Food Composition Databases: Needs, New Opportunities and International Collaboration

U. Ruth Charrondiere, PhD
Barbara Stadlmayr
Barbara Burlingame, PhD
FAO, Rome

Outline

- Present challenges worldwide
- Needs
- Possible solutions
- Conclusions

Where we are today (1)

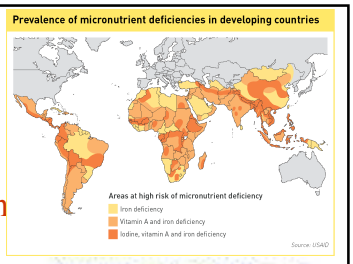
Double burden of malnutrition. Obesity endemic has reached developing countries. Non-communicable diseases are increasing worldwide. Undernutrition and micronutrient deficiencies are persisting

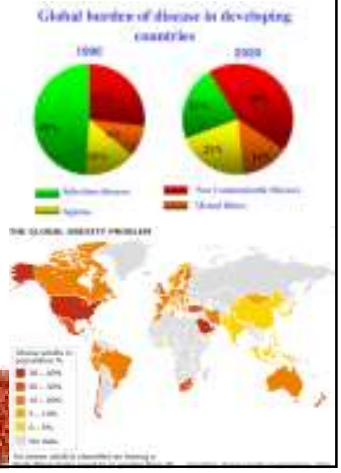
Increased consumption of animal products in e.g. China and India and of **processed foods**

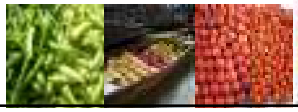
Simplification of diets and shift towards westernized diets

Medicalised approach (fortification and supplementation) is favored instead of food-based for nutrition

Fat Tax to lower fat intake since 2011 in Denmark







Where we are today (2)

World Population is increasing. Today we have 7 billion people.

Environment is deteriorating. Erosion. Climate change is continuing (in 2010 increase of CO_2 emission of 6%) and threatens agriculture

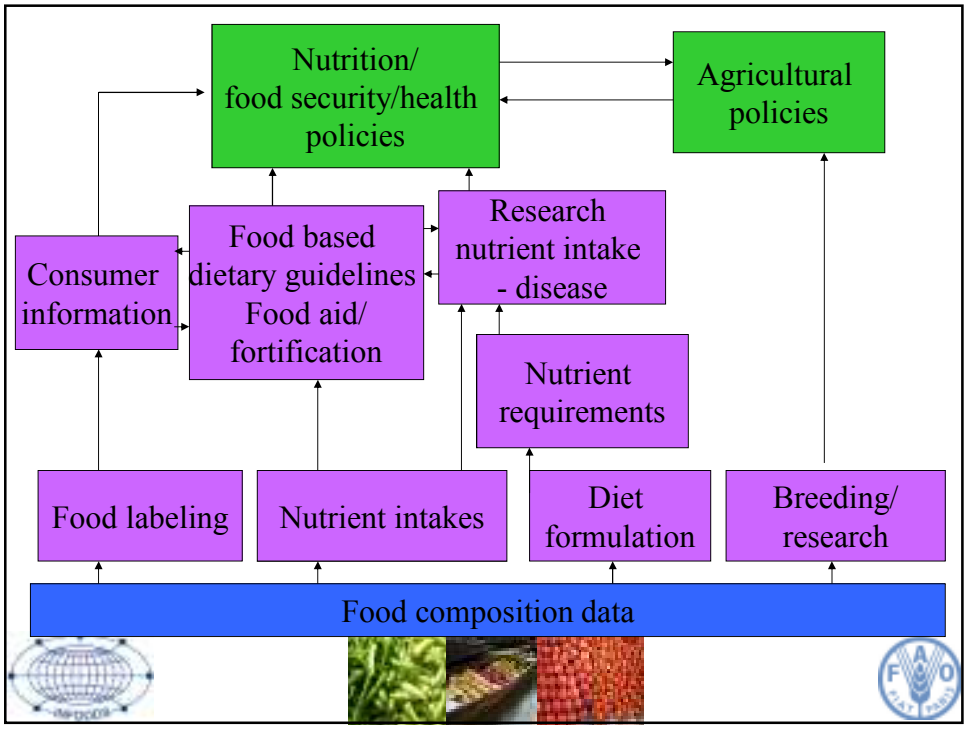
Limited **natural resources:** Energy, water and agricultural land. Loss of soil fertility.

Food Waste: 30% of the produced food is lost or wasted (1.3 billion tons per year) = waste of inputs and unnecessary increase of CO_2

Subsidies are rarely on fruits and vegetables but often on soy, wheat, sugar, soy oil (in a olive oil producing country) = enhances wrong food choice

Food security is threatened in many countries, worsened through increased **food prices** and financial crisis

Needs and role of food composition data



Needs (1)

- **Compositional data which is**
  - **up-to-date** **- according to international standards**
  - **of high quality** **- documented**
  - **accessible** **- in user-friendly format**
- Food Composition Database Management System (FCDBMS) – globally accessible
- High-quality laboratories
- Funds to
  - generate, compile and publish food composition data
  - produce guidelines, standards and tools
- Political and institutional support
- Professionals who know how to correctly use, generate and compile food composition data

Needs (2)

Ideally, compositional data incorporated in software applications to

- collect and assess food/nutrient intakes (e.g. 24-h-recalls)
- calculate nutrient intakes and adequacy
- calculate nutrition label information
- calculate nutrient values of recipes
- formulate recipe with ideal composition of diets

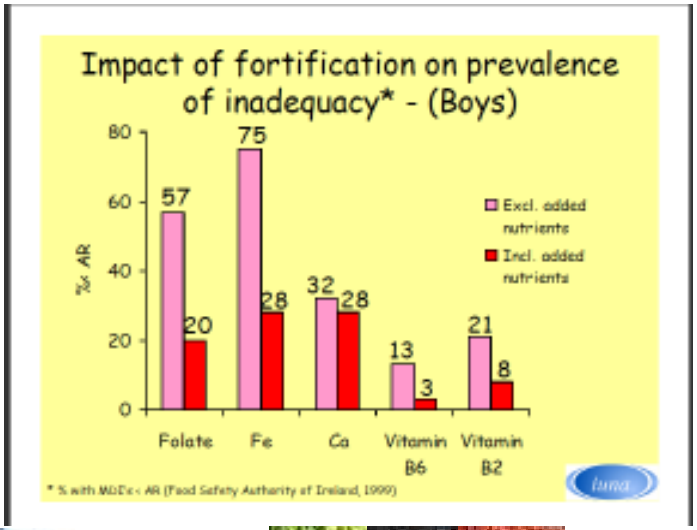
Challenges (1)

Increasing demand for FC data

- ever changing food supply
- ever increasing demands for inclusion of new components (phyto-chemicals, trans fatty acids, added sugar etc) and foods (e.g. fortified foods, recipes, brandname foods)
- for labeling (Codex discusses mandatory nutrition labeling)

Limited funding, staff, knowledge and political interest

Difference in nutritional inadequacy when copying NV from labels of fortified foods as compared of only using UK FCT



Source: Hannon, Kiely, Flynn – 7th IFDC

Challenges (2)

- How to assure high-quality FC data?
- How to get the data to the users?
- How to choose the right approach to combat malnutrition?

What food composition data are available worldwide?

More than 100 food composition tables and databases

- national or regional or international
- printed or on-line
- old/outdated or updated
- restricted or comprehensive coverage of foods and components
- covering a wide range of components or only specific ones (phytochemicals)
- according to international or local standards
- solely analytical or also compiled/estimated/imputed data
- free-of-charge or with fee
- well or badly documented or black box
- for different purposes, e.g. for labeling, research, consumers

Some examples (1)

FCDBs in North America

- **USDA**:
  - yearly new SR (24);
  - Dietary Supplement Ingredient Databases (DSID);
  - 3 DB on phytochemicals: Flavonoid (release 3; 2011); USDA-Iowa State University Database on Isoflavone (2008); Proanthoycanidin (2004);
  - Alaska Traditional Knowledge and Native Foods Database;
  - Choline, Release 2 (2008);
  - Fluoride, Release 2 (2005);
  - Oxalic Acid Content of Selected Vegetables
- **University of Minnesota** – Nutrition Coordinating Center: Food and Nutrient Database
- **Cancer Research Center of Hawaii: Cancer Research Center of Hawaii FoodComposition Table** (not publicly available)
- **Health Canada**: Canadian Nutrient File

Some examples (2)

Repositories

- **INFOODS**: for 110 countries, regions or international use their printed and on-line FCT/FCDB
- **LanguaL**: for 54 countries/regions on-line FCT/FCDB

Some examples (3)

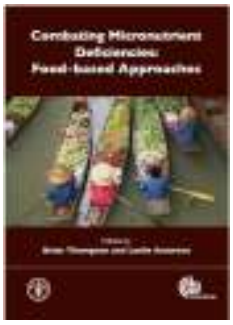
Software packages for intake assessment or labelling

- **On INFOODS website 'softwares'(examples)**
  - **WorldFood Dietary Assessment System**
  - **CBORD**
  - **ESHA Research (commercial)**: (1) Nutrient Analysis Programs; (2) Nutrient Processor and (3) on-line Food Prodigy; http://www.esha.com
- **Nutritionist Pro (commercial)**: (1) Nutritionist Pro™ Knowledge Base (DB); (2) Nutritionist Pro™ Diet Analysis and (3) Nutritionist Pro™ Food Labeling http://www.nutritionistpro.com/
- **Optifoods** (London School of Hygiene and Tropical Medicince, UK) for recipe/diet formulation meeting nutrient requirements (under pilot testing)

Prevention of micronutrient deficiency

1. **Food-based approach -> increased evidence that it works**

- Food biodiversity including wild and underutilized foods
- Traditional foods revival
- Nutrition education
- Change in agriculture production and increased home gardening



2. **Medicalised approach:** Fortification and/or supplementation -> **increase doubts**: read the commentary of Michael Latham 'The Great vitamin A Fiasco' at http://www.wphna.org/wn_commentary.asp)

Vitamin A deficiency in Micronesia

- Traditionally, vitamin A deficiency was **not know**
- With shift to **westernized diets** (e.g. white rice and mutton tails) vitamin A deficiencies arrived
- **Nutrition programme** developed based on green leafy vegetables did not work as considered 'pig foods'
- Exploration of **traditional diets** showed that local varieties of bananas and taro were very rich in carotenoides –> current programme re-introduces the traditional diet seems to work. See http://www.islandfood.org

Differences in food composition

	Protein g	Fibre g	Iron mg	Vitamin C mg	Beta-Carotenes mcg
Rice	5.6 - 14.6		0.7 - 6.4		
Cassava	0.7-6.4	0.9-1.5	0.9-2.5	25-34	<5-*790*
Potato	1.4-2.9	1-2.23	0.3-2.7	6.4-36.9	1-7.7
Sweet potato	1.3-2.1	0.7-3.9	0.6-14	2.4-35	100-23100
Taro	1.1-3	2.1-3.8	0.6-3.6	0-15	5-2040
Eggplant		9 - 19		50 - 129	
Mango	0.3 - 1.0	1.3-3.8	0.4-2.8	22-110	20 – 4320
GAC					6180 – 13720
Apricot	0.8-1.4	1.7-2.5	0.3-0.9	3.5-16.5	200-6939 (beta carotene equivalent)
Banana			0.1-1.6	2.5-17.5	<1 – 8500

Impact of food biodiversity on dietary adequacy

Protein content	Protein content (g/100 g)	Cassava intake in Congo g/d/p	Part of the RDI for protein covered by cassava intake, in %
Average	3.24	286	20.6
Minimum	0.95	286	6.0
Maximum	6.42	286	40.8

Banana	β-carotene content in mcg/100 g	Banana intake in Philippines in g/d/p	Vitamin A intake through banana in mcg RE/d/p	RDI for vitamin A covered by banana intake, in %
USDA	26	93	4	0.7
Lacatan	360	93	56	9.3
Utin Iap	8508	93	1318.7	219.8

Extent of genetic uniformity in rice

Country	Number of varieties grown		
	Past	Present	Remark
Bangladesh	5,000	23	
Japan	1,302	-	>70% of area cultivated under three varieties
Rep. of Korea	4,227	12	
Philippines	-	13	
Sri Lanka	2,000	100	
Taiwan Province of China	1,679	50	> 82% of area cultivated under three varieties
Thailand	16,185	37	50% of area cultivated under two varieties

Source: Paroda, 1999

Biodiversity and nutrition

- Dietary energy supply *can* be satisfied without diversity
- Micronutrient supply *cannot* be satisfied without diversity

"Agricultural biodiversity is a matter of life and death for us.... We cannot separate agrobiodiversity from food security."

—Zambian delegate to the Conference of Parties, Convention on Biological Diversity, May 1998

Food Biodiversity

- **Two Nutritional Indicators for Biodiversity** New in English, French and Spanish:
  1. **on food composition** (FAO, 2008) ➔ yearly reporting (in 2008 over 4700 foods reported, in 2011 a total of 12800 mainly from scientific literature)
  2. **on food consumption** (2010 and 2011) ➔ reporting every second year (in 2009 over 3000 food reported in food consumption surveys on food biodiversity, in 2011 increase to 4900 foods)
- **FAO/INFOODS Food Composition Database for Biodiversity.** New Only analytical data. First edition in 2010 with 2400 foods, in 2011 with 2600 foods, and in April 2012 over 6000 foods

Biodiversity & Nutrition

For food composition database compilers:

- Sample and generate nutrient data for wild foods and individual cultivars, also by ecosystem
- Compile these data comprehensively, systematically and centrally, and disseminate widely

For food consumption surveys

- Include biodiversity questions and/or prompts in food consumption surveys
- Report food consumption also by ecosystem and/or ethnic group
- Communicate to food composition database compilers the need for compositional data for these specific foods

For nutrition education

- Investigate traditional foods and varieties
- Promote the most nutritious among them
- Promote home gardening
- Integrated programmes with agricultural production

International Collaboration

- INFOODS (International Network of Food Data Systems)
- EuroFIR (European Food Information Resource Network)

INFOODS

- Established in 1984
- Under UNU and FAO.
- IUNS Task Force
- Coordination since 1999 in FAO
- **Objective**: to stimulate and coordinate efforts to improve the quality and availability of food analysis data worldwide

INFOODS achievements

- **Standards** and **guidelines**
- **Capacity development**
- **Tool development**: FCDBMS: Compilation Tool
- **Publications** and **Declarations**
- **Databases and tables**
- **Laboratory Quality Assurance**
- **Biodiversity**

Standards and guidelines

- **Component identifiers** also called tagnames: Since 1989 over 800 tagnames published
- **Food nomenclature** (Truswell et al., 1991)
- **Interchange of food composition data** (Klensin 1992; FAO, 2004)
- **Guidelines on compilation** of food composition data (Rand et al., 1991)
- New **energy conversion factors** (FAO, 2003)
- **Food matching guidelines** (FAO/INFOODS, 2011) New
- **Guidelines on Conversion among different Units, Denominators and Expressions** in preparation New
- **Guidelines on Checking Food Composition Data prior to the Release of a User Database** in preparation New

Capacity development

- Involved in/ co-organized **over 20 international training courses**
- Organized **10 training courses**
- Published *distance learning* tool **Food composition Study Guide** in *English, French and Spanish* together with *12 PowerPoint presentations* summarizing the main points of the modules

Food Composition Study Guide developed by FAO/INFOODS

New

Objectives

- To reach a wider audience cost-effectively, which otherwise would never be served
- To assist learners to fill their specific knowledge gaps and assess their knowledge acquisition
- To assist learners to perform better when generating, managing or using food composition data
- To assist teachers to prepare lessons and test students

Target Population

- self-learners, FoodComp courses, **universities**: compilers and users and also analysts; teachers and students

Tool development: FCDBMS

- FCDBMS is needed to compile a FCDB
- FCDBMS exist:
  - for national/regional programmes
  - commercial products for different uses (e.g. labelling)
  - for certain projects
- No FCDBMS exists for international use as yet
- BUT especially **developing countries and researchers** do not have the financial means to develop their own FCDBMS software

New

➔ **Compilation Tool** was developed by FAO/INFOODS to fill this gap (in Excel allowing data compilation according to INFOODS standards and to document all data)

Publications and Declarations

- **Food Composition Data: A User's Perspective** (Rand et al., 1987)
- **Food Composition Data – production, management and use** (Greenfield & Southgate) In English (2003), Spanish (2006), French (2007) and Korean (2008)
- **Journal of Food Composition and Analysis** (JFCA) was the official INFOODS journal from 1987 to 2010
- **Indigenous Peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health**. (Kuhnlein et al., 2009) New
- **AFROFOODS declaration** (2010) New
- **Bangkok Declaration** (2009) from the 8th International Food Data Conference New

Laboratory Quality Assurance

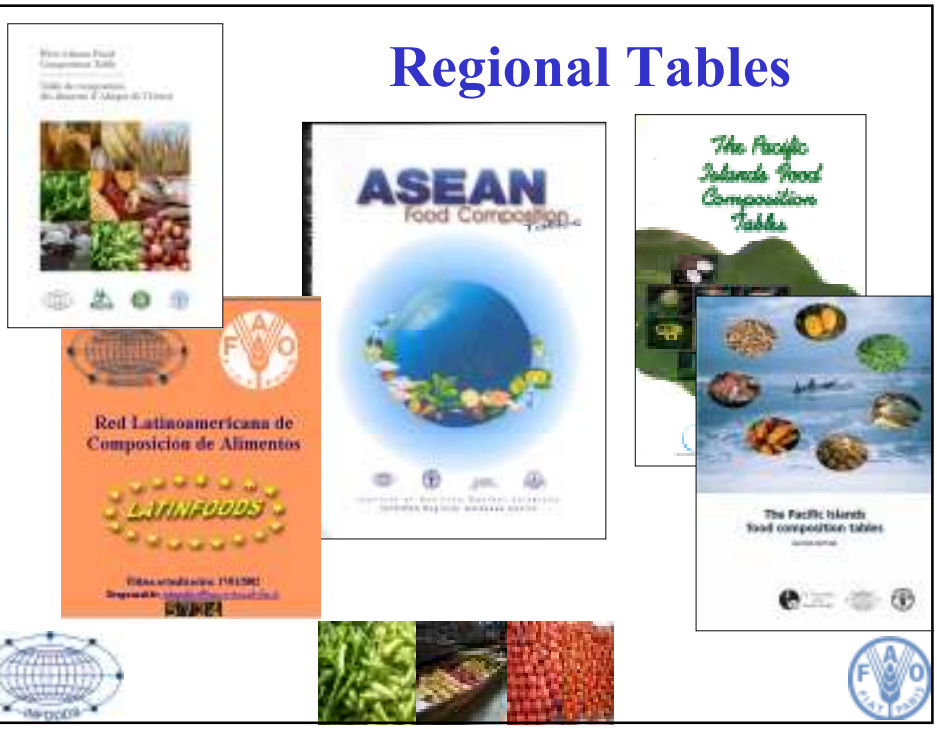
- Several proficiency testing (PT) were organized, especially in ASEANFOODS countries. More PTs are planned in SAARCFOODS countries
- Strengthening laboratory capacity in food composition (including accreditation) in the South Pacific in 2002-2004 through FAO
- ASEAN Manual of Nutrient Analysis (2011) New

Databases and tables (1)

- **co-published 9 FCTs**: ASEANFOODS (2000), LATINFOODS (2002), Pacific Islands (1994, 2004), Lesotho (2006), Brazil (2008), Armenia (2011), New Composition of selected foods in West Africa (2010), New West African Food Composition Table (2012) New
- FAO/INFOODS **Density Database** (2011) New

→ **Future work**: co-publish more national and regional FCDBs and DBs on yield and retention factors

Regional Tables



Databases and tables (2)

- However, many FCTs/FCDBs compile data from existing sources (often USDA) and are not well documented
- Analytical data are missing especially in developing countries (specifically minerals and vitamins) and on food biodiversity
- FAO/INFOODS is compiling FCDBs with **solely analytical data** (one for biodiversity and one for all foods) to avoid reuse of compiled data of compilations

Conclusion

- INFOODS assist countries through guidelines, tools and DB
- North America and other developed countries are well advanced in FCDB and applications and are source of data for other countries
- An increasing number of FCTs/FCDB are published, also on-line and free-of-charge following US example
- Analytical data are still missing for many foods, especially in developing countries and on food biodiversity and for processed foods
- These data could then be used to promote food-based approaches (without or limited fortification and supplementation)
- With more awareness by consumers and agriculture → more **nutritious and delicious food** supply and more consumers **eat** these foods

Thank you

- INFOODS website
  http://www.fao.org/infoods/index_en.stm
- ruth.charrondiere@fao.org