Food Composition Databases: Needs, New Opportunities and International Collaboration

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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 CO₂ emission of 6%) and threatens agriculture


**Food Waste**: 30% of the produced food is lost or wasted (1.3 billion tons per year) = waste of inputs and unnecessary increase of CO₂

**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); Proanthocyanidin (2004);
  - Alaska Traditional Knowledge and Native Foods Database;
  - Choline, Release 2 (2008);
  - Flouride, 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 Food Composition 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.eshacom](http://www.eshacom)

• Nutritionist Pro (commercial): (1) Nutritionist Pro™
  Knowledge Base (DB); (2) Nutritionist Pro™ Diet
  Analysis and (3) Nutritionist Pro™ Food Labeling

• Optifoods (London School of Hygiene and Tropical Medicine, 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](http://www.wphna.org/wn_commentary.asp)
Vitamin A deficiency in Micronesia

- Traditionally, vitamin A deficiency was not known.
- 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 carotenoids -> current programme re-introduces the traditional diet seems to work. See [http://www.islandfood.org](http://www.islandfood.org)

### Differences in food composition

<table>
<thead>
<tr>
<th></th>
<th>Protein g</th>
<th>Fibre g</th>
<th>Iron mg</th>
<th>Vitamin C mg</th>
<th>Beta-Carotenes mcg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>5.6-14.6</td>
<td>0.7-6.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava</td>
<td>0.7-6.4</td>
<td>0.9-1.5</td>
<td>0.9-2.5</td>
<td>25-34</td>
<td>&lt;5-790</td>
</tr>
<tr>
<td>Potato</td>
<td>1.4-2.9</td>
<td>1.2-2.3</td>
<td>0.3-2.7</td>
<td>6.4-36.9</td>
<td>1-7.7</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>1.3-2.1</td>
<td>0.7-3.9</td>
<td>0.6-14</td>
<td>2.4-35</td>
<td>100-23100</td>
</tr>
<tr>
<td>Taro</td>
<td>1.1-3</td>
<td>2.1-3.8</td>
<td>0.6-3.6</td>
<td>0-15</td>
<td>5-2040</td>
</tr>
<tr>
<td>Eggplant</td>
<td>9-19</td>
<td></td>
<td></td>
<td></td>
<td>50-129</td>
</tr>
<tr>
<td>Mango</td>
<td>0.3-1.0</td>
<td>1.3-3.8</td>
<td>0.4-2.8</td>
<td>22-110</td>
<td>20-4320</td>
</tr>
<tr>
<td>GAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6180-13720</td>
</tr>
<tr>
<td>Apricot</td>
<td>0.8-1.4</td>
<td>1.7-2.5</td>
<td>0.3-0.9</td>
<td>3.5-16.5</td>
<td>200-6939 (beta carotene equivalent)</td>
</tr>
<tr>
<td>Banana</td>
<td>0.1-1.6</td>
<td>2.5-17.5</td>
<td></td>
<td></td>
<td>&lt;1-8500</td>
</tr>
</tbody>
</table>
### Impact of food biodiversity on dietary adequacy

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

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

### Extent of genetic uniformity in rice

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of varieties grown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Past</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>5,000</td>
</tr>
<tr>
<td>Japan</td>
<td>1,302</td>
</tr>
<tr>
<td>Rep. of Korea</td>
<td>4,227</td>
</tr>
<tr>
<td>Philippines</td>
<td>-</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>2,000</td>
</tr>
<tr>
<td>Taiwan Province of China</td>
<td>1,679</td>
</tr>
<tr>
<td>Thailand</td>
<td>16,185</td>
</tr>
</tbody>
</table>

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** 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.** 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)
- Guidelines on Conversion among different Units, Denominators and Expressions in preparation
- Guidelines on Checking Food Composition Data prior to the Release of a User Database in preparation

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

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

→ 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)
- **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)
- **AFROFOODS declaration (2010)**
- **Bangkok Declaration (2009)** from the 8th International Food Data Conference

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)**
Databases and tables (1)

- **FAO/INFOODS Density Database** (2011)

→ **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

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