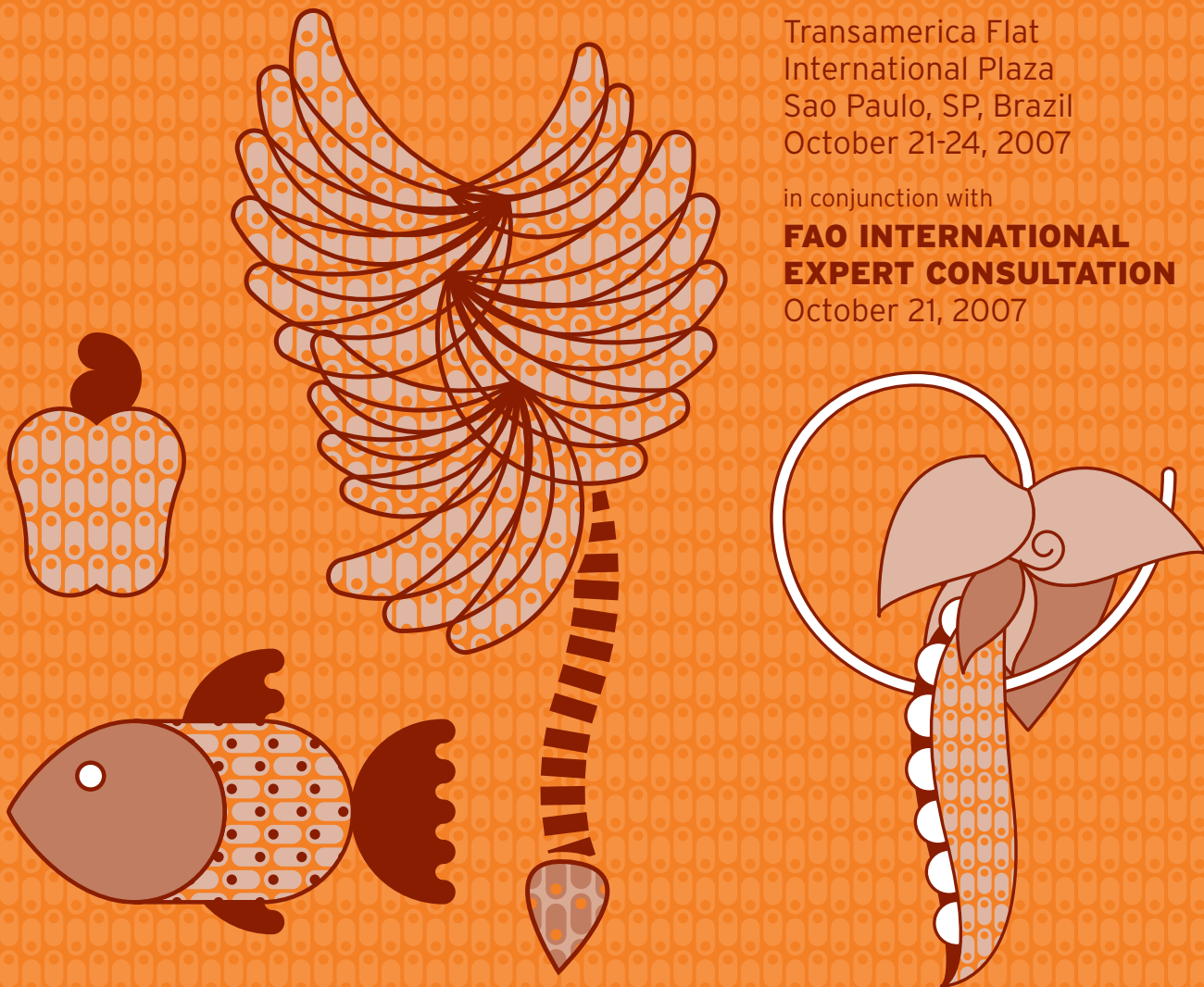


# SEVENTH INTERNATIONAL FOOD DATA CONFERENCE

## Food Composition and Biodiversity

Transamerica Flat  
International Plaza  
Sao Paulo, SP, Brazil  
October 21-24, 2007

in conjunction with  
**FAO INTERNATIONAL  
EXPERT CONSULTATION**  
October 21, 2007



BRASILFOODS



EuroFIR

Conference convened by the University of Sao Paulo (USP), the Brazilian Network of Food Data Systems (BRASILFOODS) and the Food and Agriculture Organization of the United Nations (FAO)

# **SEVENTH INTERNATIONAL FOOD DATA CONFERENCE**

## Preface

The Seventh International Food Data Conference (7<sup>th</sup> IFDC) is convened by the University of Sao Paulo (USP), the Brazilian Network of Food Data Systems (BRASILFOODS) and Food and Agriculture Organization of the United Nations (FAO), in conjunction with FAO International Expert Consultation and in cooperation with the 9<sup>th</sup> National Congress of the Brazilian Society for Food and Nutrition (SBAN). The main objective of the Conference is to discuss subjects that will define guidelines on the activities related to food composition worldwide, considering the importance of biodiversity in this context.

The conclusions and recommendations of the Conference will be prepared by BRASILFOODS and divulged on the 7IFDC website ([www.fcf.usp.br/7ifdc](http://www.fcf.usp.br/7ifdc)).

English will be the official language of the Conference

Sao Paulo, Brazil, 2007

**SEVENTH  
INTERNATIONAL  
FOOD DATA  
CONFERENCE**

Food Composition and Biodiversity

October 21-24, 2007

Sao Paulo, SP, Brazil

Coordination:

Elizabete Wenzel Menezes

and Franco M. Lajolo

University of Sao Paulo

(USP)/ BRASILFOODS

[www.fcf.usp.br/7ifdc](http://www.fcf.usp.br/7ifdc)

in conjunction with

**FAO INTERNATIONAL  
EXPERT CONSULTATION**

Indicator Development for Nutrition  
and Biodiversity

October 21, 2007

Sao Paulo, Brazil

Coordination:

Barbara Burlingame

Food and Agriculture Organization

of the United Nations (FAO)

Upon invitation only

in cooperation with

**9<sup>th</sup> NATIONAL CONGRESS  
OF THE BRAZILIAN  
SOCIETY FOR FOOD AND  
NUTRITION (SBAN)**

October 24-27, 2007

Sao Paulo, Brazil

[www.sban.com.br](http://www.sban.com.br)

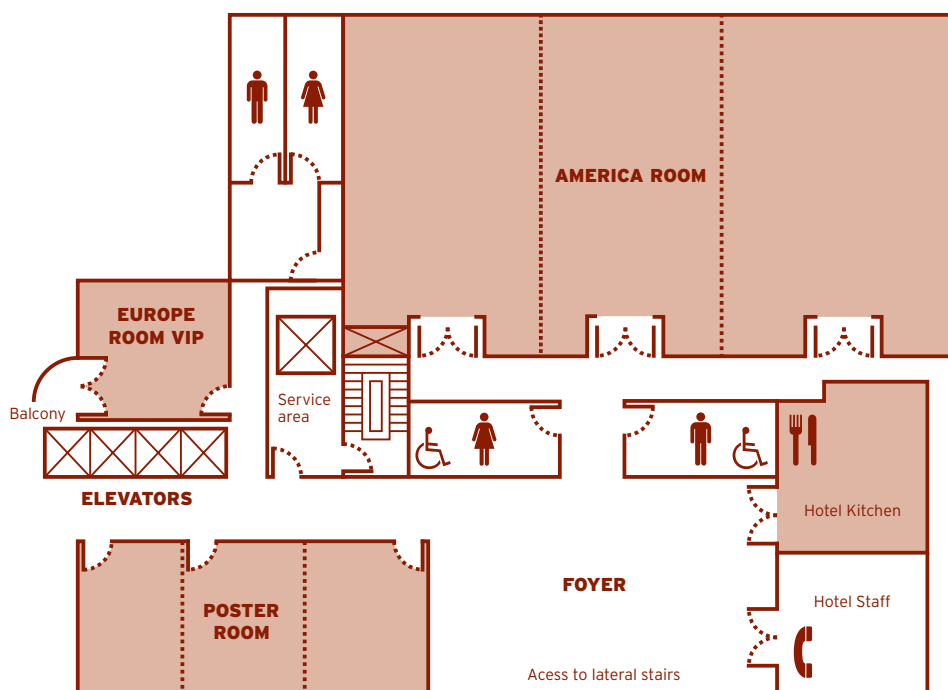
Sao Paulo, Brazil, 2007

Conference convened by the University of Sao Paulo (USP), the Brazilian Network of Food Data Systems (BRASILFOODS) and the Food and Agriculture Organization of the United Nations (FAO)

# SEVENTH INTERNATIONAL FOOD DATA CONFERENCE

## Event plant

Transamerica Flat International Plaza  
Al. Santos, 981 - Cerqueira Cesar  
Sao Paulo, SP, Brazil



1<sup>st</sup> floor

This book of abstracts contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the University of Sao Paulo, BRASILFOODS and Food and Agriculture Organization of the United Nations. The designations employed and the present-

tation of material in this publication do not imply the expression of any opinion whatsoever on the part of USP, BRASILFOODS or FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

## Message from the Chairs of Seventh International Food Data Conference, Elizabete Wenzel Menezes and Franco M. Lajolo

We would like to welcome all participants in the Seventh International Food Data Conference. We hope you enjoy Sao Paulo and have a great time during the next days.

Thinking about food composition studies over the past decades, they have passed through four revolutions. The first one, with Atwater, who described the energetic value of foods; the second one, with the characterization of vitamins and minerals, shown to be important in order to prevent diseases caused by their deficiency; the third revolution happened when food composition was known better and associations between diet and diseases were made, including the ones related to malnutrition and non-transmissible chronic diseases. The fourth revolution is about the discovery of other food substances that also have effects on human health, such as bioactive compounds. The fifth revolution will possibly be related to biodiversity. According to FAO, the wide knowledge of information about the composition of foods of different cultivars, regions and countries is extremely important in order to guarantee the preservation and sustainable use of biodiversity in food security and human nutrition programs. The main objective of the Seventh International Food Data Conference "Food Composition and Biodiversity" is to discuss subjects that will define guidelines on the activities related to food composition worldwide, considering the importance of biodiversity in this context.

The 7IFDC is a unique opportunity of interaction between renowned researchers and participants from several countries; international organs such as FAO, INFOODS, EuroFIR, UNU; Brazilian regulatory organs and government agencies like ANVISA, Ministry of Environment, Foreign Affairs Agency; industries; food producers; nutritionists and other health professionals. We hope everyone takes full advantage of these days, exchanging experiences and knowledge, meeting old colleagues, structuring new partnerships and, more than ever, discussing aspects that may improve the food composition area.

Our grateful thanks to the colleagues and professionals Eliana B Giuntini and Milana CT Dan for their great cooperation in all phases of the conference organization, from the preparation of texts for the first version of the website in 2006 until now, during the event, trying to solve eventual problems.

Also, we would like to thank the Brazilian Society for Food and Nutrition (SBAN) for having faith in this event and for trusting us its juridical structure, without which it would be impossible to receive any kind of financial support.

We appreciate all industries and national and international organs for their cooperation and sponsorships. Finally, we thank the Local Arrangements Committee and other professionals from Pharmaceutical Science School and University of Sao Paulo for organizing numerous logistical details required to hold a successful conference.

## Message from the Program Chairs of Seventh International Food Data Conference, Elizabete Wenzel Menezes and Franco M. Lajolo

On behalf of the Scientific Advisory Committee, we would like to welcome all participants in the Seventh International Food Data Conference. Thank you all for the prompt reply to the abstract solicitation. We received more than 142 abstracts from 46 countries.

Several authors required oral presentation at the conference; however, due to the lack of time availability in the program, several solicitations could not be accomplished, even with the excellent quality of the works.

We thank the members of this committee for evaluating the abstracts in a short period of time and for cooperating with great suggestions. The scientific program, based on the submitted abstracts, is made of 55 oral presentations and 87 posters. Part of the program has biodiversity as the main subject, therefore special attention was given to researches about variety and wild, uncommon and subutilized species; ecosystems and the environment influence over food composition; and the contribution of these foods to the nutrition field and food security. Another part is related to food composition issues, and the follow-

ing topics are considered: data quality, food sampling, analytical methods, food composition database (compilation, new features, applications and sustainability), national food composition database and tables, bioactive compounds and functional foods, regional foods and specific nutrients/ products, food consumption and nutrient intake. We would like to express our sincere thanks to Barbara Burlingame (FAO) and Paul Finglas (EuroFIR), for the cooperation in the scientific program, not only for their valuable suggestions but also for allowing the participation of several researchers in this conference.

## Message from the Chair of FAO International Expert Consultation, Barbara Burlingame

### OBJECTIVES

To identify existing data and data sources needed to develop a nutrition indicator for biodiversity related to food composition

To propose a nutrition indicator for biodiversity related to food composition

To identify data gaps and research needs (e.g. sampling, reporting) to improve the indicator

To develop a mechanism for reporting, which will allow FAO to monitor the indicator over time

To identify agencies and institutes that will report to FAO on the indicator on a yearly basis

### BACKGROUND

Development of nutrition indicators for biodiversity is an international collaborative process, led by the Food and Agriculture Organization of the United Nations (FAO), together with Bioversity International and other partners.

It has been acknowledged that biodiversity is essential for food security and nutrition and can contribute to the achievement of the Millennium Development Goals (MDGs) through improved dietary choices and positive health impacts. In 2004, the *Convention on Biological Diversity's* Conference of the Parties to the Convention on Biological Diversity (CBD-CoP) recognized the

linkage between biodiversity, food and nutrition and the need to enhance sustainable use of biodiversity to combat hunger and malnutrition, and thereby contribute to Target 2 of Goal 1 of the MDGs (Decision VII/32). The initiative on biodiversity for food and nutrition was formally established by decision VIII/23 A of the Conference of the Parties, in March 2006.

During this same period, the Commission on Genetic Resources for Food and Agriculture (CGRFA 10<sup>th</sup> session) requested the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture to "provide guidance to FAO on how it could best support countries, on request, to generate, compile and disseminate cultivar-specific nutrient composition data, as well as indicate the relative priority of obtaining cultivar-specific dietary consumption data, in order to demonstrate the role of biodiversity in nutrition and food security."

Existing food composition databases (FCDB) vary across regions and countries, but all include a range of foods and nutrients, and some include subsets of bioactive non-nutrients (including those with medicinal properties), antinutrients and contaminants. Historically, the main purpose of a FCDB was to provide "representative year-round nation-wide mean

values” for foods. These average measures can hide large differences.

Similarly, dietary assessment instruments have been developed to capture the usual or habitual intakes of foods as reported by subjects in a study. Until recently there was little demand to provide compositional data at the species or subspecies level, because the traditional users of the data - those conducting dietary assessments - only recorded intake data at the more generic level. Conversely, diet surveys did not attempt to collect intake information on species or varieties, because compositional data were not available for evaluation and because it was widely believed that survey participants were not able to recognize foods at species or subspecies level. However, recent

research suggests that this is not the case. For example, a recent survey in Bangladesh has shown that over 80% of households were able to identify rice by cultivar and 38 different cultivars were named.

If in the future food composition data generators and compilers publish data at the species and subspecies levels, and food consumption surveys report at this level, then the contribution of biodiversity to a vast range of nutrition initiatives could be determined and valued.

Thus, in order to monitor biodiversity and nutrition, at least two indicators will be needed, one on food composition and one on food consumption. This Consultation will concentrate only on the food composition indicator for biodiversity and nutrition.

## Message from the President of Brazilian Society for Food and Nutrition (SBAN), Silvia Cozzolino

The Brazilian Society for Food and Nutrition (SBAN), is joined to IUNS (International Union of Nutritional Sciences), and has the objective to stimulate and develop the science of nutrition in Brazil. It is a scientific multidisciplinary Society, and our associates are from different areas of knowledge, all interested in Nutrition. The Journal of the Brazilian Society for Food and Nutrition is a scientific publication of SBAN, that has the periodicity of three numbers by year, with original articles and reviews. It is distributed for the associates, and for others institutions interested, Universities, Nutrition Schools, Government. We have in the editorial board, professors

and researchers with different graduation, such as nutritionists, pharmaceuticals, physicians, food engineers, chemistries, economists, psychologists, educators among others. This Journal is indexed on Chemical Abstracts and LILACS. Every two years we promote our Congress, and this year, right after the 7IFDC, we will have the 9<sup>th</sup> Congress, that will be held in São Paulo, from October 24 to 27, 2007, at the FECOMERCIO Convention Center, with the subject is “The Science of Food and Nutrition: new paradigms”, for what we invite you all. Thank you very much. For more information please access [www.sban.com.br](http://www.sban.com.br).

# Committees

## **ORGANIZING COMMITTEE**

7IFDC Chair: Elizabete Wenzel de Menezes (USP/BRASILFOODS) (wenzelde@usp.br)

FAO International Expert Consultation Chair: Barbara Burlingame (INFOODS/ FAO) (Barbara.Burlingame@fao.org)

Local Arrangements Committee: Eliana Bistriche Giuntini, Milana Cara Tanasov Dan, Juliana Ferreira dos Santos, Gabriela Compiani, Nelaine Cardoso (FCF/USP) (7ifdc@usp.br)

## **SCIENTIFIC ADVISORY COMMITTEE**

7IFDC Chair: Franco M. Lajolo (USP/ BRASILFOODS)

Barbara Burlingame (INFOODS/ FAO), Ruth Charrondiére (Italy), Ligia Bicudo Almeida Muradian (Brazil), Pablo Eyzaguirre (Bioversity International), Paul Hulshof (Netherlands), Harriet V. Kuhnlein (Canada), Lilia Masson (Chile), Delia Rodriguez-Amaya (Brazil), Gustaaf Sevenhuysen (Canada), Elizabeth AFS Torres (Brazil), Ian Unwin (UK), Louwrens Smit (South Africa), Maria Inés Genovese (Brazil), Eduardo Purgatto (Brazil), Paulo Y. Kageyama (Brazil - Ministry of Environment), Bráulio F. S. Dias (Brazil - Ministry of Environment), Rubens Onofre Nodari (Brazil - Ministry of Environment), Lídio Coradin (Brazil - Ministry of Environment). All members of IUNS-INFOODS Task Force.

IUNS-INFOODS Task Force Members:

Barbara Burlingame (FAO), Nevin Scrimshaw (IUNS/ UNU), Ricardo Uauy (IUNS), Osman Galal (IUNS), Elizabete Wenzel de Menezes (BRASILFOODS/LAT-INFOODS), Hettie Schonfeldt (AFROFOODS), Mbome Lape (CAFOODS), Wilbad Lorri (ECAFOODS), Gharbi Tahar (NAFOODS), Henry Gadaga (SOAFOODS), Esther Sakyi-Dawson (WAFOODS), Prapasri Puwastien (ASEANFOODS), Pauline Samuda (CARICOMFOODS), Musa Aidjanov (CARKFOODS), Paul Finglas (EUROFOODS), Fanny Ribarova (CEECFOODS), Wulf Becker (NORFOODS), Abdulrahman Musaiger (GULFOODS/ MEFOODS), Norma Sammán (LATINFOODS), Ana Victoria Román (CAPFOODS), Saturnino de Pablo (SAFOODS), Yang Yuexin (NEASIAFOODS), Joanne Holden (NORAMFOODS), Bill Aalbersberg (OCEANIAFOODS), Heather Greenfield (OCEANIAFOODS), Jehangir Khan Khalil (SAARCFOODS), Catherine

Champagne (Task Force Expert), Kunchit Judprasong (Task Force Expert)

FAO International Expert Consultation Chair: Barbara Burlingame (INFOODS/ FAO)

## **COOPERATION**

Convened by: University of Sao Paulo (USP), Department of Food Science and Experimental Nutrition - Pharmaceutical Science School - USP, Brazilian Network of Food Data Systems (BRASILFOODS), Food and Agriculture Organization (FAO)

In cooperation with: Brazilian Society for Food and Nutrition (SBAN), United Nations University (UNU), International Food Data Conference Task Force, Latin American Network of Food Data Systems (LATINFOODS), The International Union of Nutritional Sciences (IUNS), Consultative Group on International Agriculture Research (CGIAR), International Life Sciences Institute - Brasil (ILSI)

## **SPONSORSHIP**

Food and Agriculture Organization (FAO), European Food Information Resource Network (EuroFIR), Bioversity International, Global Facilitation Unit for Underutilized Species (GFU), Convention of Biological Diversity (CBD), Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), Ministry of Environment, Danone Ltda, Unilever Brasil, Coca-Cola - Recofarma Ind. do Amazonas Ltda, Sadia S.A., Nestlé Brasil Ltda, Grupo Bimbo do Brasil, National Starch Food Innovation, Food Intelligence Consultoria Técnica em Alimentos Ltda, DSM Produtos Nutricionais Brasil Ltda, Wickbold & Nosso Pao Ind. Alim. Ltda, Fundação Instituto de Pesquisas Farmacêuticas (FipFarma)

## **MEETING MANAGEMENT**

Vemago Congressos e Eventos

## **GRAPHIC DESIGN**

Imageria Estúdio

## **WEBDESIGN**

Palavra Chave Ass. Com. Ltda

## **EVENT AUTOMATION**

B2 Automação de eventos



**SEVENTH  
INTERNATIONAL  
FOOD DATA  
CONFERENCE**

Food Composition and Biodiversity

October 21-24, 2007

Sao Paulo, Brazil

Coordination:

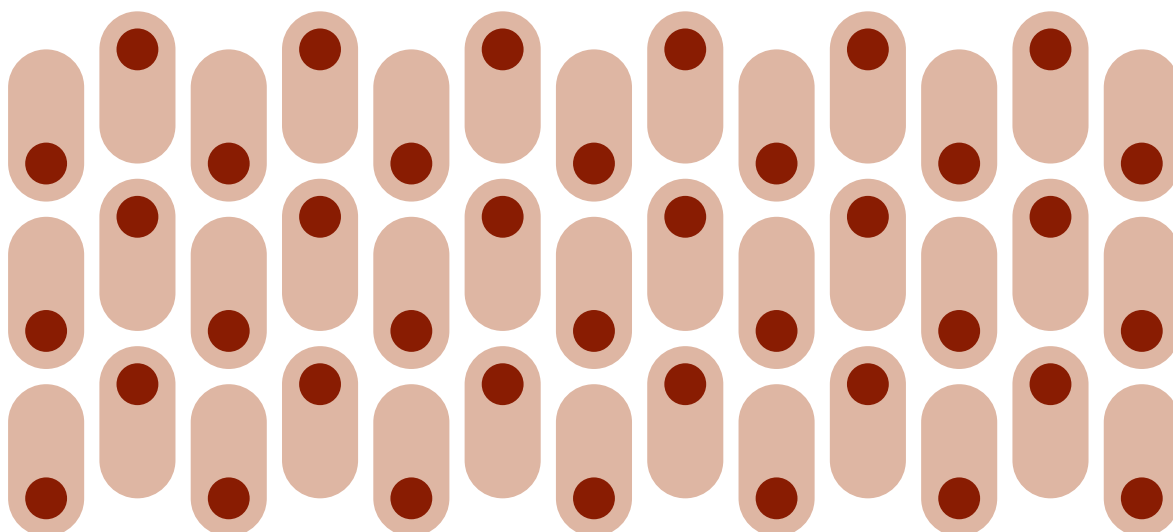
Coordination: Elizabete Wenzel  
Menezes and Franco M. Lajolo  
University of Sao Paulo (USP)/  
BRASILFOODS

**PROGRAM AND  
ABSTRACTS**

Transamerica Flat International Plaza  
Al. Santos, 981 - Cerqueira Cesar  
Sao Paulo, SP, Brazil

2007

Conference convened by the University of Sao Paulo (USP), the Brazilian Network of Food Data Systems (BRASILFOODS) and the Food and Agriculture Organization of the United Nations (FAO)



## SEVENTH INTERNATIONAL FOOD DATA CONFERENCE

# Food Composition and Biodiversity

October 21-24, 2007

### PROGRAM

The 7IFDC will be held in the Transamerica Flat International Plaza

#### SUNDAY, OCTOBER 21, 2007

**16:00-18:00**

**Early registration** (Foyer)

**18:00-20:00**

**Welcome cocktail** (Foyer) - *All conference attendees are welcome to stop by*

#### MONDAY, OCTOBER 22, 2007

*All sessions will be held in the America Room*

**8:00-9:00**

**Registration** (Foyer)

**9:00-10:00**

#### **SESSION I - WELCOME AND KEYNOTE ADDRESSES**

**Welcome** - Conference Chair, Elizabete Wenzel Menezes - BRASILFOODS/USP (10 min)

**Keynote addresses** - Introductions by Elizabete Wenzel Menezes - Brazil

Franco M Lajolo - University of Sao Paulo - Brazil (10 min)

Barbara Burlingame - FAO - Italy (10 min)

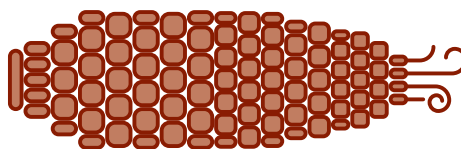
**1. Evolution and perspectives of food composition tables.** Ricardo Bressani - Guatemala (25 min)

**2. LATINFOODS Homage to Professor Ricardo Bressani: Brief biography.** Norma Sammán - Argentina, Adriana Blanco (5 min)

**10:00-10:30**

**Coffee-break** (Foyer)

**Poster exhibits** (Poster Room) - **POSTER SESSION I: A, B, C, D**



**10:30-12:45**

**SESSION II - BIODIVERSITY**

CoChairs: Pablo Eyzaguirre (Bioversity International)/ Prapasri Puwastien (Thailand)

- 1. Food composition is fundamental to the cross-cutting initiative on nutrition and biodiversity.** Barbara Burlingame - Italy, Ruth Charrondiere, Francisca Smith (25 min)
- 2. Species of actual or potential economic value of local or regional use - Plants for the future.** Lidio Coradin, Rubens Onofre Nodari - Brazil (15 min)
- 3. A cross-cutting initiative to mainstream biodiversity conservation in order to improve food and nutrition.** Sílvia Porto - Brazil (15 min)
- 4. Biodiversity of food resources in Northeast India.** T Longvah - India (15 min)
- 5. Nutritional properties of "bush meals" and their importance in achieving the nutrition requirements of North Cameroon's rural populations.** Djoulde Darman Roger - Cameroon, Francois Xavier Etoa, Wilna Oldewage-theron, Abdulkadir Egal (15 min)
- 6. Biodiversity of edible wild plants of Arunachal Pradesh and use in maintaining health and nutrition.** Rakesh Bhardwaj - India, Arvind K Rai, Lobsang Wangchu, Amish K Sureja, Dharmendra Singh, Ranjay K Singh, Hui Tag (15 min)
- 7. Indigenous peoples' food systems: A wealth of knowledge in food and food composition.** Harriet Kuhnlein - Canada, IUNS Task Force on Indigenous Peoples' Food Systems and Nutrition **BOOK LAUNCH. Indigenous peoples' food systems for nutrition and health** (15 min)

Discussion (20 min)

**12:45-14:00**

**Lunch (La Fortuna Restaurant)** - *All conference attendees are welcome*

**14:00-16:10**

**SESSION III - DATA QUALITY/ FOOD SAMPLING**

CoChairs: Joanne Holden (USA)/ Paul Finglas (United Kingdom)

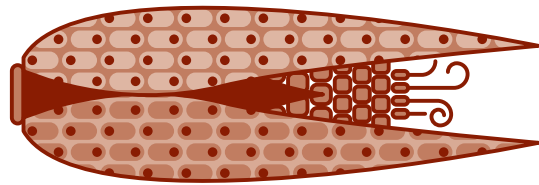
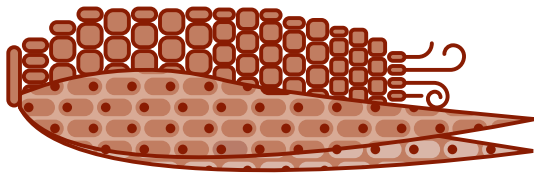
- 1. Validation study of the USDA's data quality evaluation system.** Seema A Bhagwat, Kristine Y Paterson, Joanne M Holden - USA (25 min)
- 2. EuroFIR approach to improve the quality of food data banks.** Isabel Castanheira - Portugal, Susanne Westenbrink, Marine Oseredczuk, Paul Hulshof, Peter Hollman, Jayne Ireland, Anders Møller, Simonetta Salvini, Hedwig Beernaert, Maria Antonia Calhau, Paul Finglas (20 min)
- 3. Establishing proficiency testing for laboratories and compilers to assess data quality for food composition databanks as part of EuroFIR project.** Amanda Earnshaw - United Kingdom, Linda Owen, Isabel Castanheira, Maria A Calhau, Paul Finglas (20 min)
- 4. Sampling for biodiversity and food composition studies.** Heather Greenfield - Australia, Barbara Burlingame (20 min)
- 5. The magnitude of seasonal, regional and individual effects on contents of carrot and spinach components and its use in sample size determination.** Yoshiki Tsukakoshi - Japan, Shigehiro Naito, Nobuaki Ishida, Akemi Yasui (20 min)

Discussion (25 min)

**16:10-16:40**

**Coffee-break** (Foyer)

**Poster exhibits** (Poster Room) - **POSTER SESSION I: A, B, C, D**



**16:40-18:10**

**SESSION IV - BIOACTIVE COMPOUNDS**

CoChairs: Maria Inés Genovese (Brazil)/  
Perkins Muredzi (Zimbabwe)

**1. Micro-constituents and antioxidant activity of three tropical fruits.** [Christian Mertz](#) - France, Anne-Laure Gancel, Zya Gunata, Pascaline Alter, Claudie Dhuique-Mayer, Fabrice Vaillant, Ana Mercedes Perez, Jenny Ruales, Pierre Brat (15 min)

**2. Antioxidant capacity and components of underutilised Malaysian fruits.** [Amin Ismail](#) - Malaysia, Salma Idris, Emmy HK Ikram, Halimatul SM Nazri, Abbe MM Jalil, Azrina Azlan, Norzatol A M Diton, Khoo H Eng (15 min)

**3. Food composition table: Antioxidant capacity and phenolic content of fruit, vegetables and commercial frozen pulps.** [Neuza MA Hassimotto](#) - Brazil, Maria Inés Genovese, Franco M Lajolo (10 min)

**4. Isoflavones and antioxidant capacity of Peruvian (*Lupinus mutabilis* sweet) and Brazilian (*Lupinus albus* and *Lupinus angostifolius*) lupin cultivars.** Lena Galvez Ranilla, [Maria Inés Genovese](#) - Brazil, Franco M Lajolo (10 min)

**5. Wine and grape juice by-products as a source of functional compounds: Sensory evaluation of grape pomace sorbet.** [Emília Y Ishimoto](#) - Brazil, Andréa CG Matias, Deborah HM Bastos, Aldo Baccarin, Elizabeth AFS Torres (10 min)

**6. Comparative study on phytochemical compounds in Brazilian rice (*Oryza sativa*, L.).** Nádia V. Mussi de Mira, Cristina SCI Pascual, Isabel Massaretto, Priscila A Pinto, [Ursula M Lanfer-Marquez](#) - Brazil (10 min)

Discussion (20 min)

**19:00-20:00**

**Meeting of INFOODS Regional Data Centre Coordinators and Task Force Meeting (America Room).** Barbara Burlingame (Italy)

**TUESDAY, OCTOBER 23, 2007**

*All sessions will be held in the America Room*

**8:30-10:20**

**SESSION V - FOOD COMPOSITION DATABASE: COMPILATION AND NEW FEATURES**

CoChairs: Ruth Charrondiere (Italy)/ Suzanne P Murphy (USA)

**1. The EuroFIR Project - linking European food composition databases using the langual food description thesaurus.** [Paul Finglas](#) - United Kingdom, Anders Møller, Jayne Ireland (25 min)

**2. Development of a food composition and biological effects database for plant-based bioactive compounds.** [Lucinda Black](#) - Ireland, Jorn Gry, Paul Kroon, Folmer Eriksen, Kirsten Pilegaard, Jenny Plumb, Darina Sheehan, Paul Finglas, Máiréad Kiely (20 min)

**3. Harmonisation of recipe calculation procedures in European food composition databases.** Heli Reinivuo, Marja-Leena Ovaskainen, [Simone Bell](#) - Germany, Claudia Krines, EuroFIR wp2.2workgroup (15 min)

**4. New data for traditional foods in Europe, prioritisation, collection and analysis.** [Helena S Costa](#) - Portugal, Maria Antonia Calhau, Effie Vasilopoulou, Paul Finglas (15 min)

**5. Importance of incorporating fortified foods into food composition databases.** [Evelyn Hannon](#) - Ireland, Mairead Kiely, Albert Flynn (15 min)

Discussion (20 min)

**10:20-10:50**

**Coffee-break** (Foyer)

**Poster exhibits** (Poster Room) - **POSTER**

**SESSION II: E, F**

**10:50-12:40**

**SESSION VI - FOOD COMPOSITION DATABASE: APPLICATIONS AND SUSTAINABILITY**

CoChairs: Hettie Schönfeldt (South Africa)/ Paul Hulshof (Netherlands)

**1. NUBEL food planner.** Carine Seeuws - Belgium (15 min)

**2. Sustaining national food databases - developing partnerships with key users and stakeholders - special reference to the German nutrient database cooperation platform.** Ana Lucía Vásquez-Caicedo - Germany, Bernd Hartmann, Simone Bell, Ulrich Oltersdorf (15 min)

**3. Using mobile phones to bridge the gap between food composition data and the consumer - the BaToo Toolkit.** Robert Adelman, Paolo Colombani - Switzerland (15 min)

**4. Computer-based dietary menu planning.** Barbara Korousic Seljak - Slovenia (15 min)

**5. Training in food composition: A self-guided study workbook.** Ruth Charrondiere - Italy, Barbara Burlingame (15 min)

**6. Understanding natural variability in crop composition utilizing ILSI crop composition database ([www.cropcomposition.org](http://www.cropcomposition.org)).** William Ridley - USA, Raymond Shillito, Marci Levine (15 min)

Discussion (20 min)

**12:40-14:00**

**Lunch** (La Fortuna Restaurant) - *All conference attendees are welcome*

**14:00-16:05**

**SESSION VII - NATIONAL DATABASES**

CoChairs: Saturnino de Pablo (Chile)/ Norma Sarmán (Argentina)

**1. USDA's nutrient databank system - A tool for handling data from diverse sources.** David B Haytowitz - USA, Linda E Lemar, Pamela R Pehrsson (25min)

**2. Building a Portuguese food composition network.** Luísa Oliveira - Portugal, João Barga, Andreia Porto (15 min)

**3. Development, compilation and use of Iranian food composition tables.** Anahita Houshiyarrad - Iran, Mina Esmaili, Morteza Abdollahi, Mahin Aza (15 min)

**4. Food composition tables for South Africa - a developing country perspective.** Petro Wolmarans, Natasha Danster - South Africa, Annalien Dalton (15 min)

**5. Development of SICA-COR, a food composition information system for Costa Rica.** Adriana Blanco - Costa Rica. Leonardo Ortiz, Mireya Fernandez, Victoria Chan (15 min)

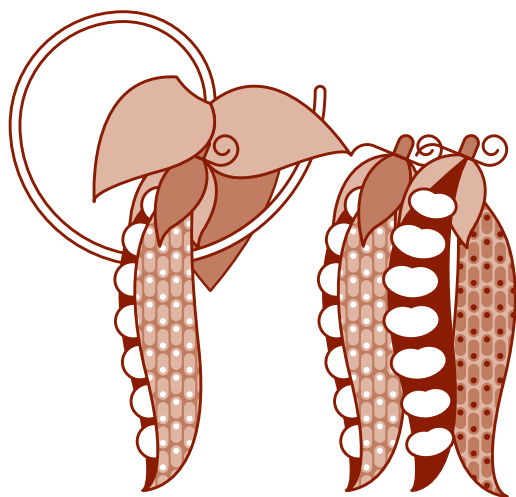
**6. TBCA-USP / BRASILFOODS: carbohydrate database.** Elizabete Wenzel Menezes - Brazil, Eliana B Giuntini, Milana CT Dan, Franco M Lajolo (15 min)

Discussion (25 min)

**16:05-16:35**

**Coffee-break** (Foyer)

**Poster exhibits** (Poster Room) - **POSTER SESSION II: E, F**



**16:35-17:50**

**SESSION VIII - ANALYTICAL METHODS**

CoChairs: Delia Rodriguez-Amaya (Brazil), Virginia Melo (Mexico)

**1. Development of rice reference materials and their use for evaluation of analytical performance of food analysis laboratories.**

Prapasri Puwastien - Thailand, Kunchit Judprasong, Naruemol Pinprapai (15 min)

**2. Resistant starch: benefits and *in vitro* measurement.** Terry E Finnocchi - USA (15 min)

**3. A continuous-flow dialysis system hyphenated inductively coupled plasma optical emission spectrometer for *in vitro* estimation of mineral bioaccessibility.** Kunchit Judprasong - Thailand, Atitaya Siripinyanond, Juwadee Shiowatana (15 min)

**4. The use of stable isotope analysis for geographic origin of green coffee.** Carla Rodrigues - Portugal, Rodrigo Maia, Marco Miranda, Cristina Máguas Hanson (15 min)

Discussion (20 min)

**19:30-23:00**

**Dinner Event** (Transamerica Flat International Plaza lobby - for transfer to Restaurant A) - *All conference attendees are welcome*

**WEDNESDAY, OCTOBER 24, 2007**

*All sessions will be held in the America Room*

**8:30-12:35**

**SESSION IX - REGIONAL FOODS and SPECIFIC NUTRIENTS**

CoChairs: Naveed Murtaza (Pakistan)/ Lilia Masson (Chile)/ Heather Greenfield (Australia)

**1. National survey of composition of Australian retail pork 2006.** Heather Greenfield - Australia, Timothy Stoba, Jane A Barnes (15 min)

**2. Physical and chemical characteristics and malt quality of sorghum (*Sorghum bicolor*) grain varieties grown in Kenya.** Anselimo O Makokha - Kenya (15 min)

**3. Vitamin D metabolites in milk products.** Jette Jakobsen - Denmark, Erling Saxholt (15 min)

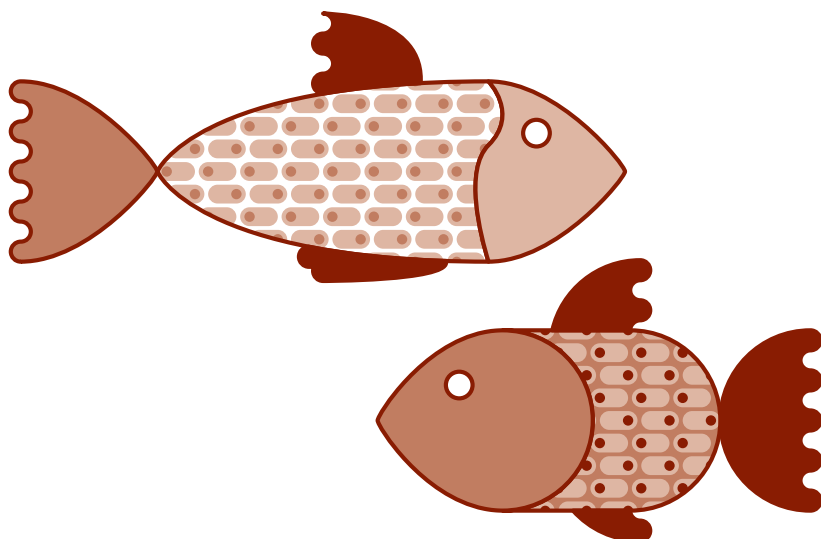
**4. Fatty acid, sterols and tocopherols composition of three native Chilean seeds oils.** Lilia Masson - Chile, Conrado Camilo, Luis Cornejo, Andrea Caceres, Katherin Gonzalez, Maria Esperanza Torrija (15 min)

**5. Trans fatty acid content of selected Swiss foods - the TRANSSWISSPILOT study.** Paolo C Colombani - Switzerland, Eva K Richter, Karem Albash Shawish, Martin RL Scheeder (15 min)

**6. Fat and trans fatty acids intakes in Iran.** Mina Esmaeili - Iran, Anahita Houshyarrad, Morteza Abdollahi, Naser Kalantari (15 min)

**10:00-10:30**

**Coffee-break** (Foyer)



**7. Analysis of folic acid in flours used as raw material in enriched dry cereal.** Ana Elisa Ferreira Presoto, Ligia Bicudo de Almeida-Muradian - Brazil (15 min)

**8. Physico-chemical and nutritional properties of Nigerian tamarind (*Tamarindus Indica* L.) fruits.** Abiodun A Adeola - Nigeria, Ogugua C Aworh (15 min)

**9. Composition of fourteen varieties of amaranth reintroduced in the Andean zone of Jujuy.** Elina Acuña, Alberto Andrade, Norma Sammán - Argentina (15 min)

**10. Phenotypic, agronomic and nutritional characteristics of 7 varieties of Andean potatoes.** Maria E Jimenez, Analia Rossi, Norma Sammán - Argentina (15 min)

**11. Formulating nutrition snacks with inulin and oligofructose.** Vanessa D Capriles - Brazil, Rosana AM Soares, José AG Arêas (15 min)

**12. Contribution of native Brazilian foods to nutrients in diets, 1974-2003.** Ronald Calitri - USA (15 min)

Discussion (35 min)

#### 12:35-12:45

##### **Announcement Regarding the 8<sup>th</sup> International Food Data Conference**

Prapasri Puwastein (Thailand)/ Paul Finglas (United Kingdom)

#### 12:45-13:00

##### **Closing Remarks** (15 min)

Elizabeth Wenzel Menezes (Brazil)/ Barbara Burlingame (Italy)/ Franco M. Lajolo (Brazil)

#### 13:00-14:00

**Lunch** (La Fortuna Restaurant) - *All conference attendees are welcome*

#### 14:00-16:00

**LATINFOODS Meeting** (America Room )  
Norma Sammán (Argentina)/ Adriana Blanco (Costa Rica)

#### 14:00-17:00

**Journal of Food Composition and Analysis Meeting** (Europe Room)  
Barbara Burlingame (Italy)

## Poster sessions

### MONDAY, OCTOBER 22, 2007 (Poster Room)

(8:00-9:00 - Fix posters; **10:00-10:30/ 16:10-16:40 - Poster exhibits**; 16:40-18:10 - Remove)

#### POSTER SESSION I

##### A - BIODIVERSITY

**1. Biodiversity, nutritional importance and marketing of local spices in Nigeria.** Akanni K Adekunle - Nigeria

**2. Biodiversity study in wheat cultivars for salinity resistance.** Naveed Murtaza - Pakistan, Waqas Malik, Abdul Qayyum

**3. Chemical composition of tannia (*Xanthosoma mafaffa* Schott).** Luciana T Yoshime, Otilia T Carvalho - Brazil, Marilene DVC Penteado

**4. Nutritional aspects of fonio and fonio products.** Yara Koreissi - Mali, Nadia Fanou, Inge Brouwer, Paul Hulshof, Michael Zimmermann

**5. Studies on composition and viability of *Stevia rebaudiana* in humid coastal tropics.** Kaushik Ramakrishnan S, Geetha Muthukumaran, K Hemalatha, Usha Antony - India

**6. Chemical characterization of five loquat fruit cultivars (*Eriobotrya japonica* Lindl.) in ripening stage.** Patrícia NH Gushiken - Brazil, Rafael Pio, Beatriz R Cordenunsi, Franco M Lajolo, Eduardo Purgatto

**7. Organic acids in different ripe banana cultivars.** Roberta Ghedini Der Agopian - Brazil, Eduardo Purgatto, Beatriz R Cordenunsi, Franco M Lajolo

**8. Chemical composition of baru (*Dipteryx alata*, Vog) from Goiás state.** Daniela Fernandes, Thays Cunha, Elizane Souza, Luiz Teixeira, Maria Margareth Naves - Brazil

**9. Conception of the vegetable classification for application in the nutritional and sensorial quality evaluation (NSQE) system.** Lúcia Chaise Borjes - Brazil, Rossana Pacheco da Costa Proença, Suzi Barletto Cavalli

**10. Brazilian initiative on biodiversity for food and nutrition.** Rubens Onofre Nodari - Brazil, Lidio Coradin

**11. New data for ethnic foods in Europe, prioritisation, collection and analysis.** Penelope Gilbert - United Kingdom, Santosh Khokhar



## **B - BIOACTIVE COMPOUNDS AND FUNCTIONAL FOODS**

**1. Functional effect of kavun rice (*Oryza sativa*) and fish oil on the lipid profile of selected type II dyslipidemic diabetics.**

Jemima Beryl Mohankumar - India, E Kannan

**2. Influence of common bean (*Phaseolus vulgaris*, L.) colour on total phenolic, tannin and antioxidant activity.** Solange G Canniatti-Brazuca - Brazil, Richard A Frazier

**3. Digestibility and polyphenol interaction in common beans (*Phaseolus vulgaris*, L.) of different colours.** Solange G Canniatti-Brazuca - Brazil, Richard A Frazier, Eddie R Deaville

**4. Brazilian and peruvian bean (*Phaseolus vulgaris* L.) cultivars: polyphenol composition in seed coat and cotyledon fractions.** Lena Gálvez Ranilla, Maria Inés Genovese - Brazil, Franco M Lajolo

**5. Identification of the phenolic components of snow pea tip, snow pea pod, sugar pea pod, dry green pea, cowpea, blackeye pea, long bean pod, mung bean, and lentils by LC-DAD-ESI/MS.** Long-Ze Lin - USA, James M Harnly

**6. Antioxidative activity and oxidative stability of mungoong, a shrimp extract paste, during extended storage.** Soottawat Benjakul - Thailand, Wanwisa Binsan, Wonnop Visessanguan

**7. Characterization of antioxidative peptides from protein hydrolysate of yellow stripe trevally (*Selaroides leptolepis*).** Vilailak Klompong - Thailand, Soottawat Benjakul, Kirby D Hayes, Fereidoon Shahidi

**8. In vitro antioxidant activity during shelf life period of garlic (*Allium sativum*) and byproducts.** Yara S Queiroz, Geni R Sampaio, Emília Y Ishimoto, Rosana AM Soares, Deborah HM Bastos, Elizabeth AFS Torres - Brazil

**9. In vitro antioxidant activity of tamarillo (*Cyphomandra betacea*) in natura and pulp.** Mariana Grandisoli, Emília Y Ishimoto, Yara S Queiroz, Silvio JV Vicente, Elizabeth AFS Torres - Brazil

**10. Identification of phenolic compounds in grape berries from Minas Gerais - Brazil.** Lucile Tiemi Abe - Brazil, Márcia da Silva Pinto, Any Elisa de Souza Schmidt Gonçalves, Maria Inés Genovese, Franco M Lajolo

**11. Influence of some agricultural variables and conventional cooking on the carotenoid composition of snow peas (*Pisum sativum* ssp. *Macrocarpum*).** Otilia T Carvalho - Brazil,

Luciana T Yoshime, Simone ASC Faria, Marilene DVC Penteadó

**12. Antioxidant capacity and ascorbic acid content of some fruits consumed in Brazil.**

Lucile Tiemi Abe - Brazil, Marcia da Silva Pinto, Any Elisa de Souza Schmidt Gonçalves, Maria Inés Genovese, Franco M Lajolo

**13. Quantification of total ellagic acid in strawberries (*Fragaria x ananassa* Duch.).** Márcia da Silva Pinto, Lucile Tiemi Abe - Brazil, Any Elisa de Souza Schmidt Gonçalves, Franco M Lajolo, Maria Inés Genovese

**14. Antioxidant capacity of exotic fruits and commercial frozen pulps from Brazil.** Any Elisa de Souza Schmidt Gonçalves - Brazil, Márcia da Silva Pinto, Lucile Tiemi Abe, Franco M Lajolo, Maria Inés Genovese

**15. The Amazonian fruits taperebá (*Spondias mombin*) and murici (*Byrsonima crassifolia*) have higher levels of quercetin than commercial fruits.** Igor da Silva Drago, Lísia Senger Huber, Delia B Rodriguez-Amaya - Brazil

**16. Native Brazilian green leafy vegetables are richer sources of carotenoids than commercial leafy vegetables.** Cintia Nanci Kobori - Brazil, Delia B Rodriguez-Amaya

**17. Antioxidant capacity and phenolic content of stingless bee honey from Amazon.** Michele CM dos Santos, Simone Mendonça, Elizabeth AFS Torres, Deborah HM Bastos - Brazil

**18. Composition, physicochemical and functional properties of maca (*Lepidium meyenii* Walpers) root starch.** Gerby G Rondán Sanabria, Flavio Finardi Filho - Brazil

**19. Separation, identification and antioxidant activities of native isoflavones and prenylisoflavones in different plant sources.** Rong Tsao - Canada, Zhongying Liu, Raymond Yang, Chris Yang, Honghui Zhu

**20. Separation, identification and antioxidant activities of prenylated flavonoids in berberidaceae plants.** Zhongying Liu, Rong Tsao - Canada, Raymond Yang, Honghui Zhu, Chris Young



## C - FOOD CONSUMPTION AND NUTRIENT INTAKE

**1. Relating eating well with Canada's food guide to Canadian nutrient file foods.** Josie Deeks, [Marie-France Verreault](#) - Canada, Margaret Munro, Maya Villeneuve, Konstantinia Arvaniti, Stefa Katamay

**2. Development of a quantitative food frequency questionnaire (QFFQ) to assess food, nutrient and heterocyclic amine intake in Japanese Brazilians.** [Sangita Sharma](#) - USA, Motoki Iwasaki, Claudia Kunieda, Junko Ishihara, Shoichiro Tsugane, Gerson S Hamada, Nelson T Miyajima, Loïc Le Marchand

**3. Food intake of people at a suburb area of Hanoi capital in 1999-2005.** [Tuong Pham Duy](#) - Vietnam

**4. Spatial distribution of nutritional status and nutrient intakes in Iraq, estimates from international data.** [Ronald Calitri](#) - USA

**5. The composition of essential elements in the typical diet of the Amazonian riparian population.** Fábio SB Evangelista, Elene P Nardi, Luciano Tormen, Adilson J Curtius, M Lemire, Jean Remy Guimarães, Miriam Fillion Donna Mergler, [Fernando Barbosa Jr](#) - Brazil

**6. Creation of nutrient and food component definitions.** [Suzanne P Murphy](#) - USA, Lynne R Wilkens, Leo WK Cheung, Donna Lyn MT Au, Sherri De Coronado

## D - ANALYTICAL METHODS

**1. Significant figures in carotenoids orange and tomato results obtained by HPLC.** M Graça Dias, M Filomena GFC Camões, [Luísa Oliveira](#) - Portugal

**2. Identification of the polyphenolic components of 17 pear skins by LC-DAD-ESI/MS.** [Long-Ze Lin](#) - USA, James M. Harnly

**3. Evaluation of the survey on food sciences and nutrition metrology in Africa.** [Djoulde Darman Roger](#) - Cameroon, Francois Xavier Etoa, Wilna Oldewage-theron, Abdulkadir Egal, Essia Ngang Jean Justin

**4. Application of solid-phase extraction-electrospray ionization mass spectrometry for the quantification of food folates.** Shyamala Vishnumohan, Russ Pickford, [Jayashree Arcot](#) - Australia

## 5. Characterization of eucalyptus and citrus monofloral honeys by moisture contents.

[Cristiane B Cano](#) - Brazil, Maria Lurdes Felsner, Roy E Bruns, Jivaldo R Matos, Lígia B Almeida-Muradian

**6. Characterization of eucalyptus and citrus monofloral honeys by glass transition temperatures (TG).** [Maria L Felsner](#) - Brazil, Cristiane B Cano, Roy E Bruns, Jivaldo R Matos, Lígia B Almeida-Muradian

**7. Vitamin B<sub>1</sub> - quantification of thiamine and 2-(1-hydroxyethyl) thiamine a necessity.** [Jette Jakobsen](#) - Denmark, Tina Rasmussen, Hanna Sara Strandler

## TUESDAY, OCTOBER 23, 2007 (Poster Room)

(8:00-8:30 - Fix posters; **10:20-10:50/ 16:05-16:35 - Poster exhibits**; 16:50- 18:10 - Remove)

## POSTER SESSION II

### E - FOOD COMPOSITION DATABASE AND TABLES

**1. Synchronization and harmonization of coding scheme and description of foods in plant food database.** [Haeng-Shin Lee](#) - Korea, Young-Ai Jang, Yoonna Lee, Hae-Jeung Lee, Jae-Jin Moon, Hye-Kyung Park, Yoon-Ju Choi, Jong-Wook Kim, Cho-il Kim

**2. Development of recipe and nutrient database for dishes served at schools and worksites for national health and nutrition survey in Korea.** [Yoonna Lee](#) - Korea, Young-Ai Jang, Haeng-Shin Lee, Hae-Jeung Lee, Jae-Jin Moon, Cho-il Kim

**3. Comparison of the nutritional composition of dishes obtained by analysis and by the use of food composition tables.** Dora Romaguera, Viviana Taboada, Marianela Peralta, Manuel Lobo, Josep Tur, [Norma Sammán](#) - Argentina

**4. Comparison to EuroFIR recommendations for nutrient loss and gain factors currently used in European food composition databases.** [Simone Bell](#) - Germany, Ana Lucía Vásquez-Caicedo, Bernd Hartmann, Ulrich Oltersdorf

**5. Bioactive compounds database. TBCA-USP/ BRASILFOODS.** Elizabete W Menezes, Maria Inés Genovese, Nelaine C Santos, Eliana B Giuntini, [Milana CT Dan](#) - Brazil, Franco M Lajolo

**6. Partial update of the Colombian food composition table.** [Clara Esperanza Serrano](#) - Colombia, Lucy Barros, Patricia Restrepo, Olga Cobos, Pedro Nel Pacheco, Patricia Martinez, Horacio Castellanos

**7. Food composition tables of Costa Rica (TCA-COR).** [Adriana Blanco](#) - Costa Rica, Paulina Silva, Thelma Alfaro, María de los Angeles Montero, Mary Tere Salas, Rosa Novygrodt, Mireya Fernández, Melany Ascencio

**8. Analysis of indigenous green leafy vegetables towards development of Lesotho food composition table.** [MM Lephole](#) - Lesotho, MC Khaketla, M Monoto

## F - REGIONAL FOODS AND SPECIFIC NUTRIENT AND PRODUCTS

**1. Production and preservation of date juice beverage.** [Abdorrezza M Nafchi](#) - Iran, Leila Nouri, Mohammadreza Saeedi Asl

**2. Effect of gelatin, tannin and pH on clarification of date juice beverage.** [Abdorrezza Mohammadi Nafchi](#), [Leila Nouri](#) - Iran, M Reza Saeedi Asl

**3. Information on the nutrient content of cow's milk, goat's milk and soy milk.** [Beulah Pretorius](#) - South Africa, Louwrens E Smit, Hettie C Schönfeldt

**4. Vitamins B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub> and PP in royal jelly.** [Elaine Cristina Pinto Moreschi](#), [Ligia Bicudo de Almeida-Muradian](#) - Brazil

**5. Effect of cooking, popping, toasting and extrusion on amaranth seeds starch digestibility.** [Vanessa D Capriles](#) - Brazil, Karina D Coelho, Andréa G Matias, José AG Arêas

**6. Amaranth: from Andeans to Brazilians through extrusion cooking.** [Vanessa D Capriles](#) - Brazil, Karina D Coelho, José AG Arêas

**7. Amaranth seeds beneficially affect the intestinal tract of rats.** [Andrea C Guerra Matias](#) - Brazil, Nágila RT Damasceno, Robison Cruz, Jose Alfredo G Arêas

**8. Nutritional quality of raw and extruded bovine rumen protein.** [Ana Carolina Conti e Silva](#) - Brazil, Robison José da Cruz, José Alfredo Gomes Arêas

**9. Extruded amaranth: a novel raw material for healthy foods.** [Karina D Coelho](#) - Brazil, Vanessa D Capriles, José AG Arêas

**10. Lipids data composition of edible ant egg *Liometopum apiculatum* M. Escamoles.** [Virginia Melo](#) - Mexico, Horacio Sandoval, Karina Sánchez, Concepción Calvo, Ma. del Carmen Herrera, Jorge Rivero-Martínez

**11. Chemical and nutrient changes of Turkish hazelnut varieties during the maturation.** [Erdal Ertas](#), [Gulcin Satir](#), [Hayrettin Ozer](#) - Turkey, Gul Loker

**12. Vitamin E stability during storage of dried bee pollen pellets.** [Ilana L P de Melo](#), [Ligia Bicudo de Almeida-Muradian](#) - Brazil

**13. Macro and micronutrient contents of foods commonly consumed in northern Benin.** [Evariste C S Mitchikpe](#) - Benin, Romain A M Dossa, Eric-Alain D Ategbo, Joop M A van Raaij, Paul J M Hulshof, Frans J Kok

**14. Composition of foods consumed by the Awajun communities of Bajo Cenepa in the Peruvian Amazon.** [Lizette Ganoza](#) - Peru, Maria Luisa Huaylinos, Irma Tuesta, Miluska Carrasco, Marion Roche, Hilary Creed-Kanashiro, Harriet Kuhnlein

**15. The nutritional contribution of pulque, a traditional alcoholic drink in rural Mexico as well as mineral and trace element contents in other Mexican foods.** [Luis Raul Tovar](#) - Mexico, Doris Neri-Cortes

**16. Utilization of response surface methodology in the development of a pesto sauce to maximize its antioxidant activity.** [Guilherme Afonso](#), [Marcela P Monteiro](#), [Geni R Sampaio](#), [Elizabeth AFS Torres](#) - Brazil

**17. Natural and artificial radioactivity in feedstuffs and food commodities imported and exported by Brazil.** [Patricia E Pileggi](#), [Brigitte RS Pecequilo](#) - Brazil, Marcelo B Nisti, Marcelo F Máduar

**18. Carbohydrate changes during ripening in different banana cultivars.** [Claudinéia Aparecida Soares](#) - Brazil, Roberta Ghedini Der Agopian, Eduardo Purgatto, Franco M Lajolo, João Roberto O do Nascimento, Beatriz R Cordenunsi

**19. Fatty acids profile of rice bran.** [Simone ASC Faria](#), [Rosangela P Torres](#), [Selma N Kuakuzo](#), [Priscila Z Bassinello](#), [Jorge M Filho](#), [Marilene DVC Penteado](#) - Brazil

**20. Soybean hypocotyl and cotyledon: physicochemical, biochemical and nutritional characteristics.** [Ana Cristina L Barbosa](#) - Brazil, Franco M Lajolo, Maria Inés Genovese

**21. Composition of goat's milk: South African data compared to other countries.** [Louwrens E Smit](#) - South Africa, Hettie Schönfeldt

**22. The contribution of South African lamb to the diet.** [SM van Heerden](#) - South Africa, HC Schönfeldt

**23. Soil health key to food security.** [Joyce Jemima S](#) - India, Sivashankari M

**24. Nutrient composition of South African wheat and white bread flour.** [Natasha Danster](#) - South Africa, Petro Wolmarans, Corlia Buitendag

**25. Changes in non-starch polysaccharides of three banana cultivars (*Musa acuminata* L.; cvs Mysore, Terra and Nanicão) during ripening.** [Tânia M Shiga](#) - Brazil, Claudinéia A Soares, João Roberto O Nascimento, Eduardo Purgatto, Beatriz R Cordenunsi, Franco M Lajolo

**26. Chemical analysis of conventional and genetically modified varieties of soybean: nutrient and isoflavon content.** [Cintia Bezuti Giora](#), [Juliana Costa](#), [Maria Inés Genovese](#), [Jorge Mancini Filho](#), [Flavio Finardi Filho](#) - Brazil

**27. Influence of time, temperature and solution concentration in the osmotic dehydration of dried cashew apple from Cerrado.** [Mayra Martins](#), [Thays Cunha](#) - Brazil, Mara Silva

**28. Extraction and characterisation of oil from Zimbabwean African chestnuts (*Sterculia Africana* / Mungoza).** [P Muredzi](#), [W Winini](#) - Zimbabwe, S Hunguru

**29. Proximate and sensory evaluation of selected Zimbabwean soya bean varieties earmarked for soy milk production.** [P Muredzi](#) - Zimbabwe, M Mudyiwa

**30. Potency of vitamin D sources.** [Jette Jakobsen](#) - Denmark, Helle Sommer, Anette Bysted, Hanne Maribo

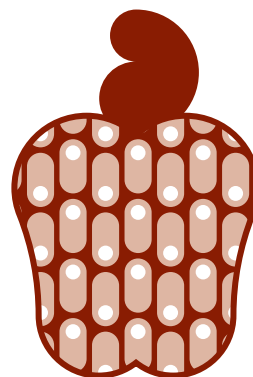
**31. Evaluation of the specific surface area and granule size distribution of starches extracted from sweet potato (*Ipomoea batatas*) grown in Jamaica: correlation with  $\alpha$ - amylase digestion.** [Cliff K Riley](#) - Jamaica, Sarafadeen A Adebayo

**32. Nutrient and non nutrient composition of selected traditional foods of gujarat, western India.** [Suneeta S Chandorkar](#) - India, Kafila Jaipuri

**33. Study of the effects of salting on the fatty acid composition of golden mullet fillet (*Liza aurata*, Risso, 1810).** [Masoud Hedayatifard](#) - Iran, Tahereh Ebrahimpour

**34. Volatile organic compound profile determination of coffee blends by spme-hs-gc-ms - what can we guess about flavour, roasting and blend composition?** [Carla Rodrigues](#) - Portugal, Rodrigo Maia, Cristina Máguas

**35. Folate content of fruits using microbiological assay.** [Lalitha A](#) - India, Shyamala Vishnumohan, Uthira R, Sheela Ramachandran, Jayashree Arcot



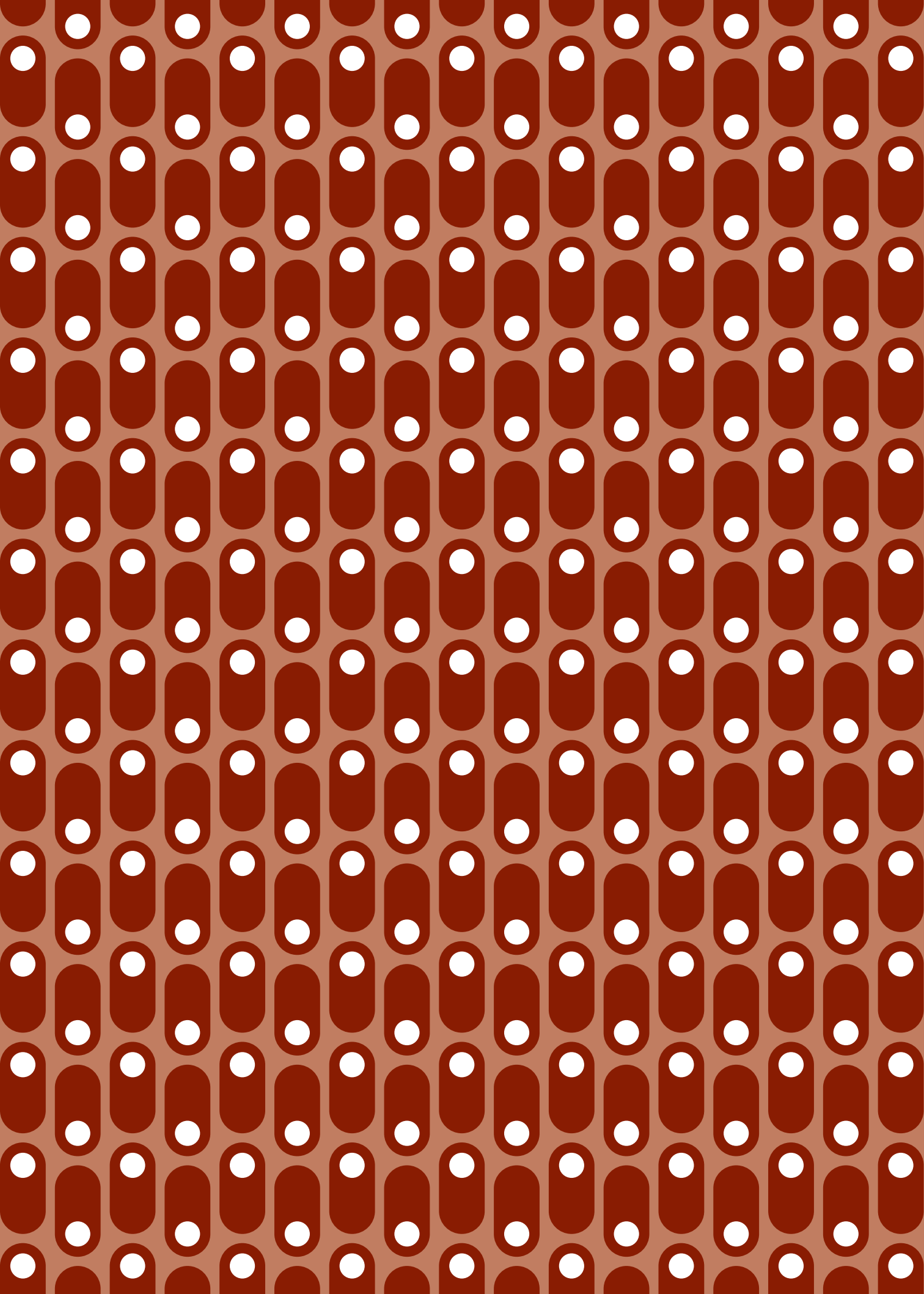
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INTERNATIONAL  
FOOD DATA  
CONFERENCE**

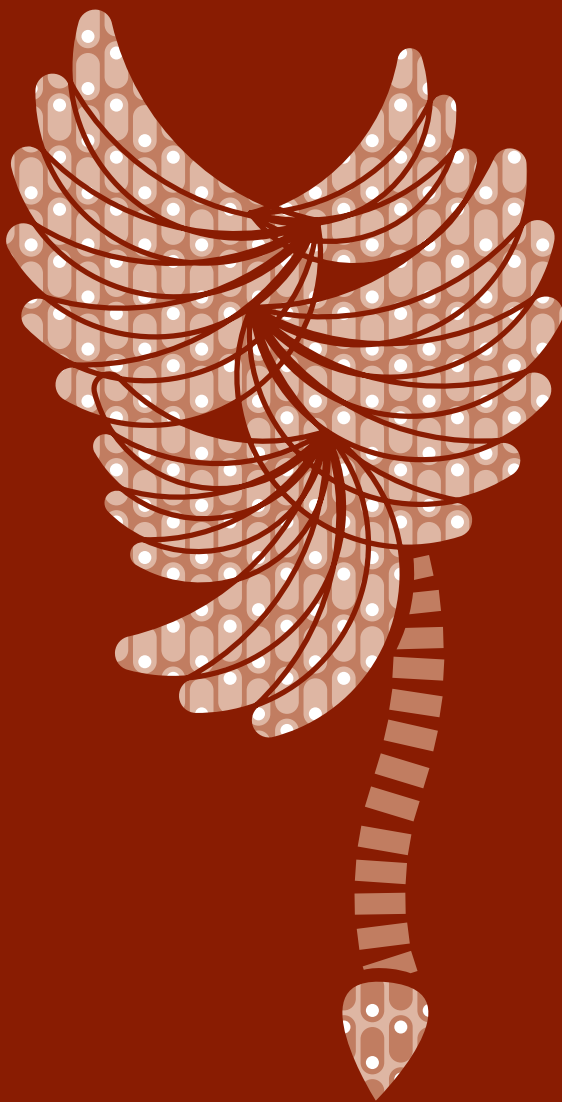
Food Composition and Biodiversity

October 21-24, 2007

Sao Paulo, Brazil

**ABSTRACTS**





## Oral abstracts\*

Monday, October 22, 2007

**SESSION I - WELCOME AND KEYNOTE ADDRESSES**

**SESSION II - BIODIVERSITY**

**SESSION III - DATA QUALITY/ FOOD SAMPLING**

**SESSION IV - BIOACTIVE COMPOUNDS**

Tuesday, October 23, 2007

**SESSION V - FOOD COMPOSITION DATABASE: COMPILATION AND NEW FEATURES**

**SESSION VI - FOOD COMPOSITION DATABASE: APPLICATIONS AND SUSTAINABILITY**

**SESSION VII - NATIONAL DATABASES**

**SESSION VIII - ANALYTICAL METHODS**

Wednesday, October 24, 2007

**SESSION IX - REGIONAL FOODS AND SPECIFIC NUTRIENTS**

\*The name of the abstract presenter is underlined



## SESSION I - WELCOME AND KEYNOTE ADDRESSES

### SI-1

#### EVOLUTION AND PERSPECTIVES OF FOOD COMPOSITION TABLES

Ricardo Bressani<sup>1</sup>

<sup>1</sup>Science and Food Technology Center, Guatemala, Guatemala

It has been stated that Food Composition Tables are true national treasures. This statement is true from various points of view. The added analytical cost of many nutrients for a large number of food results in a high investment. Likewise, the richness of the information provided by the tables is quite high whether for nutrition purposes or for the development of food products, or for purposes of research or for industrial development. These are some of the incentives to be introduced in food composition tables for their larger acceptance and extended use by different sectors of society. From the start of this activity, significant advances have been made in food sampling methods for their analysis. Likewise the analytical technology utilized has been improving in simplicity, reproducibility and preciseness. With respect to the analytical equipment, it has become more sophisticated and specific in the analysis. The presentation of the data for the users has improved and possibly the use of food composition tables is increasing by group not necessarily in the field of nutrition. It is necessary to increase and improve the information already available, and it is important to provide data for other nutrients such as essential amino acids, macro and micro mineral content and fatty acids, information already available in some food composition tables. The information of nutrient variability, often available in the past, and explained as due to genetic or environmental effects has given origin to biofortification of staple foods by geneticists and agronomist. Likewise, the increase of transgenic crop production makes it necessary to validate the substantial equivalent concept based on chemical analysis of the raw food as well as the processed one. There is need to monitor

the effects on nutrient content and availability of foods processed by the new processing technologies. As important as the above is the identification of the nutrient content of the edible fauna and flora of various regions in Latin America.

### SI-2

#### BRIEF BIOGRAPHY OF DR. BRESSANI CASTIGNOLI

Norma Sammán<sup>1</sup>, Adriana Blanco<sup>2</sup>

<sup>1</sup>President of LATINFOODS, Argentina. <sup>2</sup>Vice-President of LATINFOODS, Costa Rica

Dr. Ricardo Bressani Castignoli devoted his career to Food Science and Technology. He was a teacher and a formative influence on many generations of young people who now hold strategic positions in their respective countries. He was awarded many distinctions, most of them for his important contribution to finding solutions to health and nutrition problems with an advanced view of integration. Among these are: The Babcock Hart Award presented by the Institute of Food Technologists of the U.S.A. in 1970, the McCollum Award presented by the American Society of Clinical Nutrition in 1971, a PhD Honoris Causa conferred by Purdue University in 1976, the Albert Einstein World Award of Science presented by the World Cultural Council in 1984, the Abraham Horowitz Award presented by the Pan American Health Organization of Switzerland in 1990, Gold Medal in Science and Technology from the Congress of the Republic of Guatemala in 1997, and the Orden del Quetzal en Grado de Gran Cruz presented by the Government of Guatemala in 1999. Today, the LATINFOODS family is particularly grateful for his pioneering in promoting investigations intended to yield food composition data that can be used to improve the diet and nutrition of our region. He was

president of LATINFOODS during its first ten years and was the organizer of the “First Meeting on Food Composition Tables for Latin America and the Caribbean” which took place in Guatemala in November, 1986 and had as its main achievement the establishment of the regional network's structure and the formation of a work team with representatives from all Latin American countries who strengthened and promoted the development of LATINFOODS by working with enthusiasm and determination. Today, from that perspective and as a now member of his

Consulting Committee, Dr. Bressani continues to contribute ideas and knowledge to our organization with positive repercussions for the improvement of the health and nutrition of our people. Some of Dr. Bressani's personal qualities, considered virtues in a scientist, are worth mentioning: humility, empathy, honesty, good interpersonal skills, and always respectful and honorable manner. Without doubt, his disciples and colleagues know that in him we will always find a friend, a workmate and a person willing to continue teaching and giving guidance.



## SESSION II - BIODIVERSITY

### SII-1

#### **FOOD COMPOSITION IS FUNDAMENTAL TO THE CROSS-CUTTING INITIATIVE ON NUTRITION AND BIODIVERSITY**

Barbara Burlingame<sup>1</sup>, Ruth Charrondiere<sup>1</sup>, Francisca Smith<sup>2</sup>  
<sup>1</sup>FAO, Rome, Italy. <sup>2</sup>Bioversity International, Rome, Italy

Many factors are known to affect the nutrient content of foods, including climate, geography and geochemistry, agricultural practices, and the variety (cultivar/sub-species/breed). To date, varietal differences have received the least attention among these. In the past, generic food composition data were considered sufficient for most purposes. However, the usefulness of varietal composition data is becoming increasingly acknowledged. These data are important for the sectors of health, agriculture, trade and the environment. Recent research has confirmed the micronutrient superiority of some lesser-known cultivars and wild varieties over some more widely-utilized cultivars. Sweet potato cultivars have been shown to differ in their beta carotene content by a factor of 60, protein content of rice varieties can range from 5-13 percent, provitamin A carotenoid content of bananas can be less than 1 mcg/100 g for some cultivars, and as high as 8,500

mcg/100 g for other cultivars. Intake of one variety over another can be the difference between micronutrient deficiency and micronutrient adequacy. In agriculture, information on cultivar-specific nutrient content can be used in breeding programs to enhance the nutrient content of common varieties of the same species, eliminating the need for transgenic modifications. In trade, absence of cultivar-specific food composition data can constitute a technical barrier, since most potential export markets for unique species and cultivars require or encourage nutrient composition data for food labels and point-of-purchase materials. And for the environment sector, knowledge of nutrients and other bioactive components helps to value neglected varieties encouraging their sustainable use. The importance of nutrition is recognized by the Convention on Biological Diversity and the Commission on Genetic Resources for Food and Agriculture. At the request of the CBD, FAO is leading the “Cross-cutting initiative on biodiversity for food and nutrition”, in collaboration with Diversity International, and developing/improving compositional databases will form a significant part of the initiative. Once the data are prepared and compiled, they can be used in nutrition education, community nutrition,



nutrition interventions, food emergencies, and more. These data should be mainstreamed into national and regional food composition databases giving recognition and importance to cultivars, varieties and breeds as foods in their own right.

## SII-2

### **SPECIES OF ACTUAL OR POTENTIAL ECONOMIC VALUE, OF LOCAL OR REGIONAL USE - PLANTS FOR THE FUTURE**

Lidio Coradin<sup>1</sup>, [Rubens Onofre Nodari](#)<sup>1</sup>  
<sup>1</sup>Brazilian Ministry of the Environment

Brazil is the main one among those megadiverse countries, bearing 15 to 20% of the total number of the earth species. Biodiversity is the basis of agriculture, husbandry, aquaculture and forestry activities, and is also essential to the biotechnology industry. However, the utilization of biodiversity depends on the availability of raw materials, investments in technology and on the establishment of market chains. The commercial exploitation of biodiversity or their use for subsistence require and involve diversified activities, such as research, bioprospection, production, transformation and marketing of many products, including food, pharmaceuticals and phytoterapics, cosmetics, fibers, wood, among others. Notwithstanding the existence of a high number of domesticated species or in domesticating process, which goes back to the first American people, the commercial utilization of the autochthonous genetic resources is still incipient in the country. The domestication of native plants, including those already known and commercialized by local people, with little entrance in the national or international market, is a great opportunity to be exploited. In Brazil, this richness is yet under-utilized, particularly due to cultural patterns, imposed and strongly deep-rooted, which favor exotic crops and products. However, the most significant markets, either national or international, are avids for new options. This is the reason why the Brazilian biological and genetic resources show enormous potential to accomplish these market demands and to generate wealth. In this context, initiatives towards the accomplishment of market demands for new products become very important in the national and international scenarios. It is fundamental, however, for the country to intensify its investment to pursue a better utilization for its biodiversity. Considering the exis-

tence of these rich biodiversity, yet under-utilized, the Ministry of the Environment considers that the promotion of a better utilization of this genetic heritage is crucial. To further accomplish the utilization of this richness, the started the initiative called "Plants for the Future". The main objective was to organize a partnership between the governmental and non-governmental institutions to develop a diagnosis of the Brazilian flora with actual or potential economic value, of local or regional use. The initiative aims: (i) to identify new options of species for small farmers, with the reduction of production costs; (ii) to promote the opening of new opportunities for investments by the industrial sector; (iii) to verify the degree of use and the gaps on the scientific knowledge and technology; (iv) to value the biodiversity and the genetic resources species, in a way to demonstrate to people the importance as well as the possibilities of their use; and (v) to increase the food security, since with the growth of the population we must create new options to explore. To start the activities, the Ministry of the Environment selected five sub-projects, one for each of the five country geographical political regions. The results were very impressive, with the prioritization of 775 species. Of these, 255 are from the South, 128 from Southeast, 131 from Central Plateau, 162 from Northeast and 99 from the North region. All these species belong to 12 groups of use: food; fruit; medicine; aromatic; ornamental; oil; timber; honey-bee species; fiber; forages; toxic/biocids and environmentals. By advancing to the knowledge, conservation and promotion of the use of these genetic resources, the initiative contributes also to minimize the vulnerability of the Brazilian food system. To discuss the results and broadening the use of these species and to develop partnerships towards the characterization of the nutritional value of the food species, future actions include meetings with the academic and the industrial sectors.

## SII-3

### **A CROSS-CUTTING INITIATIVE TO MAINSTREAM BIODIVERSITY CONSERVATION IN ORDER TO IMPROVE FOOD AND NUTRITION**

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Keywords: commercialization, biodiversity, familiar agriculture

The paper presents, in a resumed way, the National Supply Company (Conab), the Food Acquisition Programme (PAA), other initiatives related to the subject, possible activities to be developed within the project subject and possible contributions from Conab and its partners at PAA. It characterizes Conab, presents its mission and structure as well as its actions at the "Fome Zero" Programme, since 2003. It presents the law that regulated the PAA, its objectives, its beneficiaries, the distribution of the acquired products, the role in the agroextrativism, organic production and native seeds varieties ("crioulas"), the managing group of the Programme, the operational system for the actions, the financial resources used, the acquired products and a brief analysis of the PAA. It is also discussed the revitalization project for the Company and the production and commercialization net for the familiar agriculture outputs. A projection for further activities related to the issue is discussed, as well as possible contributions from Conab and the PAA institutional partners.

#### SII-4

### **BIODIVERSITY OF FOOD RESOURCES IN NORTHEAST INDIA**

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It is now well recognized that wild foods are important genetic resources in global efforts to maintain biodiversity. However developmental efforts have brought about a drastic narrowing of food base and erosion of the knowledge of traditional foods. Northeast India located in the Himalayan biodiversity hotspot accounts for 24% of the total forest cover in India. The indigenous people living in the region utilize the rich flora and fauna within their environment as food sources, many of which remains unknown outside their land. This paper provides an overview of the biodiversity of foods available in northeast India, their nutrient composition (100 foods), *in vivo* protein quality evaluation (4foods) and nutritional evaluation of perilla seed oil. Analytical results showed that neglected cereals like Job's tears and Amaranth were better sources of protein and fat than normal cereals. Millets have much higher micronutrients and vitamins than rice or wheat. These grains have low glycaemic index making them attractive healthy

foods. All the legumes analyzed showed protein content ranging from 20.8 to 36.4%. Tree beans are consumed right from the tender stage till maturity. The mature beans had 28.8% protein and 33.6% fat. Little known legume like *bauhinia purpurea* also had 27% protein and 15% fat. *Vigna vexillata* is another legume whose leaves and roots are also consumed. *Flemingia vestita* is a tuber normally consumed raw with high carbohydrate (80.5%) content. Some of the uncultivated green leafy vegetables (GLV) are not only utilised as food but have traditional therapeutic uses which needs to be explored. Fermented foods, mushrooms, insects and other foods also has a place in the diet of the indigenous population of northeast India. A traditional oilseed *perilla frutescens* had 17% protein and 50% oil of which 56.6% is alpha linolenic acid. Studies using perilla oil have shown hypolipidemic effects attributed to the high Alpha linolenic acid content. The study revealed a rich biodiversity of food resources in Northeast India whose diversification of production and consumption can offer local responses to nutritional and health challenges in a global food system.

#### SII-5

### **NUTRITIONAL PROPERTIES OF "BUSH MEALS" AND THEIR IMPORTANCE IN ACHIEVING THE NUTRITION REQUIREMENTS OF NORTH CAMEROON'S RURAL POPULATIONS**

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Main food source of rural populations of the sudano sahelian Zone of North Cameroon are coming from activities based on collecting and gathering crop products and wild resources. In a context of great interest of the international community towards the safeguarding of the biodiversity, several regulations and restrictions towards collection and use of some species from biodiversity as source of foods have been done by the government. However the nutritional contribution of these food products for these local population's daily needs has not been taken into account by these restriction on biodiversity use. This

can lead to possible nutritional deficiencies among the population. The aims of this work were to check the nutritive value and nutritional contribution of some foods collected from local biological diversity, in the nutritional requirements of the populations of North Cameroon. Samples of buffalo, snakes, antelope, and monkey's based dishes were collected from both bush restaurant and at the household level. Proximate analysis, amino acid profiles and Vitamins content of dishes were screened. Buffalo-based dishes and antelope-based dishes were found to present the best amino acid profile and snake based dishes contained quite good quality of lipids. Some of these food products were found to contribute up to 80% of the daily energy requirement, and 95% of vitamins requirement for the local population. Taking it into account this, the maintenance of the use of these wild resources seems very important in the nutrition of these local populations. Unfortunately, these resources are available on the same spot where restrictions are applicable thus depriving local populations of a great part of their food resources. It is thus urgent to work out on a program of nutrition education intended to highlight nutritional value of these foods and exchange them by new foods which will consider local cultural authenticity.

## SII-6

### **BIODIVERSITY OF EDIBLE WILD PLANTS OF ARUNACHAL PRADESH AND USE IN MAINTAINING HEALTH AND NUTRITION**

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Keywords: wild fruits/vegetables, identification, biodiversity, survey, recipe contest, food composition

Objective: A study was started in Arunachal Pradesh in 2006 to identify new edible wild plants of value for nutritional analysis for cultivation potential and for inclusion in Indian food composition data bases. Methodology: This study was conducted in three districts of Arunachal Pradesh, Northeastern India, in remote locations where there is considerable dependence of people on wild fruits and vegetables.

Pre-tested semi quantitative food frequency questionnaires were used to explore specific additional uses of these food plants, such as medicinal value, cultural/religious importance and processing methods. Prior informed consent was the major backbone for creating awareness about intellectual property rights for indigenous traditional knowledge and for developing relationships of trust and faith. Recipe contests were organized and the participants brought cooked foods along with raw food samples for identification. Information on recipe methods was recorded, raw samples were photographed and herbarium specimens were prepared. Focus group discussions were held post-recipe contest to draw maps showing location and availability of different edible wild plants. Participants were asked to rate the ethnic foods based on their perceptions of nutritional value, energy value, cultural significance etc. in order to prioritize the selection of specific ethnic food(s) for analysis. Raw samples were collected in sufficient quantity for selected food from three-four locations in different seasons for composition analysis in laboratory. Findings: About 60 new vegetables/fruits were identified and taxonomy was carried out; information on recipes and special usage was also recorded. Analytical data for proximate and mineral composition was obtained for selected (fifteen) fruits and vegetables. Conclusion: There is a great wealth of biodiversity in this region with potential for further nutritional analysis, cultivation for human food use and inclusion in food composition databases for dietary surveys.

## SII-7

### **INDIGENOUS PEOPLES' FOOD SYSTEMS: A WEALTH OF KNOWLEDGE IN FOOD AND FOOD COMPOSITION**

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Indigenous Peoples' food systems are comprised of unique and diverse foods within a relatively small geographical area, including often hundreds of species and varieties of foods known within an ecosystem. Depending on the extent of influx of globalized foods into communities of Indigenous Peoples,

unique species and their patterns of preparation can still contribute large portions of dietary energy and nutrients. While research on nutrient composition as well as scientific identifications of all species and their varieties continue as work in progress, there are many fascinating data for reflection. Data gleaned from 12 regions of Indigenous Peoples in different parts of the world by members of the Task Force on Indigenous Peoples' Food Systems and Nutrition of the International Union of Nutritional Sciences highlight this wealth of knowledge. The

proportion of daily adult energy from local foods varied from 10% to a high of 98%, and the number of species within a community's traditional knowledge varied from 35 to 317, without considering numbers of varieties within species. Understanding cultural values of these foods, as well as their nutrient properties is at the heart of improving health using local food. Supported by the Canadian Institutes of Health Research, Institute of Aboriginal Peoples' Health and Institute of Nutrition, Metabolism and Diabetes.



## SESSION III - DATA QUALITY/ FOOD SAMPLING

### SIII-1

#### VALIDATION STUDY OF THE USDA'S DATA QUALITY EVALUATION SYSTEM

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**Introduction:** The Nutrient Data Laboratory (NDL) of USDA has conducted a validation study of the USDA Data Quality Evaluation System. The system evaluates the quality of analytical data by rating important documentation concerning the analytical method, analytical quality control, number of samples, sampling plan and sample handling. A "Quality Index" and "Confidence Code" are created for each nutrient and food. **Objectives:** 1) To measure the variability of ratings assigned by evaluators, 2) To test the robustness of the rating scale and 3) To assess the objectivity of the system categories. **Methods:** Fifteen individuals who participated in the International Postgraduate Course for Food Composition offered by EuroFIR in Slovakia evaluated a research article containing analytical data on catechin in black grapes. The various rating scores

assigned by the participants were analyzed to assess the success of above objectives. The maximum score for each category is 20. Results: Preliminary observations revealed the importance of documenting, procuring and handling of food samples as well as analytical methods. Reasonable consistency was observed if the pertinent information was provided as reflected in the ratings for sample handling (12-17 range) and sampling plan (11-16 range). The ratings for the analytical method category ranged from 6.7 to 10.7. The rating for the number of samples category was 14 by all the participants, as reported. The authors did not report conducting analytical quality control although they did use quality control material for the validation of the analytical method. Therefore analytical quality control ratings were zero by all the participants. **Conclusions:** Clear documentation by authors will reduce the variability in responses. Some questions in the Data Quality Evaluation System about critical issues will require additional refinement and/or specificity, e.g., the difference between the reference material and the analytical quality.

### SIII-2

#### EUROFIR APPROACH TO IMPROVE THE QUALITY OF FOOD DATA BANKS

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One of the key purposes of national Food Composition Databanks (FCDBs) in Europe is to provide data, in accordance with international standards, to assist national and multi-center studies investigating diet and health relationships and nutritional labelling information. As part of the EuroFIR (European Food Information Resource Network of Excellence) activities, the scientific validation and exploitation of food composition data will be ensured by the development of a quality framework. This abstract outlines the processes and procedures implemented during the initial development of this quality framework for national compilers and for laboratories generating new data. EuroFIR's strategic quality objectives are structured around laboratories, national compilers, databank systems and users/stakeholders. In order to implement quality principles, several practices and tools are being developed. Elements of a quality management system include criteria for quality control and quality assurance of the compilation process and computerized systems. It comprises several quality requirements such as data assessment systems for quality. The results and findings obtained so far for the proposed quality framework indicate that existing guidelines and standards for laboratories (including pre analytical and analytical stages) can be adapted to meet EuroFIR requirements. A major activity is to identify each step of the compilation process, its hazards and critical points in order to prepare Standard Operating Procedures (SOPs). Examples of SOPs are presented. Pilot testing, especially for the new tools to be developed, will also be an imperative step of the process. Plans for testing data quality assessment systems and compilation processes through some form of proficiency testing are underway. Furthermore, interactive training is considered as a keystone for the development, dissemination and improvement of quality criteria. The development of the EuroFIR quality policy through open and constructive discussions among compilers, laboratories and users strengthens the proposed quality principles and practices. This is fundamental to improve quality for the exchange of

data across Europe and beyond.

This work was completed on behalf of the EuroFIR consortium and funded under the EU 6th Framework Food Quality and Safety Programme.

### SIII-3

#### ESTABLISHING PROFICIENCY TESTING FOR LABORATORIES AND COMPILERS TO ASSESS DATA QUALITY FOR FOOD COMPOSITION DATABANKS AS PART OF EUROFIR PROJECT

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Keywords: EuroFIR, data quality, proficiency testing

Food composition databases (FCDBs) provide detailed information on nutritional composition of foods. The control of data quality to reduce overall variations on nutritional values is important. EuroFIR, the European Network of Excellence on FCDBs is a partnership between 46 universities, research institutes and small-to-medium sized enterprises. EuroFIR aims to develop a comprehensive and validated FCDB. Proficiency testing is an external analytical quality assurance (AQA) measure. Participation in proficiency testing or external AQA schemes is crucial to the independent assessment of laboratory performance. In 2006, EuroFIR set up proficiency tests to assess the data quality of laboratories supplying nutritional values to FCDBs. Six laboratories took part. The tests included: 1) Ash, moisture, nitrogen and dietary fibre in breadcrumbs. 2) Moisture, ash, total fat, nitrogen, sodium, chloride in cheese and pasta meal. 3) Calcium, phosphorus and zinc in canned meat. 4) Vitamin B2, vitamin B6, total niacin and folate in breakfast cereal. One laboratory obtained an unsatisfactory assessment for moisture in breadcrumbs and all other laboratories were satisfactory. The cheese and pasta meal proved problematic for one laboratory that received unsatisfactory results for moisture and nitrogen. One of the participants for nutritional elements in meat was unsatisfactory. The vitamins test presented most difficulties. Two laboratories did not return results and 2 laboratories obtained unsatisfactory z-scores.

Quality of FCDBs is needed to minimise errors associated with analytical and compilation processes. Proficiency tests for laboratories will therefore continue and a proficiency testing programme will be set up for the compilation process.

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### SIII-4

#### SAMPLING FOR BIODIVERSITY AND FOOD COMPOSITION STUDIES

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In response to the new international initiative on biodiversity for food and nutrition led by FAO and Biodiversity International (formerly the International Plant Genetic Resources Institute, IPGRI), the international food composition community has to place new tasks on its agenda. Explicit in the goals is systematically to generate, compile and assemble food composition data for wild foods, different plant cultivars and varieties, wildlife and domesticated breeds. For this task, sampling becomes a key consideration. Food composition studies have, in the past, been notorious for their lack of adequate detail about food identification and sampling, although improvements in quality have been seen in the last two decades due to the establishment of INFOODS, the International Food Data Conference series and the Journal of Food Composition and Analysis, which have toughened the criteria for published food composition data. However, taking on the field of biodiversity implies the whole Web of Life and requires interactions with specialists in areas such as taxonomy, molecular biology and genetics, ethnography, ecology (particularly feeding behaviour); and perspective shifts in sampling schema to represent ecosystems instead countries and regions. How can sampling frameworks best be drawn up? How are the relevant details best documented? Food composition teams may need to include specialist collaborators from these groups when planning and carrying out analytical programs. Given the need to incorporate principles of sustainability, there are ethical implications in carrying out such food composi-

tion studies on species that are rare and endangered, on the one hand, but necessary for survival, on the other hand, for humans or other species.

### SIII-5

#### THE MAGNITUDE OF SEASONAL, REGIONAL AND INDIVIDUAL EFFECTS ON CONTENTS OF CARROT AND SPINACH COMPONENTS AND ITS USE IN SAMPLE SIZE DETERMINATION

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A statistical basis is the key to designing sampling plans for a high-quality food composition database (Holden, 1994; Greenfield and Southgate, 2003). The committee for the Japanese Food Composition Table also recognized the importance of the sample being representative of items eaten by more than 1 billion Japanese people. Moreover, the sampling design is important given the limited resources for sampling and analysis. Our study seeks to reveal how composition varies by season, region and individuals and to design an efficient multi-stage sampling plan and evaluate its cost and precision. We collected 120 fresh carrots following an unbalanced four-level nested design. The levels are: four seasons, seven prefectures chosen throughout the Japanese archipelago using production statistics, two agricultural cooperatives and two farmers. We photographed the carrots and recorded their size, cultivation style, and cultivars. More than 10 cultivars were collected. The moisture, total sugar, and  $\alpha$  and  $\beta$ -carotene concentrations in the carrots were determined by the same laboratory that determined the original data for the current Japanese food composition table. The result was analyzed by applying a random effect model and demonstrated that, based on an average of four compositions, 24% of the total variation in carrot composition is attributable to the seasonal change, 46% to region, 24% to farmer, and 6% to individual. For spinach variations, these were 48% to season, 18% to region, 28% to farmer, and 5% to individual. Analytical variability was 1% for both vegetables. The proportions of variances differed among components. We simulated the precision of several sampling scenarios using the data and quantitatively demonstrate how



composite samples improve the representativeness of the data. Other findings are that the distributions of many compositions, especially total sugar, were highly skewed. The goodness-of-fit test indicated that the log-normal distribution approximates the

distribution better. Moisture content was an exception; however, the dry matter content fit the log-normal distribution well. This study is supported by the Ministry of Education, Culture, Sports, Science and Technology.



## SESSION IV - BIOACTIVE COMPOUNDS

### SIV-1

#### MICRO-CONSTITUENTS AND ANTIOXIDANT ACTIVITY OF THREE TROPICAL FRUITS

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Keywords: polyphenol, carotenoid, ORAC value, blackberry, tamarillo, naranjilla

Objectives: The aim of this study was to perform a fine chemical characterisation of three tropical fruits having a high nutritional potential. This work mainly focuses on the qualitative and quantitative analysis of phenolics and carotenoids. Determination of antioxidant capacity was also achieved. Material and methods: Fruits. Blackberry (*Rubus glaucus* from Ecuador and *Rubus adenotrichus* from Costa-Rica), tree tomato (*Cyphomandra betacea*) and Naranjilla (*Solanum quitoense* from Ecuador) were harvested at full ripe stage and immediately freeze dried and grounded. HPLC-DAD-MS analysis. For phenolics, a C-18 column was used with a gradient of acetonitrile in 2% formic acid. The HPLC apparatus was equipped with a diode array detector (DAD) and coupled to an ion trap mass spectrometer (ThermoFinnigan). For carotenoids, a C-30 column was used. The mobile phases were water, methanol and MTBE as

eluent. Quantifications of both phenolic and carotenoids were achieved using an Agilent 1100 system. Total phenolics. The total phenolic content was determined with an optimized Folin-Ciocalteu method (George et al., 2005). Absorbance measurements were made on a CE 7200 UV spectrophotometer at 760 nm. ORAC assays. ORAC assays were performed with a microplate spectrofluorimeter TECAN Infinite 200, in 96-well polypropylene plates. The excitation and emission wavelengths were 485 nm and 520 nm respectively. Results: Polyphenolic compounds were identified and quantified in the acetonic extracts of the edible part of fruits. Ellagitannins and anthocyanins were predominant in blackberries and phenolic composition can be used for distinguishing the two species. Similar composition was found in red and yellow tree tomato except for anthocyanins which were major in the red variety. Flavonoids and phenolic acids were detected in the naranjilla pulp. Carotenoids were analysed and vitamine A activity was calculated. ORAC values and total polyphenolic content were estimated and results were compared with published values in common fruits. Conclusions: The specific composition of three tropical fruits with highly antioxidant capacity has been established. The production of added value from these fruits will be carried out to access the European market. Support: This work was financially supported by the European Union (PAVUC project, INCO n° 015279).

## SIV-2

### ANTIOXIDANT CAPACITY AND COMPONENTS OF UNDERUTILISED MALAYSIAN FRUITS

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Malaysia is a one of the country that is full of underutilized fruits that are and commonly grown wild at the Peninsular Malaysia, Sabah and Sarawak. These underutilized fruits were reported to contain high amount of vitamins, minerals and dietary fiber. Some of these fruits grow wild and are rarely eaten, unknown and unfamiliar. Due to a broad spectrum of their flesh and skin colour, besides its potential benefits to human health; it is a must to include these fruits in health promotion campaign. In addition, some of these fruits have a potential to be commercialized and exported. However, these underutilized fruits have not generally received much attention as antioxidant sources compared to commercial fruits like guava, papaya and pineapple. However, this study aimed to evaluate the antioxidant capacity and components as value added information of these fruits that have been sparsely reported. Aqueous and organic solvents were used to extract components of more than 70 underutilized fruits, for examples *Mangifera* spp., *Nephelium* spp., *Bouea* spp., *Syzygium malaccense*, *Cynometra cauliflora*, *Pouteria caimito*, *Garcinia atroviridis*, *Canarium odontophyllum*, and other rare species for antioxidant capacity test according to the  $\beta$ -carotene bleaching and FRAP assay. Our findings showed that antioxidant capacity was higher for fruits that have high degree of sour and bitter taste, regardless of different solvents used. Aqueous extracts have higher antioxidant capacity compared to organic extracts. Carotenoids and water-soluble substances such as vitamin C, phenolic acids, flavonoids and other substances could contribute to the high antioxidant capacity of these fruits. Some of these fruits have extremely high content of total phenolic content. The high antioxidant properties of the studied indigenous fruits might be due to their phenolic components or other antioxidant components. This study indicated that some of these underutilized fruits have the potential to be promoted and used for health.

## SIV-3

### FOOD COMPOSITION TABLE: ANTIOXIDANT CAPACITY AND PHENOLIC CONTENT OF FRUIT, VEGETABLES AND COMMERCIAL FROZEN PULPS

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Keywords: flavonoids, anthocyanin, phenolic compound, antioxidant capacity

Several epidemiological and research studies suggest that a high intake of food rich in natural antioxidants increases the antioxidant capacity of the plasma and reduces the risk of some kinds of cancers, heart diseases, and stroke. These properties are attributed to a variety of constituents, including vitamins, minerals, fiber, and numerous phytochemicals, including phenolic compounds, such as phenolic acids and flavonoids. In this way, beyond the composition of the usual macronutrients and micronutrients, the antioxidant capacity of foods seems to be also important to inform. This information could help researchers in nutrition and the food industry to explore the potential of the foodstuff and then, contribute to the health. For this purpose, 27 samples, including fruits, vegetables, and commercial frozen pulps (FP) consumed in the Brazilian diet were analyzed for antioxidant capacities and phenolic compounds level. The antioxidant capacity of samples analyzed varied from 0,73 to 19,8  $\mu\text{mol}$  BHT equivalent/g (FW). The highest values were observed for wild mulberry (*Morus nigra*) (19,8  $\mu\text{mol}$  BHT equivalent/g), açaí (*Euterpea oleraceae*) FP (18,2  $\mu\text{mol}$  BHT equivalent/g) and watercress (*Nasturtium officin*) (9,6  $\mu\text{mol}$  BHT equivalent/g). In general, all anthocyanin-rich samples showed high antioxidant capacity as compared with samples without anthocyanins. The phenolic content varied from 0,45 to 3,28 mg galic acid equivalent/g (FW), and the highest content was obtained for açaí FP. It was observed a high correlation between antioxidant capacity and phenolic compounds for fruits ( $r=0,82$ ), but a low correlation was obtained for FP and vegetables, suggesting that the antioxidant activity is a result of a combination of different compounds having synergic and antagonistic effects. According to the results obtained, it appears that an important criteria for predicting a high antioxidant capacity of fruits and vegetables is their anthocyanin content.



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#### SIV-4

### ISOFLAVONES AND ANTIOXIDANT CAPACITY OF PERUVIAN (*Lupinus mutabilis* sweet) AND BRAZILIAN (*Lupinus albus* and *Lupinus angostifolius*) LUPIN CULTIVARS

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Keywords: *Lupinus mutabilis* sweet, *Lupinus albus*, *Lupinus angostifolius*, isoflavones, antioxidant capacity

The objective of this study was to determine the distribution and contents of isoflavones in seed coat, cotyledon and hypocotyls of different lupin cultivars and their relation with the antioxidant capacity. 6 Peruvian cultivars (*L. mutabilis* sweet) were provided by the Legume and Cereal Program of Agraria University (Peru) and 2 (*L. angostifolius* and *L. albus*) by the Agronomic Institute of Parana (Brazil). Seed coats, cotyledons and hypocotyls were manually removed and the fractions obtained were milled under refrigeration into flour (60 mesh). Identification and quantification of lupin isoflavones were achieved using analytical reverse phase HPLC coupled to a diode array detector, according to the method of Arabbi et al. (2004) with some modifications. A hydrolysis process was included for seed coat and hypocotyl samples. Antioxidant capacity was assayed by the DPPH method according to Brand-Williams et al. (1995). Genistein and a genistein derivative, probably mutabilein as was found by Dini et al. (1998), were detected in seed coat and cotyledons from Peruvian cultivars. Total isoflavones ranged from 9.8 to 87, 16.1 - 30.8 and 1.3 - 6.1 mg/100 g of sample in fresh weigh (FW) (expressed as genistein) in seed coat, cotyledon and hypocotyl fractions, respectively. No isoflavones were detected in *L. angostifolius* and *L. albus* cultivars. A significant correlation ( $r = 0.99$ ) was found between the total isoflavone levels and the antioxidant capacity in all fractions of the Peruvian samples. The H-6 cultivar is promising due to its high isoflavone content and antioxidant capacity. These results provide evidence that cultivars from the same spe-

cies have similar isoflavone profiles and the total isoflavone contents contributes significantly to the antioxidant capacity.

This research was supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

#### SIV-5

### WINE AND GRAPE JUICE BY-PRODUCTS AS A SOURCE OF FUNCTIONAL COMPOUNDS: SENSORY EVALUATION OF GRAPE POMACE SORBET

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Keywords: grape by-products, red wine, grape juice, antioxidant polyphenols, fiber, sorbet

By-products of plant food processing represent a major disposal problem for the industry. The most important by-product of grape crop is grape pomace (GP), which amounts over 9 million tons per year. On the other hand, GP is a good source of bioactive compounds, like polyphenols and fiber, which are known as preventive agents against noncommunicable diseases. Therefore, GP can be considered a cheap source of high value ingredients, and its use can also reduce the environmental impact. Objective: To evaluate the GP of two different grape varieties as a potential ingredient to elaborate some food products. Material and methods: Red GP (skin and seeds) were supplied by a winery and a fruit juice company, providing Cabernet Sauvignon and Izabel grape varieties, respectively. To obtain the pomace flour, the samples were freeze-dried, milled and sifted. The composition of both flours was determined according the AOAC methods, and the sorbets were elaborated in a pilot plant. Grape pomace juice sorbet (GPJS) and grape pomace wine sorbet (GPWS) were submitted to a 45-member sensory panel to assess the attributes of color, texture, flavor and overall acceptance (OA), according to a 9-point hedonic scale. Results: Mean values of both flours composition were: moisture 6.4%, protein 9.2%, ashes 2.5%, fat 5.9%, non-fiber

carbohydrate 11.9%, and dietary fiber 64.1%. Total phenolics (as Gallic Acid Equivalent) were 0.2 and 0.4 mg/g for grape pomace wine and grape pomace juice flour, respectively. With regard to sensory evaluation, both formulations were well accepted, even though GPJS presented better results. The values within a range from 6 to 9 were considered as approved. Thus, the OA means for GPJS and GPWS were  $7.1 \pm 1.8$  and  $6.1 \pm 1.9$  (mean  $\pm$  SD), respectively. Concerning the other attributes, 84% for GPJS and 60% for GPWS were in the approved range. Conclusion: It is possible to use GP as an ingredient to make high phenolics and fiber sorbet with acceptable sensory attributes. Support: FAPESP and CNPq. Acknowledgements: Vinícola Miolo Ltda, Produtos Alimentícios Superbom Ind e Com Ltda, Food Intelligence Consultoria Técnica em Alimentos Ltda.

#### SIV-6

### COMPARATIVE STUDY ON PHYTOCHEMICAL COMPOUNDS IN BRAZILIAN RICE (*Oryza sativa*, L.)

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Keywords: *Oryza sativa* L., rice varieties, gamma-oryzanol, vitamin E homologs, phenolic compounds

There are multiple links between biodiversity, food, nutrition and human health. This study was conducted to evaluate in different rice varieties, belonging to *indica* and *japonica* subspecies, the concentration of phenolic compounds, gamma-oryzanol and vitamin E homologs, which have been reported to be beneficial on human health. Encouraging individuals to increase the regular consumption of brown rice, which still presents about 10% remaining bran, could result in health-promoting effects. Twenty-one samples of commercial as well as prototype strains of brown rice (*Oryza sativa* L.) including six samples of red rice and one sample of black rice were obtained from Agronomic Institutes in Brazil. The systematic assessment of eventual disparity of these compounds together with valuable agronomic characteristics would contribute with strategies to decide for genetic breeding of promising phytochemical-rich rice genotypes.

Gamma-oryzanol and vitamin E were extracted by isopropanol and hexane, respectively and quantified by HPLC-UV and fluorescence detection. Soluble phenolics were extracted with ethanol 80% and quantified espectrophotometrically by the Folin-Ciocalteu method. Insoluble bound phenolics were released by alkaline hydrolysis and quantified in a similar manner. Averaged values across all samples evidenced different levels and combinations of total phenolics, gamma-oryzanol and vitamin E homologs. Black rice presented the highest amounts of gamma-oryzanol (425.7 mg/kg dry wt) followed by mean values of 267.4 and 223.2 mg/kg dry wt corresponding to *japonica* and *indica* rice samples. Similar mean differences between *japonica* and *indica* cultivars were also observed for total vitamin E contents. *Japonica* and *indica* non-pigmented samples were not distinguishable from each other by their total phenolic contents (mean value 5.3  $\mu$ moles equivalents of ferulic acid /g dry wt) but it was observed that pigmented cultivars had until 4.4 times more total phenolics, mainly due to their significant higher levels of soluble phenolic compounds. More studies are stimulated since only limited efforts have been made to identify available sources and biodiversity within rice, even though it is well recognized that different varieties show different nutrient and non-nutrient composition.

Acknowledgments: We wish to thank the Agronomic Institutes (Epagri S/A and IRGA) for providing rice samples, CNPq and Fapesp for financial support and individual research fellowships.



## **SESSION V - FOOD COMPOSITION DATABASE: COMPILATION AND NEW FEATURES**

### **SV-1**

#### **THE EUROFIR PROJECT - LINKING EUROPEAN FOOD COMPOSITION DATABASES USING THE LANGUAL FOOD DESCRIPTION THESAURUS**

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Keywords: food description, food composition, data-  
base, internet, XML

Objective: The EuroFIR (European Food Information Resource Network) project will provide a validated European food composition databank system. LanguaL is used to link the European databases together. Material and methods: LanguaL, "Langua alimentaria" or "language of food", is a multilingual, faceted thesaurus for describing foods. Thesaurus information is used in EuroFIR to link together food composition data sets. Potentially, 27 national food composition databases and some 10-15 European or international specialized datasets are available. Results: Presently, some 20 national databases have been indexed using LanguaL. For the data interchange, an XML template, the EuroFIR Food Transport Package, has been developed. As a prototype, the online LanguaL search facility can be used to look up food information in LanguaL indexed food composition databases in Europe and USA with online links into the Internet based food composition databases. The use of an XML (eXtensible Markup Language) template is used to demonstrate how to offer specific information to the users in a standard data interchange format. Significance: Food composition data have over the most recent years been introduced by national authorities and private enterprises on the Internet - in Europe, 15 food composition databases are presently Internet-based.

Their presentations cover a wide range of technical solutions and the layouts are of very diverse appearance. For the user, the EuroFIR approach provides a standardized presentation of validated data. The EuroFIR project and the LanguaL based search system demonstrates the benefits of using standardized systems for linking food composition data from all over the world. Disclosure: The EuroFIR Network of Excellence (FOOD-CT-2005-513944) is funded under the EU 6th Framework Food Quality and Safety Programme.

### **SV-2**

#### **DEVELOPMENT OF A FOOD COMPOSITION AND BIOLOGICAL EFFECTS DATABASE FOR PLANT-BASED BIOACTIVE COMPOUNDS**

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Keywords: food composition database, bioactive com-  
pounds, biological effects

Objectives: Bioactive compounds are food constituents that are not classified as nutrients but have putative health-promoting effects. Mounting evidence suggests that bioactive compounds may help to promote optimal human health and may help to reduce the risk of chronic disease, such as cancer, cardiovascular disease and osteoporosis. Currently in Europe, food composition databases of individual bioactive compound classes exist, but there is no database that encompasses multiple compound classes. As part of the European Food Information Resource Network (EuroFIR), funded under the EU 6th Framework Pro-

gramme, this project aims to develop an internet-deployed food composition database that comprises multiple plant-based bioactive compound classes and includes critically evaluated published data on the biological effects of those compounds. Material and methods: Data on the food composition and biological effects of plant-based bioactive compounds have been gathered from published literature in peer-reviewed journals. Food composition information obtained includes the plant source and origin, plant processing, sampling techniques and bioactive compound composition. Biological effects data obtained include plant source and origin, plant processing, compound purity, experimental design, methodology and experimental outcome. Using established criteria, literature has been quality-assessed and data submitted via an electronic online input form. Results: An internet-deployed food composition and biological effects database for plant-based bioactive compounds has been developed. The database currently covers 19 compound classes, 380 compounds and approximately 300 plant foods, with data sourced from quality-assessed, peer-reviewed literature. Conclusions: The internet-deployed database will aid the quantification of dietary intake of bioactive compounds and will provide information for researchers, food consumption database managers, food regulatory and risk assessment authorities and product developers within the food industry. The system has been designed to accommodate ongoing development and growth to ensure that its content remains abreast of current research.

Support: This work was prepared on behalf of the EuroFIR consortium and funded under the EU 6th Framework Food Quality and Safety Programme (Project Contract No: FOOD-CT-2005-513944).

### SV-3

#### **HARMONISATION OF RECIPE CALCULATION PROCEDURES IN EUROPEAN FOOD COMPOSITION DATABASES**

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Keywords: food composition database, recipe calculation, yield factor, retention factor

Objective: To specify a standard recipe calculation procedure for European food composition databases. This project is a part of EuroFIR, which is the world-leading European Network of Excellence on Food Composition Databank systems. Material and methods: The project reviewed the most commonly used recipe calculation procedures. In addition, selected examples of recipe calculation procedures used by EuroFIR partners (n=7) was reviewed. Based on this information, the standard recipe calculation procedure will be established. This work was done in collaboration with EuroFIR work package 1.8, which is also responsible for collecting nutrient loss and gain factors including nutrient retention and weight yield factors for fat and water. Results: The review of recipe calculation procedures showed that there are currently a number of different ways to calculate recipes. The EuroFIR proposal for harmonized recipe calculation procedures will be established in spring 2007. This harmonized recipe calculation procedure will take into account both weight changes during preparation (yield factors), and nutrient specific estimates for losses (retention factors). The project has further shown that the need for training expands beyond compilers of food composition information and could create a new platform for co-operation with e.g. small- and medium-sized companies (SME), who utilize recipe calculation for labeling purposes, or software developers, who implement such procedures in their commercial programmes. Conclusions: In conclusion, it is important to achieve common understanding on recipe calculation procedures and establish a standard recipe calculation procedure. Training of compilers, SMEs and other important users of food composition data on recipe calculation is needed. Trained compilers and documented calculation procedures are also a crucial part of high quality management of food composition databases.

Support: This work was completed on behalf of the EuroFIR consortium and funded under the EU 6th Framework Food Quality and Safety Programme. Project contract No: FOOD-CT-2005-513944.

### SV-4

#### **NEW DATA FOR TRADITIONAL FOODS IN EUROPE, PRIORITISATION, COLLECTION AND ANALYSIS**

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A key objective of EuroFIR ([www.eurofir.net](http://www.eurofir.net)), the world-leading European Network of Excellence on Food Composition Databank Systems, is to provide data on the nutritional composition of traditional foods for inclusion in national food composition tables with representative raw ingredients and recipes. Traditional foods include foods that have been consumed locally or regionally for a long time and the methods of preparation of such foods have been passed from generation to generation. As such, there is little information about the nutrient composition of these foods. In this study, 13 European countries selected 5 different traditional foods or primary products per country to be analysed. To achieve this, a EuroFIR consensus based method with standardised procedures was applied for the systematic study of traditional foods or recipes. The method included applying the EuroFIR definition of the term "traditional" to elaborate a list of traditional foods and to provide an historical and folkloric review to document the traditional identity of foods. Then, a prioritised list of traditional foods per country was elaborated based on the following specific selection criteria: documentation of traditional character; food consumption data; composition data; positive health effects and marketing potential. From the prioritised list, the 5 traditional foods to be analysed per country were finally selected to represent a full meal course. A protocol with guidelines for recipe recording and sampling of the selected traditional foods has been developed to establish a common approach for all countries. Chemical analyses to determine the nutrient value of each food will be performed. The laboratories to perform these analyses have been selected according to quality requirements. This work will contribute to expanding the knowledge of traditional foods across Europe, as there are many cultures within Europe, each with their own distinct dietary habits. Data on the nutritional composition of traditional foods will also be an outcome and we hope to continue to raise awareness of the positive health effects of traditional foods and increase interest among food manufacturers.

**Acknowledgements:** This work was completed on behalf of the EuroFIR Consortium and funded under the EU FP6 'Food Quality and Safety Programme' (Contract no FP6-513944). The authors would like to thank EuroFIR traditional foods workpackage partners.

## SV-5

### IMPORTANCE OF INCORPORATING FORTIFIED FOODS INTO FOOD COMPOSITION DATABASES

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**Keywords:** fortified foods, food composition database, Ireland

**Objective:** To demonstrate the importance of incorporating fortified foods into food composition databases to obtain accurate estimates of prevalence of inadequate intakes and risk of excess intakes of micronutrients in Irish children. **Material and methods:** Analysis is based on the Irish National Children's Food Survey (NCFS) (2003-2004) (n=293 boys, 301 girls, aged 5 to 12 years) which measured food consumption (including branded products) using a 7 d weighed food diary. Analysis of dietary intake data was carried out using the UK Composition of Foods database, supplemented with Irish food composition data. Foods that were voluntarily fortified by manufacturers (FF) were identified from the presence of one or more micronutrients in the ingredient list. New FF was assigned new food codes with corresponding nutrient composition data from manufacturers. **Results:** Of the 1945 foods consumed in the NCFS, 189 (9.7%) were voluntarily fortified. Over half of all FF were breakfast cereals. Only 15% (n=29) of the 189 FF consumed were contained in the UK Composition of Foods database. Almost 85% (n=160) of the 189 FF, were assigned new food codes and added to the food composition database. In FF consumers (98%), mean % energy from FF was 9%. By incorporating FF into the food composition database, the accuracy of estimates of the prevalence of inadequate intakes (e.g. Fe: 40%, Ca: 32% & folate: 28%) and risk of excess intakes of micronutrients in Irish children were improved. The 95th percentile (P95) of intake of vitamins B6 and D, as a % of the tolerable upper intake level (UL), were 34% and 25%, respectively. **Conclusions:** In a country like Ireland where, similar to the UK and the US, liberal voluntary fortification practices have been permitted for many years, it is essential that the food composition database on which dietary intake data is based can incorporate new FF and that the nutrient composition of these foods is regularly monitored and updated to reflect changing levels of micronutrients in FF.

**Support:** This project was funded by the Irish Govern-

ment under the National Development Plan 2000-2006. EUROFIR, funded under the EU FP6 Food

Quality and Safety Programme (Contract no. FP6-513944), is supporting attendance at this conference.



## **SESSION VI - FOOD COMPOSITION DATABASE: APPLICATIONS AND SUSTAINABILITY**

### **SVI-1**

#### **NUBEL FOOD PLANNER**

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Keywords: online food database, linking databases, interfaces for current database uses, use of data by industry and other stakeholders

The Nubel food planner is a software programme based on the food composition database to calculate the nutrient intake of different user-groups. The software is for the moment translated in 2 languages but it can be converted in any language. Every day you can find a tip of the day on the screen. That gives you the possibility to inform the users about a healthy lifestyle, well-balanced nutrition, physical activity, how to use a food composition database. This programme is developed for the use in schools to calculate the nutritional intake and to motivate the students to do some physical activity. It is very important that the population and in particular the children have a stable energy-balance. EuroFIR wants to develop tools on nutrition for several user groups. EuroFIR wants to identify stakeholders and users for the internet-based food composition databank systems and disseminate this information in Europe and beyond by using existing concepts. Nubel offers that possibility.

### **SVI-2**

#### **SUSTAINING NATIONAL FOOD DATABASES - DEVELOPING PARTNERSHIPS WITH KEY USERS AND STAKEHOLDERS - SPECIAL REFERENCE TO THE GERMAN NUTRIENT DATABASE COOPERATION PLATFORM**

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Keywords: cooperation platform, food composition database, data management system, key users and stakeholders, sustainability

Objective: To delineate the design of the Cooperation Platform of the German Nutrient Database (BLS) and its use by key stakeholders, such as the German food industry, private laboratories and partner research institutions in Germany and other EuroFIR partner countries. Issues concerning data transfer, nutrient calculation and documentation taking place within this platform will be presented. Material and methods: The Cooperation Platform is the central software used to generate the BLS, which comprises analytical data as well as nutrient retention factors, weight yield factors and portion sizes. Each nutrient value is combined with all required information for corresponding documentation (metadata), including its



origin and record of changes. Furthermore, this Cooperation Platform provides the basic component for the BLS network, associating partners with the aim to develop the national and international food composition data pool for the BLS. Results: At present, the national BLS network consists of federal institutes, state departments of food control and analysis, university units, research facilities and private laboratories. The German food industry is also part of this network and will supply the database with nutritional information about industrially processed foods. Data transfer is voluntary, and confidential. Therefore, utilization of the Cooperation Platform requires the use of a particular password-protected area. Furthermore, European compilers have been invited to use this Cooperation Platform to generate nutrient data for their own databases. Conclusions: The BLS team has developed a technical solution to improve the generation and documentation of national nutrient data. Key users and stakeholders play an important role in data generation, because they are also part of the BLS network and can provide their own data via the Cooperation Platform. At the same time, partners are able to understand factors influencing data generation, thus ensuring data transparency. This represents an important data-input and feedback system for the update and improvement of the German Nutrient Database.

Support: The presentation of this work is supported by the EuroFIR consortium and funded under the EU 6th Framework Food Quality and Safety Programme. Project contract No: FOOD-CT-2005-513944.

### SVI-3

#### USING MOBILE PHONES TO BRIDGE THE GAP BETWEEN FOOD COMPOSITION DATA AND THE CONSUMER - THE BATOO TOOLKIT

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Keywords: food data, consumer information, mobile phones, barcode recognition

Objective: Many information resources containing data related to food products are available today, such as commercial product databases like SINFOS

(<http://www.sinfos.com>) or an increasing amount of free databases like WikiFood (<http://www.wikifood.ch>) or Codecheck (<http://www.codecheck.ch>). The information accessible by these resources is often more extensive as the food composition data printed on the product package itself (e.g. information on the content of allergens, genetically modified ingredients or consumer comments), representing an added value to the consumers. Even though such data might be highly relevant for some user groups, the access to this information is not readily granted. The aim of this work was to develop a tool that allows an easy, unbiased and fast access to this information when it matters most, e.g. when one is standing in the supermarket and deciding what to buy. Material and methods: Recent advances in mobile phone technology allowed us to address this issue and to close the gap between food information and the consumer. We have developed a free software, the Barcode Recognition Toolkit BaToo (<http://people.inf.ethz.ch/adelmanr/batoo/>), that enables a fast and simple recognition of the EAN13 barcodes printed on virtually all retail products, using standard mobile phones. The recognition is performed with the mobile phone's built-in-camera, eliminating the need to use additional hardware like a laser scanner. Once recognized, a product's world wide unique EAN13 code can be used to access additional information over the mobile phone network. Results and Conclusion: The developed software allows consumers to get direct access to a product's information provided by different organizations or databases, anywhere, anytime. Already implemented prototypical applications foster our believe that camera-equipped mobile phones may become a valuable tool in assisting the consumers with their everyday food choices.

### SVI-4

#### COMPUTER-BASED DIETARY MENU PLANNING

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Keywords: menu planning, evolutionary optimization, linear programming, web-based application

Dietary menu planning may be defined as an optimization problem which goal, or objective, is to maximize the number of various seasonal foods and



minimize the cost as well as the deviations from uniformly distributed aesthetic standards for taste, consistency, color, temperature, shape, and method of preparation. In addition, there are many nutritional and gastronomic guidelines and recommendations, or constraints, that must be met. Some of the objectives and the constraints may conflict with others making the problem even more intractable. In this paper, we introduce a multi-objective evolutionary algorithm for computer-based multi-level menu planning that quickly finds a diverse set of feasible solutions - i.e., nutritionally and gastronomically adequate menus - with the lowest objective function values without examining all possibilities. We applied this algorithm within a Web-based application for personalized menu planning that is aimed for feeding specialists and nutritionists in Slovene schools and kindergartens as well as hospitals. The application is built upon data about nutrients and non-nutrients from several food composition databases and tables, such as Souci-Fachmann-Kraut, Slovene and USDA. By default it respects the D-A-CH reference values of the German Nutrition Society and the Nutrition Societies of Austria and Switzerland. However, a user can redefine her/his own reference values. We have used the algorithm to optimize nutrition for special conditions and dietary needs (i.e., for patients in hospitals and sportsmen). The algorithm proved to be a simple and efficient method for solving the menu planning problem. In the future, we wish to extend the food composition database with data about food additives, toxins, etc., enabling the algorithm to deal also with these relevant parameters. The work has been supported by the Ministry of Health of the Republic Slovenia and the CINDI Slovenia, which is part of the World Health Organization's Regional Office for Europe.

#### SVI-5

### TRAINING IN FOOD COMPOSITION: A SELF-GUIDED STUDY WORKBOOK

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Training courses on the production and use of food composition data in nutrition have been ongoing since 1992 in Wageningen, the Netherlands, and in other parts of the world. These courses are very important in the dissemination of knowledge and

to create networks of experts in this area. Over the years, the need for a web based training tool has been expressed. In response, FAO and INFOODS have prepared a self-guided study work book. It treats the main issues of food composition and could be used in training courses or independently to improve the knowledge on food composition. It is based on the Greenfield and Southgate book on 'Food composition data - production, management and use', FAO/INFOODS manuals, and other publications and electronic resources. It is constructed as different modules such as principles of food composition programmes, users, foods, components, sampling, analytical methods, compilation, data quality, documentation, interchange and biodiversity. Every module is structured as follows: (1) stating the learning objectives, (2) required reading, (3) questions, (4) answers with scores, (5) exercises, (6) model answers with scores, and (7) general feedback using the self rated scores. The work book is intended primarily for professionals working with food composition data, students in nutrition and dietetics, and any others who wish to upgrade their knowledge in the field of food composition. It would not, however, replace the ongoing food composition courses as they provide deeper learning opportunities and practice.

#### SVI-6

### UNDERSTANDING NATURAL VARIABILITY IN CROP COMPOSITION UTILIZING ILSI CROP COMPOSITION DATABASE ([www.cropcomposition.org](http://www.cropcomposition.org))

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Objective: To understand the natural variability in crop composition utilizing the capabilities of the ILSI crop composition database. Materials and methods: The ILSI database ([www.cropcomposition.org](http://www.cropcomposition.org)) is a compilation of data on the nutrients, anti-nutrients, and secondary metabolites for conventional maize, soybean and cottonseed samples obtained from controlled field trials in multiple worldwide locations covering the years 1995 and 1997-2004. The development and application of the database has been described

in the Journal of Food Composition and Analysis, 17, 423-438 (2004). Inclusion criteria require that samples are analyzed using validated analytical methods and that each data point is associated with an analytical method. Results: Version 3.0 of the database, released in April 2006, contains approximately 118,000 data points that may be searched based upon user-selected queries. Data can be retrieved according to the year of production, the geographic region in which the crop was grown, the tissue sample of interest or the method utilized and expressed on a fresh or dry weight basis. Many factors are known to affect nutrient composition, including the germplasm of the crop, soil conditions, weather conditions and other environmental variables. The scope of the data in the database permits the user to assess this variability due to the interaction between plant genetics and environmental factors. Data is provided in summary

format with minimum and maximum values, mean value and total data points contributing to the summary. In addition, individual data points are provided at the request of the user. Conclusions: The database complements existing food and nutrient databases, such as the USDA Nutrient Database and FAO's IN-FOODS database and has proven to be an important tool for research and regulatory scientists in many areas such as plant biology, food science and animal nutrition. The database was referenced by the European Food Standards Authority (EFSA) in its journal (EFSA Journal [2004] 99, 1-93) as an important tool for the safety assessment of genetically modified food and feed, and serves as a baseline for the development of nutritionally enhanced crops. Support: The database was developed by an ILSI Task Force composed of representatives from six agricultural biotechnology companies.



## SESSION VII - NATIONAL DATABASES

### SVII-1

#### USDA'S NUTRIENT DATABANK SYSTEM - A TOOL FOR HANDLING DATA FROM DIVERSE SOURCES

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This talk describes key features of USDA's Nutrient Databank System (NDBS), which allows processing of data from diverse sources, including USDA's National Food and Nutrient Analysis Program, food industry, scientific literature, and food labels. NDLS designed the NDBS as a 3-tiered data management system (Initial, Aggregation, and Compiled) with modules to facilitate handling of data. Raw data and documentation

(data source, sample description, sample handling, and analytical methods) are migrated into "Initial". NDLS scientists compare new data with old and decide how to combine "Initial" data in "Aggregation". Data can be grouped and weighted by parameters such as study, source, and market share. Depending on the type of data, various statistical algorithms generate statistics, such as: mean, standard error, number of data points, and error bounds. At the "Compiled" step, food names are finalized and common measures selected. Full nutrient profiles and missing components are imputed according to scientific principles from similar foods or by using the formulation module, which employs standardized procedures and existing data for limited nutrients and ingredient lists to estimate formulations and full nutrient pro-

files. A recipe module allows calculation of nutrient profiles based on ingredients and their proportions. The NDBS automatically documents how each value was derived and incorporates quality control checks at all levels. Prior to release, the completed nutrient profiles are sent for review. Finally, the data are disseminated. The NDBS brings together a number of standalone applications into one integrated system allowing the management of ~7,300 food items for up to 140 nutrients/food components. Data points and documentation are managed and maintained in one place providing an “audit trail” for each data point. The NDBS contains modules to assign confidence codes using NDL’s expert system. The NDBS permits the annual release of reliable, current data for a comprehensive suite of components for a wide variety of foods on NDL’s web site: <http://www.ars.usda.gov/nutrientdata>. Nutrient data is provided for the “What We Eat in America” component of the National Food and Nutrition Examination Survey (NHANES) and other food surveys. Through these releases, NDL provides critical data for researchers, diet and health professionals, and consumers.

## SVII-2

### **BUILDING A PORTUGUESE FOOD COMPOSITION NETWORK**

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Keywords: food composition, network, maximizing resources, spreading of excellence

Introduction: INSA is a partner in EuroFIR (European Food Information Resource) the European Network of Excellence on Food Composition Databank Systems, which aims to develop and integrate a comprehensive, coherent and validated databank, providing a single, authoritative source of food composition (FC) data in Europe. The European Databank will be built and maintained by National compilers of authoritative FC datasets. In Portugal all existing Food Composition Tables have been published by INSA/CSAN, the last one in May 2006. FC Data production and management involves the co-operation of Laboratories, Compilers and Users. Although INSA’s activities

encompass all these areas and INSA has traditionally produced food composition datasets mainly for national food consumption survey (also its responsibility), it decided to broaden the range of users by making available fit-for-purpose products. Being aware of the scarcity of resources, INSA launched the beginnings of a National network on FC in order to contribute to the European goal. Objectives: To build a National network on food composition data including users and stakeholders, food composition data producers and regional authorities on agriculture and health for maximizing resources (knowledge, financial, human, equipment...), spreading of excellence and amplifying national capability. Material and methods: At the official launch of the new Portuguese Food Composition Table, all participants (health professionals, food industry, etc) were invited to become involved and a questionnaire was distributed to identify their areas of activity. A list of Portuguese food companies associations and organisations concerned with patient support was compiled, and all list members were contacted by e-mail with information about the network and an invitation to participate. Results: 141 questionnaires were distributed or sent but only 129 reached the target due to e-mail problems. The percentage of response was 47% with 100% of adherence to the network. Members’ activity areas are as follows: production (19); trade and distribution, mainly catering (10); clinical nutrition and consumers associations (20); communication (5); regulation (3); research (21) and education (24).

Support: This work was completed on behalf of the EuroFIR Consortium and funded under the EU 6th Framework Food Quality and Safety Programme (FOOD-CT-2005-513944).

## SVII-3

### **DEVELOPMENT, COMPILATION AND USE OF IRANIAN FOOD COMPOSITION TABLES**

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Assessment of nutritional value of dietary pattern at the national level is critical for food policy. Therefore, food composition tables are important tools having wide application in both clinical and

public practice. The food composition tables (FCT) commonly used in Iran were published in 1975, and because of limited recourses to undertake detailed chemical analysis for building nutrient data bank, errors are expected in the Iranian FCT. This study was conducted to modify the aforementioned Iranian FCT by replacing older and missing values with new ones obtained from different nutrient databanks. Seven hundred commonly consumed foods were chosen on the basis of the "national comprehensive study on household food consumption pattern and nutritional status IR Iran, 2001-2003". Twenty eight nutrients were included (such as proximate composition, minerals and vitamins). USDA nutrient data bank; the composition of foods (MacCance and Widdowson's) and Australian FCT were used. In addition, recipe for common mixed dishes were calculated. In addition, the nutrient content of mixed dishes was estimated based on the nutrient content of their ingredients. Also, to validate the final food composition tables; fifty commonly consumed foods were chosen and the nutrient content determined by direct methods. In the previous tables values for 224 food items were reported and no data on dietary fiber, or vital minerals such as zinc, or other vitamins were available. Differences in estimated dietary intakes were found for iron when different values were used. The estimated iron intake based on newer values is 15mg whereas based on previous data the average intake of iron was 31mg. The generated nutrient database can be used for nutrition and clinical research, food trade and agriculture policies.

#### SVII-4

### FOOD COMPOSITION TABLES FOR SOUTH AFRICA - A DEVELOPING COUNTRY PERSPECTIVE

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Keywords: food composition, challenges, developing country

The objective of this presentation is to discuss food composition tables for South Africa from a developing country perspective. The first and second editions of the Food Composition Tables for South

Africa were published by the Medical Research Council (MRC) in 1981 and 1986, respectively. Since 1991 the third edition of the MRC Food Composition Tables has been the main reference source of food composition, used by nutrition professionals and the food industry in South Africa. New food composition data on South African foods became available through the efforts of the South African Food Composition Data Committee (SAFCoD) and with financial assistance from the Department of Health and the meat industry. This resulted in the publication of two Supplements viz., Composition of South African Foods: Vegetables and Fruit (1998) and Composition of South African Foods: Milk & milk products, Eggs, Meat & meat products (1999). A special effort was made to include more information on indigenous and traditional foods in the Supplement on vegetables and fruit. The need arose to combine the information in the 1991 Food Composition Tables with that in the two Supplements, resulting in the Condensed Food Composition Tables for South Africa (2007). Many challenges were faced when combining the information from the different publications, e.g. changes in food codes and different methodologies used for the analysis of nutrients. The new format of the printed tables will simplify the updating and distribution of food composition data to the nutrition fraternity in South Africa. Limitations such as shortages of money and staff, inadequate infrastructure and the lack of skilled staff often make it difficult for developing countries to provide country-specific data on a regular basis. A country-specific food composition database is also a goal for developing countries, but there are limiting factors that impact on the process.

#### SVII-5

### DEVELOPMENT OF SICA-COR, A FOOD COMPOSITION INFORMATION SYSTEM FOR COSTA RICA

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Keywords: food composition, LATINFOODS, COSTA RICAFOODS, information system

SICA-COR is the Costa Rican food composition infor-

mation system developed to attend the increased demand of local food information by health workers and decision makers, consumers, food industry among others. It is an informatic solution that allows to update and manage the information in a more versatile, cheaper and accessible way than conventional food composition tables. Since this system could be also useful for data exchange among countries, the purpose of this work is to present the development and current state of the SICA-COR. Main steps in the system development included: (a) identification of needs, sources and type of information available; (b) information capture and quality; (c) software development; (d) establishment of the data base. The software was developed using Microsoft SQL Server database engine and a Java application. At present, SICA-COR has a validated, LATINFOODS compatible information capture form, including detailed description of the data source, food name and characteristics, data quality parameters and the possibility of recording at least 80 different nutritional components presented as 100g/food. Of 1200 completed compilation forms with information from scientific publications, reports from a public food regulation laboratory and from the industry, 83% fulfilled LATINFOODS standards, to be incorporated to the data base. Most of the information refers to proximal composition. Software pre-designed reports are available for specific and general end users, such as the LATINFOODS Regional Center, decision-makers and consumers. The current SICA-COR version (0.9) is a standalone application intended to eventually evolve to a web application. Specific actions to test and improve the software are underway.

This work was supported by: INCIENSA, ITCR, CONICIT, LATINFOODS.

## SVII-6

### TBCA-USP/ BRASILFOODS: CARBOHYDRATE DATABASE

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Foods containing unavailable carbohydrates or dietary fiber are very important for the prevention of non-transmissible chronic diseases (NTCD), not only because they have low energy value but also because

of their benefic effects for health provided by the products of their fermentation in the colon. On the other hand, foods that are sources of available carbohydrates present higher energy value and, generally, provide a high increase of post-prandial glycemic response. Some biomarkers, such as glycemic index (GI) and glycemic load (GL), classify the carbohydrates according to their capacity of increasing blood glucose. Knowing the low GI and low GL foods and meals may be important in order to use them for preventing and controlling NTCD. Food composition tables in Brazil do not provide data about different fractions of carbohydrates (individually analyzed), although this information is very important in functional foods and for health. At the same time, a lot of quality data is not being published or is decentralized and disperse in scientific publications. The Brazilian Food Composition Database - TBCA-USP/BRASILFOODS, which has been presenting quality data about Brazilian food chemical composition since 1998, aims also to amplify and divulge information about carbohydrates. Therefore, a database with information about the concentration of the different carbohydrates of foods and the glycemic response produced after the ingestion of these carbohydrate sources is being created. The GI and GL of foods are being evaluated in healthy individuals, following the protocol proposed by FAO. Food concentrations of available carbohydrates (soluble sugars and available starch), total and resistant starch, dietary fiber, fructans and indigestible fraction are being quantified by official methods. At the same time, other national data from publications and from the different food laboratories of University of Sao Paulo are being compiled. Aiming to improve data interchange, the INFOODS tagnames were adopted and the form elaborated by BRASILFOODS for carbohydrates compilation was updated. The TBCA-USP/ BRASILFOODS ([www.fcf.usp.br/tabela](http://www.fcf.usp.br/tabela)) is an important database used by professionals and the population and it will be offering additional information, not only chemical but also biological, about carbohydrates.

Keywords: available carbohydrates, unavailable carbohydrates, dietary fiber, fructans, prebiotics, glycemic response, TBCA-USP database.



## SESSION VIII - ANALYTICAL METHODS

### SVIII-1

#### DEVELOPMENT OF RICE REFERENCE MATERIALS AND THEIR USE FOR EVALUATION OF ANALYTICAL PERFORMANCE OF FOOD ANALYSIS LABORATORIES

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Data quality is one of the major concern in development of food composition database and to editors of many peer-reviewed journals in accepting a scientific paper for publication. Regular use of a reference material and participation in a proficiency testing could indicate reliability of developed data and analytical performance. The objectives of this project were to prepare rice test materials with assigned values and to use them to assess the analytical performance of laboratories who are involved in research and analysis of rice. The international guidelines: ISO Guide 35, ISO 13528 and ISO Guide 43, were followed as much as possible throughout the preparation of reference materials and the laboratory performance study. Two species of rice, Rice-1 (unpolished rice) and Rice-2 (unpolished rice with dark brownish red skin) were ground to particle size which passed completely through a sieve with pore size 250 microns and packed in laminated aluminium foil bags under vacuum. Based on the analyses of representative nutrients - moisture, protein, iron, zinc and vitamin B1 - the samples were demonstrated homogeneous. Ten expert laboratories from various countries, 36 laboratories from Thailand and 16 laboratories from ASEAN and Asia registered for the laboratory performance study. The samples were sent for analysis of main nutrients, iron, zinc, and vitamin B1 using routine analytical methods. The assigned values of the nutrients in the test materials, as robust mean  $\pm$  robust SD or predicted SD, were established with their uncertainties. The laboratories showed unsatisfactory performance on the analyses

of dietary fibre and vitamin B1. The evaluation of the submitted results of moisture, protein and iron with their uncertainties against the assigned values of the test materials using En score was also demonstrated. Finally, the consensus values of nutrients in the rice samples as mean  $\pm$  SD were developed from the analytical results of laboratories with good performance for both within and between laboratories. The materials can be used as reference materials for internal and external quality control system to increase the quality of the analytical data.

### SVIII-2

#### RESISTANT STARCH: BENEFITS AND *in vitro* MEASUREMENT

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Keywords: resistant starch, fiber, analytical methods

Objectives: To summarize key health benefits of resistant starches and to give an overview of the various *in vitro* methods available for the analytical determination of resistant starch (RS) in foods. Material and methods: The presentation will summarize information relating to health benefits of RS based on *in vivo* and *in vitro* procedures described in several peer reviewed publications. Additionally, results will be presented on *in vitro* evaluation of RS containing ingredients by methods used for determination of fiber (AOAC 991.43) and RS (AOAC 2002.02 & modified Englyst procedure [Englyst et al.,1992, Euro. J. Clin. Nutr. 46 (S.2): S33]). Conclusions and Support: In recent years, much attention has been devoted to macronutrients that provide unique health benefits and functionality in foods. Among those ingredients, RS stands out as a unique material. Resistant starch (RS) is defined as the starch that escapes digestion in



the small intestine and passes to the colon where it exhibits properties similar to dietary fibers. Numerous clinical studies have validated the health benefits of RS, some of which include improvement of digestive health, maintenance of healthy blood sugar levels and energy balance in the hours following a meal. Emerging literature also points to possible satiety and fat oxidation benefits. Most of RS will assay as dietary fiber using accepted *in vitro* methodologies, thereby contributing to fiber nutrient content claims. Although several analytical methods exist for the quantification of RS in commercial food products, no one method has universal acceptance. There is also some confusion around the differences between RS and fiber analytical methods. This presentation will compare and contrast the key RS and fiber analytical methods that are available to today's food formulators.

### SVIII-3

#### **A CONTINUOUS-FLOW DIALYSIS SYSTEM HYPHENATED INDUCTIVELY COUPLED PLASMA OPTICAL EMISSION SPECTROMETER FOR *in vitro* ESTIMATION OF MINERAL BIOACCESSIBILITY**

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The total amount of a nutrient (e.g. mineral) in a food does not reflect the amount that is available to the body through absorption. Bioavailability is a function of at least the digestibility, the absorbability, and the ability to use a nutrient for metabolic functions. A continuous-flow dialysis (CFD) method with an on-line inductively coupled plasma optical emission spectrometric (ICP-OES) simultaneous multielement measurement for the study of *in vitro* mineral bioaccessibility (or bioavailability) was developed. The method was based on a simulated gastric digestion in a batch system followed by a continuous-flow intestinal digestion. The simulated intestinal digestion was performed in a dialysis bag placed inside a channel of flowing stream of dialyzing solution (NaHCO<sub>3</sub>). The mineral concentrations in dialysate were determined by ICP-OES. The pH of dialysate was also monitored on-line to ensure the change of the pH to

be similar to that of the gastrointestinal tract. The developed system was applied to determine the dialysability of five essential elements (Ca, Mg, P, Fe, Zn) for various kinds of foods, i.e., milk-based infant formula reference material (NIST SRM 1846), milk powder, kale, mungbean, chicken meat, jasmine rice, and acacia pennata. The system demonstrated how the dialysis profiles obtained could be exploited to understand the differences of dialysability of various forms of calcium, iron and zinc fortificants and the effect of enhancers and inhibitors. Dialysis profiles and their cumulative plots showed different dialysis patterns and clearly demonstrated the effect of chemical forms of fortificant on dialysability. The iron bioavailability by the developed *in vitro* method was compared with human absorption *in vivo* human study. Both methods showed same tendency of inhibition effect of chili on Fe absorption. However, the inhibition effect in turmeric was shown in the *in vitro* method whereas no significant effect was demonstrated in the *in vivo* human study. The developed *in vitro* CFD-ICP-OES method could be used as a tool to monitor the absorption pattern of different forms of minerals and their rates during the change of pH and to demonstrate the effect of enhancers and inhibitors on mineral bioaccessibility.

### SVIII-4

#### **THE USE OF STABLE ISOTOPE ANALYSIS FOR GEOGRAPHIC ORIGIN OF GREEN COFFEE**

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Keywords: coffee, isotopes, origin

The aim of this work was to develop an analytical protocol for green coffee discrimination according to their provenance and consequently its geographical origin. The use of stable isotopes, in particular carbon, nitrogen, oxygen and sulphur, to discriminate geographical origins has been used in different types of products, including wine, olive oil, fruit juices, etc. Carbon isotopic composition of plant material is dependent on the photosynthetic pathway (C3 or/and C4 metabolism), as well as environmental conditions



(i.e. drought and temperature) where plants are growing. Nitrogen isotope composition can be used not only to identify atmospherically nitrogen fixation, but also as a tracer for different types of soil and different agricultural practices. In this work we have used carbon, oxygen and nitrogen stable isotope composition, elemental composition as well as geographic and climate data to discriminate between green coffee from 21 different geographic origins covering 4 continents. The 63 green coffee samples analysed included gourmet and certified coffees and some of them were from fair trading commerce. The percentage of carbon and nitrogen of green coffee was de-

termined by elemental analysis (EA) and its isotopic composition ( $d^{13}C$ ,  $d^{15}N$  and  $d^{18}O$ ) by isotope ratio mass spectrometry (EA-IRMS). Experimental results were correlated with geographic and climate data and Principal Component Analysis (PCA) allowed us to discriminate between the origins studied. We concluded that stable isotope mass spectrometry is a valuable tool to discriminate the origin of green coffee. The same approach could also be applied to other plant products such as tea and cocoa.

This work was financed by ORITOCAFE research project, ADI Agency, Portugal and Novadelta, Comércio de Cafés, S.A.



## SESSION IX - REGIONAL FOODS AND SPECIFIC NUTRIENTS

### SIX-1

#### NATIONAL SURVEY OF COMPOSITION OF AUSTRALIAN RETAIL PORK 2006

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**Objectives:** To provide update information on the nutrient composition of Australian fresh pork, given changes to animal feeding regimes and production methods over the decade since the last study in 1994. **Methods:** Sampling from the capital cities of three states, Western Australia, Queensland and Victoria, representative of retail pork supply to all major cities, covered minor variations in feeding regime. The design took into account socioeconomic class, statistical local area, butchers and supermarkets, and produced duplicate samples from each state. Gross composition was measured by Food Science Australia (FSA) for all individual 72 purchases (24 from each state). Composites (four for each cut,

fat and lean, raw and cooked) were freighted fresh chilled to the University of New South Wales for folate analysis; and fresh chilled or frozen to the National Measurement Institute (NMI) in Melbourne for remaining nutrient analyses. One cut, loin chop, was studied separately across the three states for all nutrients in order to ascertain variability in gross and nutrient composition. Twelve other cuts were analyzed as individual nationwide composites for those nutrients demonstrated to be present in loin chop. **Results:** New information included data for vitamins B12, B6, folate and pantothenic acid. All fat samples contained water-soluble B vitamins contrary to expectations. Significant levels of folate were found in both fat and lean of all cuts. Variations in composition of some minerals suggested a need to review pig feed formulations. There were small differences in fatty acid composition by state, reflecting pig feeding practices. **Conclusion:** Findings confirmed that Australian pork is of relatively consistent composition Australia-wide. Re-analysis at least every 10 years for major meat commodi-

ties is needed in order to monitor animal feeding practices, to keep food composition tables current, and to provide consumers with the most recent nutritional information.

## SIX-2

### PHYSICAL AND CHEMICAL CHARACTERISTICS AND MALT QUALITY OF SORGHUM (*Sorghum bicolor*) GRAIN VARIETIES GROWN IN KENYA

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Keywords: sorghum, varieties, characteristics, utilization, malt

Sorghum grain is an important traditional food staple in many African countries. However, it is very much under-utilized, and there is great potential to increase its production and use. The objective of this study was to determine the physical characteristics, nitrogen and tannin content of different varieties of sorghum grain grown in Kenya, and assess those with good potential for industrial application in malt production. Physical characteristics of 40 varieties of sorghum grain grown in Kenya were assessed by determining the grain colour, Kernel weight testa presence, and endosperm texture. Nitrogen and tannin content are also determined. Malt quality of ten of these varieties was assessed after germinating for 48, 72, 96 or 120 hours by determining diastatic power (DP),  $\bar{D}$  and  $\bar{D}$  amylase activity determined separately, and free amino nitrogen (FAN) of the malt. In respect to colour, 34% of the samples were cream, 38.3% red, 19.1% brown and 8.5% mottled. Less than half of the samples (38.6%) had testa, whereas 61.4% had no testa. Over half of the samples (60%) had a starchy endosperm, 25% had a corneous endosperm, while 15% had an intermediate endosperm. The nitrogen and crude protein levels ranged from 1.23% to 2.33%, and 7.7% to 14.6%, respectively. Most of the sorghum grain samples (59%) had high tannin content of more than 1.0% Catechin Equivalents (CE), while 35% were low tannin samples, with CE less than 0.2%. The diastatic power of the grain after 48, 72, 96 and 120 hours of germination ranged between a minimum of 5.4 to a maximum of 15.8, 8.1 to 24.8, 10.9 to 27.7 and 13.5 to 28.5 Sorghum Diastatic Units (SDU), re-

spectively. The corresponding alpha amylase activity ranged between 2.5 to 16.6, 3.3 to 23.9, 5.4 to 25.5, and 7.4 to 29.1 SDU, respectively. Beta amylase activity for the same periods ranged between 0.1 to 6.5, 2.2 to 7.5, 1.9 to 7.5, and 2.1 to 10.6, SDU, respectively. The FAN content ranged between 81.2 and 144.3, 86.2 to 167.0, 98.3 to 195.5 and 103.9 to 262.4 mg FAN/100 g DM, respectively. In conclusion there was wide and significant variations among the sorghum varieties in the physical characteristics, nitrogen.

## SIX-3

### VITAMIN D METABOLITES IN MILK PRODUCTS

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Aim was to establish new specific values for vitamin D in dairy products, make a comparison to data derived from an unspecific biological assay, and to investigate the association between the fat and the vitamin D content. Sampling was stratified according to sales from Danish dairies and season. Increments for each sample (n=9-11) were collected for each of the four seasons. Selected sample types were semi-skimmed milk (1.5% fat), organic whole milk and whole milk (3.5% fat), cream (13% and 38% fat) and butter. Analysis was conducted for vitamin D3 (vitD3) and 25-hydroxyvitamin D3 (25OHD3). Content of vitD3 and 25OHD3 in the products varied between 0.005-0.19  $\mu$ g/100 g and 0.004-0.097  $\mu$ g/100g, respectively. For both vitamers a significant positive association with content of fat was shown. Content of vitD3 and 25OHD3 significantly depended on season as summer products had the highest content. In average, the content of 25OHD3 was 0.9 of vitD3. In conclusion, vitamin D activity in the products derives from vitD3 and 25OHD3. There is a significant positive association between content of fat, and a dependence on season for both vitamers. Calculation of total vitamin D activity depends on the relative potency between 25OHD3 and vitD3. Usually, 25OHD3 is regarded to have the potency of 5 compared to vitD3, but a recent study in pigs showed the potency to be equal. Comparison to the present data in Danish Food Data Bank derived from biological assay depends on the potency used, and will be presented at the conference.

#### SIX-4

### FATTY ACID, STEROLS AND TOCOPHEROLS COMPOSITION OF THREE NATIVE CHILEAN SEEDS OILS

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Research looking for new sources of vegetable oils has been increased in the last years. This work is part of the research project related with the fatty acids composition and bioactive components present in native and adapted vegetable species growing in Chile. The present contribution presents the fatty acid composition of three native Chilean seeds oils: Chañar (Ch) (*Geoffroea decorticans* (Gill., ex Hook & Arn.) Burk), Palma (Pa) (*Jubalea chilensis*), and Peumo (Pe) (*Cryptocarya alba*). Pa and Pe grow in the central region of Chile and Ch more in the north region. All are wild species. Ten batches of samples for every species were taken in the local place where they grow. The seeds were obtained from the respective fruits. The seeds fat content was 47.5; 67.4; and 9.8% for Ch, Pa and Pe respectively. For Cha and Pe seeds oils, the main saturated fatty acid was palmitic with percentages between 8 and 17% and Pa the main sat. fatty acid was lauric with percentage 24%, oleic acid was the main monounsaturated fatty acid with percentages between 13 and 35% and linoleic acid was the most important polyunsaturated fatty acid with percentages between 42 and 48% for Pe and Ch. The relationship among polyunsaturated : monounsaturated : saturated fatty acid, based in the saturated group for each seed oil was the following: 2 : 2 : 1 for Cha seed oil; 0.2 : 1 : 8 for Pa seed oil and 2 : 1 : 1 for Pe seed oil. The sterols content was 3200; 1000; and 3400 ppm for Cha, Pa and Pe respectively. For these three seeds oils, the main sterol was  $\beta$ -sitosterol with percentages 72; 48 and 85% respectively. The Tocopherols content was 708; 84; and 4678 ppm for Cha, Pa and Pe respectively. For Ch and Pa seeds oils, the main tocopherols were  $\alpha$  and  $\gamma$ . For Pe seeds oils, the main tocopherols were  $\gamma$  and  $\delta$ . The Chañar and Peumo seeds oils coming from native Chilean species can be considered a good source of linoleic and oleic acid, with a good relationship between both fatty acids and good source of sterols and tocopherols.

#### SIX-5

### TRANS FATTY ACID CONTENT OF SELECTED SWISS FOODS - THE TRANSSWISSPILOT STUDY

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**Objectives:** The intake of trans fatty acids (TFA) originating from the industrial process of partial oil or fat hydrogenation has been identified as a risk factor for cardiovascular diseases. Since only very limited information about the TFA content of food sold on the Swiss market was available, a broad selection of food items suspected to contain TFA were analyzed to obtain an overview of the situation. **Material and methods:** We selectively purchased 120 food items (puff pastries, cakes, wafers, chocolate bars, ice cream, cookies, breakfast cereals, cooking oils & fats, margarines, fast food and other fried food) from retailers, bakeries and restaurants in the city of Zurich between February and August 2006 and analyzed them for their content of 18:1, 18:2, and 18:3 TFA by gas chromatography. TFA were defined as industrially originated TFA if the proportion of vaccenic acid (t11 18:1) was <45 % of the total 18:1 TFA content. **Results:** The total TFA proportion ranged from 0 to 29 % of total fat with the highest content found in a hydrogenated rapeseed fat. Thirty percent of the analyzed samples had a content of more than 2 % industrial TFA. Trans-18:1 were the predominant TFA in all samples except for the plant oils, in which the 18:2 + 18:3 TFA isomers made up to 80 % of the total TFA content. However, in these oils the total TFA content was always below 2 %. **Conclusion:** The finding that 30 % of the analyzed food items had a higher total TFA content than legally tolerated in Denmark, the only country having adopted a limit for TFA in food, was surprising. Although the main Swiss food retailers now have declared to reduce the TFA content in most of their products to meet the limit of 2 % TFA within the next years, it is suggested that a legal limit shall be introduced in Switzerland and/or that an obligation to declare the TFA content on the food composition label shall be considered.

**Support:** This work was partially supported by the Swiss Federal Office of Public Health (grant number 05.002802).

## SIX-6

### FAT AND TRANS FATTY ACIDS INTAKES IN IRAN

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Background: trans fatty acids (TFA) are formed during the process of the partial hydrogenation of vegetable oils. The structure of trans fatty acids are similar to saturated fats which inhibit the enzymatic desaturation of linoleic and linolenic acids. Studies have shown that trans fatty acids increase plasma concentrations of low-density-lipoprotein cholesterol and reduce concentrations of high-density-lipoprotein cholesterol relative to the parent natural fat. Material and methods: Data from the national survey on household food consumption pattern and nutritional status 1991 and 2000 were used. Food intake data were collected using a 24 hour recall and weighing method for 3 consecutive days. Results: The mean intake of fat increased from 40g in 1999 to 46g in 2002 and the proportion of energy from fat intake was 14% and 15.1% respectively. Hydrogenated oil constituted 80% of fat intake. In addition, the intake of TFA increased from 10.4 in 1999 to 12.02g in 2002. Similarly, in 1999, 3.52% and in 2002, 4.10% of energy were supplied by trans fatty acids. Conclusion: Considering the nutrition transition in Iran and prevalence of deaths from coronary heart disease (50% of total annual deaths) trends in fat and trans fatty acids intakes may be a major risk factor in Iranian diets. Hence, information on the trans fatty acids content of food must be available to consumers.

## SIX-7

### ANALYSIS OF FOLIC ACID IN FLOURS USED AS RAW MATERIAL IN ENRICHED DRY CEREAL

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The objectives were to analyze folic acid naturally present in oat, wheat, rice, corn and barley flours used as raw materials in enriched dry cereals and to compare the results with food composition table data for further use in food development projects. Forty one samples were obtained from Brazilian flour manufacturer (pre-

liminary analysis). Ten other samples were used for conclusive data. Total folate was determined by microbiological assay based on DeVries et al. (2005) and Presoto and Almeida-Muradian (2005) methods using *Lactobacillus casei* (ATCC # 7469) as microorganism assay. Buffer solution and alpha-amylase were used for sample extraction followed by incubation (30 min/42°C) and autoclave (20 min/102°C) treatments. Validation parameters such as accuracy (spiked samples), precision (intra-day assay) and quantification limit were calculated according to INMETRO directives (2003) and they were reliable and satisfactory. The quantification limit (0.5 µg/100g) was determined based on the calibration curve and a sample dilution of 10g/100 mL. Considering data presented in Brazilian Food Composition Tables, only two tables presented folic acid data, but just for wheat and maize flours. International Food Composition Tables presented folic acid data for flours; rice and barley flours data were similar to our results. Oat flour were higher and this can mean that this Brazilian flour can not be considered a source of folic acid. Brazilian maize and wheat flours presented higher values for folic acid mainly because 5 from 7 analyzed samples were enriched. In conclusion, it is necessary to make a previous program before the final formulation of an enriched dry cereal, especially about the quantity added and losses during processing, taking in to account the natural vitamin content and synthetic vitamins added, because if it is not, it can present an excessive ingestion of this micronutrient.

## SIX-8

### PHYSICO-CHEMICAL AND NUTRITIONAL PROPERTIES OF NIGERIAN TAMARIND (*Tamarindus indica* L.) FRUITS

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Keywords: physico-chemical, tamarind, nutrients, anti-nutrients

Objective: Tamarind fruits are found growing wild and largely under-utilised in Nigeria. This study assessed the physico-chemical and nutritional properties of Nigerian Tamarind fruits. Material and methods: Pulp of mature tamarind fruits were hand-scraped and

analysed for their physical, chemical and nutrient contents, using standard methods. Results: Tamarind fruits contained 18.2 - 32.3% moisture, 2.7 - 5.2% protein, 3.1 - 3.2% lipids, 2.9 - 4.8% ash, 3.0 - 4.1% crude fibre, 2.3 - 5.8% sugar and 0.2-0.5% starch, 4.2 - 7.4 mg/100g ascorbic acid and 15.36 - 20.7% carotenoids. The fruit pulp colour varied from 0.26-1.41. Dietary fibre components of tamarind fruits were 4.4-5.4% NDF, 6.0-7.4% ADF, 2.6-3.7% lignin, 1.5-2.2% hemicellulose and 2.8-4.2% cellulose. The soluble solid, pH, total acidity and tartaric acid of tamarind were 16.5-19.4 oBrix, 2.4-2.7, 3.1-3.9% and 5.6-20.2%, respectively. The mineral content of tamarind fruits ranged between 0.46-1.08% for calcium, 0.29-0.61% for magnesium, 0.21-0.63% for potassium, 0.11-0.35% for sodium, 0.24-0.38% for phosphorus while the zinc, copper and lead contents were insignificant. Na/K and Ca/P ratios ranged between 0.42-0.85 and 1.53-3.64, respectively. Tamarind fruits had 0.02-0.58% tannin, 0.45-1.45% phytates, 0.28-0.48% oxalate and 0.13-0.79 TIU/mg proteins. Sugars identified in tamarind fruits include glucose, galactose, fructose, xylose and arabinose. Conclusion: Encouraging the cultivation and consumption of Nigerian tamarind could lead to improved health and food choices of citizens since they are cheap sources of important nutrients.

## SIX-9

### COMPOSITION OF FOURTEEN VARIETIES OF AMARANTH REINTRODUCED IN THE ANDEAN ZONE OF JUJUY

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Keywords: amaranth, varieties, proximal composition

Objective: Fourteen varieties of Amaranth seeds with different agronomic characteristics (precocity, tolerance to extreme drought, yield) were assessed, with the purpose to reintroduce them in the Andean zone of Jujuy. Material and methods: Crops were harvested disregarded furrows of each variety according to the system of free competition. The seeds were stored in paper bags until they were processed. Grains of each variety were processed in order to obtain flour with a particle size of 0.4 mm. Proximal Composition was determined using the AOAC Meth-

ods. The fatty acid profile was evaluated by gas chromatography (UNE 55-037-73). Results: The following average values were obtained: moisture 10.68±0.42 %, protein 15.26±0.54 %, ash 2.36±0.30 %, total fat 7.71±0.66 %, total dietary fiber 7.71±1.33 %. The analysis of variance showed significant differences ( $p < 0.05$ ) among species. *A. mantegazzianus* (MT2) showed the highest values of moisture (11.25±0.26 %), ash (2.93±0.06 %), total fat (8.71±0.15 %), and total dietary fiber (10.49±0.06 %), whereas *A. caudatus* (CT10) showed the greatest protein content (16.84±0.13 %). The greatest variability among species was observed for their fiber content and the lowest value (5.30±0.15 %) corresponded to *A. caudatus* (CT2). The fatty acid profile was also significantly different among the species. SFA: the maximum value (26.20 %) corresponded to *A. hypochondriacus* (HI1) and the minimum (22.40 %) for *A. caudatus* (CT5). MUFA: *A. caudatus* (CT6) showed the maximum value (31.92 %) and *A. mantegazzianus* (MT2) showed the minimum value (25.75 %). PUFA: *A. caudatus* (CT3) y *A. caudatus* (CT6) had the maximum (44.10 %) and the minimum (39.39 %) values respectively. The main type of fatty acid present in all the varieties was linoleic, ranking between 38.00 and 42.92 %. On the other hand, the linolenic acid content is in low, with values lying between 0,13 and 0,70 %.

Project financed by CIUNT, Consejo de Investigaciones de la Universidad Nacional de Tucumán.

## SIX-10

### PHENOTYPIC, AGRONOMIC AND NUTRITIONAL CHARACTERISTICS OF 7 VARIETIES OF ANDEAN POTATOES

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Keywords: andean potato, vitamin C, centesimal composition

There are more than 200 Andean potato varieties, but only few of them are cultivated, running the risk of affecting the actual biodiversity. They form part of the basic food stuff of the Andean populations. Objective: To characterize 7 varieties of Andean potatoes, determining its phenotypic, functional and nutritional properties. Materials: Andean Potatoes, varieties: Col-

lareja, Runa, Churqueña, Señorita, I. Colorada, I. Negra and Revolución, acquired in C.A.U.Que.Va, Jujuy. Reference: Commercial Potato (*Solanum tuberosum*, Spunta variety). Methods: The average weight and/or size and edible portions were determined as well as the phenotypic characteristics using the INTA Balcarce catalogue as reference; the proximal composition was determined using AOAC methods and the vitamin C content by the Roe method. Results: The different varieties of Andean potatoes show differences in their agronomic properties such as the zone and altitude of production, yield by hectare, resistance to plagues and dates of sowing and harvest. They are adapted to different altitudes (from 1.800 to 3.800 meters above the sea level), which influence their agronomic characteristics. The yield varies between 8.000 - 18.000 kg/ha according to the variety. They present a diversity of forms, sizes and colors. Their content of energy oscillates between 75 and 101 kcal/100 g, greater values to those of the variety of reference (57 kcal/100g). The content of vitamin C is variable, ranging from values of 10,5 mg/100 g found in Revolución varieties to 15,6 mg/100 g in Collareja potatoes; the content of vitamin C found in Spunta lies within this range (13,3 mg/100 g of potato). The knowledge of the nutritional, agronomic and functional properties of the Andean potato varieties contributes to conserve the biodiversity, which is a patrimony that is due to take care of. Project financed by CIUNT, Consejo de Investigaciones de la Universidad Nacional de Tucumán.

## SIX-11

### FORMULATING NUTRITION SNACKS WITH INULIN AND OLIGOFRUCTOSE

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Keywords: inulin and oligofructose, prebiotic, snacks, sensory acceptability, starch digestibility

Consumers nowadays have increased substantially their demands for foods that combine convenience and nutrition. Inulin and oligofructose are the most studied prebiotic compounds. Human clinical studies have shown that the ingestion of these fructans significantly increases calcium absorption. The present work intends to produce a snack enriched with inulin and

oligofructose and to evaluate its nutritional value and sensory acceptance. A corn snack produced through extrusion cooking was flavored with a water solution, containing inulin and oligofructose, flavor compound and salt. The proximate composition and the *in vitro* starch digestibility were determined by official methods. Color and texture were verified instrumentally. Snacks texture, flavor and overall acceptability were evaluated by forty consumers in a 1 to 9 hedonic scale. Snacks presented 4g of fructans/portion (30g). The developed product presented 3.8g of ash, 0.1g of lipids, 6.9g of proteins, 16.9g of fibers, 72.4g of starch (dry weight) and a caloric value of 335.3 kcal (1408.3 kJ). Market available snacks in Brazil presents about 467.2 kcal (1962.2 kJ); 15g of lipids, 6.8g of proteins, less than 2g of dietary fiber and 77.7g of starch. These data allow the claim "light snack" for the new product, with the appeals "fat free" and "fiber source" according to Brazilian Food Legislation. Corn extrudate presented a high hydrolysis value (HI): 130.8 and rapidly digestive starch (RDS) contents: 61.3%, due to the drastic conditions of the extrusion process. The fructans significantly reduced the HI: 79.52 and the RDS: 33.67%, possibly because of its viscosity properties. No significant difference was observed in snacks texture when compared to a traditional one; however it was detected a significant difference in brightness, probably because it was greatly affected by fat presence in the latter. The new snack was sensory accepted: flavor (6.5±1.8), crunch (6.9±1.6), overall acceptability (6.6±1.7); only flavor acceptance was lower than the traditional snack one, but it may be improved by using higher amounts of flavoring compounds. We conclude that it is possible to develop a convenient food such as a snack, with superior nutritional composition, functional properties, high sensory acceptance and with great potential to replace the traditional ones. Support: FAPESP.

## SIX-12

### CONTRIBUTION OF NATIVE BRAZILIAN FOODS TO NUTRIENTS IN DIETS, 1974-2003

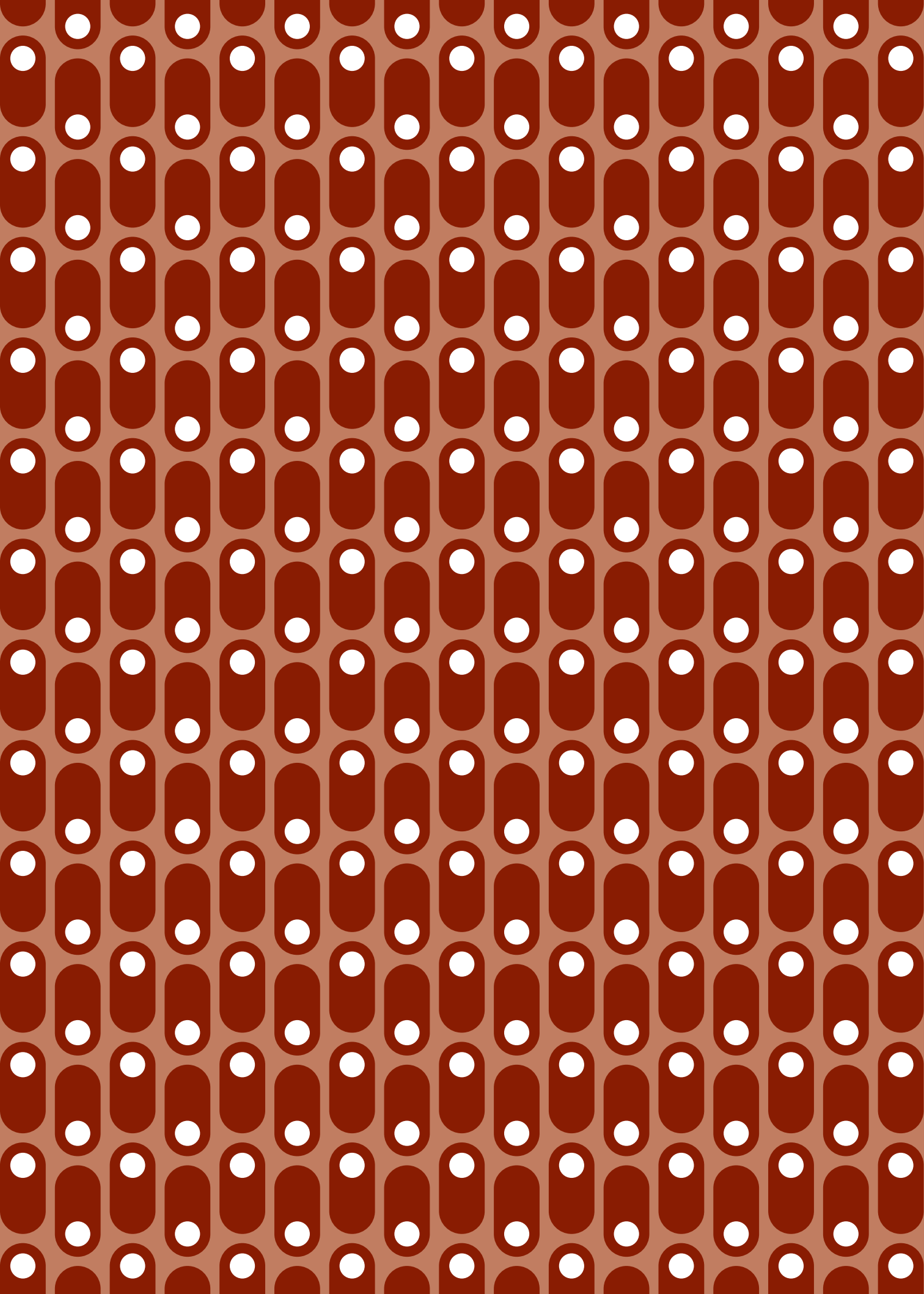
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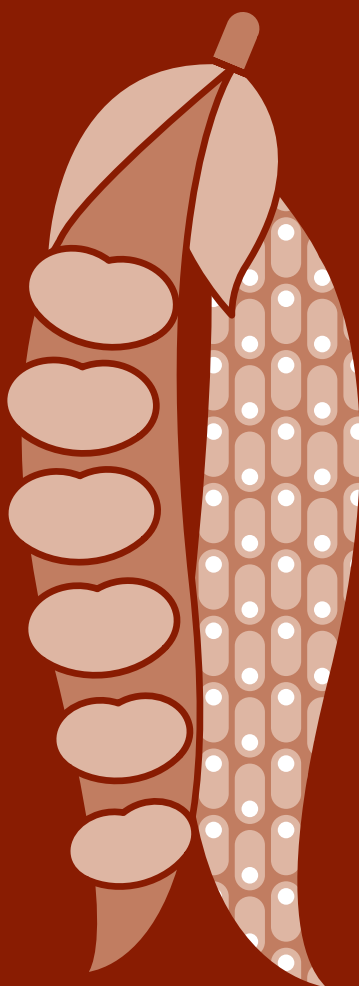
The available food composition data is used to study the contribution of biodiversity in Brazilian foods to residents' dietary and nutritional status. Four sur-



veys over this period monitored household food consumption. The POF (2002-3) collected data on the consumption of over 1000 individual foods and food groups, and surveyed household characteristics and anthropometrics. Comparable data was collected by ENDEF (1974-75). Food and household characteristics were surveyed by the POF (1986-7, 1995-6). Previous studies estimating dietary sufficiency for these surveys have aggregated foods and food groups to a number under 20 percent of the total surveyed. All foods are examined here, beginning with the POF (2002-2003), by studying whether consumption of individual food amounts within aggregate groups was associated with deviations from anticipated household characteristics and anthropometric nutritional status. The relationships are modeled using local and spatial regression on population-weighted microdata, resulting in incidence maps for the entire country. Nutritional status by age is measured using height for age, weight for age, weight for height and BMI for children (WHO-CGS, 2006) and BMI for adults. The individual foods whose consumption is associated with deviations from anticipated nutritional status are categorized on the basis of domestic or international origin, and in some cases by location within Brazil, and biodiversity. It is anticipated that numerous population groups will be identified consuming native Brazilian foods and enjoying improved nutritional status, or perhaps deficits. It is also intended to assess the combinatorial array of individual foods, including traditional recipes identified through literature search and correspondence. The discussion of trends will be oriented towards determining whether relationships of biodiversity and nutritional status were persistent across decades, and to identify foods whose further determined composition would likely result in improved diets and nutritional status. Further details of this research will be communicated by e-mail.







## Poster abstracts\*

Monday, October 22, 2007 - Coffee-break times  
Poster Session I

**A - BIODIVERSITY**

**B - BIOACTIVE COMPOUNDS AND  
FUNCTIONAL FOODS**

**C - FOOD CONSUMPTION AND  
NUTRIENT INTAKE**

**D - ANALYTICAL METHODS**

Tuesday, October 23, 2007 - Coffee-break times  
Poster Session II

**E - FOOD COMPOSITION DATABASE  
AND TABLES**

**F - REGIONAL FOODS AND SPECIFIC  
NUTRIENTS AND PRODUCTS**

\*The name of the abstract presenter is underlined



Poster Session I

## A - BIODIVERSITY

A-1

### **BIODIVERSITY, NUTRITIONAL IMPORTANCE AND MARKETING OF LOCAL SPICES IN NIGERIA**

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Keywords: ecological zones; local spices; diversity; nutrition; marketing

Common local spices in Nigeria include green pepper, onion, garlic, ginger and alligator pepper. They are major sources of vitamins, protein and mineral salts required for a healthy growth of man. Deficiency of these items in the human body is manifested in series of malformation and diseases. Differences in the nation's climatic and ecological structures are largely responsible for the diversity of these items across the country. Their local supply is far below demand level since techniques of production are still largely traditional (primitive). There are however some limitations in the marketing and distribution patterns as marketers have limited access to credit facilities and are not properly organized. There is also seasonal variation in the market prices of the commodities. This study therefore investigated the diversity, nutritional importance and marketing strategies of the Nigerian local spices. Samples comprised of 400 producers/marketers of the commodities who were randomly drawn from various ecological zones. Data were gathered over two (2) farming seasons with the aid of structured questionnaire. Onion and green pepper are the most consumed while garlic and ginger are particularly famous in the dry northern region. Volume of annual rainfall, quality of soil and farm size largely determined the level of production of the produce. High transportation costs and poor storage facilities are the major limiting problems to the marketing and distribution of the commodities

nationwide. With increased level of production, moderate marketing costs and better storage facilities, a higher market supply of the local spices in Nigeria will be assured.

A-2

### **BIODIVERSITY STUDY IN WHEAT CULTIVARS FOR SALINITY RESISTANCE**

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To study the variability present in under utilized wheat germplasm against salt stress. A set of wheat genotypes were assessed for tolerance to NaCl stress. The seeds of twenty five genotypes were sown under the normal laboratory conditions at University College of Agriculture, Bahauddin Zakaryia University, Multan, Pakistan. These genotypes were evaluated for seedling traits under the salinity levels i.e. Control, 100mM, 150mM and 200mM. Analysis of variance revealed the significant difference in the five seedling traits indicating the presence of notable genetic variability among the wheat genotypes. The NaCl salinity reduced the seedling shoot length, seedling root length, seedling shoot weight, seedling root weight and total biomass, but the most drastic effects were recorded on the seedling root length. On the basis of absolute salt tolerance the seedling root length data showed that the genotypes Naeem 82, Florkwa 2 and Inqalab 91 performed better than the all other genotypes and on the basis of means of relative salt tolerance genotypes BWP 2000, Falk, and Iqbal 2000 were found to be salinity tolerant. The estimate of broad sense heritability for seedling root length was found higher (0.90), suggesting that the improvement for NaCl salinity tolerance is possible by exploiting the existing variability present in these underutilized wheat genotypes through selection breeding.

This project was funded by the higher education commission, Pakistan.

### A-3

#### CHEMICAL COMPOSITION OF TANNIA (*Xanthosoma mafaffa* Schott)

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Tannia (*Xanthosoma mafaffa* Schott) is characterized as a rustic plant found in tropical countries such as Brazil. Vegetables are sources of carotenoids that could be used in prevention of vitamin A deficiency. Considering the generally higher cost of animal foods, the provitamin A from vegetables should be considered as an expressive and easily obtainable source of vitamin A in developing countries. Although tannia are popularly classified as a source of carotenoids, studies on its chemical composition are rare. Thus, because of the absence of cultivation, tannia as well as others non-traditional vegetables may become extinct and still be classified as potential sources of nutrients. Therefore the goal of the present study is to characterize the chemical composition and carotenoids profile of raw (RT) and cooked tannia (CT). It was analyzed 4 different crops of tannia from the countryside of Sao Paulo state harvested between years 2005 and 2006. When compared to RT, CT presented less ( $p < 0.05$ ) water, protein and fat. Regarding the total amount of energy, RT presented values between 95,12 to 143,60 kcal/100 g while CT presented values between 100,96 to 142,91 kcal/100 g. In both RT and CT it was found great quantity of calcium (RT = 290,60 mg/100 g; CT = 330,0 mg/100 g), iron (RT = 3,90 mg/100 g; CT = 1,8 mg/100 g), potassium (RT = 1408,70 mg/100 g; CT = 1300,4 mg/100 g) and zinc (RT = 4,2 mg/100 g; CT = 5,20 mg/100 g). It was found alpha-carotene and zeta-carotene in both RT and CT. Cooking did not change the chemical isomerization of these carotenoids. However, the CT presented smaller ( $p < 0.05$ ) concentration of these carotenoids when compared to RT. In conclusion, tannia can not be considered a good source of provitamin A because of the small concentration of alpha-carotene. Although the great quantity of important minerals, more studies are necessary to elucidate their bioavailability in tannia.

### A-4

#### NUTRITIONAL ASPECTS OF FONIO AND FONIO PRODUCTS

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Fonio (*Digitaria exilis*) is cultivated in a vast area in West Africa and is known to be used as staple food harvested 2 to 3 months before the main crops mature, providing nutrients in the hungry season. So fonio consumption could be considered as one of the coping strategies for increasing household food security. A EU financed international research project (FONIO) commenced in 2006, aiming to upgrade the quality and competitiveness of fonio for improved livelihoods in West Africa. The FONIO project involves interdisciplinary research teams from 3 European countries (France, Netherlands and Belgium) and 4 West African countries (Mali, Guinea, Burkina Faso and Senegal). As part of this project, a study on the nutritive value of fonio and fonio products and its contribution to nutrient intake and nutritional status is being prepared in Mali. More specifically the objectives are: 1) to study the nutritional value of different fonio varieties, milled fonio and diverse fonio products, especially with respect to macronutrients, iron, zinc, and inhibitors of iron and zinc uptake; 2) to determine the role of fonio in the dietary pattern and the contribution to nutrient intake and nutritional status; 3) to determine the bioavailability of iron from fonio-based diets. The study area will be located in Bamako, the capital city of Mali. For the study of the nutritional value of different fonio varieties, fonio grains will be collected from 34 farmers in 2 regions in the south, contributing to approximately 70% of the total fonio production in Mali (Sikasso and Segou). In total 12 fonio varieties will be selected based on the sample frame described in work package 5 of the INCO-FONIO project. Fonio paddy will be cleaned, milled, washed and drained to get mid-wet, dried, precooked, cooked and parboiled fonio. Processed fonio will be made according to standardized local procedures. Nutrient analysis will be performed in the milled fonio and in the mid-wet, dried, precooked and parboiled products. The new data from this study will be used to update the Malinese food composition database.

**A-5****STUDIES ON COMPOSITION AND VIABILITY OF *Stevia rebaudiana* IN HUMID COASTAL TROPICS**

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Keywords: stevia, stevioside, cultivation, composition, climate, humid tropics

This study evaluates the changes in composition of *Stevia rebaudiana* grown under coastal tropical conditions in India. The test plot for cultivation of stevia was approximately an area of 22,000 sq. ft. situated near the coastal city of Chennai. Another site about ten kilometers away from the main site was also used for comparison. The average temperatures of the region over the past five years suggested that August was the best time to begin planting. One further planting was carried out in March to determine crop survival under heat stress conditions. Two such cycles of planting were carried out and the harvested leaf from each of those crops was analysed by standard methods for steviol glycosides content and other proximate components. Causes for crop susceptibility to mortality were also analysed. The results showed that aqueous extracts of the leaf reflected a concentration of 100 -120 mg of steviol glycosides per gram of dried leaf and 11.7 mg of precipitable phenolics per gram of dried leaf. The steviol glycoside values are in accordance with the reported concentrations for the crop. Crop mortality was due to wilt caused by heat stress and fungal infection. The average temperature reaches above 35C in the month of May peaking at 40°C. This along with the crop's susceptibility to fungal infections including *Sclerotium sp.* gives the crop a bleak chance of survival without proper care. The stevioside content of leaves does not vary much between seasons and is in the range with the reported concentration of the strain we used. The plants flourished in the winter months between August and March and immediately died out upon onset of summer either due to heat stress or infection caused by stress. Infections were caused by earlier reported ubiquitous pathogens of stevia and not by any species-specific pathogen, proving that pathogens of stevia have not reached our shores. Our conclusion is that, although

stevia might be a viable cash crop for the humid tropics, strain improvement for more hardy varieties is necessary before it can become entirely successful in this climatic region. The project was funded by the Department of Biotechnology, Government of India as part of entrepreneurship development in farm women. Project title: "Entrepreneurship development of small scale farmers in stevia cultivation" DBT File No: No.BT/PR3514/SPD/11/335/2002.

**A-6****CHEMICAL CHARACTERIZATION OF FIVE LOQUAT FRUIT CULTIVARS (*Eriobotrya japonica* Lindl.) IN RIPENING STAGE**

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Keywords: loquat, fruit, cultivar, composition, taste

Loquat is a pome fruit cultivated mainly in the South-east area of Brazil. Although this fruit reaches high market values, there are few available varieties for consumption, and little information about its quality characteristics. New loquat fruit cultivars, developed at Instituto Agronômico de Campinas, using classical genetic breeding, were analyzed to assess its chemical traits. Five cultivars were selected to analysis mainly by their high productivity and resistance to diseases. The cultivars analyzed were Centenária, Mizuho, Mizumo, Néctar de Cristal and Mizauto. Sugars (glucose, fructose, sucrose and sorbitol) and organic acids were determined by liquid chromatography. The dietary fiber was determined by enzymatic method and the moisture was calculated in basis of weight loss after the heating of the samples in stove (105°C). The cultivar that presented the highest moisture value was Mizuho (90,78%). The total dietary fiber quantity in all cultivars was about 1,0-1,5%. The cultivar that presented the highest total sugar concentration was Mizumo (10,5%) and the lowest concentration was found in Centenária (3,87%). Sucrose was the main sugar in all cultivars. Néctar de Cristal contains the highest value of sorbitol, around 1,08%, which contributes to more sweet taste. Mizauto presented more organic acids than other cultivars, 1,11%. Malic

acid was the major organic acid and consequently responsible for acidity in fruit. Other organic acids also present in loquat fruit are citric, succinic and ascorbic, but in lower concentrations. Each cultivar presented different chemical characteristics which gives the customer many options of taste. SUPPORT: Fapesp, IAC (Instituto Agronômico).

## A-7

### ORGANIC ACIDS IN DIFFERENT RIPE BANANA CULTIVARS

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Banana is the most cultivated tropical fruit in the world and is a staple food in developing countries like Brazil. Fruit ripening is a complex process that involves drastic changes in various physiological and biochemical events. These events include the development of unique flavours that result, in part, from increased synthesis of organic acids. Organic acids are important attributes of fruit flavour and, along with soluble sugars and volatile compounds, contribute to the overall organoleptic quality of fresh market banana. The aim of the present study was to analyze the organic acids content in nine different banana cultivars (Terra, Figo, Maçã, Mysore, Nanicão, Ouro, Pacovan, Prata and Roxa). For this purpose, the organic acids were determined by liquid chromatography equipped with a Supelcogel C-610H column (at 20°C) with an UV-V detector and the elution system consisted of 0.5% H<sub>3</sub>PO<sub>4</sub>, running isocratically at a flow rate of 0.4 ml/min. The results were analyzed by Statistic test with ANOVA test multiple comparison and Post Hoc of Newman Keuls ( $p < 0.05$  to significant and  $p < 0.01$  to very significant). As in most other fresh fruits, the malic and citric acids predominated in all cultivars analyzed, while the other acids occurred in trace amounts. The dominating organic acid was malic acid and consequently the responsible for acidity in this fruit. Terra cultivar had the highest malic acid content (803 + 30 mg/100g). Banana Terra and Figo showed the highest level of total organic acid with 887 and 664 mg/100g respectively, while the Maçã cultivar had a lower proportion of total organic acid (170 + 6 mg/100g), with very significant difference

( $p < 0.01$ ) when compared with the others. It is concluded that the observed difference in organic acids composition are of such magnitude that they may affect sensory properties among different banana cultivars. CAPES supported this work.

## A-8

### CHEMICAL COMPOSITION OF BARU (*Dipteryx alata*, Vog.) FROM GOIÁS STATE

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Keywords: cerrado, chemical composition, amino acid

This study was carried out with six plants of baru (*Dipteryx alata*, Vog.) from southeastern region of Goiás State. The purpose was to establish chemical composition of baru seeds from different plants of "cerrado" in order to evaluate the potential value as a food or feed source and to contribute to the preservation of Brazilian native species. The fruits were collected at the harvest time and they were chosen randomly. After the maturation period, samples of seeds were roasted (140°C/30min) and analysed to determine their chemical composition, amino acid profile and mineral content by means of standard methods. The data showed that the seeds have low moisture contents (3.21-4.07g/100g) and high levels of lipids (38.4-42.0g/100g), which represent a good source of energy. The protein contents varied between 23.8 to 28.2g/100g, with significant differences (Tukey Test,  $P < 0.01$ ) between plants. The amino acid profile revealed that lysine (chemical scores between 64%-80%) and methionine+cysteine (chemical scores between 80%-85%) were the most limiting amino acids relative to the FAO/WHO requirement patterns. In relation to the mineral content, the baru seeds showed high contents of calcium (110.4-149.2 mg/100g), iron (3.93-5.88 mg/100g) and zinc (4.08-5.41 mg/100g). After all, the chemical composition varied between six analysed samples which reinforce the necessity of stratifying the sampling in the study of native food composition. Also, the protein content and amino acid profile indicate that some plants have high nutritive potential, especially concerning to sulfur-containing amino acids that are commonly

deficient in leguminous. Thus, baru seeds can be used in human and animal feeding as energy, protein and mineral sources. Therefore, this study could contribute to the selection of potential clones and for rational using of native species of "cerrado" by local population.

Support: CNPq and Funape.

**A-9**

### **CONCEPTION OF THE VEGETABLE CLASSIFICATION FOR APPLICATION IN THE NUTRITIONAL AND SENSORIAL QUALITY EVALUATION (NSQE) SYSTEM**

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The study aimed to search a classification of vegetables used in Meal Producing Units (MPUs) correlating, concomitantly, the nutritional, sensorial and technical characteristics of processing, allowing its applicability in the Nutritional and Sensorial Quality Evaluation (NSQE) system. The research initiated with the identification of the vegetable classifications, available in scientific literature, and its analysis, verifying the possible suitability with regard to the NSQE system requirements. As none of the classifications presented the necessary characteristics, it was gone to the conception of a new vegetable classification, called NSQE Vegetable Classification. For this, several crossings between the identified characteristics in the classifications were being done, until associating, simultaneously, the desired characteristics. The new classification resulted, then, of the association between the classification for the eatable botanical part and the classification according to the glycide content, considering, also, the preparation techniques. As a result, 99 vegetables had been analyzed and the conceived classification divides them into 7 groups. The presentation of NSQE classification contains, for each vegetable, information about the family and botany, pigments, main nutritional components and bioactive compounds, along with the antinutritional components besides the main applications in MPU. It was found that through the control of the interaction between nutritional and sensorial aspects and processing techniques, from the acquisi-

tion of ingredients to the distribution of the meal, it is possible to provide healthier food. It was highlighted that, during these stages, the nutrients may be preserved, and have their bioavailability increased or their losses minimized. Moreover, the control of the sensorial quality of foods can influence the selection and consumption of ready-made foods.

**A-10**

### **BRAZILIAN INITIATIVE ON BIODIVERSITY FOR FOOD AND NUTRITION**

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During the eight Conference of the Parties (COP-8) of the Convention on Biological Diversity (CBD), held in the city of Curitiba, from 20 to 31st March 2006, a cross-cutting initiative on "Biodiversity for Food and Nutrition" - BFN - was approved. The initiative is a partnership between CBD, Food and Agriculture Organization - FAO - and the International Plant Genetic Resources Institute - Bioversity (ex IPGRI). The overall aim of the initiative is to promote and improve the sustainable use of biodiversity in programs contributing to food security and human nutrition, given the existing linkage among biodiversity, food and nutrition. One of the most important elements of this initiative is the description and evaluation of the linkage among biodiversity, food and nutrition, particularly, in clarifying the relationship between biodiversity, dietary diversity, food preferences, and the relevant links between human health and ecosystem health. Taking into account the importance of this issue, Brazil decided to create the Brazilian Initiative on Biodiversity for Food and Nutrition. Many governmental institutions have shown their interest on this matter, particularly the Ministry of the Environment, Agriculture, Livestock and Food Supply, Agrarian Development, Health, Culture, Science and Technology, Social Development, National Agency of Sanitary Vigilance, Brazilian Enterprise for Agricultural Research, National Company for Food Supply and the National Council for Food Security. To achieve the objectives of the BFN initiative several activities are being developed by these institutions. Brazil has, therefore, a unique opportunity in the implementation of the BFN initiative, now by means of the construction of a transversal approach encompassing governmental



institutions and non-governmental organizations. Taking into account the COP-8 decision and the growing importance of this topic, the Bioversity started the elaboration of a project to be submitted to GEF, to which Brazil was invited to be one of the partners. During this Conference, it will be presented the main features of each one of the on going activities and the strategies and perspectives for future actions of this initiative in Brazil.

**A-11**

### **NEW DATA FOR ETHNIC FOODS IN EUROPE, PRIORITISATION, COLLECTION AND ANALYSIS**

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Keywords: prioritisation, ethnic foods, collection and Europe

Objective: One of the objectives of EuroFIR (European Food Information Resource) is to provide new and reliable data on the composition of ethnic foods consumed by both ethnic and mainstream populations for inclusion in national food composition databases. Material and methods: To achieve this, the criteria for the prioritisation of ethnic foods were developed: i) size and significance of the ethnic population, ii) food consumption recorded in dietary surveys, iii) size of the food industry and iv) the impact on nutrient intake and health. For the purpose of developing standards for providing new and reliable food composition data on ethnic foods, a list of 5 foods from each partner country (n=40) will be analysed. A protocol for sample collection, preparation and storage was developed. Composite samples [n=6-12] have been collected from supermarkets, restaurants and takeaways and pooled to represent the range and variation in the composition. Whilst each ethnic food [n=3-6] will be prepared by the volunteers to represent the variation in food preparation methods and minor ingredients used. The selection of laboratories for analysis was based on their scope of accreditation for each component being analysed, participation in proficiency testing, value for money and validated methods for analysis of nutrients. Nutrients were prioritised (n=35) by their in food composition, those specific to ethnic foods (nutrient deficiencies and requirements) and the importance of nutrients for each specific food type. Results:

Five prioritised foods from each partner country have been collected and prepared for analysis. The list included Congolese in Belgium, North African (Maghreb) and West Indian in France, Israeli, Mediterranean and Ethiopian in Israel. Asian, African and Romanian in Italy, Surinamese in Netherlands, Latin American/Mexican and Asian in Spain and Indian in the UK. Conclusions: Criteria for the prioritisation of ethnic foods in selected 8 EU-countries has been established. A standard protocol for sample collection, preparation and storage of foods has been developed. New and reliable data on 40 commonly consumed foods in 8 EU member countries will be provided.

Support: This work was completed on behalf of the EuroFIR consortium and funded under the EU 6<sup>th</sup> Framework Food Quality and Safety Programme contract No: FOOD-CT-2005-513944. Also, thanks to EuroFIR Ethnic Food partners.



## B - BIOACTIVE COMPOUNDS AND FUNCTIONAL FOODS

### B-1

#### FUNCTIONAL EFFECT OF KAVUN RICE (*Oryza sativa*) AND FISH OIL ON THE LIPID PROFILE OF SELECTED TYPE II DYSLIPIDEMIC DIABETICS

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Keywords: kavun rice, fish oil, functional food, type 2 diabetes, dyslipidemia

Introduction: Functional foods have components that provide demonstrated physiological benefits or reduced risk of chronic diseases, above and beyond their basic nutritional function. Kavun rice (*Oryza sativa*) is an uncommon variety of rice grown in Tamilnadu, India. Objectives: 1. To determine the composition of the selected variety of rice with reference to bioactive components of interest. 2. To assess the impact of kavun rice on the biochemical indices in the selected type 2 dyslipidemic diabetics. Material and methods: Kavun rice was analyzed for specific food components like fiber and fat by the AOAC procedures. A feeding trial was carried out using the before and after treatment with control experimental design. There were three experimental groups and one control group. Group I (fish oil and Kavun rice, n=35), group II (Kavun rice with wheat and oat bran n=35), group III (Kavun rice n=35), group IV (lipotropic drugs control, n=70). The inclusion criteria was Type 2 DM patients on OHA and the exclusion criteria was those with nephropathy, retinopathy, foot ulcers, septicemia, keto acidosis, liver diseases, hypo and hyperthyroidism, and those on steroids including insulin. The selected patients were randomly assigned to one of the four groups. The feeding was for 60 days. 100g of the rice was substituted for the regular rice in the diet of the selected patients. The recommended ration was taken in two meals. Results: This study has shown that there was a signifi-

cant decrease in the serum cholesterol (t=6.95), TG (t=9.9), LDL (t=4.66), and VLDL (t=7.11) levels and an increase in the HDL (t=8.35) in the group given fish oil and Kavun rice. Conclusion: Changes in life style have brought about an intake of refined foods which is detrimental to health. This study supports the recommendation to include at least two conventional foods with health benefits every day.

### B-2

#### INFLUENCE OF COMMON BEAN (*Phaseolus vulgaris*, L.) COLOUR ON TOTAL PHENOLIC, TANNIN AND ANTIOXIDANT ACTIVITY

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The objective of this research was to evaluate the influence of common bean (*Phaseolus vulgaris*, L.) seed coat colour on total phenolics, tannins and antioxidant capacity before and after cooking. Beans with white, black and red coloured seed coats were used in the study. Colour was determined using a Hunter Lab Colour Quest with the C.I.E. L\*a\*b\* scale and by calculating Croma and H°. Prior to further analyses, the raw or cooked (121°C for 10 minutes) beans were lyophilized and milled. Tannin contents were determined by the butanol acid assay and total phenolics were determined as catechin equivalents using the Folin-Ciocalteu reagent. In vitro protein digestibility was assessed by the multienzyme method and antioxidant activity by the 2,2'-diphenyl-1-picryl-hydrazil (DPPH), ABTS radical and TEAC assays. Raw white beans exhibited the lowest free radical scavenging activity and black beans the highest. After cooking the antioxidant activity of all beans was lowered. Determination of Pearson correlation coefficients indicated

that total phenolics and tannin content were positively correlated, as were tannin content and DPPH radical scavenging activity. The values of H<sup>o</sup> and ABTS radical scavenging activity also were correlated positively. Negative correlations were found for total phenolics, tannin and DPPH radical scavenging activity with b\* and Croma, respectively. Meanwhile, a\* showed correlation with the results of the ABTS scavenging activity assay; L value could be correlated with tannin content and DPPH scavenging activity. These results indicated that the colour is an important factor to determine the tannin content, total phenolic compounds and the antioxidant activity of common bean. The cooking process decreased the antioxidant capacity for all colours of beans with also a decrease of the amount of total phenolics and tannins.

### B-3

#### **DIGESTIBILITY AND POLYPHENOL INTERACTION IN COMMON BEANS (*Phaseolus vulgaris*, L.) OF DIFFERENT COLOURS**

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Raw bean digestibility is generally found to be lower than in cooked beans. The increase in protein digestibility has generally been attributed to protein denaturation, inactivation of protease inhibitors, and protein aggregation mediated by basic residues. However, there may also be some link to protein-polyphenol interactions. Therefore, this research evaluated the interaction between proteins (BSA and phaseolin) and polyphenols extracted from beans of different seed coat colour, before and after cooking. Raw and cooked<sup>2</sup> beans with white, black and brown coloured seed coats were milled. Polyphenols were then extracted into methanol. To evaluate protein-polyphenol interactions, an isothermal titration calorimeter (ITC) was used to measure enthalpy changes associated with the interactions. Protein precipitation assays were also performed for the various polyphenol extracts. The precipitation capacity varied with the cultivars and with the cooking process, because the polyphenol composition is different from different beans and heat alters polyphenol

structure. Raw bean extracts presented higher precipitation capacity than the cooked bean extracts in all cases. The black beans had the highest precipitation capacity among raw beans, but after cooking the red beans presented the highest capacity. The difference between before and after cooking for the white beans was low, but for red and black beans it was high, indicating the different polyphenol composition of the extracts. By ITC analysis, the interactions between polyphenols and BSA or phaseolin were weak and exothermic. Polyphenols extracted from black and red raw beans gave a stronger protein interaction than those extracted from white beans. Cooking decreases the interactions between proteins and polyphenol for black and red beans, but for white beans no difference was observed, which was the same as for the precipitation assay. The white beans present the lower interaction between polyphenol and protein.

### B-4

#### **BRAZILIAN AND PERUVIAN BEAN (*Phaseolus vulgaris* L.) CULTIVARS: POLYPHENOL COMPOSITION IN SEED COAT AND COTYLEDON FRACTIONS**

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Keywords: *Phaseolus vulgaris* L., seed coat, cotyledon, polyphenols, Brazilian and Peruvian bean cultivars

The objective of this work was to determine the polyphenol composition of seed coat and cotyledon in bean cultivars with different seed coat color patterns. 25 cultivars were provided by the Brazilian Company of Agricultural Research and the 3 Peruvian ones by the Legume and Cereal Program of Agraria University (Peru). Seed coats and cotyledons were manually removed and the obtained fractions were milled under refrigeration into flour (60 mesh). Phenolic compounds were determined in each fraction by HPLC coupled to a diode array detector, according to the method of Arabbi *et al.* (2004) with some modifications. Condensed tannin contents were assayed as well (Price *et al.*, 1978). Seed coats exhibited higher concentrations of phenolic compounds than cotyledons. These fractions were rich

in condensed tannins which ranged from 11.5 to 449 mg of catechin equivalents/ g in fresh weight (FW), flavonols such as quercetin and kaempferol glycosides (0.5 - 95 and 0.8 - 750 mg of aglycon/100 g FW, respectively), and only black and red seed coat cultivars contained anthocyanins (1.79 - 553 mg of cyanidin/100 g FW). In this way, BRS Grafite and FT Nobre black coats were the major sources of anthocyanins, BRS Timbó red coat showed the highest level of quercetin glycosides while Jalo Precoce, Jalo EEP 558 and Canario Centenario coats are promising for their high levels of kaempferol derivatives. On the other hand, cotyledons presented cinnamic acid derivatives such as ferulic, sinapic, chlorogenic and other hydroxycinnamic acids. In general, the seed coat color pattern and the type of cultivar showed an important influence on the variability of phenolic profiles and levels, respectively.

This research was supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

## B-5

### IDENTIFICATION OF THE PHENOLIC COMPONENTS OF SNOW PEA TIP, SNOW PEA POD, SUGAR PEA POD, DRY GREEN PEA, COWPEA, BLACK EYE PEA, LONG BEAN POD, MUNG BEAN, AND LENTILS BY LC-DAD-ESI/MS

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A standardized screening method using LC-DAD-ESI/MS was applied to analyze the flavonoids of snow pea tip, snow pea pod, sugar pea pod, dry green pea, dry yellow pea (*Pisum sativum* L., varieties and cultivars), cowpea, blackeye pea, long bean pod, mung bean (*Vigna* spp., varieties and cultivars), and three dry lentils (*Lens calinaria* L., varieties and cultivars). 3-O-Sopporotriosides and sophorosides of quercetin and kaempferol, and their acyl derivatives were detected in the tested pea samples from *Pisum* spp. Tetra- and tri-glycosylated kaempferols and their p-coumaroyl derivatives were detected in the lentils. Cowpea, blackeye pea, and long bean from *Vigna* genus contained 3-O-glycosylated flavonols, and hydroxycinnamates. Mung bean (*Vigna radiata*) contained seven C-glyco-

syated flavones. This is the first detection of hydroxycinnamates in peas of *Vigna* species, and some of the flavonol glycosides in the other materials.

## B-6

### ANTIOXIDATIVE ACTIVITY AND OXIDATIVE STABILITY OF MUNGOONG, A SHRIMP EXTRACT PASTE, DURING EXTENDED STORAGE

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This investigation aimed to determine fatty acid profile and mineral composition of Mungoong, a Thai shrimp extract paste, and to monitor antioxidative activity and lipid oxidative stability of Mungoong during storage. Mungoong from white shrimp (*Penaeus vannamei*) cephalothorax with dark brown in color was subjected to different analyses. Another portion was placed in polypropylene container and closed tightly. The samples were stored at room temperature (28-32°C) and 4°C for 8 weeks. Samples taken at day 0, 1, 2, 4, 6 and 8 were determined for antioxidative activity using DPPH and ABTS radical scavenging activities and ferric reducing activity power (FRAP) assays as well as thiobarbituric acid (TBA) value. Mungoong contained polyunsaturated and saturated fatty acids at levels of 42.3 and 57.7%, respectively. Oleic acid (C18: 1 (n-9)) and linoleic acid (C18: 3 (n-6)) were the major fatty acids in Mungoong. It was rich in n-3 fatty acids including C20:5 n-3 (EPA) (4.31 g/100g) and C22: 6 n3 (DHA) (7.07 g/100 g). Mungoong consisted of Na (15.3 g/kg) and Ca (8.07 g/kg) as the major minerals. Fe and Cu, the pro-oxidants, were found at very low content. Mungoong water extract showed antioxidative activity determined by ABTS, DPPH radical scavenging activities and FRAP of 100.96, 4.5 and 16.41 micromol Trolox equivalent/g sample, respectively. During the storage of 8 weeks, antioxidative activities determined by all assays remained constant within the first week (P>0.05). Thereafter, only slight decreases in activities were noticeable. The residual activities greater than 80% were retained after 8 weeks of storage. For TBA values, the sample had the increase in TBA values during the first 2 weeks of storage (P<0.05), followed by the gradual decrease up to 8 weeks. No marked changes in

antioxidative activities and TBA values were observed between both storage temperatures. Thus, antioxidative peptides or Maillard reaction products (MRPs) in Mungoong might contribute to the retardation of lipid oxidation of Mungoong during storage.

## B-7

### CHARACTERIZATION OF ANTIOXIDATIVE PEPTIDES FROM PROTEIN HYDROLYSATE OF YELLOW STRIPE TREVALLY (*Selaroides leptolepis*)

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Keywords: antioxidative activity, protein hydrolysate, purification, alcalase, flavourzyme

The objective of this study was to characterize the antioxidative peptides from protein hydrolysate of yellow stripe trevally (*Selaroides leptolepis*) produced by Alcalase (HA) and Flavourzyme (HF). To prepare protein hydrolysates, yellow stripe trevally meat was hydrolyzed by Alcalase 2.4L and Flavourzyme 500L to obtain the degrees of hydrolysis (DH) of 15% using pH-stat method. The fractions with different MWs (<3, 3-5, 5-10, 10-30, >30 kDa) were prepared using ultra filtration. Antioxidative activity of hydrolysates and their fractions was determined using Trolox equivalent antioxidant capacity (TEAC) assay. HA and HF containing peptides with MW smaller than 3 kDa showed the highest antioxidative activity. At the same level used, HA possessed the stronger antioxidative activity than did HF ( $p < 0.05$ ). The peptides of HA and HF separated using Sephadex G-50 column also were measured for antioxidative activity. The fraction of HF with MW of 1.77 kDa exhibited the strongest antioxidative activity, compared with other fractions. For fractions of HA, that having MW of 2.44 kDa showed the highest antioxidative activity. Thereafter, the Sephadex G-50 fractions with the strongest antioxidative activity from both HA and HF were subjected to a SP-Sephadex C-25 column. The fraction of HF generally showed the higher antioxidative activity than did that of HA ( $p < 0.05$ ). However, those peptides isolated from both HA and HF had a lower antioxidative activity than

did Trolox at the same concentration tested ( $p < 0.05$ ). These results indicated that the peptides from yellow stripe trevally hydrolysates can be used as the natural antioxidant and the activity was governed by the enzymes used as well as its MW.

## B-8

### In vitro ANTIOXIDANT ACTIVITY DURING SHELF LIFE PERIOD OF GARLIC (*Allium sativum*) AND BYPRODUCTS

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Keywords: in natura garlic, commercial garlic byproducts, antioxidant activity, shelf life

The interest for ready-to-eat garlic byproducts increased in the last decade. Garlic has phenolic and sulfur compounds, which are responsible for the singular flavor and antioxidant activity. Objectives: This study aimed to evaluate the antioxidant activity (AA) of in natura garlic and its commercialized byproducts, and to correlate the data with phenolics content during shelf life period. Material and methods: Methanolic extracts of in natura garlic (ING) and its products, i.e., chopped with salt (CWP), chopped without salt (CS), fried (FG) and mixed garlic - in natura garlic with dehydrated garlic (MG) were evaluated in three different moments during the shelf life. This evaluation based on the measurement of the following parameters: total phenolic compounds and AA. The AA was evaluated using three different methods: DPPH (1,1-diphenyl-2-picrylhydrazyl) assay,  $\beta$ -carotene/linoleic acid system and Rancimat® method. Phenolic content was measured using the Folin-Ciocalteu method. Results: Total phenolics content ( $\mu\text{g}/\text{mg}/\text{galic acid equivalent}$ ) of the extract in relation to the dried residue was higher in FG and the content of these compounds decreased during shelf life for CWP (4.78 to 2.10), CS (6.36 to 2.55), FG (8.32 to 6.45) and MG (6.21 to 2.74), while it increased in ING (6.99 to 8.70). Regarding the AA, FG showed the best activity in all measurements. Throughout the shelf life, the free radical scavenging capacity (DPPH) decreased for all samples (FG decreased from 60.85 to 49.83 %), except for ING,

which presented no changes. Concerning to  $\beta$ -carotene/linoleic acid system and Rancimat® method, the AA values increased or kept the same during the shelf life, for all samples. Conclusion: This study showed the antioxidant potential of garlic, therefore its consumption may be recommended as part of a healthy diet. Grants: FAPESP, CNPq and CAPES. Acknowledgements: Fresh Garlic LTDA.

## B-9

### **In vitro** ANTIOXIDANT ACTIVITY OF TAMARILLO (*Cyphomandra betacea*) IN NATURA AND PULP

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Keywords: tamarillo, pulp, antioxidant activity, phenolic compounds

Due to increasing interest in health and food industries many studies have been conducted in order to investigate the antioxidant activity in fruits and vegetables. Tamarillos (*Cyphomandra betacea*) or tomato tree are tropical oval-shaped fruits with redish peel, orange pulp and seeds. In Brazil, this fruit is mainly cultivated in Minas Gerais State, in the southeast. Objectives: Determine the proximate composition in tamarillo pulp (TP) and in natura (T), total phenolic compounds (TPC) and antioxidant activity (AA) in ether extract. Material and methods: TP was supplied by a jelly manufacturer and T was purchased in a local supermarket in the city of São Paulo. The proximate composition was conducted according to AOAC, 1995. TPC were determined using the Folin-Ciocalteu reagent. For AA evaluation, the samples were freeze-dried and tamized in order to perform the DPPH and  $\beta$ -carotene/linoleic acid methods. Results: The average of proximate compositions of TP and T were respectively: moisture 88.91% and 88.07%; ashes 1.28% and 1.03%; lipids 0.75% and 0.87%; proteins 1.74% and 1.63%; carbohydrates 7.32% and 8.4%. TPC in TP and T were respectively 87.2mg/100g/GAE (galic acid equivalent) and 104.98mg/100g/GAE. For DPPH determinations two ether extracts concentrations were used: 0.4 and 0.6 mg/ml. In the first, the AA was not satisfactory. In the second, TP presented

39.81% of AA and T 46.53%. In regard to  $\beta$ -carotene/linoleic acid method, the samples extract from TP and T presented 67.36% and 81.67% respectively of lipid oxidation inhibition. All tests indicated better results of T, i.e., TPC was higher in T ( $p=0.007$ ), which also presented better outcomes for DPPH ( $p=0.064$ ) and  $\beta$ -carotene/linoleic acid ( $p=0.008$ ) assays, when compared to TP. Conclusions: T presented better AA in relation to TP, which can be explained by the inappropriate processing of the pulp, thus diminishing the nutritional value.

Grants: USP, FAPESP and CNPq. Acknowledgements: A Senhora das Especiarias.

## B-10

### IDENTIFICATION OF PHENOLIC COMPOUNDS IN GRAPE BERRIES FROM MINAS GERAIS - BRAZIL

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Keywords: phenolic compounds, flavonoids, grapes

The objective of this work was to identify and quantify phenolic compounds including resveratrol, anthocyanins and other flavonoids in five grape cultivars cultivated in EPAMIG - Caldas - Minas Gerais. Two cultivars of *Vitis labrusca* (Niágara Rosada rootstocks IAC 766 and 196-17, and Folha de Figo rootstocks 420A and 196-17) and three cultivars of *Vitis vinifera* (Syrah, Merlot and Moscato Embrapa) were analyzed. Total phenolic was determined by the Folin Ciocalteu method according to Zielinki and Kozłowska (2000) and phenolics compounds were identified and individually quantified by HPLC coupled to a diode array detector, according to the method of Arabbi et al. (2004). The content of total phenolics varied significantly, from  $65 \pm 1$  to  $390 \pm 30$  mg gallic acid equivalents/100 g of FW (Fresh Weight). Malvidin, delphinidin, peonidin and cyanidin were the anthocyanidins identified in different amounts depending on the cultivar. The total content of anthocyanins varied from  $6.7 \pm 0.2$  to  $154 \pm 4$  mg of cyanidin equivalents/100 g FW. Resveratrol was found in three cultivars, in contents from  $0.022 \pm 0.001$  to  $0.60 \pm 0.03$  mg/100 g of FW. In addition to hydroxycinnamic acids, flavonoids such as



catechin, epicatechin, quercetin and kaempferol were also present. The grapes of Moscato Embrapa cultivar (White grapes) presented a total phenolic content about four times lower than those of red cultivars. The darker grapes presented higher anthocyanin contents and consequently higher total phenolic contents. Support: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP).

## B-11

### **INFLUENCE OF SOME AGRICULTURAL VARIABLES AND CONVENTIONAL COOKING ON THE CAROTENOID COMPOSITION OF SNOW PEAS (*Pisum sativum* ssp. *Macrocarpum*)**

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Snow peas are well adapted to Brazilian climate because they tolerate high temperatures, despite they grow mostly in South and Southeast regions. As Brazil is a big country, climate differences can influence vegetables nutritional characteristics. The aim of this work was to evaluate the influence of place and seasonal variations on carotenoids profile of snow peas cultivated in São Paulo and Minas Gerais as well as to estimate changes occurred due to conventional cooking for five minutes. Three crops from the two states were collected randomly at CEAGESP in 2005 April, 2006 February and September. Carotenoids were separated by open column chromatography and their spectra were read in spectrophotometer in wavelengths from 350 to 550nm. Two carotenoids were identified: lutein and  $\beta$ -carotene, which varied from 16,07 to 49,72 $\mu$ g/g and from 3,68 to 12,05 $\mu$ g/g respectively. After using F test to check variance similarities, data were statistically analyzed by ANOVA two-way ( $p < 0,05$ ). In snow peas from São Paulo,  $\beta$ -carotene varied between the three crops, being its content significantly higher in 2005 April and the lowest in 2006 February. Lutein content differed between the crops of 2005 April and 2006 September, being in this period lower than that. On the other hand, snow peas from Minas Gerais did not differ in their content of  $\beta$ -carotene among the harvest periods studied, but the amount of lutein was higher in

2006 February than in 2006 September. Then, carotenoids in peas from the two regions were compared and no significant difference was observed. Besides, cooking did not cause significant changes in the content of any carotenoid. These results show that crop is the factor that most influences the content of carotenoids in snow peas and conventional cooking for five minutes is not enough to alter carotenoids composition. However, there should be more studies over the year covering all the seasons to have more data and express the complete variation all over the year.

## B-12

### **ANTIOXIDANT CAPACITY AND ASCORBIC ACID CONTENT OF SOME FRUITS CONSUMED IN BRAZIL**

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Keywords: antioxidant capacity, fruits, vitamin C  
Epidemiological evidence links high intake of antioxidant micronutrients like ascorbic acid and phytochemicals to health promotion. Fruits in general contain different phytonutrients, other than vitamin C, many of which have antioxidant properties. The objective of this work was to determine the Folin Ciocalteu reducing capacity, the 1,1-diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging capacity and to quantify vitamin C in twenty fruits consumed in Brazil. Folin Ciocalteu reducing capacity was determined according to Zielinski and Kozłowska (2000) and varied from 31 to 1052 mg gallic acid equivalents/100 g of FW (Fresh Weight). The antioxidant capacity analyzed using the DPPH method varied from 2.6 to 64  $\mu$ mol trolox equivalents/g FW. Total ascorbic acid, determined according to Potters et al. (2005), ranged from 3.7 (grape) to 217 mg/100 g FW (cashew), however in some fruits ascorbic acid was not detected. Grumixama (*Eugenia brasiliensis*) showed the highest antioxidant capacity, followed by jaboticaba (*Myrciaria jaboticaba*) in both methods. The highest level of ascorbic acid was found in cashew (*Anacardium occidentale*), followed by white guava (*Psidium guajava*). In all fruits analyzed, DPPH activity was found to have a good correlation with Folin Ciocalteu reducing capacity. This



study demonstrates the wide diversity of antioxidant capacities and ascorbic acid contents in fruits from different species and families. The fruits such as grumixama, jaboticaba and grape presented high antioxidant capacity, but presented low content of ascorbic acid, suggesting that phytochemicals present in fruits would be superior to ascorbic acid for contributing to biological activity.

Support: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP).

### B-13

#### QUANTIFICATION OF TOTAL ELLAGIC ACID IN STRAWBERRIES (*Fragaria x ananassa* Duch.)

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Keywords: strawberry, ellagic acid, hydrolysis, optimization

Strawberries are one of the most popular edible fruits in Brazil and their consumption has been increasing with the development of new varieties available at almost all seasons. This fruit represents the main source of ellagic acid derivatives in the Brazilian diet and this polyphenol can exist as free form (rarely found), glucoside or linked as ellagitannins. The detection and quantification of this compound are based in the fact that when the ellagitannins are exposed to acids the free ellagic acid is formed. Many authors have reported that although the common analytical techniques for measuring ellagic acid have good reproducibility, the results differ depending on the method of extraction used and whether the extract is hydrolyzed before analysis. According to this, the objective of this study was to optimize the conditions to determine the total ellagic acid content in strawberries by testing different methods previously reported. The results showed that the hydrolysis condition using 1.2M HCl for 20 hours resulted in a high ellagic acid content. However, the highest content was obtained by the method using 2N TFA at 120°C for 90 minutes. The other methods tested resulted in lower recoveries, indicating incomplete hydrolysis of ellagitannins. The best solvent for the extraction was also determined and the results

showed that 80% acetone was the most efficient. Besides this, the hydrolysis temperature was tested and the results showed that hydrolysis using 2N TFA at 120°C for 60, 90 or 120 minutes did not change significantly the total ellagic acid contents obtained. In conclusion, the best condition for the determination of the total ellagic acid content in strawberries was the following: extraction with 80% acetone, and hydrolysis using 2N TFA at 120°C for 60 minutes.

Support: Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP).

### B-14

#### ANTIOXIDANT CAPACITY OF EXOTIC FRUITS AND COMMERCIAL FROZEN PULPS FROM BRAZIL

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Keywords: antioxidant capacity, fruits, frozen pulps

Epidemiological studies and clinical trials have indicated that high intake of fruits and vegetables may be associated with low incidence of numerous degenerative diseases. It is known that antioxidant capacity is associated with potency of the bioactive compounds present in food and it can be determined through several methodologies. In this study, the antioxidant capacity of exotic fruits and commercial frozen pulps was measured by different assays, such as DPPH radical scavenging assay and the oxygen radical absorbance capacity assay (ORAC), with fluorescein as the fluorescent probe. Also, the Folin-Ciocalteu reducing capacity was evaluated for comparison. Among the fruits, camu-camu extracts showed the highest DPPH radical scavenging activity, ORAC and Folin-Ciocalteu reducing capacity. Fruit samples showed a strong correlation in DPPH x Folin Ciocalteu ( $r=0.99$ ), ORAC x DPPH ( $r=0.93$ ) and Folin Ciocalteu x ORAC ( $r=0.93$ ). The frozen pulp cambuci demonstrated the best DPPH radical scavenging activity, and the frozen pulp cagaita presented the highest ORAC. Araça frozen pulp showed the highest Folin-Ciocalteu reducing capacity. Commercial frozen pulps samples showed good correlation only in DPPH x Folin Ciocalteu ( $r= 0.72$ ). In conclusion,

this study demonstrated that exotic fruits from Brazil analyzed in this work represent good sources of antioxidants. However, it is not possible to confirm that commercial frozen pulps showed the same efficiency. The effects of processing should be considered as a negative impact in regard to the content of bioactive compounds, such as polyphenols and vitamins.

Support: Fapesp.

## B-15

### THE AMAZONIAN FRUITS TAPEREBÁ (*Spondias mombin*) AND MURICI (*Byrsonima crassifolia*) HAVE HIGHER LEVELS OF QUERCETIN THAN COMMERCIAL FRUITS

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Keywords: flavonoid, HPLC determination, fruits

Objective: To determine the five major flavonoids (myricetin, quercetin, luteolin, kaempferol and apigenin) in the Amazonian fruits taperebá and murici. Material and methods: Three lots of taperebá and murici fruits were sampled and analyzed. At each sampling for each fruit, 500 g were taken from each of three sites in Belém, Pará, and transported by air to Campinas for immediate analysis. The fruits from the three sites were mixed, 100 fruits were taken and homogenized after removal of inedible portions. Fifteen g subsamples of the homogenized pulp were submitted to duplicate analysis. The flavonoids were determined as aglycones by HPLC-DAD. The optimum conditions for hydrolysis were established using Central Composite Design (CCD). A Symmetry C-18 (2.1x150 mm, 3.5 µm) Waters column was used. The mobile phase consisted of methanol and water, both acidified with 0.3% formic acid. A multilinear gradient was applied from 20:80 to 52:48 in 6 minutes, this proportion being maintained until 29 minutes, then changed to 72:28 in 2 minutes, this proportion being maintained until 40 minutes. Results: Optimum conditions for hydrolysis/extraction, defined by CCD, differed between fruits; the final HCl concentration was 0.5M for taperebá and 0.8M for murici and the hydrolysis time were 105 minutes for taperebá and 27 minutes for murici. Quercetin was found in taperebá (92±17 µg/g) and murici (58±6 µg/g). Myricetin was

encountered only in taperebá (3.4±1.1 µg/g). Luteolin, kaempferol and apigenin were not detected in any of the fruits. Conclusions: The quercetin content of taperebá surpasses those of commercial Brazilian fruits (Ribani and Rodriguez-Amaya, 2005), including apple (75±11 µg/g), internationally considered rich source of this compound, and pitanga (62±9 µg/g), the Brazilian fruit with the highest level. The quercetin concentration in murici is also higher than the commercial fruits, except apple and pitanga.

Support: FAPESP (PRONEX Project no. 2003/10151-4).

## B-16

### NATIVE BRAZILIAN GREEN LEAFY VEGETABLES ARE RICHER SOURCES OF CAROTENOIDS THAN COMMERCIAL LEAFY VEGETABLES

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Keywords: carotenoid composition, HPLC, native Brazilian vegetable

Objective: To determine the principal carotenoids (neoxanthin, violaxanthin, lutein and β-carotene) in five native leafy vegetables. Materials and methods: The following indigenous Brazilian leafy vegetables were analyzed by HPLC: caruru (*Amaranthus viridis* L.), mentruz (*Lepidium pseudodidymum* Thell), taioba (*Colocasia esculenta* L.), serralha (*Sonchos oleraceus* L.) and beldroega (*Portulaca oleracea* L.). Parsley (*Petroselinum crispum* (Mill) Nyman ex A.W Hill) and coriander leaves (*Erygium foetidum* L.), shown to be the richest among commercially produced leaves in previous studies were also analyzed for comparison. Five sample lots collected at different times during the year were analyzed for each vegetable immediately after harvest. The carotenoids were extracted with acetone, partitioned to petroleum ether, concentrated in a rotary evaporator, and brought to dryness with nitrogen. The sample was dissolved in HPLC grade acetone, filtered and injected into the liquid chromatograph (Waters separation module with a UV visible photodiode array detector). The column was monomeric C18 Spherisorb ODS2, 3µm, 4.6x150mm. The mobile phase consisted of acetonitrile (containing 0.05% of triethylamine), methanol and ethyl acetate, used at a flow rate of 0.7mL/min. Results: Lutein concentration was

119±21, 111±48, 104±44, 87±7 and 34±15µg/g, and β-carotene content was 114±22, 97±40, 66±18, 72±9 and 32±14µg/g for caruru, mentruz, taioba, serralha and beldroega, respectively. Except for beldroega, these values were higher than those of commercial leaves. Parsley had 71±31µg/g of lutein (56±7µg/g in a previous study) and 53±21µg/g of β-carotene (30±12µg/g in a previous study). Coriander leaves contained 75±8µg/g of lutein and 54±5µg/g of β-carotene. The violaxanthin and neoxanthin concentrations were also higher in the native leaves. Conclusions: The native leafy vegetables investigated are richer sources of carotenoids than commercial leafy vegetables.

Support: Fundação de Apoio à Pesquisa do Estado de São Paulo (FAPESP) through the PRONEX Project no 2003/10151-4.

### B-17

#### ANTIOXIDANT CAPACITY AND PHENOLIC CONTENT OF STINGLESS BEE HONEY FROM AMAZON

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Keywords: honey of stingless native bees, total phenolics, flavonoids, antioxidant activity

Amazon region has a huge potential for production and exportation of stingless bee honey (*Meliponinae* family), which is increasing due to initiatives towards sustainable development of the rain forest. This honey is quite different from Apis (European bee) honey and is traditionally used for medicinal purposes. Besides sugar and water, other compounds, present in low content in honey, play an important role in flavor and biological properties. Phenolic compounds are responsible for the antioxidant activity and are also used as biomarkers of Apis honey origin. Up to date there are no data concerning phenolic compounds composition and antioxidant activity of stingless bee honey from Brazilian Amazon region. Objectives: Quantify total phenolic compounds (TPC) and evaluate in vitro antioxidant activity of *Meliponinae* methanolic extract from honey collected in Amazon region during 2004-2005. Material and methods: Four samples of *Melipona seminigra merrillae* bee

(MSM) and one sample of *Melipona compressipes manaosensis* bee (MCM) honey, were obtained from different regions of Amazonas, directly from producers. The extraction of total phenolics was performed in glass column with the resin Amberlite XAD-2. The Folin-Ciocalteu method was used to quantify total phenolics. Flavonoids were quantified after addition of AlCl<sub>3</sub>. Antioxidant capacity was determined through scavenging DPPH free radical and expressed as IC<sub>50</sub>. Results: The TPC varied from 572,9 (±65,9) to 1329,4 (±121,8) µg/100 g QE (Quercetin Equivalent) and the flavonoids content varied from 85,0(±7,1) to 203,2(±58,7) µg /100 g QE in MSM honey extracts. MCM honey presented total phenolic content of 458,7(±0,6) µg/100 g/QE and flavonoid of 74,8 (±21,3) µg/100 g QE. The IC<sub>50</sub> varied from 26,34 to 5,89 µg/100 g QE compared to BHT (6,32 µg/ml). Conclusion: This study showed that honey samples of Brazilian bees species present antioxidant potential which might be related to the phenolic compounds composition.

Support: Fapesp and CNPq.

### B-18

#### COMPOSITION, PHYSICOCHEMICAL AND FUNCTIONAL PROPERTIES OF MACA (*Lepidium meyenii* Walpers) ROOT STARCH

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Keywords: starch, maca, *Lepidium meyenii*

Maca (*Lepidium meyenii* W.) is an edible root found in Central Andes of Peru, presenting high content of protein and carbohydrates. The roots are stored and consumed all year long. The aim of this study was determine some physicochemical and functional properties of maca starch extract. The root samples were obtained in local market of Arequipa - Peru, four days after harvest. The starch chemical composition was determined according AOAC (1995) and IAL - Brazil (1985) procedures. The starch isolated was suspended whit NaOH 0.5 M solution, and the resulting mass neutralized with CH<sub>3</sub>COOH 0.5 M; followed by precipitation and washed with ethanol at 80%. The precipitated starch was hydrolyzed with amyloglucosidase/α-amylase and quantificated by Antrona Reactive. Total fiber was determined using the enzymatic/gravimetric

method; total and reducing sugar contents using phenol-sulfuric and 3,5-dinitrosalicylic acid, respectively. The rate amylose/amylopectin of the starch was evaluated by staining with I2-KI solution; the swelling power of the granules was determined by gravimetric method. The viscosity of the extract starch was analyzed using a viscoamylograph (Brabender PT 100) and the morphology of the granules was observed by scanning electronic microscopy (Jeol JSM 840A). The starch granules showed oval and spherical-oval shapes with sizes varying from 7.37 micrometer to 11.93 micrometer, and diameters from 4.18 micrometer to 5.30 micrometer. The extracted starch showed 87 % of purity, with 0.2 % of lipids and 0.12 % of mineral residues, without remaining protein. The total sugar and reducing sugar contents were 1.52% and 1.21%, respectively, and the amylose content was of 20.4%. At 46.4 °C, maximum temperature of gelatinization, the viscoamylogram showed a peak of 1260 UB, and the starch had 38.11 % water absorption capacity at 80 °C. The results of the maca, starch characterized by the reduced size and low temperature of gelatinization, without the presence of protein, suggest its use in foods that need mild process temperature. Financial support: CAPES, CNPq.

## B-19

### SEPARATION, IDENTIFICATION AND ANTIOXIDANT ACTIVITIES OF NATIVE ISOFLAVONES AND PRENYLISOFLAVONES IN DIFFERENT PLANT SOURCES

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Isoflavones are a unique group of secondary metabolites mostly found in leguminous plants, many of which have been used in our diets and as herbal medicines. Isoflavones have been found to lower risks of human breast cancer, cardiovascular diseases and to alleviate symptoms of postmenopausal syndrome. Separation and detection of isoflavones have been found difficult because these compounds can be at minute concentrations in a highly complex matrix, and most isoflavones are in glycoside forms in plants. In this study we developed a method using high-performance liquid chromatography

(HPLC) coupled with a diode array detector (DAD) and an electrospray ionization-mass spectrometer (LC-ESI-MS) for the separation and detection of native forms of isoflavones (aglycones, glucosides and malonylglucosides) in 5 soybean and 13 red clover cultivars, and in the flour of a Chinese herb, kudzu (*Pueraria thomsonii*). We also developed a method for semi-preparative high-speed counter-current chromatographic (HSCCC) purification method for isoflavones and prenylated isoflavones from the above mentioned plants and a native American tree fruit, the Osage orange (*Maclura pomifera*). The antioxidant activities of the crude extracts and purified isoflavones were evaluated using different *in vitro* methods. The results showed that different soybean or red clover varieties varied significantly in the total and individual isoflavone content. Isoflavones in red clovers were mostly formononetin and biochanin A in their aglycone form, particularly in the leaf (up to 32 mg/g DW), whereas the total isoflavone contents in the soybeans ranged from 3.4-5.4 mg/g DW, mostly as malonylglycosides of genistein and daidzein. Kudzu contained 7.1 mg/g DW, mainly puerarin and daidzin (glycosides). Osajin and pomiferin were found to be the major prenyliso-flavones in *M. pomifera*. The antioxidant activity of isoflavones also depended greatly on the structural features.

## B-20

### SEPARATION, IDENTIFICATION AND ANTIOXIDANT ACTIVITIES OF PRENYLATED FLAVONOIDS IN BERBERIDACEAE PLANTS

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Many plants in the Barberry family have been used in traditional medicines to treat various human diseases such as anti-fatigue, immunoregulation, improvement of liver function, strengthening of bone and connective tissues, and prevention of cardiovascular diseases. However, the actual bioactive components are not well known. Research in recent years revealed that prenylated flavonoids might play an important role in the bioactivities of plants of the genus *Epi-medium*. Prenylated flavonoids were found to have

stronger antioxidant activity against microsomal lipid peroxidation, and greater antiproliferative and cytotoxic effects against several human cancer cell lines than non-prenylated flavonoids, and unlike some non-prenylated flavonoids, they do not have pro-oxidant activity even at high concentrations. In this study, we investigated the composition and factors affecting the prenylated flavonoids in different plants, and developed a method for semi-preparative separation of these compounds. Structural identification was done by ultraviolet spectrometry, mass spectrometry and nuclear magnetic resonance, and quantitative

analysis was performed using high performance liquid chromatography. The results showed that different varieties of *Epimedium* varied significantly in the composition and quantity of prenylated flavonoids. A complete profile of prenylated flavonoids in native Canadian plant *Vancouveria hexandra* was obtained for the first time. A total of 9 prenylated flavonoids were identified and their antioxidant activities evaluated using several different in vitro methods. The antioxidant activity of different extracts varied significantly, and it was found to be related to both the composition and concentration of prenylated flavonoids.



## C - FOOD CONSUMPTION AND NUTRIENT INTAKE

### C-1

#### RELATING EATING WELL WITH CANADA'S FOOD GUIDE TO CANADIAN NUTRIENT FILE FOODS

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**Objectives:** The 2007 Eating Well with Canada's Food Guide (CFG) is a key document for guiding food choices. The Canadian Nutrient File (CNF) is an exhaustive food composition database. Relating the CNF foods to the Food Guide provides extended information on groups and serving sizes. It provides a tool to link food intake data, within Food Guide group assignments, to the nutrient database, permitting comparison of intakes to Food Guide recommendations in a standardized fashion. The objectives to creating this tool were to: 1) provide a tool to facilitate standardization of data reporting within food groups particularly for nutrition assessment and monitoring purposes; 2) allow for the computer-

assisted breakdown of diets into Food Guide servings. **Designs:** The four CFG basic food groupings were retained while expanding these groups into 48 additional subgroups. Development of thresholds facilitates subgroup assignment. Serving sizes are consistent with those described in the Food Guide and in some cases reflect common sense eating patterns (e.g. 1 medium apple). In addition, 7 subgroups termed "Other foods" reflect foods with little or no nutrient density. **Results:** Users of this tool may access the information about specific foods online by doing individual food searches, downloading and manipulating the database or accessing the Excel subgroup files. Documentation reporting the rationales, thresholds and decision-making process accompany these files. **Outcomes:** The new assignments have been applied to the latest National Nutrition Survey data to assess Canadian eating patterns. Reception from health professionals accessing the older version of this tool has been very positive and the availability of a standard will allow comparison from one survey to another.

**C-2****DEVELOPMENT OF A QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE (QFFQ) TO ASSESS FOOD, NUTRIENT AND HETEROCYCLIC AMINE INTAKE IN JAPANESE BRAZILIANS**

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**Objectives:** The aim is to develop an ethnic-specific Quantitative Food Frequency Questionnaire (QFFQ) to assess intakes of specific foods, nutrients and heterocyclic amines, in a colonoscopy-based case-control study of colorectal adenoma among Japanese Brazilians (JBs) in Sao Paulo, Brazil. **Materials and methods:** To identify foods for inclusion in the QFFQ, a trained dietitian collected 24 hour recalls covering all days of the week in 60 outpatients (30 men, mean age 58 yrs; 30 females, mean age 57 yrs) without diseases causing change in diet. **Results:** All foods reported at least once by any subject were included in the QFFQ, which contains 161 food items grouped into 15 food groups (rice, pasta=11, breads=6, fruits=17, vegetables=25, beef and pork=21, chicken=13, fish=12, meat alternatives=2, soups=5, pizza and pies=8, cakes, biscuits, desserts and sweets=8, dairy products=13, snack foods=3, drinks=11 and alcohol=6). The frequency of consumption is assessed in eight categories ranging from 'never during the last year' to 'two or more times a day' (10 categories for drinks). Amounts consumed are estimated using familiar household units or 3-Dimension food models. The QFFQ underwent extensive pilot testing and was refined. The QFFQ will be interview-administered to assess usual food and nutrient intakes during the past 12 months. The QFFQ data will primarily be analyzed using the published Brazil and Japan food composition tables (FCT). As FCT values for mixed dishes are limited, we are collecting weighed recipe data for most composite dishes. A sub-study is planned using 24 hour recalls to calibrate results with those of parallel adenoma studies being conducted in Honolulu, Hawaii and Tokyo, Japan. **Conclusions and Support:** The QFFQ is culturally appropriate and up-to-date, and is expected to provide valid estimates of usual dietary intake to determine the association of intake

of specific foods or compounds such as heterocyclic amine intake with risk of colorectal adenoma in JB. Supported in part by AICR and US NCI.

**C-3****FOOD INTAKE OF PEOPLE AT A SUBURB AREA OF HANOI CAPITAL IN 1999-2005**

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**Objective:** To assess the change on Hanoi outskirts citizens diets, a study "Household dietary changes after 6 years (1999-2005)" was conducted. **Material and methods:** The sample size 96 households at 6 communes of Dong Anh district - Hanoi which was randomly selected. Food intake was surveyed by weighing households' food consumed in 24 hours in consecutive. The food composition table of Vietnam 2000 was used to calculation of nutrients value of food intake /person. **Results:** Over the 1999 and 2005 period the changes were observed in the amount of rice intake ( $426.30 \pm 105.0$  and  $340.8 \pm 87.4$ ), bread, noodle ( $6.90 - 102.8$  and  $250.0 - 88$ ) sweet potato ( $7.6 \pm 24.5$  and  $8.6 \pm 20.5$ ) bean ( $1.8 \pm 5.9$  and  $3.8 \pm 7.2$ ) peanuts, sesame ( $2.5 \pm 6.5$  and  $7.2 \pm 20.4$ ) Tofu, soybean ( $99.9 \pm 51.5$  and  $92.1 \pm 49.6$ ), root vegetables ( $95.7 \pm 96.8$  and  $74.8 \pm 61.5$ ) leaf vegetables ( $143.6 \pm 72.4$  and  $139.9 \pm 64.5$ ), fruit ( $1.5 \pm 7.9$  and  $79.0 \pm 89.9$ ), sugar, cake sweet ( $1.3 \pm 5.3$  and  $25.4 \pm 35.0$ ), fish sauces ( $22.6 \pm 14.4$  and  $26.8 \pm 13.8$ ), oil / fat ( $8.1 \pm 8.5$  and  $18.8 \pm 11.4$ ), meat and products ( $51.1 \pm 48.2$  and  $87.6 \pm 45.2$ ), egg - milk ( $10.5 \pm 16.9$  and  $32.0 \pm 30.2$ ), fish and fish products ( $15.6 \pm 27.2$  and  $19.2 \pm 30.0$ ), other sea foods ( $5.7 \pm 17.3$  and  $7.0 \pm 14.2$ ). **Nutrients values of dietary:** Energy (Kcal) ( $1928.5 \pm 368.1$  and  $2188 \pm 422.7$ ), protein(g) ( $65.5 \pm 14.5$  and  $75.1 \pm 15.7$ ), animal protein (g) ( $15.1 \pm 9.3$  and  $25.3 \pm 11.2$ ). **Vitamin and mineral:** Ascorbic ( $67.6 \pm 38.0$  and  $72.1 \pm 33.7$ ), Niacin (mg) ( $11.4 \pm 2.9$  and  $12.1 \pm 3.4$ ), Riboflavin (mg) ( $0.6 \pm 0.3$  and  $0.8 \pm 0.2$ ), Thiamin (mg) ( $1.0 \pm 0.3$  and  $1.1 \pm 0.3$ ) Carotene (mcg)  $3171.5 \pm 1654.3$  and  $4384.3 \pm 2398.4$ , Vitamin A (mcg)  $172.8 \pm 454.0$  and  $256.5 \pm 406.7$ , Fe (mg)  $22 \pm 7.9$   $26.5 \pm 9.6$ , Ca (mg) ( $495.5 \pm 242.3$  and  $659.4 - 379.3$ ). **Conclusions:** Food consumption of people in Dong Anh-Hanoi Vietnam has changed: Rice was reduced 85g and increased meat, eggs, milk, fruits. Vegetable intake was reduced, fish intake had no change. Energy of dietary was reached



to recommended dietary allowances in 2005. Lipid consumption was increased two times compared with 1999. Some vitamins and mineral reached the recommended dietary allowances.

#### C-4

### SPATIAL DISTRIBUTION OF NUTRITIONAL STATUS AND NUTRIENT INTAKES IN IRAQ, ESTIMATES FROM INTERNATIONAL DATA

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Research was undertaken to determine whether population nutrient intakes can be modeled in the absence of dietary surveys by using anthropometric indices of nutritional status, socioeconomic variables and national level food supply data. An experimental dataset was compiled based on 131 countries with simultaneously surveyed national average stunting, underweight and wasting in children under 5 (NCHS/WHO 1974) (SUW) in the Global Database on Child Growth and Malnutrition 1972-2004, and national averages for per capita energy, protein, and fat availability (EPF) for the survey year in the FAO Food Balance Sheet database (interpolated for 2004 surveys). The total population of the sample at latest survey year (median=2000) was 5.446 billion. There were no remarkable differences between the sample and all countries on nutritional, income or demographics dimensions, though populations living above 40 degrees N latitude were not well represented. Very strong relationships were identified between SUW and EPF worldwide, especially when measured using spatial and local regression and conditioned by demographic and socioeconomic data. Using a sparse model, EPF was projected from SUW, income and income distribution to 95 Iraq districts surveyed by WFP/COSIT (12/2003), estimate standard errors less than 10 percent. More extensive data including several hundred social, economic, food-related and health variables was available from the 6-8/2005 WFP/COSIT survey for 97 districts. This allowed the sparse model to be complemented with a more detailed food system model. Results were compared with estimated national nutrient availabilities, based on food balance sheet details for 2002 (FAO). Production, trade and processing were adjusted to literature; and food composition

values were employed from the literature. A simplified model combining both approaches was projected to Iraq regions (1991) and governorates (1996, 1997, 1998, 2000, 2003, 2005). The results indicate increasing nutritional inadequacies in Iraq after 1991, somewhat abating after 1997 and worsening over 2003-2005, and unevenly distributed spatially. Sub-national SUW and EPF variations range across world-wide variations; and with this proviso the method appears suitable for projecting food supply estimates into sub-national and other regions where dietary survey results are not available.

#### C-5

### THE COMPOSITION OF ESSENTIAL ELEMENTS IN THE TYPICAL DIET OF THE AMAZONIAN RIPARIAN POPULATION

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Keywords: essential elements, food samples, ICP-MS, Amazonian population diet

Trace elements play an important role in human biology, because they are either inadequately synthesized or not synthesized in the body. Malnutrition with non-adequate intake of essential elements is a major concern for many tropical developing countries. Then, the aim of this study was to document essential elements concentration in the typical diet of Amazonian riparian population. Thirty-three different food samples typically consumed by Amazonian riparian, situated on the banks of the Tapajós River, a major tributary of the Amazon were collected from four communities in 2006. About 200 mg of powdered food were accurately weighed into a Teflon digestion vessel. Then, 3 ml of 20% v/v of concentrated nitric acid and 1 ml of hydrogen peroxide were added. Decomposition of samples was carried out in a microwave digestion system (Milestone, ETHOS-1600). A five-step programme (20 minutes total time), with



maximum power of 600 W (150°C), was applied. Samples were analyzed by using an ICP-MS (PE ELAN DRC II). Rh and Y were used as internal standards. The contents of investigated trace essential elements in the diet of Amazonian riparian population were found to be in the range of 0.030-19.08 µg/g for copper, 0.04-121.92 µg/g for zinc, 0.03-35.83 µg/g for manganese, 0.98-678.4 µg/g for iron, 0.004-1.04 µg/g for cobalt, 0.05-62.96 µg/g for strontium and 0.006-4.87 µg/g for vanadium.

This work was supported by Fapesp, CNPq, IDRC.

## C-6

### CREATION OF NUTRIENT AND FOOD COMPONENT DEFINITIONS

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**Objective:** In order to facilitate collaboration and data sharing, a nutritional ontology was needed for the Thesaurus of the US National Cancer Institute (NCI). This project is part of the NCI Cancer Biomedical Informatics Grid (caBIG™) initiative to build an informatics infrastructure to connect data, research tools, scientists, and organizations. **methods:** We collected definitions of nutrients and food components from several sources: Tag names developed by the International Network of Food Data Systems (INFOODS) of the United Nations Food and Agriculture Organization; the documentation provided by the US Department of Agriculture as part of the Nutrient Database for Standard Reference; the US National Institutes of Health Office of Dietary Supplements; the NCI Nutritional Science Research Group; the International Union of Pure and Applied Chemistry; and general nutrition books. **Results:** We developed a vocabulary that includes a list of commonly analyzed nutrients and other dietary components, with definitions, units and interrelationships between items. In addition, properties, such as the USDA nutrient number, the INFOODS tagname, and whether the component has a dietary recommendation, were added. The ontology focuses on dietary components found in food and is structured under a hierarchical tree called "Bioactive Food Component". This tree includes macronutrients, such as dietary al-

cohol, carbohydrates, lipids, proteins and all subcomponents; micronutrients, such as dietary minerals and vitamins; and other components, such as dietary fiber, lignans, non-starch polysaccharides, caffeine, flavonoids, heterocyclic aromatic amines, nitrosamine, isoflavonoids, energy and ash. **Conclusions:** The final vocabulary will serve as a resource where researchers can unambiguously identify the dietary components under study and can search for dietary components that are included in a specific class, such as short chain fatty acids. In addition, new research studies can use the concepts (or NCI concept codes) to declare the definitions in use and thus help make the resulting study data more interoperable.

Support: US National Cancer Institute, Subcontract #82292CBS10.



## D - ANALYTICAL METHODS

### D-1

#### SIGNIFICANT FIGURES IN CAROTENOIDS ORANGE AND TOMATO RESULTS OBTAINED BY HPLC

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Keywords: carotenoids, significant figures, HPLC, food composition databases

**Objectives:** To contribute to the definition of the number of significant digits in the expression of carotenoids results obtained by a high-performance liquid chromatographic method (HPLC). **Material and methods:** The analytical method was validated for PDI orange (*Citrus sinensis* L. var. Lane Late) and tomato (*Lycopersicon esculentum* M. var. Lido) matrices which were also used to evaluate large scale and small-scale geographical variation, respectively. After solid-liquid and liquid-liquid extractions and concentration, HPLC isocratic method was used under the following conditions: mobile phase-acetonitrile:methanol (0.05 M ammonium acetate):dichloromethane, 75:20:5, v/v/v, containing 0.1% BHT and 0.05% triethylamine, at a flow rate of 1.5 mL/min; 5 µm Waters Spherisorb ODS2 and C18 (Vydac) columns; chromatograms extracted at 450 nm; injection volume: 50µL. Analytical measurement uncertainty was estimated based on laboratory intermediate precision and from individual contributions following the bottom up approach. The natural variation in carotenoids in oranges produced across the Algarve region was studied through analysis of representative samples from different locations; analysed tomato samples were all from the same field. Total measurement variance was the sum of the analytical variance with between-location variance. **Results:** Quantification limits for α-carotene, β-carotene, β-cryptoxanthin, lycopene, lutein and zeaxanthin varied between

0.88-1.4 µg/100g. The orange samples were rich in β-cryptoxanthin (0.16-0.23 mg/100g). The tomato samples were rich in β-carotene (0.9-1.2 mg/100g) and lycopene (7-9 mg/100g). For orange, β-cryptoxanthin total measurement uncertainty was 0.072 mg/100g. For tomato, total measurement uncertainty for β-carotene was 0.21 mg/100g and for lycopene 1.7 mg/100g. **Conclusion:** In order to give a correct account of the precision with which these constituents can be measured, considering also their natural variation, producing data for food composition tables, especially using composite samples, orange carotenoids measurement results should be reported with at maximum 2 significant figures for β-cryptoxanthin and zeaxanthin, and 1 for α-carotene, β-carotene and lutein. Results on tomato should present 2 significant figures for β-carotene and lutein and 1 for lycopene. **Support:** Work partially supported by the EuroFIR Consortium, funded under the EU 6th Framework Food Quality and Safety Programme; P. C. Nº FOOD-CT-2005-513944.

### D-2

#### IDENTIFICATION OF THE POLYPHENOLIC COMPONENTS OF 17 PEAR SKINS BY LC-DAD- ESI/MS

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A standardized screening method using LC-DAD-ESI/MS was applied to the analysis of polyphenolic components of 17 pear skin samples (*Pyrus communis*, other spp., and their varieties and cultivars). 10 hydroxycinnamates, over 20 flavone/flavonol glycosides, cyanidin 3-O-galactoside, catechin, epicatechin, and arbutin were detected in the tested pear skins. Arbutin and chlorogenic acid were the main pheno-

lics in all the pears, but their other components varied widely. 4 Asia pears contained only trace amount of other components, Yali pear contained significant amounts of dicaffeoylquinic acids, and the remaining pears contained significant amounts of the isorhamnetin glycosides, and their malonates, and lesser amounts of the quercetin glycosides. Red D'anjou and Seckel pears contained cyanidin 3-O-galactoside, red pear contained detectable amounts of kaempferol glycosides, and fragrant pear contained the glycosides of luteolin, apigenin and chrysoeriol. More than 10 phenolic compounds were detected in pears for the first time.

### D-3

#### EVALUATION OF THE SURVEY ON FOOD SCIENCES AND NUTRITION METROLOGY IN AFRICA

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500 analytical laboratories of food analysis were contacted through internet or direct contact with universities, governments' research center, and private laboratories agencies all over African continent. African food analytical laboratories cover a broad range regarding size (1-70 staff) and volume of work (2-200 analyses per day). Only 10 laboratories (18.18%) are subject to an external audit (mainly located in North Africa (Algeria, Morocco) and West Africa (Senegal) (3.66% according to ISO 17025/Guide 9.09% according to ISO 900x; 5.45% according to others; multiselection possible). Main fields of work were found to be linked to Biochemistry and Chemistry 27.27%; Medical and Pharmaceutical /consulting laboratory and quality control of pharmaceuticals 12.72%, Industries/company laboratory (Beer, Chocolate, Sugar) 7.27%; Research /laboratory in R&D; 36.36%; regulatory analysis 9.09%. 45.55% of laboratories for food analysis undertake analysis in relation to international trade. The main destinations for international trade are European Community (65%), USA (25%), Asia (9% with Japan 5%), Africa

(1% in Tunisia), other (4% including, Eastern Europe and South America). The use of reference materials and the participation in proficiency programs were found to mainly not be in accordance with the main fields of laboratory work. Only dairy and meat materials as well as various water samples are used as reference materials, and also proficiency programs targeting milk powders and cheese, meat paste and water samples are participated in. A list of unavailable reference and unavailable proficiency programs materials are discussed. The dominant reason for not using reference materials or not participating in proficiency programs is the inability to locate potential suppliers. The reason for that was found to be that the material was not developed / the proficiency scheme was not offered yet or there is a lack of information available to the laboratory. High expenses or in the case of proficiency programs an insufficient number of participants are also amongst problems. African laboratories and most of Africans FSN professionals are not aware of the importance of reference materials and proficiency programs. The self-estimation of importance of reference materials and proficiency programs for only Food analysis laboratory on a scale of 5 (high importance) to 0 (no importance) has an average of 0.5 (reference materials) and 1.3 (proficiency programs).

### D-4

#### APPLICATION OF SOLID-PHASE EXTRACTION-ELECTROSPRAY IONIZATION MASS SPECTROMETRY FOR THE QUANTIFICATION OF FOOD FOLATES

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Objectives: To measure naturally occurring folates in selected Indian foods by LC-MS/MS techniques that employ mass spectral detections and compared with the total folate obtained using the microbiological assay with *Lactobacillus casei* (ATCC 7469) as a test organism. Materials and methods: 18 Indian foods covering a wide range of matrices (cereals, pulses, vegetables and milk based preparations) were prepared traditionally and analysed for their individual folate profile and food folate content using a high performance liquid chromatography - mass spectrometry (LC-MS) procedure. The analytes were ex-

tracted from the samples using trienzyme treatment, carbon labeled ( $^{13}C_5$ ) analogue of the target folate forms were spiked into each sample as internal standards, purified on a solid phase extraction cartridge, analyzed by LC-MS/MS in the positive ion mode using electrospray ionization. The application of the system was verified by analyzing several certified reference materials. Results: The LC-MS/MS method used separated all the major food folate forms - 5-methyl tetrahydrofolate, 5-formyl tetrahydrofolate, folic acid, tetra hydro folate (THF) and 10-formyl folic acid. In contrast to the results evidenced in other studies comparing folate values determined chromatographically and microbiologically, this study revealed higher values for foods analyzed using LC-MS/MS with a remarkable increase in folate content upto 80% in fried food preparations on a dry weight basis. Conclusion: The total folate content obtained from LC-MS/MS was 2-3 times (upto 70% higher) higher in foods predominant in 5-formyl tetrahydrofolate and only a negligible difference in 5-methyl THF compared to the results obtained from microbiological assay, indicating the inability of the microorganism to utilize 5 formyl form efficiently for growth. The results also suggested that added fat interfered with the uptake of food folates by the microorganism. LC-MS/MS will enable accurate measurement of food folates for use in nutrition survey and bioavailability studies.

#### D-5

### CHARACTERIZATION OF EUCALYPTUS AND CITRUS MONOFLORAL HONEYS BY MOISTURE CONTENTS

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The variability in the moisture contents can be related with the botanical origin and climatic and geographic conditions in that this product is submitted during its elaboration. In sight of the innumerable sources of variation that can affect the moisture contents of the honeys, many times become difficult to use this physicochemical parameter to characterize its botanical origin. So, this study investigated the existence of significant differences in the moisture contents of eucalyptus and citrus honeys of some regions of the State

of São Paulo applying a hierarchical design. To verify if there was variability between the floral sources and between samples of honeys of the same botanical origin, it was carried through an analysis of Variance characteristic and intervals were calculated using the distribution  $\chi^2$  and the ratio between variances (sampling/error). All the statistical analysis was carried at a 95% confidence level, except for ratio between the variances that made use of a confidence level of 90%. The results of the hierarchical design suggested that the eucalyptus and citrus monofloral honeys present average moisture contents significantly different, although the great sampling variability observed. The eucalyptus monofloral honeys had showed superior average moisture contents (16.9 - 18.3%) in relation to obtained for the citrus monofloral honeys (15.5 - 17.5%). Thus, it can be suggested that the eucalyptus monofloral honeys are more influenced by the chemical composition of the dominant nectar in each floral type of honey than other factors such as ambiental and technological. The considerable sampling variance was attributed to the different ambiental, technological and regional conditions adopted during the production, processing and stockage of these types of honeys. In such a way, one suggests that to get a more confident characterization of the botanical origin of honeys by the use of moisture contents, attention would have to be focused on the standardization of conditions that can be controlled as practical of beekeeping and the processing.

#### D-6

### CHARACTERIZATION OF EUCALYPTUS AND CITRUS MONOFLORAL HONEYS BY GLASS TRANSITION TEMPERATURES (T<sub>G</sub>)

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Recently, the interest of many researchers in classifying the botanical origin of honeys using physicochemical parameters has been observed in literature. Each material possesses a glass transition temperature (T<sub>g</sub>) characteristic. In sight of this it has been recognized the practical significance of this physical property as a physicochemical parameter capable to govern the food processing, properties of the prod-

uct, quality and stability. In such a way, in this study, it was investigated the variability in the glass transition temperatures of eucalyptus and citrus monofloral honeys of São Paulo State. To verify if it had variability between the floral sources and between the samples of honeys of the same botanical origin, an analysis of Variance characteristic of a hierarchic design in two stages was carried and the confident intervals for these estimates was calculated using the distribution  $\chi^2$  and the ratio between variances (sampling/error). All the statistical analysis was carried in the confident level of 95%, except for ratio between variances that used a confident level of 90%. The results of the ANOVA for the hierarchical design suggested that a part of the variability in the  $T_g$  could be attributed the floral source of the honeys ( $F_{obs} = 55.83$ ) and to another part of the variability it could be associated to the differences between the samples of honey of each floral type ( $F_{obs} = 47.11$ ). The analysis of the calculated intervals for the ratio between variances agreed to the results of the ANOVA. This variability between the samples of honey can be related to external factors such as different climatic and regional conditions or practices of bee-keeping adopted during the production of the honey as well as the moisture contents that can influence in the localization of  $T_g$ . In such a way, from these results it can be suggested that the glass transition temperature of these types of honeys could be used to characterize its botanical origin.

use of a pre- or a post-column derivatisation for the quantification of thiamine and HET. Samples of the pork loin were fried for 7 and 12min and boiled for 30 and 60min, while the plaice were fried for 4 and 10min and boiled for 5 and 15min. The lowest values represented optimal eating quality. Vitamin B1 was quantified in raw and cooked samples. Two accredited HPLC-method were compared, pre- and post-column derivatisation. Both included quantification of thiamine and HET. Results from the post-column method showed that HET contributed significantly to the vitamin B1 activity. In the raw plaice the content of HET represented 44% of the content of thiamine. Maximum retention for thiamine, HET and the sum of thiamine and HET was 90%, 22%, and 83% in the fried pork loin, and in the fried plaice 128%, 11%, and 95%, respectively. Application of the pre-column derivatisation method was unable to separate thiamine and HET. Comparison between the two methods showed no difference as long as the sum of thiamine and HET was applied for the post-column method. HET contributed significantly to the vitamin B1 activity in the raw plaice and pork loin. In the future the determination of vitamin B1 in food by a post-column derivatisation has to include quantification of HET.

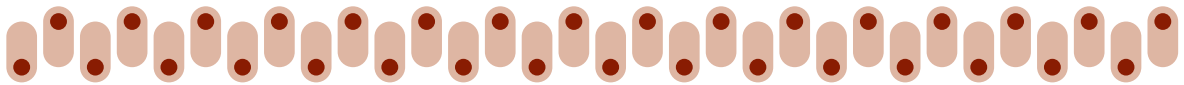
## D-7

### **VITAMIN B<sub>1</sub> - QUANTIFICATION OF THIAMINE AND 2-(1-HYDROXYETHYL) THIAMINE A NECESSITY**

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Keywords: Vitamin B1, thiamine, HET, post- and pre-column, cooking loss

To investigate the stability of the vitamin B1 active compounds during cooking, especially in regard to separate quantification of the two vitamin B1 active compounds thiamine and 2-(1-hydroxyethyl)thiamine (HET). To compare two HPLC-systems which made



Poster Session II

## **E - FOOD COMPOSITION DATABASE**

**E-1**

### **SYNCHRONIZATION AND HARMONIZATION OF CODING SCHEME AND DESCRIPTION OF FOODS IN PLANT FOOD DATABASE**

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**Objectives:** With many different databases on food composition and nutrient contents in Korea, interrelating, connecting, or comparing data among different databases have not been possible. Acknowledging such problems and limitations, we devised a food coding scheme considering standardization and/or harmonization to enhance the compatibility and comparability among different food databases recently. Onto this, we attempted to describe each food item systematically based on the proposed coding structure and using IN-FOODS system as a benchmark. **Material and methods:** We collected and analyzed information on preexisting food related databases, and a food description file was created after a scientific identification (including the taxonomic nomenclature confirmed by plant taxonomists) of each food entry in plant food groups. Then, standardized codes were assigned for each characteristic of these food items. Also the on-line food and nutrient data system which enables registration and search of individual food has been developed for easier accessibility and better usability of the system. **Results:** Each food item was described by 35 different characteristics as follows: Food Name (FN), Different Name (DN), English Name (EN), Single food or Mixed Food (SM), Food Source (FS), Scientific Name (SN), Variety, breed, Strain (VS), Part of plant or animal (PT), Country of Origin (CO), Area of Origin (AO), Food Group (FG), Manufacturer's Name (MN), Food Additives (FA),

etc. And standardized codes were assigned accordingly for more than 1,100 food entries of 8 different plant food groups in the Korean Food Composition Table. **Conclusion:** Similar work is to be completed for animal foods in 2007 and food databases would become more accessible for every stakeholder for their own uses and purposes, and for government to develop food and health-related policies.

**E-2**

### **DEVELOPMENT OF RECIPE & NUTRIENT DATABASE FOR DISHES SERVED AT SCHOOLS AND WORKSITES FOR NATIONAL HEALTH AND NUTRITION SURVEY IN KOREA**

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**Keywords:** nutrient database, food recipe database, school, worksite, National Health and Nutrition Survey

**Objectives:** With an increase in dining out frequency of Korean population, the necessity of food recipe and nutrient database for the meals taken away from home has been emphasized continuously. To provide appropriate information on diet for consumers' health and reliable database for National Health and Nutrition Survey in Korea, food recipe and nutrient database for the dishes served at schools or worksites has been developed. **Material and methods:** About 8,400 food recipes were collected from 12 schools and 3 catering services for worksite meals. After assigning codes and names to the dishes and the ingredient foods, 1st draft of standard recipes was developed for worksite/high schools, middle schools, and elementary schools separately. Among those, 100 dishes frequently consumed among Korean population and at



schools/worksites were selected and prepared accordingly to check the validity of the recipes and secure samples for further analysis of nutrient composition. The contents of energy, protein, fat, carbohydrate, and 9 vitamins and minerals were obtained through analysis. Results: Food recipe database for 824 dishes in school/worksites meals was developed and verified for three foodservice categories: worksite/high school, middle school, and elementary school. Based on the recipe database, nutrient content of 824 dishes were calculated using Food Composition Table and our own nutrient database. In addition, additional nutrient database for 100 frequently consumed dishes were developed based on the chemical analysis. Conclusions: This database will enable the assessment of food and nutrient intake of Koreans with increased reliability and linking that to health outcomes. It will also contribute toward achieving health goals stated in the Health Plan 2010 by allowing informed-consumers make better and healthy food choices.

### E-3

#### COMPARISON OF THE NUTRITIONAL COMPOSITION OF DISHES OBTAINED BY ANALYSIS AND BY THE USE OF FOOD COMPOSITION TABLES

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Keywords: analytical values, food composition tables, correlation

The Nutritional Study of the Andean Population of Jujuy (ENJU) included a dietary assessment based on the realization of a 24 h recall. In order to convert the information about food consumption into nutrient intake, a self-made food composition table (FCT) was created. Food composition data came from LATIN-FOODS and European (Spanish) tables. Objective: To compare the nutritional content of composite dishes cooked in canteens from North-western Argentina determined both by laboratory analyses of the samples and through the use of FCT. Material and methods: three food samples and details about the ingredients, amounts and cooking techniques were collected for 13 composite dishes during the field work of the ENJU. Most of them came from school canteens. The

content of protein, fat, carbohydrates, iron, zinc, water and energy were determined using two methods: The first one was based on the information of each recipe and the use of FCT. The second method was based on laboratory analyses of food samples using AOAC techniques. The results obtained using both methods were compared by paired t-test and correlation analyses. Results and conclusions: Correlation of the results of macronutrient, micronutrient, water and energy contents obtained by both methods were positive and significant. No statistically significant differences between both methods were observed in the content of water ( $p=0.67$ ), energy ( $p=0.88$ ), carbohydrates ( $p=0.34$ ), proteins ( $p=0.41$ ) and lipids ( $p=0.07$ ). However, statistically significant differences were observed in the results about the mineral content of dishes. On average, the use of FCT halved the content of iron and zinc of the dishes compared to the analytical results. These results confirm that there is a greater variability in the micronutrient determination of foods compared to their macronutrient content. Work supported by Universidad Nacional de Jujuy (Argentina) and Universidad de las Islas Baleares (España).

### E-4

#### COMPARISON TO EuroFIR RECOMMENDATIONS FOR NUTRIENT LOSS AND GAIN FACTORS CURRENTLY USED IN EUROPEAN FOOD COMPOSITION DATABASES

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Keywords: food composition data, nutrient loss and gain factors, recipe calculation

Objective: To collect and compare the nutrient loss and gain factors (NLG-factors), currently being used in European food composition databases (FCDB) for recipe calculation procedures. These factors include nutrient retention and weight yield factors (fat/water) after food preparation, processing or treatment. This inventory is a pre-requisite to harmonise FCDBs from partners involved in the EuroFIR Network of Excellence. Material and methods: Information has been requested and collected via e-mail from FCDB Compilers in 20 EuroFIR partner countries. Furthermore, a



literature search on NLG-factors was performed. Differences in the nature of the currently used factors were investigated. The recipe calculation methods, for which the factors are applied, were investigated within the EuroFIR Work Package 2.2. Results: Fifteen of the 20 European compilers investigated applied NLG-factors in their FCDBs for recipe calculation. Within the respondents, only a few different sources of these factors, like the data published by Bergström (1994), Bognár (2002) and McCance & Widdowson (2002), were used. Retention factors for vitamins are available in every source, those for minerals are found in few sources and those for protein are available in only one source. Variations from source to source in factors used for the same nutrient and the same food group were attributed to different cooking methods, cooking time and temperature, as well as to food quality. The results of this work were published in a report, which is available on the EuroFIR public website. Conclusion: The current use of only few different sources of NLG-factors in Europe may facilitate an agreement between EuroFIR FCDB compilers towards data harmonisation. The NLG-factors presented in the corresponding report will be the basis for future harmonisation of the data in recipe calculation procedures at a European level. Consequently, a proposal including recommended NLG-factors that can be applied for different cooking methods and various food groups for use by EuroFIR partners and other users is being prepared. Support: This work was completed on behalf of the EuroFIR Consortium and funded under the EU 6th Framework Food Quality and Safety Programme. Project contract No: FOOD-CT-2005-513944.

## E-5

### BIOACTIVE COMPOUNDS DATABASE. TBCA-USP/ BRASILFOODS

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Keywords: bioactive compounds, antioxidant capacity, TBCA-USP database

Fruits and vegetables contain bioactive compounds,

such as flavonoids, carotenoids, phenolic acids, vitamins C and E, among others, that are capable of restricting the propagation of chain reactions and lesions induced by free radicals. The capacity of these compounds to avoid actions that are harmful to the organisms is associated to their antioxidant, antimutagenic and anticarcinogenic properties, proving their importance to human nutrition. The phytochemicals antioxidant action depends on their chemical structure and concentration in the food, which is widely influenced by genetic factors, environmental conditions, ripening and plant variety. In Brazil, a country which has a great biodiversity, several foods and plants present these compounds with supposed benefic health effects. A lot of these foods have already been systematically and methodologically studied by researchers from the Chemistry, Biochemistry and Molecular Biology Laboratory of FCF-USP, however this information is spread in thesis, scientific papers and non-published data. In order to centralize and turn this information available, the Brazilian Food Composition Table - USP/ BRASILFOODS, which has been presenting quality data about Brazilian food chemical composition since 1998, aims to create a bioactive compounds database. This database is being created with data of flavonoids (total and specific compounds), total phenolics, vitamin C and other compounds, and also with food antioxidant capacity. Aiming to standardize data interchange, a new form for bioactive data compilation was created according to the form used by BRASILFOODS for compilation of other nutrients. At the same time, the IN-FOODS tagnames were adopted but it was necessary to propose new tagnames for specific compounds. In conclusion, the TBCA-USP/ BRASILFOODS ([www.fcf.usp.br/tabela](http://www.fcf.usp.br/tabela)) is presenting information about bioactive compounds, still little known, in Brazilian foods and with benefic human nutrition properties.

Financial support: PRONUT, USP. Participation: LATIN-FOODS, BRASILFOODS.

## E-6

### PARTIAL UPDATE OF THE COLOMBIAN FOOD COMPOSITION TABLE

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Objective: Compile and evaluate the information available in the country, regarding food composition, in order to obtain a partially updated Colombian Food Composition Table. Methodology: An analysis of the information contained in the Colombian Foods Composition Table (CFCT) version 2000, in which of 516 foods, only 293 were analyzed directly in the laboratory during the 50's and the information about the remaining foods was taken from the Panama and Central America Nutrition Institute (INCAP), and the Agriculture Handbook No.8 of 1950. Available information in the food industry, research centers and universities of the country was compiled. Information on other countries' food composition with a relevant national consumption was considered. All the information was qualified establishing quality indicators for: number of samples, analytic method, sample handling, sampling plan and analytic quality control. Based on these indicators, a qualification was assigned to each data element as follows: a: the user can have a great confidence in this value; b: the user can have a great confidence in this value, but small problems in the data base exist; c: the user may have less confidence in this value because of limited quantity or quality in the data, and d: unique data, that should be handled carefully by the user. Data on protein, carbohydrates, energy and vitamin A were recalculated because the scientific criteria for these calculations has changed through the time. Foods of the CFCT version 2000 with unknown data information origin, modified formulations, foods no longer in commerce or preparations without information on ingredients and proportions were excluded. According to INFOODS' guidelines, foods were grouped and relocated in 17 groups, and the nutritional information was structured in tables as follows: identification, proximal composition, hydro soluble vitamins, lipid soluble vitamins, minerals, and other attached tables with information on amino acids, fatty acids, cholesterol and carbohydrate composition. An interface for TCAC data consultation, register and update in the web was designed as well as an application for consultation via CD ROM. Results: Colombian Food Composition Table partially updated in written version, CD version and Web interface, with information on 1104 foods, described and identified. From these foods, 980 have information about proximal nutritional content with very few data on dietary fiber; 680 with mineral contents, specially Ca, Fe and P and in a smaller proportion data on Mg, Mn, Zn, Na and K,

and very few data on I and F; 210 with data on vitamin A; 580 with data on vitamins B1, B2, B3 and C, and in a smaller proportion about vitamins B6 and B12 and very few data on folates; in the attached tables there is information about composition on carbohydrates, fatty acids, cholesterol and amino acids. Conclusions: We count with a partially updated Colombian foods composition table, in printed document, CD Rom and Web interface. With this table, the number of foods was duplicated and the number of nutrients was increased in 60%. The Web interface permits register, consult and permanently update the information collected in the country on nutritional contents of foods to keep the table updated. The CD Rom makes any request of information quick and easy to the user.

## E-7

### FOOD COMPOSITION TABLES OF COSTA RICA (TCA-COR)

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Keywords: food composition tables, COSTA RICA-FOODS, dietetic fiber, micronutrients, LATINFOODS

In Costa Rica research projects and national food regulation programs generate continuously food composition data. Most of this information is available through scientific publications and reports, of limited access to national users. The purpose of this work is to present the first edition of the following three food composition tables: Tabla de Composición de Alimentos de Costa Rica: Macronutrientes y Fibra Dietética (TCA-COR Macronutrientes y Fibra Dietética), TCA-COR: Micronutrientes y TCA-COR: Alimentos Fortificados, each with ISBN identification. Tables include previously published and unpublished data of local foods that were chemically analyzed by INCIENSA and the Universidad de Costa Rica, Escuela de Química laboratories, as part of research projects and national fortified food regulation control programs. Data to be incorporated in the tables was selected based on criteria developed by LATINFOODS. Statistical analysis of compiled data included: mean value

and standard deviation or uncertainty value. For each food product, the specified composition content represents an average value expressed by 100 g edible portion. Year of collection and number of samples analyzed, as well as bibliographic references, are also indicated, when applicable. The TCA-COR: Macronutrientes y Fibra Dietética includes the proximal composition, dietetic fiber and starch fractions contents of 85 local foods; the TCA-COR Micronutrientes includes six minerals (Cr, Cu, Fe, Mn, Se, Zn) of 40 popular foods. The TCA-COR: Alimentos Fortificados reports the content of iron in: wheat flour, fluid and dry milk and of the fluoride and iodine content in domestic salt, all of them fulfilling since 2002 the national fortification regulations and international standards. These tables have updated and reliable data and include common foods, currently consumed in Costa Rica and other countries in the region. This work was supported by: INCIENSA, Vicerrectoria de Investigación of the UCR, MS, IFS, LANFOODS, CO-NICIT and Costa Rican industry.

### E-8

#### ANALYSIS OF INDIGENOUS GREEN LEAFY VEGETABLES TOWARDS DEVELOPMENT OF LESOTHO FOOD COMPOSITION TABLE

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Proximate and mineral concentrations were determined in 6 indigenous green leafy vegetables of Lesotho. The study plant crops were *Amaranthus hybridus*, *Chenopodium album*, *Wahlengergia androsacea*, *Rorippa nudiscula*, *Urtica dioica* and *Sisymbrium thellungii*. Other nutrient components such as vitamins were borrowed from other Food Composition Tables/Databases, and adjustments were done accordingly. Vegetables were collected countrywide to represent the four (4) agro-ecological zones and analyses were undertaken using the standardized methods. The highest levels of the inorganic constituents were found to occur in *Rorippa nudiscula*, and other vegetables were comparatively high in most mineral concentrations. The difference in means was found not to be significant among various locations. The levels of all analyzed nutrients compared well with those which have been obtained from similar studies elsewhere in the world. The results were compiled into a database using Microsoft Excel, where most of the food items' nutrient values were borrowed from other food composition database/tables and adjustments done accordingly. To minimize compilation error progress codes were used and data entering was double checked.



## F - REGIONAL FOODS AND NUTRIENT SPECIFIC AND PRODUCTS

### F-1

#### PRODUCTION AND PRESERVATION OF DATE JUICE BEVERAGE

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Shahani date was chosen as best variety to produce date juice in economic point of view, its extraction process was investigated and by chemical and enzymatic

clarification of date juice, a clear solution was produced, then with taste adjustment and organoleptic tests, a good drink was obtained. Finally preservation of date juice in dui-pack package was investigated. Pectinase and amylase were used for clarification of date juice. For  $\leq 30^{\circ}\text{BX}$  in 1 hr at  $55^{\circ}\text{C}$  and pH 3.7, optimum amount of pectinase and amylase was 0.02W% and 0.01W% respectively. Gelatin was used for clarification, too. Its optimum amount for  $<15^{\circ}\text{BX}$  was 0.02wt % and  $\geq 15^{\circ}\text{BX}$  was 0.04W%. Maximum  $^{\circ}\text{BX}$  that can use for clarification with gelatin was 20. At pH $>4$ , gelatin can not clarify date juice and clarification with gelatin was easier at  $50^{\circ}\text{C}$ . Best composition In view of taste and economic, up  $7^{\circ}\text{BX}$  or  $8^{\circ}\text{BX}$  from date juice was produced then sugar was added till obtaining  $12^{\circ}\text{BX}$  (standard BX for fruit juices). Produced drink at room temperature was storable and after 180 days from production no significant change in juice properties was reported. Such as other fruit juice, date juice can be produced as concentrate.

## F-2

### EFFECT OF GELATIN, TANNIN AND pH ON CLARIFICATION OF DATE JUICE BEVERAGE

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Clarified date juice is used to liquid sugar, carbonated and noncarbonated beverage and any where that can replace with non reducing sugar. This study involved the addition of gelatin and tannin in order to precipitate the colloidal materials which cause the turbidity of SHAHANI date juice. Different amounts of gelatin at different pH used, the best pH for clarification of date juice is 3. Best clarification was obtained when  $0.4\text{ cm}^3$  of gelatin was added to  $10\text{cm}^3$  date juice  $^{\circ}\text{BX}$  10, 15. Tannin has no effect on clarification, and at  $^{\circ}\text{BX}$  above 20 gelatin unable to clarifying Date juice.

## F-3

### INFORMATION ON THE NUTRIENT CONTENT OF COW'S MILK, GOAT'S MILK AND SOY MILK

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Keywords: cow's milk, goat's milk, soy milk, composition

The food choices one makes influence the body's health positively or negatively. Each day's choices may harm or benefit your health only a little, but when these choices are repeated over the years and decades, it may have a major effect. The objective of this review is to outline the nutrient content of cow's milk, goat's milk and soy milk and its potential health benefits and adverse effects in order for consumers to make informed decisions. The nutrient values reported were either analysed at the ARC-Irene Analytical Laboratory or obtained from the 1999 MRC Food Composition Tables. Cow's milk is more nutrient dense with higher values for protein, fat and carbohydrates, followed by goat's milk and soy milk. Cow's milk is a good source of vitamin A, vitamin B<sub>2</sub> and vitamin B<sub>12</sub>, as well as calcium and phosphorus. Goat's milk is a source of vitamin A and although the mineral content of goat's milk and cow's milk is almost the same, goat's milk is a better source of magnesium. Soy milk is a source of essential fatty acids, vitamin B<sub>1</sub> and vitamin B<sub>2</sub>, is low in saturated fatty acids and is lactose and cholesterol free. Note must be taken that merely comparing content and ratios in individual foods cannot predict the effects in the body when other foods are also consumed.

## F-4

### VITAMINS B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub> AND PP IN ROYAL JELLY

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Vitamins are essential organic compounds for human metabolism. They are present in foods in low concentrations. Vitamin B<sub>1</sub> (thiamin), B<sub>2</sub> (riboflavin), B<sub>6</sub> (pyridoxol, pyridoxal and pyridoxamine) and PP (niacin and niacinamide) are part of the B group of vitamins and act as coenzymes in energy metabolism. Royal jelly (RJ) is a honeybee's secretion from the hypopharyngeal and mandibular glands (*Apis mellifera*), used for the nutrition of honeybee workers, drones and queens. For human, it is used as food supplement, popularly known as rich in vitamins. The objective of

this work is to know the level of four vitamins and its vitamers from RJ samples. Unique extract procedure and HPLC determination for each of the four vitamins were used based on Moreschi (2006) procedure. Four samples from different Brazilian suppliers were analyzed and the results for B<sub>1</sub> vitamin ranged from 0.08 to 0.41 mg/100g, for vitamin B<sub>2</sub> ranged from 0.01 to 0.05 mg/100g; only two vitamers of B<sub>6</sub> vitamin were found: pyridoxal (0.13 - 0.38 mg/100g) and pyridoxamine (0.26 - 1.38 mg/100g) and both vitamin PP vitamers were found: niacin (0.21 - 0.57) and niacinamide (1.56 - 2.00 mg/100g). One lyophilized sample of RJ was analyzed and the vitamin profile was similar to the other samples. As the levels of studied vitamins are not negligible, it is necessary to extend the surveillance to have an overall view of the nutritional contribution of RJ and to understand the reasons for differences in the level of each vitamin (production region, seasonality, collection and storage practices).

## F-5

### EFFECT OF COOKING, POPPING, TOASTING AND EXTRUSION ON AMARANTH SEEDS STARCH DIGESTIBILITY

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Keywords: *Amaranthus cruentus*, rate of starch hydrolysis, hydrolysis index, proximate composition

Amaranth is an ancient plant, believed to be original of Central and Southern America. Over the past decade, amaranth has become an important topic of research because of its extraordinary nutritional value and adaptability in diverse climate and soil conditions. The seeds can be subjected to several treatments to be consumed as suspensions with water or milk or to be included in preparations. The present work investigated the effect of these treatments on composition and on the rate of starch digestion. Raw, cooked, popped, toasted and extruded amaranth seeds were evaluated. Proximate composition was determined in each sample. The *in vitro* starch hydrolysis, the hydrolysis index (HI), rapidly digestible starch (RDS) determination were also carried out on the same samples. All heat processes did not affect the amaranth

seeds proximal composition, which is 3.4±0.0g of ash, 7.6±0.1g of lipids, 16.2±0.4g of protein, 2.2±0.4g of soluble and 12.6±0.8g of insoluble dietary fiber and 58±0.3g of starch/100g (d.s.b). Raw seeds presented the slowest rate of starch hydrolysis: HI=86.5±2.0 and RDS=30.7±1.1% of dry weight. Cooking and extrusion increased HI to 95.9±7.9 and 93.8±1.0, respectively, relative to white bread as the standard sample (HI=100). No significant difference was observed between these samples and raw seeds. Popping and toasting enhanced the seed starch digestibility higher than white bread values (112.1±3.5 and 120.4±2.9, respectively). Extrusion cooking was the only heat treatment that did not change the RDS of the seeds. No significant differences were observed among cooked, popped and toasted RDS (36.1±3.6%, 38.0±0.2% and 42.9±0.6%, respectively), which presented lower values than bread (51.1±2.9%). These results showed that the most common methods of processing amaranth seeds preserve its nutritional value. The high digestibility observed, occurred probably due to the small size of amaranth starch granule (1-3µm of diameter) and to the fact that those heat based processes cause a complete loss of the crystalline and granular structure of amaranth starch. The digestion profile of amaranth is similar to other cereal based foods.

Support: FAPESP.

## F-6

### AMARANTH: FROM ANDEANS TO BRAZILIANS THROUGH EXTRUSION COOKING

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Keywords: amaranth, snacks, sensory acceptability, proximate composition, gluten-free

The use of amaranth dates back more than 5000 years in Andean territories of South America. Spanish colonizers banned its production and consumption for being a ritual food. In more recent times, because of its high nutritional value and cholesterol-lowering properties, amaranth was spread to other countries including Brazil; however, it's still an unknown food in this country. This study aimed at developing through extrusion cooking an amaranth based product acceptable to the Brazilian culture. The prod-

uct developed presented an original neutral flavor. It was flavored with salty (pizza) and sweet flavors (milk candy). Differently from the market available snacks, amaranth products were flavored with no fat addition, using as fixative agents a water solution on salty flavored snacks, and glucose syrup on sweet products. Proximate composition was determined in each sample. The formulations were submitted to a 40-member sensory panel to assess the attributes of texture, flavor and overall acceptance. Amaranth snack presented a high nutritional value:  $4.0 \pm 0.5$ g of ash,  $0.3 \pm 0.0$ g of lipids,  $18.2 \pm 0.1$ g of protein,  $15.8 \pm 0.9$ g of dietary fiber and  $61.7 \pm 0.5$ g of starch/100g (d.s.b.), with 2.4 times more protein and 5.5 times more fiber than similar corn products. Texture is the main sensory attribute of snacks, and no significant difference was observed between amaranth and corn snack neither in instrumental (shear tension:  $0.12 \pm 0.03$  v  $0.11 \pm 0.03$ N.mm<sup>-2</sup>) nor in sensory evaluation ( $7.4 \pm 0.2$  v  $6.9 \pm 1.6$ ). No significant difference was observed on flavor and overall acceptability between amaranth and corn snacks ( $6.1 \pm 1.1$ ,  $6.3 \pm 0.9$  v  $6.5 \pm 1.8$ ,  $6.6 \pm 1.7$ ). Although amaranth is an unknown raw material in Brazil, it shows good potential of use in the production of nutritionally balanced, ready-to-eat products in appetizing form. The good acceptance observed for either salty or sweet flavored snacks indicated that they have adequate characteristics to compete with similar commercial products. Amaranth seeds are a gluten-free food, so these snacks are also a nutritious alternative for celiac patients. Support: FAPESP.

## F-7

### AMARANTH SEEDS BENEFICIALLY AFFECT THE INTESTINAL TRACT OF RATS

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Keywords: food functional, dietary fiber, pseudocereal, physiological effects, intestinal parameters

Amaranth is a pseudo cereal from Andean origin. During colonization, once it was considered sacred in Pagan rituals, it was banned by the Spanish. Interest

in amaranth crop has increased in recent years due to its high nutritional value, especially the dietary fiber levels, around 10%. Objective: To investigate fermentative parameters of amaranth dietary fiber in a biological assay with rats. Material and methods: The amaranth seeds used in the experiments were from the species *Amaranthus cruentus* L., Brazilian variety BRS Alegria, provided by Embrapa-Cerrados (DF - Brazil). Young male Wistar rats were divided in two groups (n=12) that received control diet (5% cellulose) and experimental diet (5% amaranth dietary fiber), respectively, during 4 weeks. The colonic physiological parameters investigated were: the weight of the fecal mass collected in a time span of 96 hours, the net cecum mass and with its contents, and bulk pH. Results: Significant statistical differences were verified (p<0.01 - ANOVA) between amaranth diet and control in the following parameters: increase of excreted fecal mass ( $15.3 \text{g} \pm 2.41$  and  $12.6 \text{g} \pm 2.07$ , for amaranth diet and the control, respectively), increase of the cecal weight with content ( $4.41 \text{g} \pm 0.61$  and  $3.39 \text{g} \pm 0.34$ ), increase of the net cecal weight ( $1.47 \text{g} \pm 0.15$  and  $0.93 \text{g} \pm 0.11$ ), and moderate acidification of bulk pH ( $6.13 \pm 0.33$  and  $6.72 \pm 0.18$ ). Conclusion: These outcomes show that amaranth dietary fiber beneficially affects the intestinal tract, promoting the fecal mass enhancement, bulk pH decrease and cellular cecal tropism, suggesting colonic fermentation with short chain fatty acid production.

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## F-8

### NUTRITIONAL QUALITY OF RAW AND EXTRUDED BOVINE RUMEN PROTEIN

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The aim of this work was to investigate the nutritional quality of bovine rumen (a slaughterhouse by-product) protein, before and after extrusion, through its amino acid composition and in vivo true digestibility. The raw bovine rumen was minced, lyophilized, defatted and extruded. Amino acid composition was performed by ion-exchange chromatography. To *in vivo* protein digestibility, it was used ten young male Wistar rats, around



40g, for each group (raw bovine, extruded bovine and protein-free diet). The diets, except protein-free, had 10% of protein on dry basis. Water was provided *ad libitum* and diets were restricted to 15g per day. The animals were fed with standardized lab chow for an acclimation period of three days and with test diets during four days of preliminary period and five days of period balance. On each of these five days, feces and spilled food were collected, dried and weighted. The spilled food was used to calculate total food intake of animals and analysis of nitrogen content on feces was performed by micro-Kjeldhal. Nitrogen intake and fecal nitrogen were obtained by multiplying food intake and fecal weight by their respective nitrogen values and used to calculate the true protein digestibility. Animals were also weighted during experiment to value the capacity of bovine rumen to improve their weight gain. Bovine rumen did not present any limiting amino acid, and raw and extruded amino acid scores were, respectively, 1.28 (leucine) and 1.25 (methionine plus cystine). The animals had weight gain, mainly those fed with raw bovine rumen (animals fed with protein-free diet had weight loss). True protein digestibility of raw and extruded rumen was, respectively, 97.68 and 93.07% (values statistically different;  $p < 0.05$ ). Nevertheless, protein digestibility-corrected amino acid of both materials was 100% and extrusion did not affected protein quality of bovine rumen.

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## F-9

### EXTRUDED AMARANTH: A NOVEL RAW MATERIAL FOR HEALTHY FOODS

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Amaranth is a pseudocereal of great nutritional value and agronomic characteristics such as the possibility of utilization of the entire plant. The increasing demand for amaranth products is observed, because of its nutritious, gluten-free and reducing-cholesterol properties. The present work assessed the impact of using whole grain and defatted amaranth flour in extrudates physical properties, nutritive value and acceptability. The use of whole grain was studied because it results on a cheaper process. The extru-

sion process conditions were optimized to obtain the maximum expansion rate. It was observed that extrusion of whole amaranth and defatted amaranth flour resulted in products with similar expansion rate ( $2.0 \pm 0.2$  v  $2.6 \pm 0.1$ ). These raw materials were used in the production of pizza flavored snacks, and milk candy flavored breakfast cereals. These products were submitted to a 40-member sensory panel to assess the attributes of texture, flavor and overall acceptance. Breakfast cereal was evaluated with milk. Results showed that both products obtained with defatted flour presented texture, flavor and overall acceptance significantly higher than the ones made of the whole grain. The scores were, for defatted amaranth flour and whole grain, respectively  $7.3 \pm 1.6$ ,  $5.4 \pm 1.9$ ,  $5.7 \pm 1.8$  v  $4.7 \pm 1.9$ ,  $3.4 \pm 1.9$ ,  $3.4 \pm 1.7$  for snacks and  $7.6 \pm 0.9$ ,  $6.9 \pm 1.5$ ,  $7.0 \pm 1.1$  v  $5.9 \pm 1.9$ ,  $4.3 \pm 1.9$ ,  $5.0 \pm 1.6$  for breakfast cereal. Whole grain products were not sensory accepted, probably because the higher density ( $0.71 \pm 0.01$  v  $0.23 \pm 0.01$  mg.mm<sup>-3</sup>) and harder texture (shear tension:  $0.31 \pm 0.07$  v  $0.12 \pm 0.03$  N.mm<sup>-2</sup>). This happens probably because of the lipids effect in reducing starch gelatinization, and consequently the volumetric expansion rate during the extrusion process, concluding that it is necessary to use finely ground and defatted seeds to produce accepted products. Extrudates presented a high nutritive value ( $4.0 \pm 0.5$ g of ash,  $0.3 \pm 0.0$ g of lipids,  $18.2 \pm 0.1$ g of protein,  $15.8 \pm 0.9$ g of dietary fiber and  $61.7 \pm 0.5$ g of starch/100g of dry weight). In conclusion, the extrudate amaranth may be used in the formula of sensory accepted foods that combine convenience and nutrition, such as snacks and breakfast cereals. The results showed a great potential of commercialization for this products, especially for celiac patients and people concerned about their dietary needs. Support: FAPESP.

## F-10

### LIPIDS DATA COMPOSITION OF EDIBLE ANT EGG *Liometopum apiculatum* M. Escamoles

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Escamoles common name of the ant eggs of the *Liometopum apiculatum* M., species of edible insects, reproduced under the ground in arid and desert regions near by cactus plants during February to May months. Escamoles are highly demanded in Mexico for their sensory characteristics of flavour and texture, and are consumed as cultural tradition by different social groups, not only in rural communities but also in luxury restaurants of urban cities all year round. These organisms are a good source of macro and micronutrients. These insects were collected in Mexico State in April 2006 to be studied and to strengthen the analytical performance of samples and generate composition data of lipids. Insects were dried and fat was extracted in a Soxhlet equipment with petroleum ether; iodine value by the Hannus method to determine degree of unsaturation; saponification value with chemical method, to separate non-saponifiable fats. Vitamin E,  $\alpha$ -tocopherol, isolation with a chloroform/methanol 2:1 mixture and ethyl ether extraction followed by liquid chromatography using a fused silica column and carried out by HPLC. Saponifiable lipids, linoleic, linolenic and araquidonic acids using gas chromatography apparatus to determine the fatty acids profile, this entailed with a fused silica capillary column using helium as carrier gas. Data showed for total lipids 32.17%; vitamin E  $\alpha$ -tocopherol 2.29 mg/100g, linoleic 67.66%, linolenic 2.61%, and araquidonic 0.16% of the saponifiable fraction. Escamoles to be consumed up to three months after collection should be storage refrigerated, after that time should be frozen. Because of the high content of linoleic acid C18:3, low of linolenic C18:3 and of araquidonic C18:5, C18:4, natural antioxidants in escamoles, they present a high degree of stability. In conclusion escamoles could be an important source of fatty acids for human health.

#### F-11

### CHEMICAL AND NUTRIENT CHANGES OF TURKISH HAZELNUT VARIETIES DURING THE MATURATION

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Keywords: hazelnut, food composition, vitamins, minerals, fatty acids

Objective: Hazelnuts are the most important agricultural products that are exported from Turkey and Turkey is the world's leading producer with around 500000 tons per year (75 % of the world production). Seventeen different hazelnut varieties are available in Turkey. The most popular exported varieties are Tombul, Palaz, Delisava, Badem, Cakýldak and Fopa. In this research the composition of selected varieties were studied during different fruit development stages. Material and methods: The hazelnut varieties Tombul, Palaz, and Badem were analyzed at early development stage (ES), middle stage (MS), and harvest stage (HS) for water, ash, protein, fat, available carbohydrate, dietary fiber, minerals (calcium, iron, magnesium, phosphorus, potassium, and zinc), vitamins ( $\alpha$ -tocopherol and folic acid), amino acid and fatty acid composition. Results: The content of the analyzed components changed in accordance with the maturation period. Potassium was the most abundant, followed by phosphorus, calcium/magnesium, iron, and zinc during all three stages. The level of minerals which are given above decreased from ES to HS. Sixteen fatty acids were identified, among which 18:1 n-9 was by far the predominant one, followed by 18:2 n-6, 16:0, and 18:0. Total monounsaturated fatty acids made up from 76 to 81 % in Tombul, from 78 to 83 % in Palaz, and from 74 to 82 % in Badem from ES to HS. In contrast, the level of total polyunsaturated fatty acids decreased. No changes were observed in total saturated fatty acids at the different maturation stages. Conclusions: These results suggest that minerals and unsaturated fatty acids gave good indications with their increasing level while polyunsaturated fatty acids decreased from ES to HS. Whereas development of fruit had no effect on amount of saturated fatty acids. Acknowledgement: Attendance of this conference is partially funded by EuroFIR under the EU 6th Framework Food Quality and Safety Programme (FOOD-CT-2005-513944).

#### F-12

### VITAMIN E STABILITY DURING STORAGE OF DRIED BEE POLLEN PELLETS

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Keywords: bee pollen, vitamin E, storage

Bee pollen can be used as a nutritional supplement for human feeding. Although many authors describe bee pollen as rich in minerals and vitamins, the exact content of vitamin E is still not known. Processing and storage can damage it. In previous works, it was observed loss of vitamin E after dehydration process. This vitamin has received much attention due to its antioxidant function, it stabilizes free radicals responsible for many characteristic degenerative processes of aging. The aim of this work was to evaluate the stability of vitamin E in dry bee pollen commercialized in Brazil, after four-month storage. Three batches of dried bee pollen pellets were acquired in 2006 May and June from bee products warehouses. After the detection of Vitamin E, pollen was stored using three conditions (frozen, protected from light and exposed to light) for four months in packages supplied by the producer. Vitamin E was quantified by high performance liquid chromatography. The average content of vitamin E ranged from 9.86 to 71.18µg/g. During storage losses of vitamin E were observed between 14 and 59% when exposed to light, between 9 and 25% when in the dark and between 0 and 9% when stored in freezer. The difference was significant ( $p < 0.05$  - Student's t-test) only between the light and frozen storage. Storage in freezer was more efficient to keep the vitamin E content. The variability of loss percentage when exposed to light was high, probably due to different shapes, sizes and material of packages. These results show the need of further work with a bigger amount of samples and a study in different kinds of packages.

Support: FAPESP, CNPq.

### F-13

#### MACRO AND MICRONUTRIENT CONTENTS OF FOODS COMMONLY CONSUMED IN NORTHERN BENIN

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**Objective:** To evaluate the proximate and inorganic composition of foods commonly eaten in northern Benin. **Material and methods:** Chemical analyses were performed in 23 composite samples of most frequent-

ly consumed foodstuffs (cereals, roots and tubers, legumes, vegetables, condiments and fruits), collected from retailers in local markets. The proximate composition (protein, moisture, fibre, nitrogen, fat, available carbohydrates) was analysed by standard methods. Inorganic constituents (Ca, Fe, Zn, P, K, Mg, Mn and Cu) were analysed by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES). Results: Protein contents were in agreement with those from the FAO food composition table for Africa. Fat and fibre levels were higher than FAO data (differences amount to 6 to 100 % for fat and to 2 to 12 times for fibre). Available carbohydrate and energy levels were lower than FAO data (6 to 95 % and 8 to 82 % lower, respectively). Differences with FAO data might be mainly due to either analytical or calculation methods. Most important sources of iron and zinc in the diets in northern Benin were maize (*Zea mays*), sorghum (*Sorghum bicolor*) and millet (*Pennisetum glaucum*). In these cereals, iron and zinc ranged from 2.6 to 8.4 and 2.2 to 3.4 mg/100 g dry weight, respectively. Okra (ladies-fingers) leaves (*Hibiscus esculentus*), bombax flower calyces (*Bombax buonopozense*) and onion leaves (*Allium cepa*) were good sources of calcium (2.0-3.6 g/100 g dry weight). Conclusions: The proximate and inorganic composition of foodstuffs commonly eaten in northern Benin provide new data for the Benin food composition table and might also be incorporated in other national food composition data where similar foods are eaten.

Support: Financial support provided by Wageningen University through the North-South Interdisciplinary Research and Education Fund (INREF) is gratefully acknowledged.

### F-14

#### COMPOSITION OF FOODS CONSUMED BY THE AWAJUN COMMUNITIES OF BAJO CENEPA IN THE PERUVIAN AMAZON

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**Keywords:** Awajun, foods traditional, indigenous people

**Objective:** To construct a database of the nutritional

content of foods consumed by the Awajun population of the Rio Cenepa in the Peruvian Amazon in order to evaluate their diet. Materials and methods: A 24-hour recall of food intake was conducted on 2 non consecutive days to evaluate dietary intake of 49 mothers and their children less than 8 years old living in 6 Awajun communities. Data of the chemical composition of foods was obtained from a) existing local databases and the scientific literature for their content of energy, protein, fat, carbohydrate, total fibre, ash, humidity, calcium, phosphorus, iron, zinc, thiamine, riboflavin, niacin, ascorbic acid, folic acid and retinol equivalents, and b) proximal analysis of foods for macronutrients in our laboratory using AOAC methods. Results: We identified 111 foods consumed by the families in the dietary recall of which 36 foods were Awajun traditional foods. We present information on these 36 traditional foods: 7 roots/tubers, 6 vegetables, 8 fruits, 14 fish or meat items and 1 insect. Composition data for 22 of the traditional foods was obtained after scientific identification from the scientific literature and the macronutrient composition of 4 indigenous foods from laboratory analysis. Conclusion: This database of foods consumed by the Awajun population enables us to implement interventions to promote the production and consumption of nutrient rich traditional foods for which their nutritional content had not been described previously. Funding: CIHR through a grant to CINE (Center for Indigenous peoples' Nutrition and Environment), McGill University, Canada.

## F-15

### THE NUTRITIONAL CONTRIBUTION OF PULQUE, A TRADITIONAL ALCOHOLIC DRINK IN RURAL MEXICO AS WELL AS MINERAL AND TRACE ELEMENT CONTENTS IN OTHER MEXICAN FOODS

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Pulque is made by naturally fermenting the agave sap or aguamiel of *Agave atrovirens* with a whole array of micro-organisms including several lactic acid bacteria and yeasts such as *Saccharomyces cerevisiae*. Phytase activity in lees, liquid and freeze-dried pulque was

assayed by measuring the appearance of phosphate from phytic acid by a colorimetric method. Ascorbic acid was determined in pulque and aguamiel, respectively. Iron, zinc, calcium, magnesium and selenium contents were measured in pulque and other traditional Mexican foods. Pulque showed phytase activity but much less ascorbic acid and iron than previously reported. Lees, which is mostly made of pulque's microbiota, significantly accumulated iron and zinc but no selenium. Iron in grain amaranth (*Amaranthus hypochondriacus*) and corn smut (*Ustilago maydis*) was significantly higher than in corn tortillas and commercial nixtamalized corn flours. The latter were fortified with iron but poorly homogenized. Among the traditional Mexican foods evaluated, zinc content was the highest in grain amaranth, whereas corn smut and one of the corn tortilla samples showed the highest selenium content. Pulque intake appears to increase the bioavailability of divalent cations bound by phytate in cereals and legumes. Beta galactosidase activity is being tested in pulque.

## F-16

### UTILIZATION OF RESPONSE SURFACE METHODOLOGY IN THE DEVELOPMENT OF A PESTO SAUCE TO MAXIMIZE ITS ANTIOXIDANT ACTIVITY

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Keywords: functional foods, antioxidant activity, response surface methodology, mixture model, pesto sauce

Recent evidences have shown that high consumption of vegetables, fruits and grains can reduce the risk of non-communicable diseases. The healthy properties of these foods have been related mostly to the presence of antioxidants, substances which are known as capable of decreasing the harmful effects of free radicals. Objective: To develop a Pesto sauce formulation, based on the antioxidant properties of its main ingredients: sweet basil, Brazil nut and extra-virgin olive oil. Materials and methods: It was divided in two phases: The first one consisted in the evaluation of the interaction between the components with antioxidant activity (AA) present in the sauce's main

ingredients, applying the response surface methodology with a mixture model. A centroid simplex plan was used, in which the response measured was the AA of the extracts of different polarities from the different formulations. By using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method and the  $\beta$ -carotene/linoleic acid system, no interaction between the components with AA was detected. Although the models could not describe properly the response variation, sweet basil was identified as the main responsible for the total AA of the sauce. Sensory analysis was conducted to determine the most accepted formulation among the possibilities. The second phase consisted in submitting the formulation obtained in phase 1 to proximate composition analysis, quantification of total phenolics and four in vitro AA methods: reducing power, DPPH method,  $\beta$ -carotene/linoleic acid system and the Rancimat® method. Results: The final formulation per 100g was: 47 g of basil, 14g of Brazilian nuts, 24g of olive oil, 10g of parmesan cheese, 3g of garlic and 2 g of salt. Conclusions: This formulation, by the tests conducted in this experiment, may be considered a good source of natural antioxidants and therefore be part of a healthy diet.

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#### F-17

### NATURAL AND ARTIFICIAL RADIOACTIVITY IN FEEDSTUFFS AND FOOD COMMODITIES IMPORTED AND EXPORTED BY BRAZIL

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Natural and artificial radionuclides in feedstuffs with concentration levels surpassing the Brazilian (CNEN-NN 3.05, January 2005) and international (IAEA 115 Safety Series, 1996 and Codex Alimentarius, 2006) limits are harmless to the human health and an effective control is needed in order to only allow consumption of products presenting radiation levels below limits. Since 1988, after the Chernobyl accident, the Environmental Radiometric Laboratory at the Nuclear and Energy Research Institute, IPEN-CNEN/SP (Instituto de Pesquisas Energéticas e Nucleares), performs, on a regular basis, analysis of potassium-40, cesium-134 and cesium-137 concentrations in feedstuffs and

food commodities imported and exported by Brazil. The present work covers mostly a decade of results, from 1996 to 2006, assessed from the measurements of 2326 samples (113 samples of imported products and 2213 of exported ones, originated from 14 Brazilian States and 111 regions). Nearly 90 different kinds of feedstuffs and food commodities were measured, including condensed milk, milk powder, soy beans, sugar, raw coffee beans, etc. All samples were analyzed by high resolution gamma-spectrometry and the results, compared with Brazilian and international limits, released as a technical report. The radioactivity present in all analyzed products was within the international limits, allowing to conclude that consumption of such goods offers no health risk derived from radiation. Potential relationships between the type and the origin of the products exported and imported by Brazil and the radionuclides concentrations are also approached. Finally, all results will contribute to the establishment of a radiometric database for the radionuclides concentrations in the feedstuffs and food commodities produced in Brazil.

#### F-18

### CARBOHYDRATE CHANGES DURING RIPENING IN DIFERENT BANANA CULTIVARS

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Banana is the most tropical fruit cultivated in the world and has a great importance in developing countries like Brazil. The Brazilian production was estimated in 7 million ton in 2006, and the consumption was approximate 35 kg/per habitant/year. The fruit becomes appreciable for consumption after the decrease of the starch content, which is the main biochemical event that occurs during banana ripening, concomitantly with the increase in soluble sugars. The aim of this work was to analyze the carbohydrate changes in five different cultivars, produced and consumed in Brazil, during banana ripening. The starch content was assayed by enzymatic method, and the soluble sugars were analyzed by HPLC-PAD after ethanol extraction. Results showed that all cultivars were different in: (1) initial and residual starch levels; (2) soluble sugar accumulation; (3) starch degrada-

tion correlated enzymes activities; (4) ethylene and respiration profiles and, (5) granule starch shape and pattern of corrosion. In all cultivars sucrose was the predominant sugar, followed by glucose and fructose. Cultivar 'Prata' (AAB) showed the highest sucrose level at ripe stage with 94.2 mg/gFW, followed by 'Terra' (AAB), 'Pacovan' (AAB), 'Figo' (ABB) and 'Mysore' (AAB), with 80.0, 68.0, 56.4 and 42.0 mg/g, respectively. The lowest content of starch was observed in ripe Mysore and Pacovan bananas with 1g/100g, while 'Prata', 'Figo', and 'Terra' showed 3, 5, and 10g/100g at starch, respectively.

This work was supported by FAPESP.

### F-19

#### FATTY ACIDS PROFILE OF RICE BRAN

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Rice (*Oryza sativa* L.) is the main alimentary source for more than half of the world population and its culture is one of the main sources of job, income and nutrition in many regions of the planet. Brazil is the tenth biggest producer in the world, being polished rice consumed in greater scale in the country. Traditional process of improvement of rice contributes with 65-75% of polished grains, 19-23% of rind, 3-5% of impurities and 8-12% of rice bran. This has in its composition about 15-22% of oil containing a considerable amount of essential fatty acids and photochemical composites, which contain some antioxidant substances with beneficial properties to health, beyond being a great source of fibers. However, the intense action of lipases over glycerol causes quick deterioration by rancification of free fatty acids in the presence of endogenous lipoxigenases. For this reason, the commercial use of rice bran requires extraction of oil and enzymatic inactivation, which originates stabilized bran. The objective of this work was to characterize the profile of fatty acids in samples of rice bran supplied by EMBRAPA cultivated under different conditions (in dry land and irrigated), and that undergo different processing and stabilization techniques. Fatty acids were extracted by Folch et al. (1957) method and were sterified according to Hartman & Lago (1973). They were analyzed by gas

chromatography in a GC 17 A Shimadzu/Class GC 10 chromatography, using a silica column SP-2560 (100m x 0,25mm), with time and temperature controlled. According to data obtained, rice bran oil is composed by saturated fatty acids, mainly palmitic (0.28 - 4.23 g/100g) and stearic (0.02 - 0.55 g/100g) acids, monounsaturated fatty acids, mostly oleic acid (0.42 - 12.47 g/100g) and polyunsaturated fatty acids, being linoleic (0.50 - 10.08 g/100g) and linolenic acids (0.05 - 0.30 g/100g).

This study was supported by FAPESP and EMBRAPA.

### F-20

#### SOYBEAN HYPOCOTYL AND COTYLEDON: PHYSICOCHEMICAL, BIOCHEMICAL AND NUTRITIONAL CHARACTERISTICS

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Keywords: soy cotyledon and hypocotyl, bioactive compounds and physicochemical characteristics

Soybean has been recognized as a food rich in protein and fat and its inclusion in the Brazilian diet has been increasing greatly. There is a growing interest in soybean, focused on the characterization of its components and the relationship between its consumption and health benefits in humans. The seed presents 90% of cotyledon, 2% of hypocotyl and 9% of coat. Soybeans contain high amounts of proteins, isoflavones and dietary fiber, which have been related to health positive effects. The objective of this study was to analyze separately soybean hypocotyl and cotyledon in relation to bioactive compounds content. Commercial soybean was used and its parts were mechanically separated. Centesimal composition was determined according to AOAC (1995). The total phenolic and isoflavone contents were determined according to Zielinski & Kozolwska (2000) and Genovese & Lajolo (2001), respectively. The results showed that there was no significant difference for moisture, ash, protein, starch and trypsin inhibitory activity between the hypocotyl and the cotyledon of the soybean. On the other hand, the soybean hypocotyl showed a higher value of soluble carbohydrates, raffinose, stachyose, isoflavone and total phenolics,

of 66%, 28%, 85%, 336%, and 360%, respectively, compared to the soybean cotyledon. The cotyledon presented two times fat compared to the hypocotyl. The soluble fraction dietary fiber was predominant in the cotyledon and the insoluble one was predominant in the hypocotyl. The same occurred for soluble and insoluble dietary indigestible fraction. Considering the isoflavone profile it was observed that both presented predominance of malonylglycosides conjugates, and a profile similar to the whole soybean. However, the hypocotyl presented a predominance of glycitein and a low percentage of genistein, while the cotyledon presented genistein as the predominant fraction and a low percentage of glycitein. Most of the isoflavones (97%) are liberated after simulated gastrointestinal digestion, and only 3% remained in the insoluble dietary indigestible fraction. Therefore, we can assume that phenolics compounds are highly concentrated in the hypocotyl.

Support: FAPESP; CAPES.

## F-21

### COMPOSITION OF GOAT'S MILK: SOUTH AFRICAN DATA COMPARED TO OTHER COUNTRIES

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Keywords: goat's milk, composition, comparison

The objective of this study was to compare the nutrient composition of South African goat's milk to that of other countries. Goats are hardy animals and a familiar sight in the rural areas in South Africa where most of the people consumes goat's milk on a daily basis. One of the advantages of goat's milk is that it is more easily absorbed into the system because goat's milk contains smaller protein molecules, closer in size and composition to human milk. Chloride in goat's milk is present as potassium chloride and sodium chloride which is an advantage to lowering high blood pressure. Goat's milk was collected at three different farms in different regions in South Africa. A total of 50 samples were analysed between the three farms. Goat's milk was analysed for the following nutrients: Proximates, amino acids, fatty acids, cholesterol, minerals, fat soluble vitamins and water soluble vitamins. All

the analyses, except for the minerals, were performed at the SANAS accredited laboratory of the ARC-Irene Analytical Services. The results were statistically analysed and evaluated and compiled in a booklit. These data will also be included in the new edition of the Medical Research Council's tables. Data from the other countries were collected from their food composition tables. Proximate content of SA goat's milk was lower than the other countries. This is in a way influenced by the higher water content in SA goat's milk. Cholesterol content was the highest in SA milk. The content of retinol in SA milk compared, although lower, to that obtained in Germany, USA and UK, but the NZ value was exceptionally high. The vitamin E content of South African milk was the lowest of the countries but the variation between countries was high. It can be concluded that the composition of goat's milk does not differ significantly between data available for different countries. The composition of the milk can vary due to seasonal and regional changes, but these parameters were not investigated in this study.

## F-22

### THE CONTRIBUTION OF SOUTH AFRICAN LAMB TO THE DIET

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The objective of the study was to determine the nutrient content of raw and cooked selected wholesale cuts (shoulder, loin and leg) for South African lamb - A2 grade to determine its contribution to the diet. The same procedure as the South African retail was followed that purchases and subdivides a sheep carcass into 9 wholesale cuts (neck, thick rib, flank, shoulder, breast ("ribbetjie"), rib, loin, chump ("kruis"), leg, shank). The following nutrient analysis has been conducted on the raw and cooked meat and fat of 18 samples each from the leg, loin and shoulder cuts: Minerals: sodium (mg), potassium (mg), iron (mg), magnesium (mg), zinc (mg). Total cholesterol (mg), fatty acid profile and vitamins, thiamin (mg), riboflavin (mg), niacin (mg), vitamin B<sub>6</sub> (mg), B<sub>12</sub> (mg). Nutrient analysis on the lamb meat has been conducted on a double blind basis in a SANAS (South African National Accreditation Service) accredited laboratory.



The data collected has been statistically analysed using GenStat for Windows, 2003, computer program. From the results it is clear that A2 lamb meat is low in fat and cholesterol and is a good source of iron, zinc and B vitamins. Lamb (A2) makes a valuable contribution to the RDA for males, aged 25 - 50 years, with regard to the protein, potassium, zinc, vitamin B<sub>12</sub> and B<sub>3</sub> when included as part of a balanced meal plan. Therefore, as recommended in healthy eating advice around the world, lean meat especially lean lamb, consumed in moderation should be promoted as part of a healthy balanced diet.

## F-23

### SOIL HEALTH KEY TO FOOD SECURITY

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Keywords: food security, soil health problem, integrated nutrient management

Food security and sustainable livelihoods are the priority areas for any developing country. In order to achieve the self sufficiency in food grain production, latest agri technologies have to be used to meet the demand from ever increasing population. In view of reduction in agricultural lands in India in the recent times due to industrialization, there is a need to increase the agricultural production manifold. India food grain production is to be raised from present level of around 200 million tonnes/annum to about 400 million tonnes/annum by year 2020 to meet the increasing demand. To increase the crop productivity, the soil health management is an important aspect to be looked upon. Good soil health management will have positive impact on the crop productivity and also on the economic growth of the nation on the whole. In intensive cropping systems like India, the nutrient removal from soil remains at a greater rate than replenishment of nutrients back into the soil. This requires periodic evaluation of soil in terms of soil nutrient status and quality. Comprehensive soil analysis i.e. primary, secondary and micronutrients using Varian Atomic Absorption Spectrometer, Varian UV-Vis Spectrophotometer and other lab equipment are being carried out. Integrated nutrient management decisions arrived based on the soil test results. Internationally standardized procedures

are used for carrying out comprehensive soil analysis. Timely soil test results and recommendations on nutrient inputs are provided to the growers, who are expected to follow the given advice thoroughly to provide a long term build up of soil fertility. Soil health problem is addressed scientific and systematic manner, the crop yield is expected to increase substantially over a period of few years. Increase in crop productivity will lead to availability of food to the population at affordable rates thus will address the problem of food security.

## F-24

### NUTRIENT COMPOSITION OF SOUTH AFRICAN WHEAT AND WHITE BREAD FLOUR

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Keywords: nutritional values, wheat, white bread flour, South Africa

Objective: To generate information on the energy content and nutrient composition of South African wheat and white bread flour. Material and methods: Wheat samples received annually by the Southern African Grain Laboratory (SAGL) for the national wheat crop quality survey were used to obtain representative wheat samples for South Africa. Three composite samples were prepared and represented the three major wheat producing areas in South Africa. Samples were milled on a Bühler MLU 220 laboratory mill to obtain white bread flour samples. Different combinations of samples were made up from the wheat, as well as flour. Throughout the different sample preparations the samples were regularly tested for homogeneity. Unfortified and fortified white bread flour samples were prepared. Samples were analysed for macro- and micronutrient content; energy was calculated. Nitrogen content was measured by the Dumas method. Carbohydrate content was calculated by difference. Fat was determined by Soxhlet Ether extraction. Ash content was analysed by the oven method using Magnesium Acetate. Micronutrients were determined by HPLC and minerals by AA. Results: The energy per 100 g of wheat was 1 554 kJ and for unfortified white bread flour, 1 506 kJ.



Protein for wheat and unfortified white bread flour was 11.93 g and 11.15 g, respectively. The carbohydrate content was 75.6 g for wheat and 75.9 g for unfortified white bread flour. Analysis of the fat content showed that for wheat it was 1.8 g and for unfortified white bread flour it was 0.7 g. The riboflavin content of unfortified white bread flour was 0.03 mg and 0.16 mg after fortification. Conclusions and support: The successful completion of this study resulted in the generation of South African wheat and wheat flour values for the first time. The Winter Cereal Trust of South Africa funded this project.

## F-25

### CHANGES IN NON-STARCH POLYSACCHARIDES OF THREE BANANA CULTIVARS (*Musa acuminata* L.; Cvs Mysore, Terra and Nanicão) DURING RIPENING

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Banana (*Musa acuminata* L) is a tropical fruit with climacteric pattern of respiration. Its fast ripening and texture loss limit the expansion of its international trading. In most fruits the texture loss, that occurs during ripening, is a consequence of cell wall polysaccharides degradation. Green banana is composed of high content of starch that almost disappears during ripening. Hence, the influence of starch degradation cannot be discarded in banana texture changes. Nevertheless, the participation of cell wall polysaccharides in banana texture loss can not be discarded. Moreover, there are few works about mobilization of the monosaccharides produced during banana ripening. To have a better understanding of banana ripening process, three different cultivars (Mysore, Terra and Nanicão) that show different starch accumulation pattern were analysed at three stages of maturation (green, yellow-green and ripe). Banana cell wall polysaccharides were isolated using enzymatic-chemical method and analysed using HPAED-PAD system. Results showed that Mysore had the highest amount of non-starch polysaccharides, followed by Terra and Nanicão. The water-soluble cell wall polysaccharides (WSP) of the three banana

cultivars were composed of high amounts of glucose and mannose, medium amounts of arabinose, xylose and galacturonic acid and small amounts of fucose, rhamnose and glucuronic acid. Alike WSP, the water-insoluble cell wall polysaccharides (WIP) were constituted of high amounts of glucose and mannose and small amounts of fucose, rhamnose, galacturonic and glucuronic acids. During ripening the amount of WIP decreased about 7, 8 and 10% in the cultivars Mysore, Terra and Nanicão, respectively. The WSP decreased 14% in Mysore, while in Terra and Nanicão increased 5%. Differences in the monosaccharide composition between cultivars were also observed. Mysore showed higher mannose content and higher betaglucans solubilization during ripening when compared to Terra and Nanicão.

## F-26

### CHEMICAL ANALYSIS OF CONVENTIONAL AND GENETICALLY MODIFIED VARIETIES OF SOYBEAN: NUTRIENT AND ISOFLAVON CONTENT

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Keywords: soybean, genetically modified food, isoflavon, substantial equivalence

The aim of this work was to evaluate the chemical composition of the nutrients present in three varieties of conventional soybean and its genetically modified cultivars to tolerate the herbicide glyphosate. The soybean samples, crop 2004, were supplied by EMBRAPA: Jataí and Silvânia; Conquista and Valiosa; Celeste and Balisa, were respectively isogenic and GMs varieties. The chemical composition was conducted with analysis in triplicates for the determination of protein, fat, moisture and total mineral content, following AOAC methodology. The amino acids were determined with acid hydrolysis and quantified by post-column reaction with ninhydrin. The fatty acid profiles were obtained, after acid hydrolysis and methylation, by CG using SP-2560 Supelco column. The isoflavons were analyzed by HPLC using C18 column and quantified by diode-array detector. After an statistical analysis of the data, the results of the basic nutrient composition showed normal dis-

persion between samples with the same origin, with tendency of crescent levels of protein of 9 to 16% in GM samples ( $p < 0.05$ ). Most of the amino acid content found in the Celeste and Balisa varieties demonstrate differences between themselves and compared with others varieties. The lipid analysis revealed equivalent fractions of saturated and unsaturated fatty acids, with distinguished composition between the monounsaturated (2.9 a 5.2 g/100g) and the polyunsaturated (9.4 a 12.0 g/100g). The isoflavon content of the GM varieties presented reduced values regarding to the isogenic varieties, 37 and 47% respectively, with distinction to the GM variety Balisa that showed low content of total genistein and extremely high content of total glycitein when compared to its isogenic variety Celeste. The assemblage of results shows that there are no significant alterations on the basic nutrients between the GM and the isogenic varieties, regarding to the substantial equivalence in the soybean varieties analyzed, mainly if compared with the broad range of variability on soybean database components.

Financial Support: CNPq.

#### F-27

### INFLUENCE OF TIME, TEMPERATURE AND SOLUTION CONCENTRATION IN THE OSMOTIC DEHYDRATION OF DRIED CASHEW APPLE FROM CERRADO

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Keywords: cashew apple, *Anacardium othonianum* Rizz, osmotic dehydration, cerrado

Cashew apple from Cerrado of the region of Goiás state (*Anacardium othonianum* Rizz) was submitted to osmotic dehydration with the purpose of analyze time, temperature and solution concentration influence. The fruits were collected at the harvest time and sanfied, cut in the middle and submitted to osmotic treatment in sugar solution. The ratio of solution/sample of 2:1 (w/w), sugar concentration was in the range of 40-60% (w/w), immersion time 2-4 hours and temperatures between 30-50°C. After this, the cashew apples were treated by air-drying for 8 hours in 65°C. The finished products of osmotic so-

lution concentration, time and temperature combination were estimated to weight reduction, water loss, solid gain and phisicochemistry analysis by means standards methods. There is large variation of the moisture, pH, and sugar concentration between the treatments. The moisture and weight reduction and water loss were better in treatment of 2 hours, 30°C and osmotic concentration of 40%. The solid gain, moisture, pH and sugar concentration were larger in 4 hours treatment, 50°C and osmotic concentration of 60%. The higher water loss and weight reduction and lesser solid gain during osmotic dehydration were considered excellent conditions of processing. The treatment of 2 hours, 30°C and osmotic concentration of 40% was chosen as the best conditions. The process studies may be a good alternative for the preservation of cashew apple, because it is a simple method and has low cost.

#### F-28

### EXTRACTION AND CHARACTERISATION OF OIL FROM ZIMBABWEAN AFRICAN CHESTNUTS (*Sterculia africana* / Mungoza)

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Keywords: tocopherols, polyunsaturated fatty acids, extraction, analysis

*Sterculia africana* (Mungoza) is a tree mainly found in low altitudes in hot dry areas like in Mudzi District in Mashonaland East Province. Mungoza seeds which are full of oil and during the drought of 2001 to 2002 people of Mudzi District resorted to peeling and crushing the seeds and consume them as an alternative for cooking oil. The consumption of the oil extract from Mungoza shows that the seeds can be used as famine food during time of drought. The seeds for this project were sampled in the District in a forest setting where villagers harvest them for consumption. Seeds were crushed and ground and weighed. Oil extraction was done using a Soxhlet extractor. Extraction was done first using petroleum ether as a solvent and subsequently with hexane. On

completion of extraction, the solvent was distilled off and the extracted oil was weighed before being stored under refrigeration conditions. Extraction yielded 32.93% oil content. The oil extract yielded a high content of unsaturation in the oil during the iodine value tests. Thin Layer Chromatography and Gas liquid chromatography revealed the presence of polyunsaturated fatty acids and tocopherols. Interesting were results showing the presence of substantial amounts of Vitamin F and E. Analysis for toxins in the polar and non polar extract revealed no presence of toxins of carcinogenic nature except for low levels of saponins. The research is ongoing and initial results show safety of use of oil extract for human consumption as a famine food, however results obtained also show potential use of oil for skin care pharmaceuticals manufacturing.

## F-29

### PROXIMATE AND SENSORY EVALUATION OF SELECTED ZIMBABWEAN SOYA BEAN VARIETIES EARMARKED FOR SOY MILK PRODUCTION

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Soybeans and related products are becoming nutritionally important in developing countries like Zimbabwe and the increasing farming of these crops need to be complemented with an increasing depth of knowledge on the suitability of the varieties for making these products e.g. soymilk. Six varieties were randomly selected from the twelve varieties, which were available. The selected varieties were then taken for proximate composition analysis using relevant and affordable methods, which were available. Soymilk was extracted from each variety and the respective samples of soymilk were analyzed for proximate composition and other quality attributes like pH, which are important quality parameters for considering further processing or storage. Also sensory attributes of the soymilk varieties were assessed. It was found that only the proximate compositions of soybeans varied much in the oil and protein contents. The variations in the contents of

oil and protein in soybean varied directly with the contents in soymilk. It was therefore concluded that only protein and oil contents are the most important parameters to consider when selecting a variety for soymilk manufacture.

## F-30

### POTENCY OF VITAMIN D SOURCES

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Dietary intake of vitamin D derives mainly from the content of vitamin D<sub>3</sub> (vitD<sub>3</sub>), 25-hydroxyvitamin D<sub>3</sub> (25OHD<sub>3</sub>) in food and supplements. 25OHD<sub>3</sub> is regarded to have the potency of 5 compared to vitD<sub>3</sub>. However, the documentation for these values is rather limited. Purpose of the study was to assess the relative potency between vitD<sub>3</sub>, 25OHD<sub>3</sub> by using the biomarker for vitamin D status, serum 25-hydroxyvitamin D<sub>3</sub> (serum 25OHD<sub>3</sub>) as the end-point, and for vitD<sub>3</sub> and 25OHD<sub>3</sub> the association between the content in the meat and the content in the feed. A controlled feeding trial was conducted with Danish slaughter-pigs (n=3225) divided into 3 feeding groups fed a feed containing vitD<sub>3</sub>, 25OHD<sub>3</sub> or vitD<sub>3</sub> and 25OHD<sub>3</sub>. In a sub-group of 8 pigs analysis for serum 25OHD<sub>3</sub> and vitD<sub>3</sub>, 25OHD<sub>3</sub> and fat in the loin was performed. No significant difference on serum 25OHD<sub>3</sub> was shown between the feeds containing vitD<sub>3</sub> and 25OHD<sub>3</sub>. Contents of 25OHD<sub>3</sub> in the loin correlated significantly with the sum of vitD<sub>3</sub> and 25OHD<sub>3</sub> in the feed, while the content of vitD<sub>3</sub> correlated with the content of vitD<sub>3</sub> in the feed. Potency of vitD<sub>3</sub> was equal to 25OHD<sub>3</sub> in regard to raising serum 25OHD<sub>3</sub> and the incorporated 25OHD<sub>3</sub> in loin. However, contents of vitD<sub>3</sub> in the loin depended only on vitD<sub>3</sub> in the feed. Comparison to former used data for pork derived from biological assay depends on the potency used and will be presented at the conference.

**F-31****EVALUATION OF THE SPECIFIC SURFACE AREA AND GRANULE SIZE DISTRIBUTION OF STARCHES EXTRACTED FROM SWEET POTATO (*Ipomea batatas*) GROWN IN JAMAICA: CORRELATION WITH  $\alpha$ -AMYLASE DIGESTION**

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The effect of starchy foods on blood glucose and insulin responses may vary significantly, which could be attributed to the physiochemical properties of the starches. The degradability of starch when consumed is important especially among diabetics and hyperlipidemic individuals, as starches that are easily degraded tend to have a higher insulin demand than slower degrading starches. This can significantly affect insulin sensitivity, and influence the development of type II diabetes. The diet of diabetics is of concern; especially in the Caribbean where in Jamaica alone over 300,000 cases of diabetes is reported in a population of just over 2.7 million. Understanding the properties of starches from carbohydrate rich foods consumed and how it relates to digestibility may impact the level of control over blood glucose responses. This study was designed to investigate the relationship between granule properties and the *in vitro* digestibility of starches extracted from three local sweet potato cultivars namely; Eustace, Quarter million and Clarendon. Significant variations were observed in the particle properties of the different starches studied ( $p < 0.05$ ). The projected mean granular diameter ranged from 13.4  $\mu\text{m}$  (Eustace) to 20.1  $\mu\text{m}$  (Clarendon). The variations observed in the granular size may have influenced the surface properties of the starches, as Eustace and quarter million were found to have the largest specific surface area (224.6  $\text{m}^2/\text{kg}$  and 177.2  $\text{m}^2/\text{kg}$  respectively) while Clarendon had the lowest (143.1  $\text{m}^2/\text{kg}$ ). The results also showed a direct correlation between the particle size and specific surface area on the digestibility of the various starches. Eustace and quarter million starches, with the smallest mean granule diameters and highest specific surface areas, were found to be the most digestible ( $18.11 \pm 0.01$  and  $16.21 \pm 0.02$  % respectively), while Clarendon with the largest mean granule diameter and lowest specific surface area was the least digestible

( $13.75 \pm 0.03$  %) at 37°C under *in vitro* conditions. Starches with small granules and large specific surface areas may be more digestible than those with larger granules. This suggests that these starches may be digested and absorbed at different rates when consumed, which could be of importance to diabetic and hyperlipidemic individuals as the differences in digestibility of the different yam starches could affect post-prandial blood glucose levels.

**F-32****NUTRIENT AND NON NUTRIENT COMPOSITION OF SELECTED TRADITIONAL FOODS OF GUJARAT, WESTERN INDIA**

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The present study aimed to study the composition of some traditionally prepared foods in Gujarat, Western India using the simple processing technique of soaking, germination and fermentation. The foods selected were germinated green gram (*Phaseolus aureus* Roxb.), Moth beans (*Phaseolus acutifolius* Jacq.), Lentils (*Lens esculenta*), Soya bean (*Glycine max* Merr.); soaked Field beans (*Dolichos lablab*), Red gram (*Cajanus cajan*), Bengal gram (*Cicer arietinum*), Cow pea (*Vigna catjang*), Peas (*Pisum sativum*), Soya bean (*Glycine max* Merr.) and fermented foods named Idli from rice (*Oryza sativa*) + black gram (*Phaseolus mungo* Roxb.), Khaman from bengal gram (*Cicer arietinum*) + rice (*Oryza sativa*), Dhokla from rice (*Oryza sativa*) + bengal gram (*Cicer arietinum*) + Red gram (*Cajanus cajan*) + black gram (*Phaseolus mungo* Roxb.) and Handwa from (*Oryza sativa*) + bengal gram (*Cicer arietinum*) + Red gram (*Cajanus cajan*) + black gram (*Phaseolus mungo* Roxb.). The processed cooked samples were compared with their unprocessed cooked counterparts. The nutrients and non nutrients studied were moisture, protein, fat, ash, fiber, carbohydrate, calcium, iron, phosphorus, ascorbic acid, phytates, tannates and oxalates. The values obtained for proximate principles in unprocessed cooked samples compared well with the reported values for raw foods (ICMR 1993) suggesting no appreciable effect of cooking on the proximates. Processing treatments employed brought about a significant reduction in the non nu-

trient components named phytates, tannates and oxalates. The processed samples had lower calcium and phosphorus content. However the phosphorus: calcium ratio improved on processing. Ascorbic acid content showed a negligible increase in fermented foods only, largely due to the destruction of the same on cooking. Fermentation technology was found to be the best as it resulted in maximum reduction in non nutrients and improvement in calcium: phosphorus ratio.

### F-33

#### **STUDY OF THE EFFECTS OF SALTING ON THE FATTY ACID COMPOSITION OF GOLDEN MULLET FILLET (*Liza aurata*, Risso, 1810)**

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Keywords: fatty acid composition, Golden Mullet (*Liza aurata* Risso, 1810), lipid, salted fish

Golden mullet (*Liza aurata*) is one of the bony fish in the south basin of Caspian Sea. This comparative study has been focused on the determination of fatty acid composition in the fresh and salted golden mullet tissues in the winter. Thus, the fatty acids compositions of fresh and salted tissues have been determined by gas-liquid chromatography (GLC- Shimadzu-14 A, Japan). The fatty acid compositions of golden mullet and its salted fillet are summarized in Table 1. The results showed that oleic acid (C18:1) in the fresh golden mullet tissue and palmitoleic acid (C16:1) in the salted tissue were dominant with 30.00% and 16.3%, respectively. In addition, total omega-3 fatty acids in the fresh and salted tissues were 6.63% and 14.58%, respectively. It was found that the amount of poly unsaturated fatty acids, especially EPA and DHA in the salted tissue have a higher amount than the fresh tissue, while the lipid content is lower. Table 1: Average of fatty acids series in Caspian Sea Golden mullet fresh and salted fillet (*Liza aurata*) (gram per 100 grams lipid). Fatty acid series in fresh tissue in salted tissue: saturated fatty acids 35.20 and 43.83; unsaturated: fatty acids 53.51 and 43.51; omega-3 series (∑-3) 6.63 and 14.58; omega-6 series (∑-6) 0.51 and 0.66; monoenoic fatty acids 46.37 and 28.27;

polyenoic fatty acids 7.14 and 15.24; high unsaturated fatty acids: 6.17 and 13.46; lipid 4.53 and 2.21.

### F-34

#### **VOLATILE ORGANIC COMPOUND PROFILE DETERMINATION OF COFFEE BLENDS BY SPME-HS-GC-MS - WHAT CAN WE GUESS ABOUT FLAVOUR, ROASTING AND BLEND COMPOSITION?**

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Keywords: coffee, aroma, solid-phase microextraction

Potent odorants were identified using headspace solid-phase microextraction (SPME) and gas chromatography (GC) mass spectrometry (MS) in 12 distinct blends of roasted grinded coffee. The volatile organic compound profiles were related with sensory information and roasting conditions reported by the seller to its consumers. Each blend has a specific character that makes it distinct from the others. The set of 12 blends covered the wide range of variation of aroma, body, acidity, foam properties that are commonly offered to the consumer. A SPME fiber coating composed by three polymers (divinylbenzene (DVB), polydimethylsiloxane (PDMS) and carboxen (CAR)) was used in order to get the most efficiency in overall compound extraction present in gas headspace of each blend. The large number of volatiles extracted from the headspace of roasted coffees was grouped according to sensory notes reported in literature. For each coffee analysed, we related the aroma/flavour intensity note provided by seller with the abundance of volatile compounds identified in blends and with sensory information given to the consumer. Floral and fruity notes were related to the presence of damascenone whereas phenolic compounds and pyridines were found more abundant in blends specifically prepared for Italian espresso brewing procedure. Blends with an average aroma/flavour intensity note and smooth aroma could be related with a higher abundance of compounds of the pyrazine and furan families (sweet/nutty sensory notes). The results obtained by SPME-GC-MS can be an indicator of blend composition (type of coffee, origin, percentage of each

type/origin in blend composition) and with roasting conditions. Analytical data related well with the information provided by the seller to the consumer, which suggests SPME-GC-MS as a suitable tool for product quality control, roasting precision maintenance and development of gourmet blends.

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## F-35

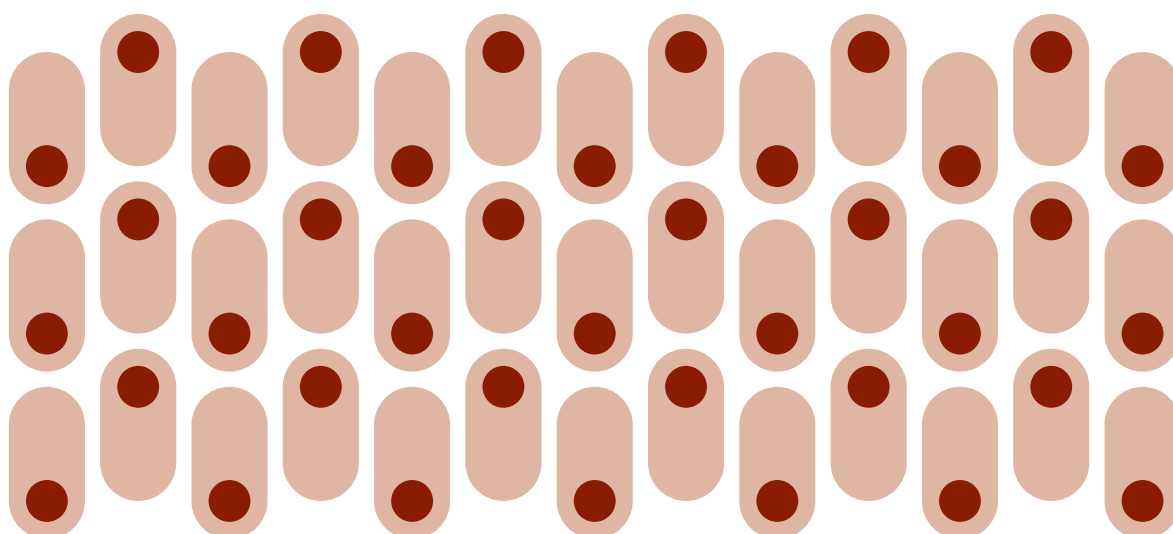
### FOLATE CONTENT OF FRUITS USING MICROBIOLOGICAL ASSAY

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Background: Reliable food composition data on folate is a pre-requisite for estimating the adequacy of folate intake in the population and for development of dietary recommendation. The link between folate and its relation to reproductive health, cardiovascular diseases and certain cancers are well established .hence compositional analysis of food would help in the formulation of intervention programmes and at the same time it will be useful to make necessary alterations in the existing strategies. Initially the work was focused on fruits as there is limited information on the folate content. Objective: To optimize and analyse the folate content of fruits using trienzyme extraction technique. Design: Thirty five fruits commonly available were purchased from five different outlets in south India, Asia. The edible portions of the fruit were homogenized and stored at -20°C. Trienzyme extraction technique using cryoprotected *L.casei* was used to analyse the folate content. Result: The folate content of fruits ranged from 0.34 µg to 50µg/100g. Among the fruits banana -Moris (*Musa sapientum* linn) had the highest of 46µg/100g and papaya (*Carica papaya*) had the lowest of 0.34µg/100g. Conclusion: The data generated will aid in developing updated food compositional tables and at the same time would help to know the contribution of folate from fruits.





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EFFIE VASILOPOULOU	SV4
ELAINE CRISTINA PINTO MORESCHI	F4

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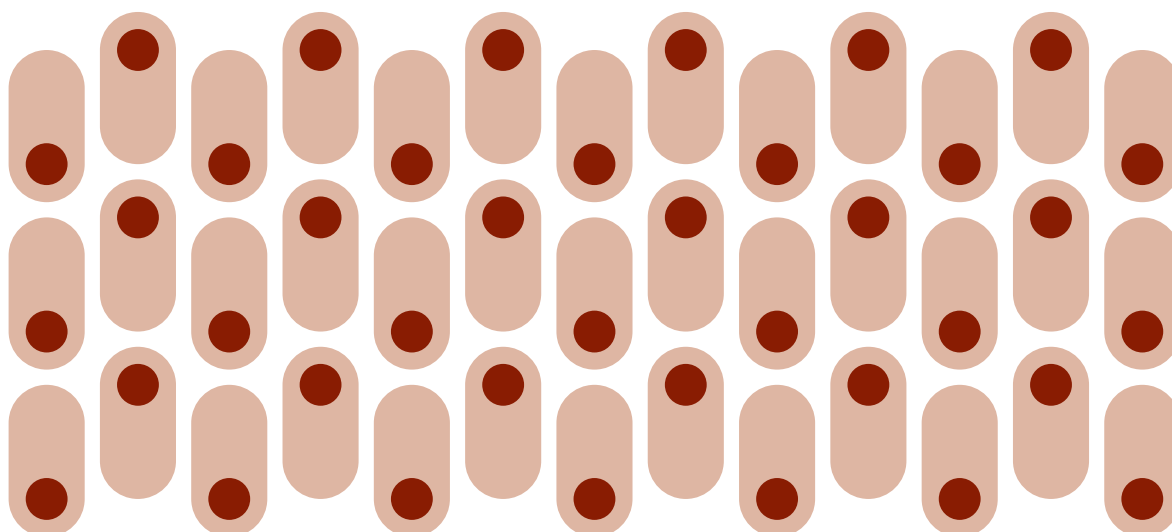
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## European Food Information Resource Network

**EuroFIR** (European Food Information Resource Network) ([www.eurofir.net](http://www.eurofir.net)) the world-leading European Network of Excellence on Food Composition Databank Systems, is a partnership between 48 universities, research institutes and small-to-medium sized enterprises (SMEs) from 25 European countries. EuroFIR will provide the first comprehensive pan-European food information resource, using state-of-the-art database linking, to allow effective management, updating, extending and comparability.

### The project objectives of EuroFIR are:

- To strengthen scientific and technological excellence in food databank systems by integrating the critical mass of resources and expertise needed to provide European leadership in this field and establish itself as a world force in this area;
- To identify and provide new information for missing data for nutrients and biologically active compounds, and covering all food groups;
- To spread excellence and enhance impact in food composition databases and public health nutrition beyond the boundaries of the partnership through training, and sharing of methods and facilities;
- To communicate with, and enter into dialogue, with all user and stakeholder groups, in order to establish and deliver requirements to ensure that the food databank systems are durable and sustainable;
- To disseminate and exploit new scientific and technological knowledge in order to strengthen the competitiveness of the food industry, including SMEs, aiming to help the European food and nutrition in-

dustry to grow into knowledge-based industry, targeted at evidence based healthier food production.

EuroFIR provides an essential foundation for all food and health research in Europe and provides:

- The building blocks for health surveys, medical research and interventions, and health policies based on them;
- Information for public health government bodies and regulators to educate their populations about health and food heritage;
- Laboratory and data analysis best practices to ensure data quality, reliability and comparability;
- Data that enables food industry to produce healthier foods, and obtain a larger share of the international food market;
- Information to consumers - via labels and via printed/electronic information, to enable them to play a more active role in protecting and enhancing their health.

EuroFIR will also identify and provide new information for missing data for nutrients and biologically active compounds with putative health effects, and all food groups including traditional and ethnic foods. EuroFIR is seeking views with all user and stakeholder groups, in order to establish and deliver their requirements for sustainable and durable food databank systems beyond the 5-year period of the Network of Excellence. EuroFIR (FOOD-CT-2005-513944) is funded under the EU 6th Framework Food Quality and Safety Priority and is coordinated by Paul Finglas ([paul.finglas@BBSRC.AC.UK](mailto:paul.finglas@BBSRC.AC.UK)), Institute of Food Research, UK.

# Food, Nutrition, and Health Charter

## the 9 COMMITMENTS of Groupe DANONE

*"Health and nutrition are at the core of our business. We have formalised our commitments in the shape of a charter: in an environment that reminds us how exacting we should be regarding our products and communications, it is everyone's responsibility to implement them."*

Franck Riboud

### 1 Propose **products adapted** to needs and tastes

Groupe DANONE will use its competencies in nutrition, technology, and sensory sciences together with its understanding of consumer needs to develop and improve its range of products: selection of the most appropriate raw materials; development of products adapted to a diversity of tastes and nutritional needs; development of products with specific health benefits; continuous improvement to the taste and nutritional properties of existing products. The Groupe will also use its expertise in order to develop products across the globe which take into account local needs, with a commitment to making such products available to as many people as possible.

### 2 Dialogue with **scientists**

Groupe DANONE undertakes to remain in regular contact with the scientific community, interacting with specialists and tracking current and emerging issues in food, nutrition, and health in order to stay at the forefront of progress.

### 3 Support **research**

Groupe DANONE undertakes to support and promote research in nutrition and health.

### 4 Promote **knowledge sharing**

Groupe DANONE undertakes to share its knowledge and findings with scientists, health professionals, and the public.

### 5 Heed **public opinion**

Groupe DANONE undertakes to maintain an ongoing dialogue with public institutions and organizations involved in nutrition and health issues, including consumer associations. This gives the Groupe the opportunity to explain its approach, and to better respond to public questions and expectations.

### 6 Communicate with **clarity and transparency**

Groupe DANONE undertakes to provide clear and transparent information to consumers, namely through the gradual introduction of nutritional labels on all products and development of consumer information services.

### 7 Guarantee the **scientific validity** of the claimed benefits

Groupe DANONE undertakes to make nutrition or health claims only with the backing of sound scientific evidence. No nutrition or health claims, other than nutritional content information, will be made for 'purely indulgent' products.

### 8 Promote **responsible advertising**

Groupe DANONE undertakes to develop a responsible approach concerning health and nutrition advertising.

### 9 Encourage **physical activity**

Groupe DANONE undertakes to encourage consumers and staff members to take part in regular physical exercise.



## Download

the whole text of the charter on  
[www.danone.com](http://www.danone.com)

