon</i> , boiled **	1700	670	2940
<i>Kirngesi</i> , boiled**	1120	660	2260
<i>Siminton</i> , boiled*	1651	484	na
<i>Siminton</i> , boiled**	1070	390	1870
<i>Fanal</i> , boiled**	170	90	330
<i>Pasruk Ebon</i> , boiled*	85	71	na
<i>Pasruk Ebon</i> , boiled**	50	30	170

\* USP Nov 2000, \*\* Roche March 2001 na- not available

Breadfruit (*Artocarpus altilis* and *Artocarpus mariannensis*)

Breadfruit has been the main local food for FSM. In previous analyses of breadfruit, it was shown to contain low levels of provitamin A carotenoids (Dignan *et al.*, 1994). Yet most analyses had been on green mature breadfruit, whereas in FSM many people eat breadfruit in the ripe stage, when the breadfruit is more yellow, indicative of more carotenoids. Analysis showed that ripe breadfruit of most cultivars did not contain high levels of provitamin A carotenoid. However, the ripe edible flesh of seeded breadfruit *Meikole* which is known to be particularly yellow, was found to have a relatively high content of carotenoids. There were other *Meikole* samples in addition to that presented here which also were found to contain a relatively high content of carotenoids. There were problems of ripening in the sample sent to USP which may account for the lower content in the sample of *Meikole* sent to the USP laboratory. Further analyses would be needed for a further confirmation. The seeded breadfruit *Meikole* is unusual, in that it can be eaten raw as a fruit, with or without the skin. It is the cultivar that is popular on the atoll islands of FSM, and is considered a delicacy. Table 3 compares values of provitamin A carotenoids determined on different samples of breadfruit.

Table 3. Carotenoids content in breadfruit, determined by HPLC analysis

<b>Cultivar</b>	<b><math>\beta</math>-carotene <math>\mu\text{g}/100\text{g}</math></b>	<b><math>\alpha</math>-carotene <math>\mu\text{g}/100\text{g}</math></b>	<b>Total carotenoids <math>\mu\text{g}/100\text{g}</math></b>
<i>Meikole</i> , boiled *	868	142	na
<i>Meikole</i> , boiled **	150	10	1260
<i>Meitoal</i> , boiled **	60	<10	670
<i>Meisaip</i> , boiled **	20	<10	170
<i>Mos Parkas</i> , boiled **	10	10	510
<i>Mos Parkas</i> , boiled *	7	8	na

\* USP Dec 2000 and July 2001 \*\*Roche March 2001

### Pandanus (*Pandanus tectorius*)

Pandanus is a very important fruit in Kosrae, outer islands of Pohnpei, Marshall Islands, and Kiribati. It is one of the few foods that can grow on some atoll islands. Not all pandanus fruit are edible. However, the plant has other uses. For example, pandanus leaves are valued for weaving and roofing material, and the wood is used for building.

There is very little information available on pandanus fruit, though the Pacific food composition tables indicate that pandanus is high in vitamin A (Dignan *et al* 1994). Yet, the ripe edible portion of the keys of the different cultivars have different coloration. The *Mweng Masal* cultivars have a much deeper coloration compared to the *Mweng Choipep* and *Mweng Oa* pandanus. The results of the carotenoid analyses showed that the light-yellow-colored pandanus were very low in carotenoid content, and the orange-colored pandanus were much higher (see Table 4).

Table 4. Carotenoids in Pandanus, determined by HPLC analysis

<b>Cultivar</b>	<b>β-carotene μg/100g</b>	<b>α-carotene μg/100g</b>
<i>Mweng Masal</i> small	393	157
<i>Mweng Masal</i> big	334	190
<i>Mweng Masal</i> new	211	67
<i>Mweng Oa</i>	87	24
<i>Mweng Choipep</i>	19	<2

\*All analyses by USP July 2001.

### **Conclusions**

Thus it is concluded:

- There is a great range in carotenoid content in the different cultivars of banana, giant swamp taro, breadfruit, and pandanus. Certain varieties contain a high content of provitamin A and other carotenoids. Yet some of them have become rare and are in danger of being lost to the modern westernised diet.
- There is potential for alleviating VAD in Micronesia with these food cultivars and reducing risk for some chronic diseases. Thus there is need to analyze for other carotenoids i.e. lutein, zeaxanthin.
- Cultivar/variety differences should be recognized, and food composition tables, dietary guidelines, and educational materials should be amended to reflect these differences.
- A systematic study for identifying vitamin A-rich foods and understanding food practices and beliefs is critical.
- Further research is needed to analyze further foods and study the bioavailability.

## **Acknowledgements**

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# FOLATE INTERLABORATORY TRIALS

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## **Introduction**

Interlaboratory trials are the ultimate tests that every reliable analytical method must pass. They are conducted to find out the way in which the method behaves when performed in different laboratories and run by various operators over a period of time. It also therefore places importance on the analytical results and how they vary between and within laboratories. So, are the laboratory's analytical values right and does the laboratory have full control over the production of the data at every step? Proper surveillance and monitoring activities at the laboratory in question are needed to answer these two questions. These activities include both external and internal quality assurance called intralaboratory and interlaboratory quality assurance programs.

An interlaboratory program involves a systematic testing program (proficiency testing), whereby uniform samples are tested by several laboratories. The program sometimes involves government organisations who seek accreditation to conduct certain types of tests. Another special form of interlaboratory testing is referred to as 'collaborative' testing. This is generally used by organisations such as AOAC/AACC.

In the case of the folate interlaboratory trials, where the microbiological assay is predominantly used, the elements that play a major role in the process are materials, methods, instruments (and reagents), analysts, time, environmental conditions and laboratories. All these elements have to be carefully controlled to avoid dubious results.

A study of several variables in the assay could improve the overall performance of the assay. This paper will address some of these issues from a participant's point of view.

## **Purpose of interlaboratory trials**

Interlaboratory trials may be conducted to:

- Measure the precision and accuracy of analytical methods routinely run by different laboratories;
- Estimate the accuracy and precision of results between laboratories;
- Identify weak methodology;
- Detect training needs; and
- Upgrade the overall quality of laboratory performance..

## **Responsibilities of the co-ordinating organisation and the participating laboratories**

In conducting interlaboratory trials, the co-ordinating organisation has a number of important responsibilities including:

- Preparing and providing a homogeneous sample and distributing portions of the sample to the participating laboratories;
- Providing a standard method or requesting that the laboratory provide satisfactory details regarding the method used;
- Collating the data and performing the statistical analysis; and
- Sending a report of the results to the participating laboratories.

Each participating laboratory has the responsibility to ensure that the sample is analysed within the specified time and that the results are submitted in the format specified by the sponsoring organisation.

Two examples of interlaboratory trials with different purposes have been explained below as examples.

### **The folate AOAC/AACC/USDA collaborative trial**

The purpose of conducting the above interlaboratory trial was to validate a revised microbiological assay using the tri-enzyme extraction for total folates in fortified cereals.

The protocol for the study was drafted by DeVries from Medallion Laboratories. A microbiological assay protocol utilizing a tri-enzyme extraction procedure was prepared and submitted for comments to some 40 laboratories with recognised experience in folate analysis. On the basis of the comments method was revised and a draft protocol prepared in an AOAC format. Thirteen laboratories participated in the study.

Participating laboratories were provided with:

- 10 mandatory samples (all cereal based) and 10 optional samples for analysis
- A detailed method of analysis (the ruggedness of which had already been tested by USDA) and
- The required forms for reporting the analytical results.

There was some variation in the methods used by different participating laboratories whereby some used test tubes and others micro-titre plates.

### Results of the trial

In summary, the between laboratory relative standard deviations were 2-22%. The within laboratory relative standard deviations were 14-21% (DeVries et al, 2000). As a result, the trialled method was recommended for First Action Status.

### **The folate ASEANFOODS trial**

The purpose of this trial was to evaluate the existing analytical status and the analytical control for folate analysis in various laboratories and to check performance of the method for the samples provided.

Participating laboratories were provided with three test samples with varied food matrices (i.e. soybean flour, fish powder and a cereal) – the homogeneity and stability of which had

already been checked. Participants were also provided with the required reporting forms. However, no particular method of analysis or protocol was provided.

### Variation between laboratories

Participating laboratories used several methods to analyse total folate including HPLC, microbiological assay (both single enzyme and tri-enzyme methods were used) and Protein Binding assay methods. The laboratories were asked to provide the method used along with the results.

### Results of the trial

In summary, the between laboratory relative standard deviation was 13-34% (Puwastien, 2001).

### **Discussion**

Some of the major points that emerged from the outcomes of the above trials and that require further consideration include:

- Should the method of analysis be specified in any interlaboratory trial?
- Should problems with the samples be made known to the participating laboratory?
- Should critical control points be mentioned for the method?

To elaborate on the third point, some of the critical control points in the folate assay include the culture (serial or cryoprotected), type of buffer and pH used, extraction method, enzyme blanks to be run, incubation time and measurement wavelength.

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## **ANALYSIS OF FAT SOLUBLE VITAMINS IN FOOD COMPOSITION BY HPLC TECHNIQUE**

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HPLC is the unique system in the analysis of fat-soluble vitamins with high performance and reproducible results. This presentation will discuss the quantitative determination and characterisation of fat-soluble vitamin especially vitamins A, E, D<sub>2</sub> and D<sub>3</sub> from complex food matrices. The vitamin precursors are hydrolysed in ethanolic potassium hydroxide solution in the presence of an antioxidant followed by petroleum ether extraction of the vitamins. Separation of organic and aqueous layers is enhanced by sodium chloride. Petroleum ether extracts are dried under nitrogen and redissolved in TMP or methanol and analysed by either normal phase or reverse phase HPLC technique with fluorescence and UV detection. This method is applicable to a wide variety of foods including fresh fish, meat, fruits and vegetables for the determination of Retinol,  $\beta$ -carotene, Ergocalciferol (D<sub>2</sub>), Cholecalciferol (D<sub>3</sub>), Tocopherol and Tocotrienol as well as the naturally occurring and most biologically active Tocopherol and Tocotrienol isomers. Recoveries are generally 87-104 % for many mixed foods. Detection limits are 0.5-5 ug/100g.

# THE DETERMINATION OF NIACIN IN CEREALS BY ALKALINE EXTRACTION AND HPLC – A TEMPLATE FOR TECHNOLOGY TRANSFER THROUGH APFAN TRAINING WORKSHOPS

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The full paper (Juraja et al, 2003) has been submitted to the *Journal of Food Composition and Analysis* for publication.

## **Abstract**

Twenty-two laboratories from the Asia Pacific Food Analysis Network (APFAN) were invited to participate in a training exercise to assist these laboratories in adopting a robust HPLC method for the determination of niacin in cereals. The exercise was divided into three discrete phases. Phase 1 of the study consisted of a “hands on” workshop for ten overseas analysts conducted at the 6th APFAN workshop held at the Queensland Health Scientific Services Laboratory in May 1999. Each analyst was required to determine the niacin content of a breakfast cereal that contained a known amount of niacin. Phase 2 involved these analysts and analysts from twelve other laboratories in the APFAN network. Each analyst was required to determine the niacin content of a fortified reference material containing niacin in the range 13.9 – 20.1 mg/100g in their own laboratory. Twelve participants reported levels of niacin ranging from 10.6 - 21.7 mg/100g. Analysts who successfully completed this phase then participated in phase 3, involving the analysis of five different cereal types of unknown niacin content. Nine sets of data were reported for phase 3. Approximately half of the data were in the expected range for the levels of niacin in the samples.

## **Introduction**

APFAN is an association of food scientists from the Asia Pacific and Oceania regions and was set up in Brisbane, Australia in 1989. APFAN is a special project of the Federation of Asian Chemical Societies (FACS) and is managed through a Coordinator who is assisted by a number of country contacts. Its motto is to serve the technical needs of food analysts and thereby promote food safety and nutrition. It provides food scientists in the region with training, information exchange and collaborative analytical procedures. Training is provided through workshops and short courses at the Queensland Health Scientific Services (QHSS) Laboratory with financial support primarily coming from the Crawford Fund and The Australian Centre for International Agriculture Research (ACIAR). In addition to the workshops and special training programs, it hosts regional conferences, supports collaborative studies and provides access to relatively low cost reference foods.

Communication to the current 500 members is through the APFAN newsletter, which is published in Malaysia. To date, APFAN has supported the training of 115 members from 14 different countries including several from the African continent.

The aim of this exercise was to conduct a training exercise in the determination of niacin in cereals using alkaline extraction followed by high performance liquid chromatography as the determinative step. This would then enable the laboratories to confidently use the method in their own work programs.

The exercise was divided into three discrete phases. Firstly, a “hands on” workshop for ten overseas analysts was held at the 6th APFAN workshop held at the Queensland Health Scientific Services Laboratory, Brisbane, Australia, in May 1999. The second stage of the exercise involved these analysts and analysts from twelve other laboratories in the APFAN network analysing samples of AACC reference material VMA 195 (fortified cereal containing niacin in the range 13.9 – 20.1 mg/100g) in their own laboratories. Analysts that successfully completed this stage were then sent five additional cereal samples of unknown niacin content. The analysts were supplied with the validated method, all of the chemicals and solid phase extraction (SPE) columns that were necessary to complete the three phases of the exercise.

Laboratories from Australia (3), Fiji (2), Indonesia (4), India (1), Malaysia (1), Nepal (1), Papua New Guinea (1), Thailand (3), The Philippines (3) and China<sup>#</sup> (1) participated in the exercise. (<sup>#</sup> *Invited/responded to invitation but had no further participation.*)

Food rich in niacin include grains, cereals (bread), yeasts, meat and fish. A deficiency in niacin results in pellagra, which is a nutritional disease endemic among communities who subsist chiefly on maize (Ball, 1994). The vitamin occurs naturally both in the free and bound forms (e.g. nicotinic acid and nicotinamide). Methods used to determine natural levels of niacin in food include the traditional colorimetric procedure using cyanogen bromide and sulphanic acid, the microbiological assay using *Lactobacillus plantarum* and various chromatographic methods (Ball, 1994). The colorimetric method, although robust, requires the use of cyanogen bromide, which is toxic and is no longer available on the international market. The microbiological assay is less robust, has a narrow range of determination and it is difficult to obtain consistent results. The methodology also requires a range of equipment and skills not common in a chemistry laboratory. Robust HPLC methods exist for a number of commodities. The HPLC procedure developed by Ward & Trenerry, (1997), which is applicable to a wide range of foods, was used for this exercise. Capillary Electrophoresis (CE) has also been used as the determinative step for the determination of niacin in food (Ward et al., 1997, Ward & Trenerry, 1997, Windahl *et al.*, 1998). The method, chemicals, SPE columns, filter discs and other disposable items of equipment were supplied to all participants in the three phases of the exercise.

## **Samples**

VMA 195 (cereal) was obtained from the American Association of Cereal Chemists (AACC), St. Paul, Mn, USA. The dried bread sample was supplied by Mr Richard Walker of the Bread Research Institute (BRI), Sydney, Australia. Other cereal samples were obtained from local outlets and ground to a fine powder with a Tecator Cyclotec 1093 sample mill. The samples were stored in airtight containers in a refrigerator at 4°C.

## Methodology (Ward & Trenerry, 1997)

Mix sample with H<sub>2</sub>O/Ca(OH)<sub>2</sub>, autoclave for 2hrs/104 kPa.  
Cool, dilute, adjust pH to 7 with oxalic acid.  
Centrifuge 2500 rpm, 0°C.  
SPE cleanup with C18 and SCX cartridges.  
Trap on SCX, elute with NH<sub>4</sub>OH/CH<sub>3</sub>OH.  
Evaporate to dryness, make to 1 ml with H<sub>2</sub>O.

### HPLC conditions

Column: 4 µm C8 (8 x 100 mm) Radpak (Waters Chromatography).  
Mobile phase: 85% H<sub>2</sub>O, 15% CH<sub>3</sub>OH + 0.005 M PIC A, 1.5 ml/min.  
UV detection: 254 nm.

### *Phase 1 of the training exercise: 6th APFAN workshop*

Ten of the twenty-eight overseas attendees at the 6<sup>th</sup> APFAN workshop chose to participate in the training exercise. Two scientists from the QHSS laboratory also joined the group. The 12 participants were divided into two equal groups and were trained separately. Each of the participants worked through the method with three samples of 'Weetbix', a finely ground wheat-based breakfast cereal (in house control sample-AGAL), that contained 17.3 mg/100g niacin (17.1-17.5 mg/100g, n=3). One of the samples was "spiked" with a known amount of nicotinic acid to act as a recovery sample. One of the sample extracts and the "recovery" sample extract were put through the SPE columns by applying pressure to the columns through a manually held syringe. The other extract was passed through the SPE columns mounted on a vacuum manifold. The final solutions were assayed by HPLC by a staff member of the QHSS laboratory. The levels of niacin in the samples and the recovery data for the two groups are presented in Figures 1 and 2. The chromatogram of the Weetbix extract is seen in Figure 3. Unfortunately, the SPE eluants for the vacuum manifold SPE cleanup for Group 1 were spilt prior to solvent removal, and so no data were available. Both groups reported levels of niacin consistent with the expected levels. All analysts reported good recoveries of added nicotinic acid. The levels of niacin determined by Group 2 were slightly higher than the expected level due to a small shoulder on the nicotinic acid peak in the chromatograms.

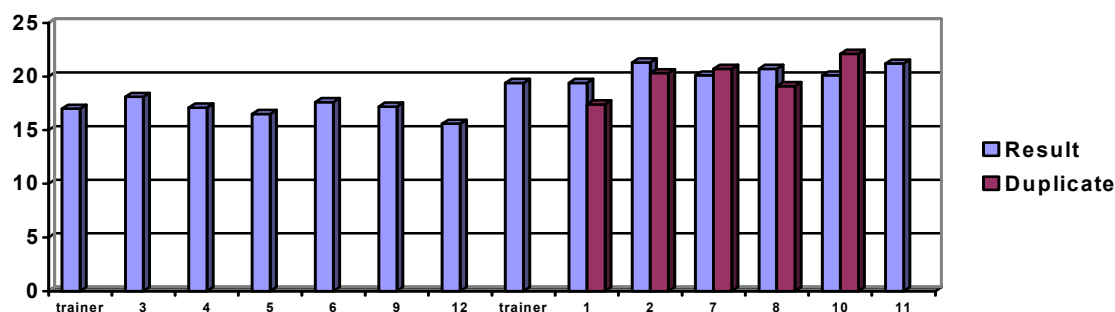


Figure 1: Phase 1-groups 1 & 2, weetbix (17.3 mg/100g)

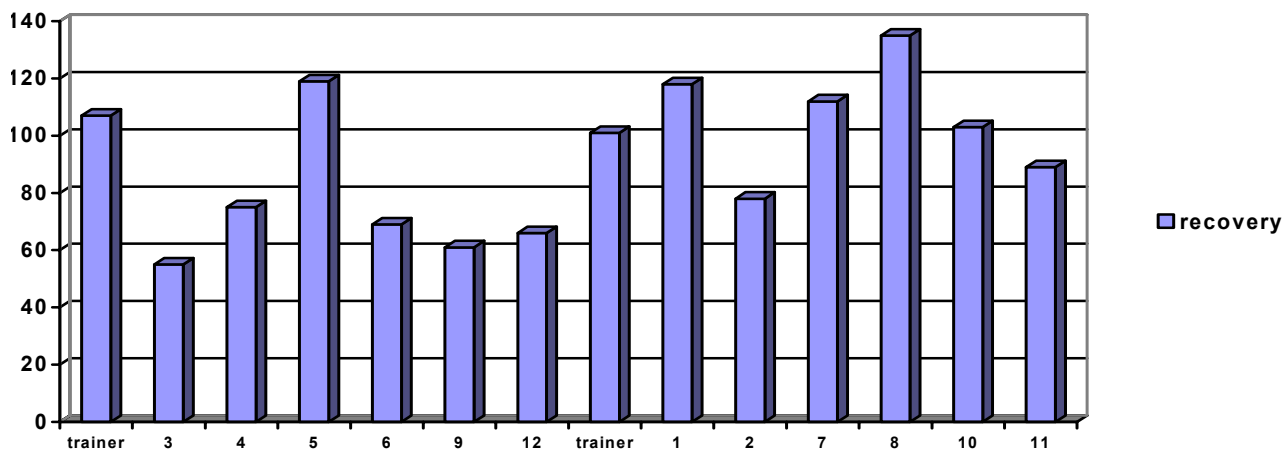


Figure 2: Phase 1-groups 1 & 2 recovery data (average 85%)

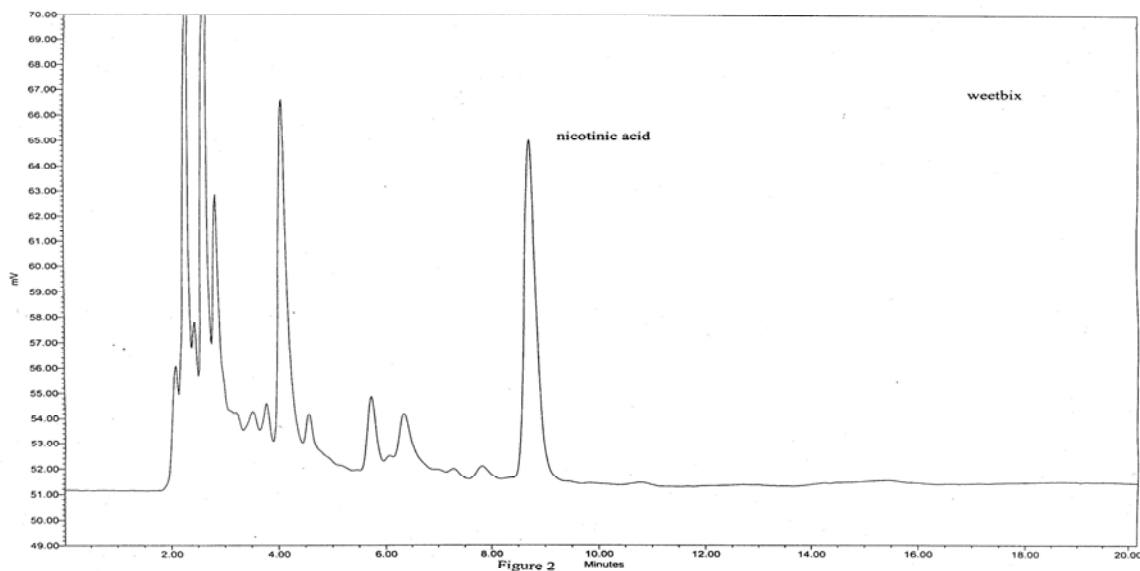


Figure 3: Chromatogram of Weetbix extract

*Phase 2 of the training exercise: Analysis of VMA 195 cereal sample.*

Twenty laboratories affiliated with APFAN participated in phase 2. These included laboratories from Australia (3), Indonesia (5), Thailand (3), Malaysia (1), The Philippines (3), Nepal (1), India (1), Papua New Guinea (1), The Peoples Republic of China (1) and Fiji (1). A number of participants in the initial training exercise at QHSS volunteered to be in the second phase.

VMA 195 is a finely ground cereal sample supplied by the AACC for use as a reference material. The certified level of niacin in the sample is 18 mg/100g (range 13.9 - 20.1 mg/100g, n=13). Prior to commencing the second phase of the exercise, seven portions of VMA 195 were analysed at AGAL (Melbourne) in one batch by an analyst unfamiliar with

the procedure. Two sets of extracts were passed through the SPE columns, the first set by applying manual pressure from a syringe to the top of the C18 column and the second set by applying a vacuum to the bottom of the cation exchange column by using a vacuum manifold (as demonstrated in phase 1 of the exercise). The average levels of niacin for the manual SPE technique and for the vacuum manifold technique were 14.8 mg/100g (CV = 7.9) and 14.3 mg/100g (CV = 2.6) respectively. For both techniques, the average levels of niacin fell in the lower part of the range when compared with the data supplied with VMA 195.

The participants were sent a detailed method (including a flow chart), vials of test material VMA 195, and information on the expected concentration of niacin in the sample. They were also provided with all of the chemicals (including nicotinic acid standard) and disposable equipment (SPE columns etc.) necessary to complete the determination. Participants were asked to determine (in duplicate) the amount of niacin in the sample. They were also asked to determine the recovery of nicotinic acid added to a sample before autoclaving and also perform a “blank recovery”, i.e. to determine the amount of nicotinic acid added to the extraction mixture that does not contain the sample (VMA, 195).

Data from thirteen laboratories were returned and are reported in Figures 4 and 5.

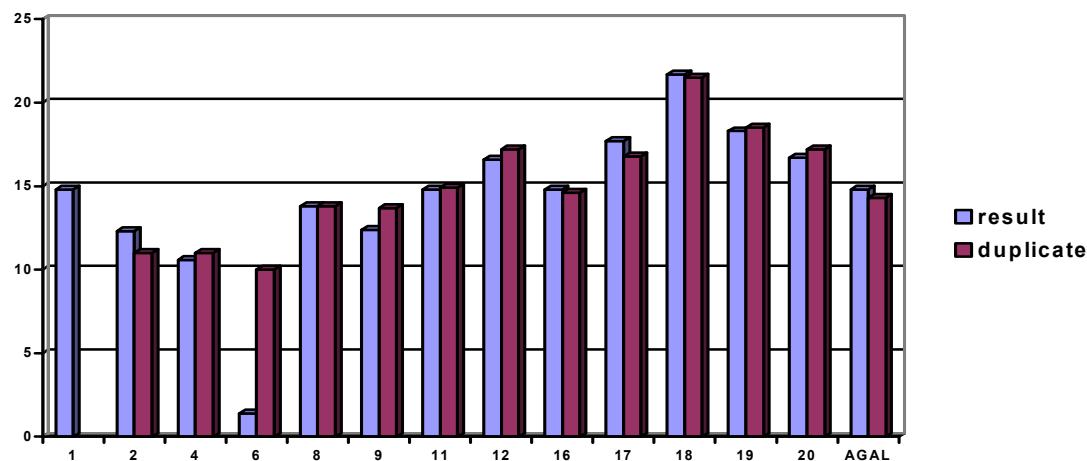


Figure 4: Phase 2- VMA cereal (range 13.9-20.1 mg/100g, n=13)

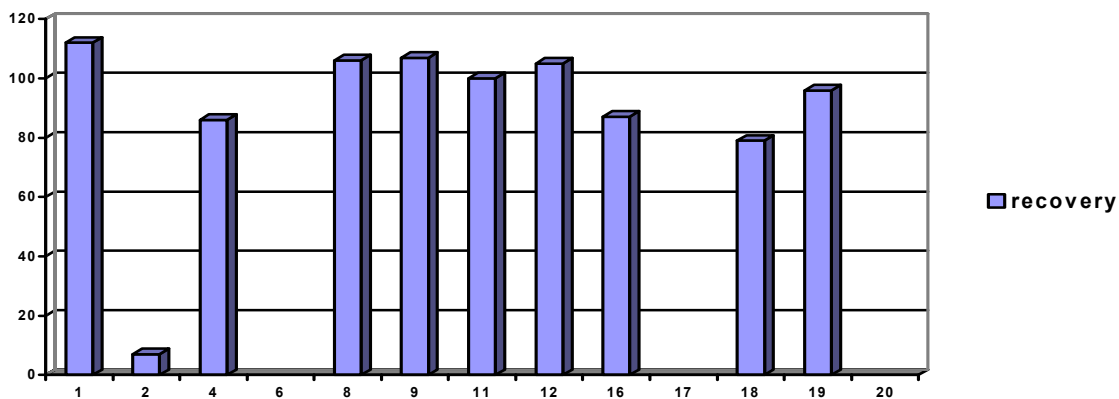


Figure 5: Phase 2-recovery data (average 100%)

Seven participants reported levels of niacin within the expected range (13.9 - 20.1 mg/100g) with four participants reporting lower values (10.6 - 13.8 mg/100g). One laboratory (18) reported a result slightly higher than the expected range. Most laboratories obtained good duplicate results and recoveries of added nicotinic acid.

*Phase 3 of the training exercise: Analysis of five different cereal samples of “unknown” niacin content.*

Five cereal samples, expected to contain niacin levels in the range 0.5 to 20 mg/100g, were selected for the third phase of the exercise. These were long grain white rice, soybean, dried bread, barley and weetbix (fortified breakfast cereal). Prior to dispatch to the participants, the levels of niacin in the samples were determined by both HPLC and CE at AGAL (Melbourne). The samples were also analysed in duplicate by microbiological assay at the Institute of Nutrition by Dr Prapasri Puwastien (Mahidol University, Thailand). The levels of niacin in the samples were similar to the levels determined by HPLC. The results are reported in Figure 6. The peak corresponding to nicotinic acid was well separated from other peaks in the chromatograms except for soybean extract. The chromatograms of the rice and barley extracts are depicted in figures 7-8.

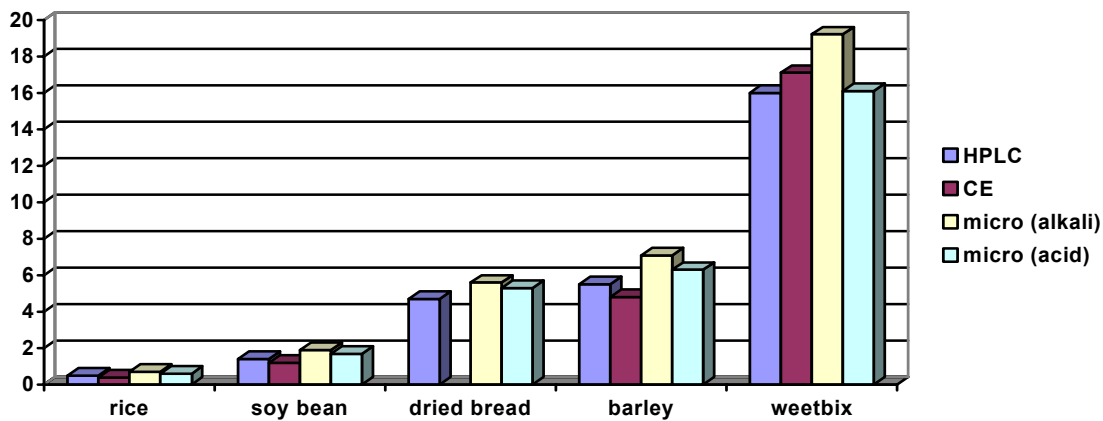


Figure 6: Phase 3-niacin content determined by 4 different methods

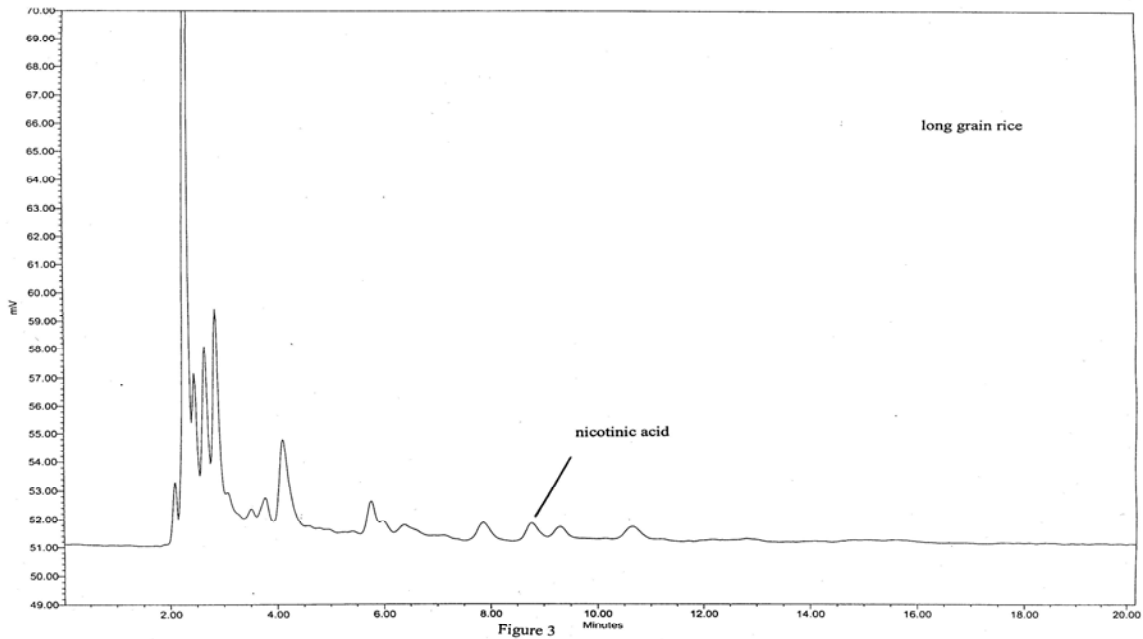


Figure 7: Chromatogram of rice extract

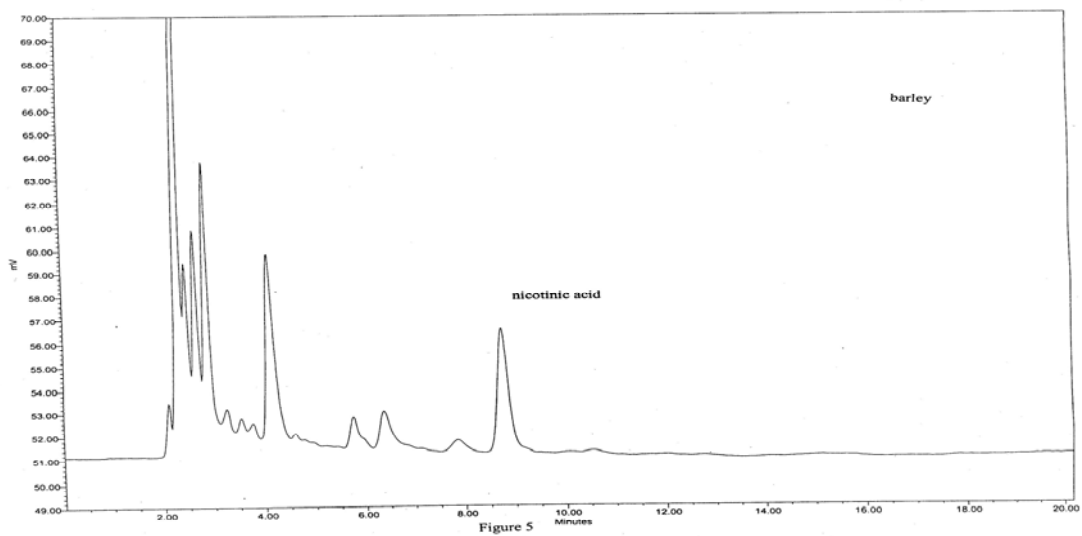


Figure 8: Chromatogram of barley extract

The samples were reanalysed for niacin content three times throughout the study by AGAL (Melbourne) to check for any variations in the levels of niacin. The levels of niacin in the samples remained reasonably constant throughout the exercise.

The participants were supplied with all of the necessary chemicals and disposable items to be able to successfully complete the exercise. Eight participants, as well as another analyst from

AGAL (Melbourne), submitted results for this phase of the exercise (figures 9-14). The “blank recovery” and the recovery data for the dried bread sample were within an acceptable range (85 -113 %, 80 - 116 % respectively) and approximately half of the data were similar to the expected levels of niacin determined from a combination of four independent test methods.

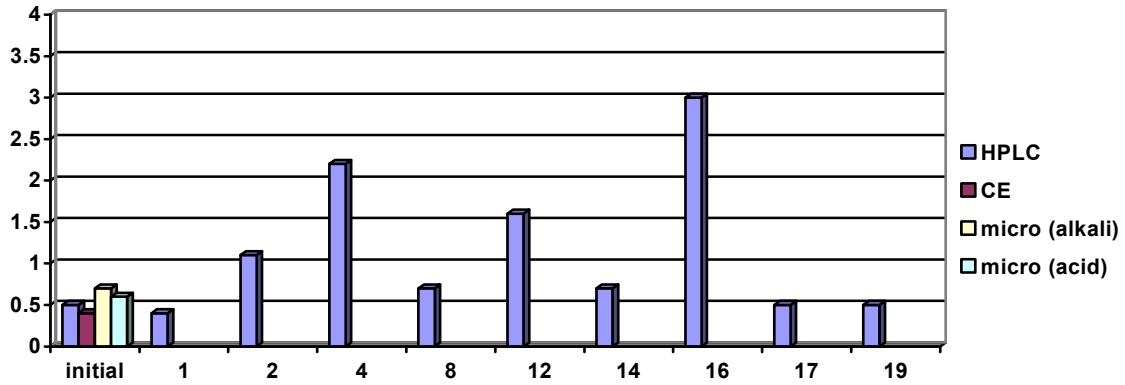


Figure 9: Phase 3-long grain rice (AGAL range 0.5-1.0 mg/100g)

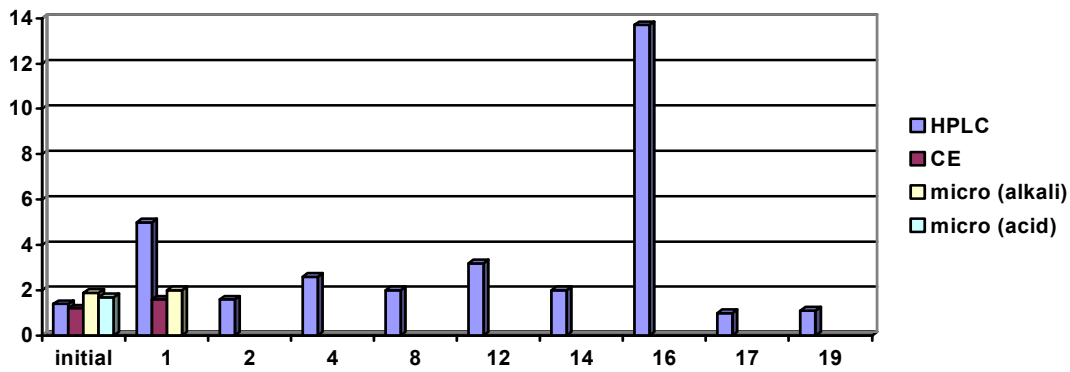


Figure 10: Phase 3-soy bean (AGAL range 1.4-3.4 mg/100g)

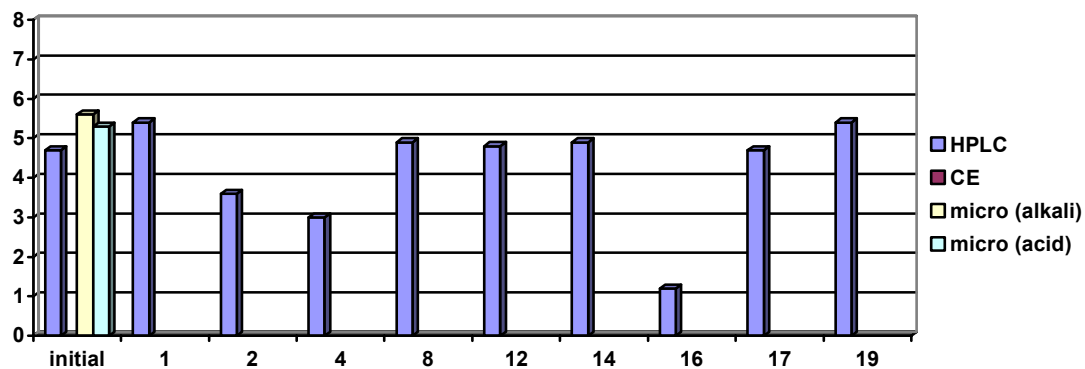


Figure 11: Phase 3-dried bread (AGAL range 4.7-5.1 mg/100g)

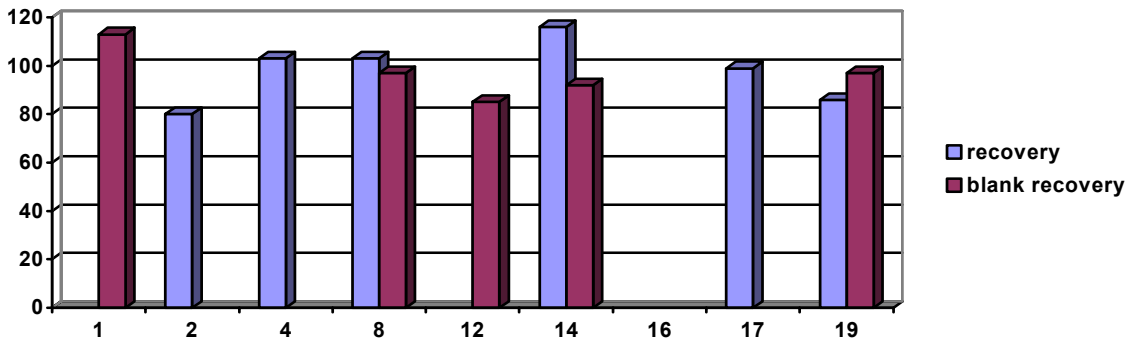


Figure 12: dried bread recovery data (98%, 97%)

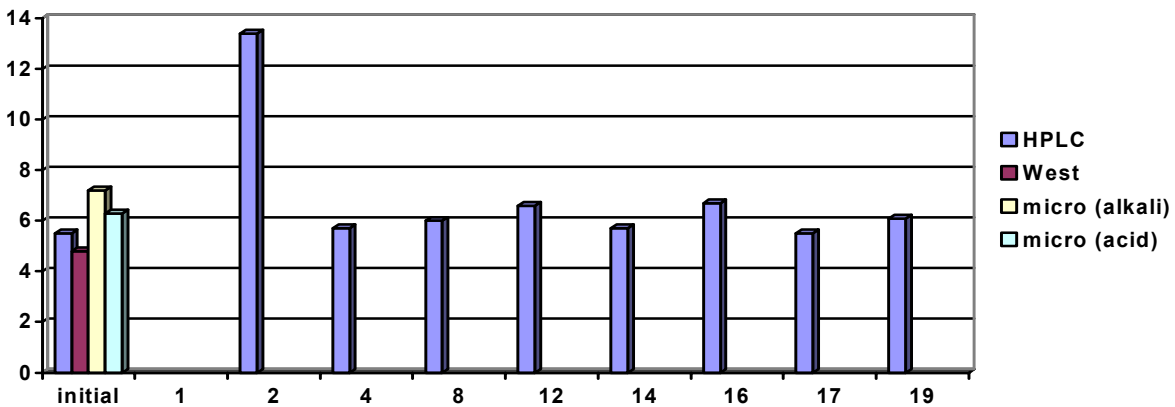


Figure 13: Phase 3 barley (AGAL range 5.7-6.7 mg/100g)

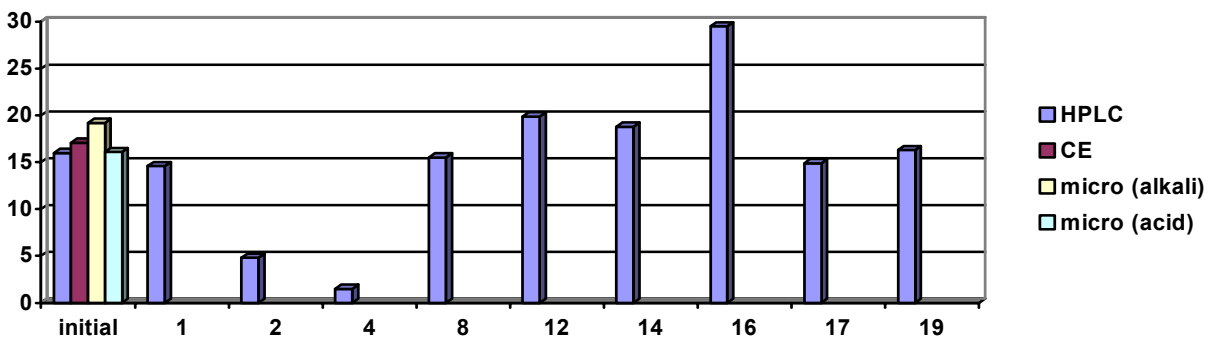


Figure 14: Phase 3 weetbix (AGAL range 16.0-18.8 mg/100g)

## Conclusion

The training exercise was divided into three discrete phases. Phase 1 was a fully supervised “hands on” session at the 6th APFAN workshop. All analysts demonstrated proficiency with the analysis. Phase 2 required analysts to determine the level of niacin in AACC reference material VMA 195 in their own laboratories. Approximately 60% of the data were within the expected range. Phase 3 of the exercise required the participants to determine the levels of

niacin in five different cereal samples of varied niacin content. Approximately 50% of the data were within the expected range. The training exercise can be considered successful with several analysts demonstrating proficiency with this assay. The development of an APFAN reference material would also be of benefit to participants.

### **Acknowledgments**

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# NUTRIENT RETENTION DURING TRADITIONAL PACIFIC EARTH-OVEN COOKING

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## **Abstract**

Food composition tables commonly present data on raw foods whereas most foods are eaten after cooking. In translating from raw to cooked values, nutrient retention factors are used. In the Pacific a common mode of traditional cooking uses an earth oven. Food is placed on top of heated rocks and then buried to retain heat and cooked for 75-90 minutes. Foods commonly cooked in the earth oven are meat, fish, root crops and a mixed Pacific dish, palusami, based on taro leaves and coconut cream.

Data on the effects of cooking such foods in an earth oven were obtained and compared to changes that occurred when the same foods were cooked by boiling, baking or microwave cooking.

True retention values were used that compare the altered amount of nutrient per mass of cooked food to the amount of nutrient per mass of raw food.

Retention values were generally in line with extensive values published in the United States Food Tables. An exception was a greater loss of the vitamins retinol and riboflavin by earth oven cooking and baking. In general, microwave cooking and boiling caused less nutrient loss than baking and lovo cooking, probably due to lower cooking temperatures and less dripping losses. Some perhaps counterintuitive results, with nutrient retention above 100%, were obtained. This includes fat in lean meat in which cooking allowed solid fat to diffuse into the lean meat, beta-carotene which is more extensively extracted from cooked food and dietary fibre, which increases due to the formation of resistant starch.

## **Introduction**

Many Pacific peoples have traditionally utilised the earth oven to cook meat and root crops which required lengthy cooking. Even today when modern cooking appliances are available, the earth oven ("lovo" in Fijian) is used on ceremonial occasions when large amounts of food need to be cooked. Food composition tables are often lacking in data on processed food and the Pacific Island Food Composition Tables lack data on foods cooked in this manner. Therefore a project was undertaken to cook in a Fijian earth oven a variety of foods normally cooked in this manner (meat, fish, root crops and a mixed traditional dish called "palusami") and compare the nutrient retention with other methods by which the foods might be cooked (boiling for root crops, baking and microwaving for meats and fish and steaming palusami).

## Methods

### 1. Sampling

In general, sampling procedures were chosen so that the nutrient data obtained would represent the food as eaten in Fiji. To this end, a composite sample of multiple food samples purchased at three sites was analysed. In some cases such as chicken, the need to be able to compare analyses among different whole chickens dictated that the samples purchased were as identical as possible, which was achieved by buying chicken of same brand (Crest). In addition to this, the chickens were all of the same size ensuring meat analysed was from chicken of the same age group since vitamin content of meat is also affected by age. It is evident from food tables that different parts of lamb have different nutritional composition. To make this factor constant only lamb chump chops were bought for analysis.

Fresh fish (*Lethrinus xanthophilus*) were bought from three different vendors in the Suva fish market. Since the skin, which is normally eaten, was difficult to homogenise in the raw sample, only flesh in the raw and cooked samples was analysed.

Three bundles of each type of root, cassava and taro, were also bought from three different vendors in the Suva market. Each bundle of taro consisted of five to seven tubers and each bundle of cassava had about eight to ten cassava tubers. Standard sub-sampling procedures were used to obtain composite samples for analysis.

Taro leaves (*Colocasia esculenta*), onion, canned coconut cream and corned mutton were the ingredients for 'palusami'. Taro leaves and onion were bought from three different vendors in the Suva market whereas canned coconut cream and corned mutton were bought from three different supermarkets.

The palusami was made by taking twelve taro leaves (total mass about 93g) and adding about 160g of corned mutton, 133g of coconut cream, 53g of onion and 0.6g of salt to a cavity in the piled leaves. The leaves were then folded over to contain the filling and wrapped in aluminium foil.

The earth oven is made by burning a base of stacked wood on which heat-retaining stones have been piled. Once the wood has burned the stones are spread out and the root crops placed on top of the thick midsection of coconut palm fronds. Meat, fish and the palusami wrapped in aluminium foil (traditionally leaves) are placed on top of the root crops. The pile is then sealed (with leaves and/or wet newspaper or sacks) which are covered with earth so that no steam is seen to be escaping. The time of cooking is normally about 90 minutes. A maximum temperature of 126°C is reached. For boiling, the root crops were cut in pieces with diameter about 10 cm and thickness of 3 cm, covered in water and boiled until the root crops were cooked. Baking was done in an oven at 175°C until cooked. The microwave cooking was done at a high setting until the food was considered cooked.

### 2. Determination of Nutrients

Official methods of analysis (AOAC, 1995) were used for the determination of all nutrients.

### *Proximates*

1. **Moisture** was determined as the loss of weight after drying the sample to a constant weight at a selected temperature (75°C) in a vacuum oven according to method 925.04 of the AOAC International (1995).
2. **Protein** was calculated from the total nitrogen determined by the manual Kjeldahl procedure described in method 981.10 of AOAC International (1995). The factor used for conversion of nitrogen to protein was 6.25.
3. **Fat** content of the samples was determined by the gravimetric method (Method 954.02, AOAC, 1995).
4. **β-Cholesterol** was determined using the AOAC method for cholesterol in animal fats. Cholesterol was quantified on GC as the acetate.
5. **Total Carbohydrates** was taken as the sum of total sugars, starch and total dietary fibre.
  - Sugars, total (fructose, glucose, sucrose, maltose and lactose) were determined by HPLC performed after extraction of sugars with ethanol.
  - Starch was determined in the residue remaining after extraction of sugars by hydrolysis of starch to glucose and measurement of glucose by HPLC. A factor of 1/1.1 was used for the conversion of the value of glucose to starch.
  - Total dietary fibre (TDF) was determined using the AOAC procedure 985.29 (1995). This is an enzymatic gravimetric method which measures an unidentified residue as dietary fibre under strictly prescribed experimental conditions.
6. **Ash - a** dry ashing-gravimetric method as described in procedure 938.08 (AOAC, 1995) was followed with ashing, performed at 550°C in a muffle furnace.
7. **Energy** values used are given below for kilojoules (kJ) per gram of food component.

Protein	17
Total Fat	37
Sugars	16
Starch	17
Dietary Fibre	8

### *Minerals*

The values of sodium (Na), potassium (K), calcium (Ca), iron (Fe), magnesium (Mg), copper (Cu) and zinc (Zn) were determined by atomic absorption spectrophotometry of an acidic solution of the ash.

## *Vitamins*

1. *Vitamin A* - total vitamin A is the sum of retinol plus one-twelfth of the  $\beta$ -carotene equivalents, which is  $\beta$ -carotene plus one-half of  $\alpha$ -carotene.
  - Retinol was determined by HPLC after saponification and solvent extraction of the food sample.
  - $\alpha$  ( $\alpha$ ) and  $\beta$  ( $\beta$ )-carotene were determined by HPLC.
2. *Thiamin (Vitamin B<sub>1</sub>) and Riboflavin (Vitamin B<sub>2</sub>)* - Thiamin was extracted simultaneously with riboflavin and the digestion procedure described in method 957.17 (AOAC, 1995) was followed, with a few modifications.

Both vitamins are determined thereafter, with riboflavin being directly measured by HPLC whereas thiamin was measured by HPLC after post-column derivatisation to thiochrome by potassium ferricyanide.
3. *Niacin* - A colorimetric method using cyanogen bromide and sulphanilic acid was used for determination of niacin in food samples. All steps followed in the digestion, extraction and determination procedure were as per method 961.14 (AOAC, 1995) for non-cereal foods and feeds.
4. Ascorbic acid (Vitamin C) was also determined by HPLC after extraction with 3% metaphosphoric acid in water.

## **Calculation of Nutrient Retention**

Nutrient retention values are reported as true retentions (TR) based on the mass of the food before and after cooking.

$$\% \text{ TR} = \frac{\text{Nutrient content per g of cooked food} \times \text{g of food after cooking}}{\text{Nutrient content per g of raw food} \times \text{g of food before cooking}}$$

## **Results and Discussion**

The results of percentage retention of each analyte are shown in the tables 1-3 below, grouped by type of analyte.

Table 1 Percentage retention of proximate nutrients, other than sugars, with different cooking methods

Method	Sample	Water	Protein	Fat	Starch	TDF	Ash
Earth oven cooked	Chicken: Whole	nc	97	79	na	na	89
	Lean only	nc	96	106	na	na	88
	Skin only	nc	100	85	na	na	93
	L/Chops: Whole	nc	99	101	na	na	72
	Lean only	nc	98	292	na	na	71
	Fat only	nc	100	89	na	na	83
	Fish	65	98	87	na	na	79
	Cassava	87	102	89	92	167	89
	Taro 'Palusami'	83	98	83	81	114	90
Boiled	Cassava	129	99	92	93	108	86
	Taro	137	100	92	89	128	89
Microwave	Chicken: Whole	61	101	75	na	na	81
	Lean only	66	100	67	na	na	81
	Skin only	47	101	85	na	na	87
	L/Chops: Whole	42	100	113	na	na	80
	Lean only	50	99	291	na	na	79
	Fat only	23	100	99	na	na	78
Fish	71	99	31	na	na	89	
Roast	Chicken: Whole	64	101	82	na	na	98
	Lean only	68	102	94	na	na	95
	Skin only	43	101	81	na	na	100
	L/Chops: Whole	46	103	98	na	na	86
	Lean only	54	100	294	na	na	86
	Fat only	21	101	96	na	na	69
Steam	Palusami	68	103	82	na	92	69

na = not analysed

nc = not calculated

Table 2 Percentage retention of minerals with different cooking methods

Cooking	Sample	Na	K	Ca	Mg	Fe	Zn	Cu
Earth oven	Chicken: Whole	59	82	81	84	87	96	90
	Lean only	59	81	83	84	87	93	100
	Skin only	74	80	72	65	98	92	71
	L/Chops: Whole	59	73	68	70	80	79	94
	Lean only	59	70	81	69	71	84	87
	Fat only	63	89	27	83	86	82	55
	Fish	50	87	95	95	30	91	77
	Cassava	73	88	88	95	89	89	102
	Taro	85	88	101	86	99	66	96
	'Palusami'	43	71	69	63	97	97	62
Microwave	Chicken: Whole	68	79	92	85	84	94	88
	Lean only	67	80	95	89	88	96	92
	Skin only	66	80	80	58	63	65	71
	L/Chops: Whole	83	85	81	86	91	86	90
	Lean only	84	86	82	88	95	89	85
	Fat only	79	75	68	79	79	96	79
	Fish	81	93	100	93	51	96	55
Oven Roast	Chicken: Whole	89	81	95	84	93	98	92
	Lean only	90	82	99	85	93	97	94
	Skin only	75	83	77	84	81	80	82
	L/Chops: Whole	86	76	54	73	85	96	81
	Lean only	88	77	53	74	92	98	93
	Fat only	62	69	59	66	74	68	68
Boil	Cassava	96	76	96	93	86	86	99
	Taro	96	83	97	99	74	65	77
Steam	'Palusami'	58	71	61	80	99	99	79
USDA*	Chicken: Whole	76	78	92	76	87	100	91
	Lean only	82	80	98	77	97	105	95
	Lamb: Lean only	75	75	100	80	100	100	80
	Sweet potato: Boil	95	90	95	95	95	95	95
	Baked	100	100	100	100	100	100	100

\*These meats were prepared by dry-heat cooking

Table 3 Percentage retention of vitamins with different cooking methods

Method	Sample	Retinol	Thiamin	Riboflavin	Niacin	Vit. C
Earth oven cooked	Chicken: Whole	20	18	43	72	na
	Lean only	nc	16	39	68	na
	Skin only	33	80	67	95	na
	L/Chops: Whole	78	13	62	73	na
	Lean only	nc	13	62	71	na
	Fat only	40	0	nc	64	na
	Fish	nc	0	nc	94	na
	Cassava	na	0	nc	89	76
	Taro	na	53	nc	83	nc
	'Palusami'	124*	51	39	63	62
Boiled	Cassava	na	58	nc	86	47
	Taro	na	78	nc	85	nc
Microwave	Chicken: Whole	91	61	22	79	na
	Lean only	na	64	16	79	na
	Skin only	72	79	64	88	na
	L/Chops: Whole	81	47	43	84	na
	Lean only	na	42	51	80	na
	Fat only	66	64	na	87	na
	Fish	na	77	na	82	na
Roast	Chicken: Whole	69	0	22	76	na
	Lean only	na	0	16	77	na
	Skin only	54	0	64	81	na
	L/Chops: Whole	42	0	43	77	na
	Lean only	na	0	na	76	na
	Fat only	46	0	51	75	na
Steam	Palusami	108*	35	30	na	0

\*β-carotene retention

Loss and gain of moisture can be attributed to the cooking method. The loss of moisture content from foods is probably through evaporation and in the form of drippings, which commonly takes place from meat samples including fish in cooking methods such as earth-oven that use dry heat. A gain of about 30-40% moisture in the boiled tubers was obvious because of the water that undoubtedly became absorbed by tubers during boiling. Other modes of cooking caused considerable water loss, without any significant difference among the methods. Retention of protein ranged from 96-103% indicating no significant loss of protein on cooking.

Retention values of fat below 100% are caused by the loss of fat in the form of drippings as fat melts at high temperatures of cooking. However, the unusually high level of retention of 292% in cooked separable lean of lamb chops was surprising. Such a high retention could be attributed to the adsorption of fat from the separable fat as it melted during cooking, into the muscle tissue of lamb chops. The USDA Tables record 192% for fat retention in lean chicken and 145% in lean lamb chops. More fat was lost from palusami on lovo cooking compared to steaming, but microwaving fish caused much greater fat loss compared to lovo cooking.

Retention factors of starch ranged from 91-93% indicating losses of only as much as 10% which can be explained by loss of soluble starch into the cooking liquor during boiling and by formation of resistant starch during heat treatment upon earth-oven cooking.

Another nutrient that needs considerable attention is total dietary fibre (TDF). On three occasions after cooking the percentage retention of TDF has risen greatly above 100% implying an increase in the contents of TDF upon cooking. Retention of 167% and 128% in earth-oven cooked cassava and boiled taro is probably associated with the formation of resistant starch in these samples. Resistant starch formed upon cooking becomes analytically associated with non-starch polysaccharides (NSP), a component of dietary fibre.

Ash, incombustible mineral residue in a sample, serves as a measure of inorganic salts. Loss in ash content of foods is directly related to the loss of mineral elements and this loss of mineral elements is possible through the leaching of inorganic compounds dissolved in the drippings or the extraction of these soluble compounds in the cooking liquor. The retention values of ash and minerals reflect the extent of dripping losses or the solubility of the mineral salts in the cooking medium. The only general trend was that baking, a dry-heat method, tended to give higher ash retention.

The third class of nutrients, vitamins, also provides some findings that are significant. The loss of retinol usually ranges from 10-30% (USDA Tables give 25% for chicken) whereas in this study a loss as high as 80% was encountered. Low retention in the range of 20-55% could be associated partly with the destruction by heat of cooking and partially with the loss into the melted fat which leached out into the drippings. As it is a fat soluble vitamin its loss with melted fat would be more pronounced than other vitamins. Roasting and lovo gave lower retention than microwaving.

For  $\beta$ -carotene a retention of 124% in palusami was found. The increase in the content of carotenes is thought to be associated with enhanced extraction efficiency of carotenes from the cooked samples compared with a greater difficulty in obtaining complete extraction in the raw sample. The difficulty in the extraction of  $\beta$ -carotene from raw sample can be due to the fact that it is present in quite stable lipoprotein complexes. After cooking, presumably a change in tissue morphology occurs, thereby allowing a greater penetration of organic solvents into the cells and an enhanced release of carotenes.

The rest of the water soluble vitamins showed retention of less than 100% reflecting their loss upon cooking. The loss of these vitamins could be due to the destruction by heat and leaching of dissolved vitamins as these vitamins are soluble in water. The extent of loss depends on the relative stability of each vitamin towards heat. Niacin and riboflavin are said to be more heat-stable compared to vitamin C and thiamin and so the retention of the former two vitamins was higher than the latter. The long cooking time in the lovo could lead to these low retentions of retinol and thiamin. USDA Tables give retentions of 60-80% for thiamin, 80-90% for riboflavin, 80-95% for niacin and 50-75% for ascorbic acid for the types of foods in the study.

Overall, except perhaps for vitamins, lovo cooking results in similar nutrient retention as other cooking modes.

## References

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AOAC. (1995) Official methods of analysis of AOAC International. 15<sup>th</sup> ed. Gaithersburg, US. AOAC International.

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## **CLOSING REMARKS**

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My final task today is to thank all of you for participating in this meeting. I hope that we are all taking away something from the meeting that will improve our food composition work and I look forward to seeing you all at future OCEANIAFOODS meetings.

I would like to thank our speakers, who volunteered their presentations with only a small amount of coercion on my part. Without exception, they have informed, amused and enlightened us.

I would particularly like to thank Dr Pieter Scheelings of the Queensland Health Department who has provided invaluable assistance in the minutiae of organising this meeting as well as the Total Diet Workshop, and my colleagues Greg and Luisa who have provided lots of hands-on support as well as each presenting a paper to the meeting.

Finally I'd like, once again, to thank the co-sponsors of this meeting, the Food and Agriculture Organisation of the United Nations. Their financial support enabled four Pacific delegates to attend.

For those of you staying for the second week of the Total Diet Workshop, I wish you well and I am sure you will be rewarded for your hard work over this fortnight. For those of you returning home tonight or tomorrow, have a safe journey. I hope to see you all soon.

## REPORT ON THE RECOMMENDATIONS AND RESOLUTIONS FROM THE FIFTH OCEANIAFOODS CONFERENCE

Recommendation/resolution	Action officer	Report
<b>Administration</b>		
1. Australia will be appointed as Convenor until the 6 <sup>th</sup> OCEANIAFOODS meeting	Judy Cunningham	Completed. New Convenor required!
2. The 6 <sup>th</sup> OCEANIAFOODS meeting will be hold in either Brisbane, Suva or Noumea in mid-2001	Convening group	Meeting in Brisbane in February 2002, following postponement from November 2001
3. OCEANIAFOODS recognises the USP laboratory as a regional centre of excellence for Pacific island food composition analysis and strongly recommends continued (financial) support for it from FAO and other development partners to continue to analyse priority Pacific foods and, further, to assist other Pacific island countries to set up and undertake food composition analysis	NA	A FAO TCDC proposal was developed in 1999 and is likely to be approved soon
4. OCEANIAFOODS will assist UNITECH in obtaining assistance, in the first instance, for a technician to participate in the Wageningen workshop through a UNU fellowship and South-South technology transfer with USP training or training in Australia via APFAN	Betty Amoa, Barbara Burlingame, FAO, Bill Aalbersberg	
5. Articles in the Proceedings of the OCEANIAFOODS Conference will be submitted to CAB Abstracts and Reviews, for which authors will provide abstracts of their article to be included in the Proceedings	Authors to conference proceedings, Editors	Done
6. Bill Aalbersberg will submit the Proceedings of the 5 <sup>th</sup> OCEANIAFOODS conference to the <i>Journal of Food Composition and Analysis</i> for review as a book review along with a précis of the proceedings that he will prepare	Bill Aalbersberg	Submitted and done
7. The Proceedings from the 5 <sup>th</sup> OCEANIAFOODS meeting will be made available electronically on the INFOODS website either directly or via link to the SPC website	Barbara Burlingame	
8. New Zealand and Australia, wherever possible, will continue to facilitate the provision of assistance for food nutrient analysis to Pacific island countries	Convenor	Asia-Pacific Food Analysis Network continues its activities – see presentation at this meeting

9. A working group (one representative from each program) will investigate the possibility and necessary harmonisation of combining the three major OCEANIAFOODS food tables and software	Convenor	This recommendation could be reconsidered at this meeting
10. A report from the 5 <sup>th</sup> meeting will be prepared and sent to ACC/SCN Newsletter	Barbara Burlingame	
11. OCEANIAFOODS strongly supports the continuation of the beneficial collaboration with ASEANFOODS	Convenor	
12. OCEANIAFOODS continue to explore collaboration with the University of Hawaii	Convenor	Dr Suzanne Murphy was invited to attend this meeting but was unable to do so
13. OCEANIAFOODS appreciates the attendance of UN agencies at this meeting and strongly supports their continued involvement in OCEANIAFOODS	NA	FAO participating in, and offering financial support for, the 6 <sup>th</sup> meeting
14. Members of OCEANIAFOODS should be supported in efforts to attend the 3 <sup>rd</sup> International Food Data Systems meeting to be hold in Rome in July 1999	NA	
<b>Technical issues</b>		
15. The Pacific Island Food Composition Tables (PIFCTs) and data base should be revised before the next meeting to include new analytical data, % edible portion and common measures or serving sizes	SPC	PIFCT book and database have not been revised. Continue to send out copies on request, and are still working on our original print run (current stock level only about 100, likely to last for some time yet). Do not believe the database has been updated. A French dietitian has reviewed the translation in the French version and found some possible problem areas - while the translation is accurate it is not understood. This version is being modified but completion not expected this year
16. All food composition-related publications by OCEANIAFOODS members should be shared with other appropriate OCEANIAFOODS members	All	Copy of AUSNUT Special Edition provided with registration material. NZ Crop and Food have provided revised tables to ANZFA
17. A capability statement identifying sources of expertise for food analysis and for training will be prepared by AGAL and USP	Pieter Scheelings, Bill Aalbersberg, Barbara Burlingame	No progress here?
18. OCEANIAFOODS laboratories developing new analyses are	John Munro, Bill	See presentation on niacin analysis at this meeting

encouraged to facilitate other laboratories to test out the methods. These include dietary fibre (John Munro), carotenoids by UV (Bill Aalbersberg), niacin by HPLC (Don Buick)	Aalbersberg, Don Buick	
19. In-house standards will be shared among the three analysis programs and ASEANFOODS for analysis and comparison	Bill Aalbersberg	Not done—some discussions held
20. OCEANIAFOODS will help facilitate the provision of a simple, easy-to-read summary document, concerning the importance of Codex Alimentarius standards, codes of practice and guidelines for Pacific island countries and world trade, especially in the areas of food labelling and food analysis	FAO, Ruth English	
21. OCEANIAFOODS members should explore a common description for indicators of quality of food composition data	Convenor	No progress?
22. John Munro and Janine Lewis will help keep OCEANIAFOODS members informed on possible new nomenclature for carbohydrates, the implications of these changes for food analysis and labelling and their relationship to nutrition	Convenor and John Munro	See paper in registration satchels
23. A listing of available reference materials and contact information be prepared and circulated	Pieter Scheelings, Bill Aalbersberg	
<b>Dissemination of information to end users</b>		
24. Because of the significantly higher content of beta-carotene, iron and other micronutrients in traditional/subsistence leafy green vegetables of Pacific Island countries, promotion/production of these vegetables should be supported in preference to the growing of imported vegetable seeds, of low nutritional value	All	Bar graphs developed and launched in Fiji

<p>25. SPC in conjunction with other agencies and National Food and Nutrition Committees to explore effective ways of making existing food composition data more accessible to the general public (e.g. bar graphs by nutrient in relation to certain diseases)</p>	<p>SPC, UNICEF, Fiji NFNC</p>	<p>Bar graph developed and launched in Fiji</p> <p>SPC has not produced bar charts centrally, but some countries have individually – e.g. Tonga, Fiji - some with SPC support e.g. for print costs. SPC has not had any requests like this from other countries. In 'Fruits we eat', 'Leaves we eat' and 'Staples we eat', and within food leaflets, SPC does have these bar charts and have no objection to people reproducing these. Currently finalising the Pacific food guide, which is based on the three food groups, and adds information on proportions, moving away from specific details of nutrient composition of individual foods, more towards general healthy varied diet</p>
<p>26. SPC to coordinate a study of the current use of PIFCTs in the Pacific and seek funding for a regional follow-up to the 1994 launch of the PIFCTs with assistance to participants for software and hardware</p>	<p>SPC, Convenor</p>	<p>No progress on study and funding idea – unsure of the motivation or intention of this recommendation. All in country nutritionists have copies of the handbook and use to varying levels. Believe many don't remember they have the software - and those that had it have lost it, or have a new computer etc etc. In last 18 months SPC has sent copies of software to three places where original copies were lost</p>
<p>27. OCEANIAFOODS liaise with UN agencies and regional organizations to encourage the consideration of food composition in relevant national projects and programs in the Pacific region, such as Food Balance Sheets, Agriculture Research &amp; Extension, Use of Codex Alimentarius, Nutrition Programs, Food Legislation</p>	<p>No action officer assigned</p>	<p>Is this recommendation too broad and should it be reconsidered?</p>
<p>28. Jayashree Arcot will gather information from all laboratories in the Oceania region involved in food composition analyses on the problems that might be encountered during analyses (whether inherent or due to different food matrices). This will be shared with developing laboratories to anticipate such problems</p>	<p>Jayashree Arcot</p>	<p>See presentation at this conference</p>

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