

## EURRECA – A Network of Excellence to align European micronutrient recommendations

Loek Pijls<sup>a,\*</sup>, Margaret Ashwell<sup>b</sup>, Janet Lambert<sup>c</sup>

<sup>a</sup>ILSI Europe aisbl, Avenue E Mounier 83-Box 6, 1200 Brussels, Belgium

<sup>b</sup>Ashwell Associates Ltd, Ashwell Street, Ashwell, North Hertfordshire SG7 5PZ, United Kingdom

<sup>c</sup>Lambert Nutrition Consultancy Ltd, 5 Britwell Road, Watlington, Oxfordshire OX49 5JS, United Kingdom

### ARTICLE INFO

#### Article history:

Received 15 February 2008

Received in revised form 1 September 2008

Accepted 2 September 2008

#### Keywords:

Alignment

Consumer understanding

EURRECA

Harmonisation

Methodology

Micronutrients

Network of Excellence

Recommended nutrient intakes

Reference nutrient intakes

Vulnerable groups

### ABSTRACT

The approaches by which reference micronutrient intakes are derived, as well as the reference intakes themselves, vary considerably across countries. Harmonisation may improve nutrition policy and eventually public health. The Network of Excellence named EURRECA (EUROpean micronutrient RECommendations Aligned, <http://www.eurreca.org>), largely funded (2007–2011) by the European Union within the Sixth Framework Programme for Research and Technological Development, aims to develop and apply a framework for systematically setting and keeping up-to-date micronutrient recommendations. With its 34 partners in 17 countries, it supports the work of EFSA and of national and regional nutrition societies, and complements EuroFIR (<http://www.eurofir.net>). Through aligning the basis of micronutrient recommendations across Europe, EURRECA can contribute to nutrition policy and eventually to public health.

© 2008 Elsevier Ltd. All rights reserved.

## 1. Paradigm of micronutrient recommendations

In the classical nutrient paradigm, nutrient requirement is defined by the lowest intake that prevents (is required to prevent) signs of ‘classical’ micronutrient deficiency, such as scurvy and beriberi. More recently it has been observed that certain nutrients have additional beneficial effects at intakes higher than those required to prevent such classical deficiencies. Therefore an alternative approach is to define nutrient requirement as the lowest intake that does not only prevent classical deficiencies, but as the lowest intake at which all aspects of health and functioning known to be influenced by the nutrient concerned, are optimal. These latter functional and health aspects may comprise minimisation of the risk of developing chronic disorders, again as far as that risk depends on the intake of the nutrient concerned.

The nutrient requirement differs between individuals, and the recommended intake for a certain population aims to cover the nutrient requirement of almost all individuals in that population. Some approaches in setting nutrient recommendations directly

estimate an intake level that is expected to cover the requirements of most individuals in a population, without estimating the requirements in series of individuals.

## 2. Uses of micronutrient recommendations

Nutrient recommendations may be used for planning or assessment purposes, both for groups and individuals. The different uses are not always as straightforward as they would seem, and certain restrictions apply (Health Council of the Netherlands, 2001; Institute of Medicine, 2006; Spaaij & Pijls, 2004), largely because of inter-individual differences in requirements. Nutrient recommendations are part of the basis for food policy and food-based dietary guidelines, and are used in nutrition labelling.

Common understanding and agreement should be sought, across countries and supranational regions, as well as globally, on the different uses and applications of nutrient recommendations, i.e. for individuals or groups, for nutrition policies, for fortification, for regulatory purposes or for trade. From such common understanding and agreement science, food producers, nutrition policy makers and education can benefit, and so can, eventually, public health.

\* Corresponding author. Tel.: +32 2 775 9135; fax: +32 2 762 00 44.

E-mail address: [lpijls@ilsieurope.be](mailto:lpijls@ilsieurope.be) (L. Pijls).

URL: <http://www.eurreca.org> (L. Pijls).

### 3. Current diversity of recommendations across Europe

Some European countries have already harmonised their nutrient recommendations beyond national borders, examples of which are the German speaking countries (German Nutrition Society, Austrian Nutrition Society, Swiss Society for Nutrition Research, 2000) and the Nordic countries (Nordic Council of Ministers, 2004a, 2004b). Nevertheless, large differences still exist across Europe and beyond (Doets et al., 2008; Pavlovic, Prentice, Thorsdottir, Wolfram, & Branca, 2007). They result from the use of different concepts, and sometimes different data. Defining nutrient recommendations involves judgemental elements such as the opinions of the selected experts on the quality of the available research papers and the potential bias towards data on national populations and research by nationally based organisations.

Recommendations are generally given for different age and gender groups, and for pregnant and lactating women. However, the age categories are often classified differently between countries, in particular for infants, children, adolescents and the elderly. This and other issues were highlighted by an expert group and workshop supported by the European Branch of the International Life Sciences Institute (ILSI Europe) (Koletzko, de la Guéronnière, Desjeux, & Krause, 2004). Although some recommendations may need to differ between countries, such as those for vitamin D due to differences in sunlight exposure and hence endogenous vitamin D synthesis, the alignment of age bands across Europe would be an important step towards harmonisation of nutrient recommendations and hence for public health nutrition at the European level, and would simplify evaluations and comparisons of dietary adequacy across populations.

### 4. Why align nutrient recommendations?

The rather small systematic physiological differences between people in across Europe do not justify the currently considerable differences in nutrient recommendations across Europe. Thus also the basis for food-based dietary guidelines is of limited quality. Differences in nutrient recommendations confuse consumers and pose difficulties for food producers who market products in more than country. There is a need to increase transparency, and a need for a common framework with agreed language and terminology to develop nutrient recommendations and to keep them up to date.

### 5. Lessons learned from other international activities

Micronutrient recommendations have been produced by a number of organisations around the world, e.g. the USA Institute of Medicine and Health Canada, the United Nations University, the European Commission's former *Scientific Committee for Food* (1992) and currently also the European Food Safety Authority (EFSA) ([http://www.efsa.eu.int/EFSA/efsa\\_locale-1178620753812\\_1211902049838.htm](http://www.efsa.eu.int/EFSA/efsa_locale-1178620753812_1211902049838.htm), accessed 27 August 2008).

In 2006 and in 2007 the Food and Nutrition Board of the US Institute of Medicine held, jointly with Health Canada, two workshops that are very relevant for EURRECA. They were entitled, respectively, *Dietary Reference Intakes Research Synthesis* and *The Development of DRIs 1994–2004: Lessons Learned and New Challenges* (Institute of Medicine 2007, 2008).

The United Nations University (UNU), in collaboration with the Food and Agricultural Organisation (FAO), World Health Organisation (WHO) and the United Nations Children's Emergency Fund (UNICEF), has proposed an international harmonisation of nutrient based dietary standards (King & Garza, 2007). It suggests fixing only two values: the average requirement and the upper limit. To

make an analogy with the risk analysis process: these two values would be the result of 'risk assessment'. Other values would be derived from these and should be flexible, depending mainly on factors other than scientific factors; this compares with the risk management process. For example the recommended daily intake, referred to as population reference intake, is typically set at the average nutrient requirement plus two times the standard deviation of requirement. Assuming requirements follow a normal distribution across populations, the population reference intake is thus expected to cover the requirements of 97.5% of the population. In some cases it may however be set at a level that covers the needs of, for example, 75%, 90% or 99.5% of the population. These approaches now need to be applied and further developed using data for European populations.

### 6. EURRECA Network of Excellence

The need for the harmonisation of micronutrient recommendations across Europe was recognised by the European Commission's Directorate-General Research in EC Call T5.4.2.1 entitled *Nutrient status and requirements of specific population groups (NoE)*:

The aim is to provide and collate data about the status and the requirements of selected nutrients, particularly micronutrients, for specific vulnerable population groups identified by the proposers (such as infants, children, adolescents, pregnant women, lactating women, post-menopausal women, elderly people, immigrants and/or low-income groups) in order to harmonise dietary recommendations Europe-wide. Existing epidemiological data from different population groups will be compared and harmonised, and new data will be provided – where necessary – in view of developing European dietary guidelines. As a result, consumer understanding will be improved and behavioural changes will be facilitated by communication to consumers, food chain operators, health professionals and policy makers. The participation of industry, new Member States and candidate countries is strongly encouraged, while the involvement of consumer organisations is essential.

The EURRECA Network of Excellence (NoE) has EC funding for the period 2007–2011. 'EURRECA' stands for *EUROPEAN RECOMMENDATIONS ALIGNED* and its full name is *aligning micronutrient recommendations across Europe with special focus on vulnerable groups and consumer understanding*. It includes 35 partners in Belgium, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, The Netherlands, Norway, Poland, Portugal, Serbia, Spain and the United Kingdom. Partners comprise universities, scientific institutes, small- and medium-sized enterprises (SMEs) including software specialists and nutrition and communication consultants, WHO Regional Office for Europe, a consumer organisation and the European Food Information Council. Partner details, as well as many other details concerning EURRECA, can be found on <http://www.eurreca.org> (see also Ashwell et al, 2008; Pijls, 2007).

### 7. Objectives

EURRECA's overall objective is to create a sustainable collaborative network to develop science based aligned nutrient recommendations across Europe. It is expected to provide Europe with science-based excellence in the evaluation of micronutrient requirements and translation into recommendations on micronutrient intake. It will develop and apply tools that help the EFSA, as well as any organisation charged with developing and revising nutrient recommendations.

In more detail EURRECA's objectives and expected results comprise:

- Integration of resources and expertise present across Europe, to mutually benefit from each partner's capacities and talents;
- A framework to set and keep up-to-date aligned science-based European nutrient recommendations. This includes provision of a supportive platform for the collaboration of research entities, and development of joint approaches for methodologies and training schemes and of joint strategy and operational approaches as exemplified by EURRECA codes of practice;
- Application of this framework in order to produce building blocks of micronutrient recommendations, such as estimates of average requirement;
- Quality control, regular review, transparency, objectivity;
- Insight into micronutrients of concern for population groups of concern;
- A common language and terminology related to the different areas of nutrient recommendations;
- Improved basis for food-based dietary guidelines;
- Sustainable European nutrition network;
- Involvement of consumer perspective; improve understanding;
- Innovation in small and medium-sized enterprises.

EURRECA will provide and apply best practice guidance for a more robust science base for devising micronutrient recommendations. Where appropriate it will include decision trees. Examples of possible tools are: consensus on markers of micronutrient status and on best methods for their measurement, and on methods to

estimate intake; the most appropriate concepts relating to nutrient recommendations for European population groups and best practice guidelines for the involvement of consumers and other stakeholders in expressing nutrient recommendations in an understandable and applicable form.

## 8. Approach

Most panels producing micronutrient recommendations are limited to review and analysis of published information, and have no opportunity to commission new field or bench research to answer the questions that arise during their deliberations. EURRECA also focuses on desk research to questions of priority, with the flexibility, however, that the exact remit of each research activity is determined in detail only in the course of the previous phase (see Fig. 1). This fluidity means that EURRECA can react to the results and conclusions as the network progresses. It investigates the steps in defining micronutrient recommendations, and will recommend future research for developing new methods and approaches.

## 9. Research activities

The initial research activities (RA1, months 1–18) have focussed on methods of intake assessment, on markers for nutritional status (Fairweather-Tait & Harvey, 2008), on the collation and review of existing micronutrient recommendations in Europe and beyond, and on developing a framework to further structure EURRECA.

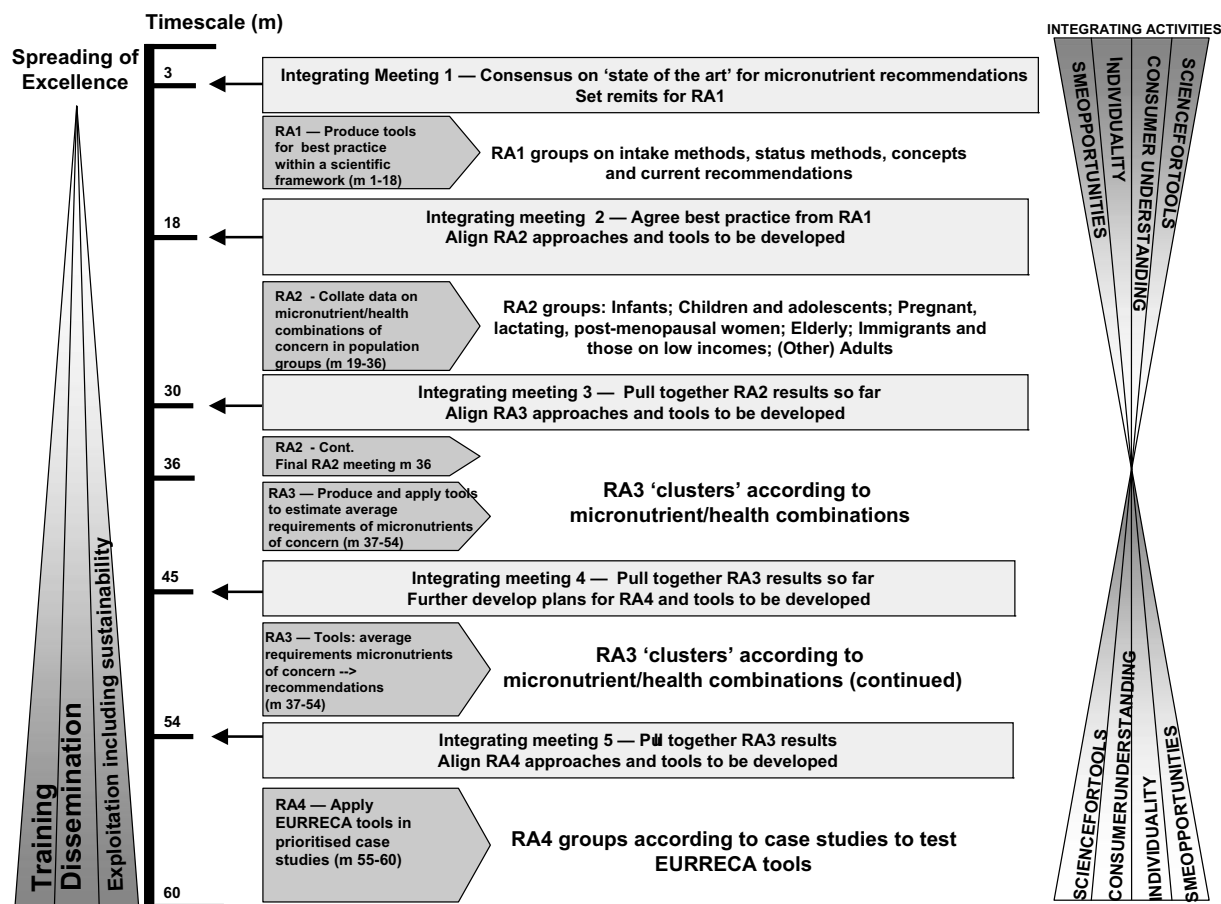


Fig. 1. Envisaged roadmap EURRECA Network of Excellence.

The initial focus of the network was on calcium, copper, folate, iodine, iron, magnesium, riboflavin, selenium, vitamin B<sub>12</sub>, vitamin D and zinc; priority setting is now taken to a next level in a transparent and systematic way. Methodology and tools to be developed will facilitate establishing micronutrient recommendations, showing their adaptation and dissemination, and incorporating relevant aspects of science, policy and culture at each stage (Fig. 2).

A second integrating meeting in June 2008 was the kick-off for the second group of research activities (RA2, 19–36 months), which apply the best practice and insights developed in the first phase of research activities. They are organised around the following population groups: infants, children and adolescents, pregnant and lactating women, elderly, (other) adults, and low-income and immigrant groups. Their aim is to create the basis for determining micronutrient requirements from evidence on valid markers of nutritional and health status. Building on the RA1 experience, the RA2 groups will conduct systematic reviews on those micronutrients that are deemed to be of major importance. Later on meta-analyses of the accumulated evidence from intervention and observational studies in adults will show how micronutrient intake affects micronutrient status and health outcomes; such analyses will be designed and initiated on studies selected. Explorative work will be undertaken on estimating requirement for micronutrients for which several markers or health endpoints are available. The research groups on infants, children and adolescents, pregnant and lactating women also explore the basis and options for applying the factorial approach. For low-income and immigrants systematic searching and reviewing of the literature also includes grey literature.

The third phase of research activities (RA3, 37–54 months) will be organised around methodological themes. The core component of RA3 is the meta-analyses on the studies in adults selected in RA2. These meta-analyses are transparent tools for estimating micronutrient requirements in a systematic way, and for deriving recommended intakes from them. RA3 will also advance insight into ways of accounting for bioavailability, vulnerability, individuality, and methods for intra- and extrapolation.

The fourth phase of research activities (RA4, 55–60 months) will further extend the basis for developing European nutrient recommendations. The focus may be on case studies to illustrate the application of the most important EURRECA tools, which will be quite diverse from the comprehensive network. For example, there could be a comparison of recommendations derived from status markers with those obtained by innovative genomic approaches. Other possibilities include investigating the role of consumer groups and the opportunities for small- and medium-sized enterprises (SMEs) and other stakeholders in achieving effective dietary changes. Most importantly it will consolidate and sustain the EURRECA network by promoting the use of the EURRECA tools and continually improving them with relevant methodologies available from other nutrition-related EU-projects. RA4 will also take the basis for developing food-based dietary guidelines to a next level.

### 10. Greater breadth of recommendations

EURRECA has a particular focus on vulnerable groups. This includes low-income and migrant groups as well as the more traditional population groups based on gender and age (infants, children, adolescents, pregnant and lactating women, and the elderly). One of the early activities was the development and distribution of a standardised questionnaire, by partners looking at current recommendations for population groups. A collation has been produced of micronutrient recommendations currently existing in Europe, as well as selected ones outside Europe (Doets et al., 2008). Another questionnaire unravels the application of micronutrient recommendations in developing nutrition policies across Europe.

### 11. Nutrigenomic approach

Previous sets of micronutrient recommendations have not usually attempted to go beyond those for population groups based on gender and age. An integrating activity envisaged for the full EC

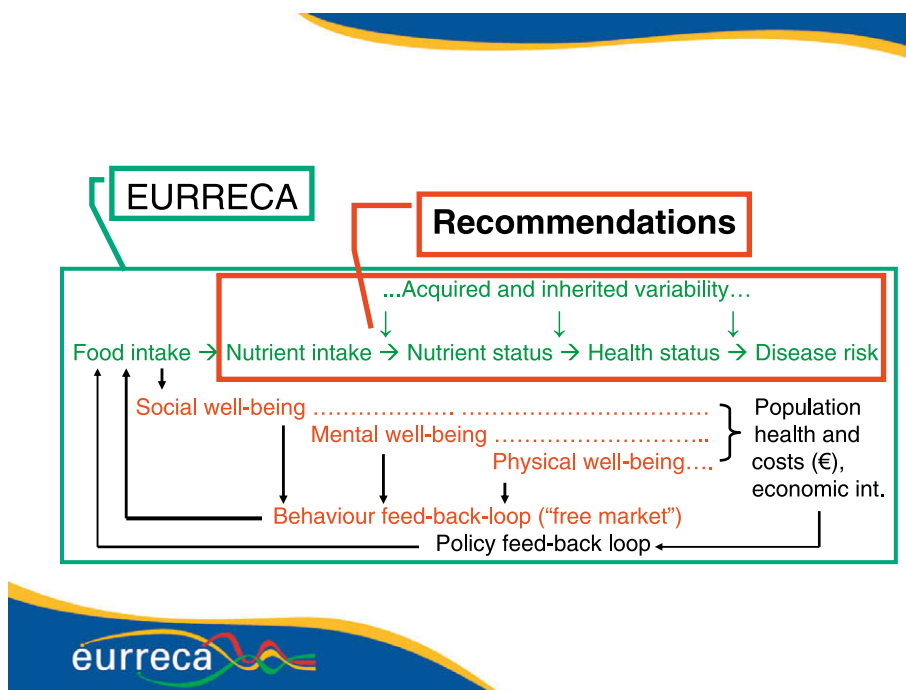


Fig. 2. EURRECA's, ambitions, beyond, micronutrient, recommendations.



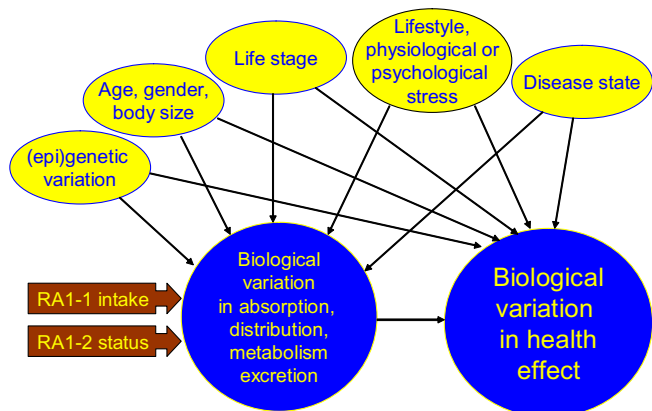


Fig. 3. Sources of variability of individual nutrient intake requirements: Biological variation.

funding period of five years investigates whether recommendations could be given according to smaller subgroups' and eventually possibly even individuals' nutritional phenotype and genotype. Variation in metabolism between individuals is complex. Recent technological developments evaluate the relationship between micronutrient status and a wide range of metabolites (including macronutrients, micronutrients and other micro-components of the diet) in ways different from those in clinical biochemistry and established nutrition and biomedical sciences.

First are defined the origins of inter-individual variation of micronutrient requirements; such variation makes some individuals more vulnerable to poor nutrition. Biological variation in absorption, distribution, metabolism and excretion lead to variations in functional or health outcomes of a given intake of a nutrient (Fig. 3). To better understand such inter-individual variation and its determinants, EURRECA describes relationships between biomarkers such as plasma concentrations of micronutrients and their health effects. EURRECA will then determine the quantitative extents to which genetic, epigenetic and dietary factors determine the nutritional phenotype, as well as the way in which they interact in doing so.

Eventually, EURRECA will create a database of 'nutritional phenotype' characteristics and their correlations. Phenotype will be correlated with micronutrient status. This will be achieved in the context of a large international effort of extensive nutritional phenotyping, linked to the European NutriGenomics Organisation (<http://www.NuGO.org>) and others. As our ability to capture and quantify the nutritional phenotype increases, understanding of the determinants of inter-individual variation of nutrient requirement will progress as well. As such we can specify recommendations to increasingly smaller and more homogenous groups. Personalised nutrition is conceivable as the potential endpoint of such development, the latter expectedly being well beyond EURRECA's EC funding period.

Another integrating activity on science and standards facilitates the integration of the different activities, as well as the development of methodologies, best practices and practical tools.

## 12. Important players in the field of nutrient recommendations

Consumer involvement, through their representative groups, is essential in the process of presenting and applying nutrient recommendations. In the past this has either been non-existent or not transparent. Since one of its ongoing integrating activities focuses on consumer issues, EURRECA increases the understanding of consumer involvement in the process of nutrition policy making through:

- Identification of criteria for assessing the direct and indirect impact of the involvement of consumers and of other stakeholders that represent consumer interests in nutrition policy making;
- Evaluation of current forms of consumer and other stakeholder involvement and impact (e.g. consultative groups, advisory committees, surveys, focus groups, citizens' juries);
- Systematic review of consumer-related issues pertinent to intake methods, status methods, concepts, definitions, individuality, vulnerability and variability, for example the extent of consumer knowledge.

SMEs collaborate with other EURRECA partners to identify opportunities for exploitation in diverse fields. This may involve SMEs that produce foods for those with special dietary needs, making available to SMEs better food-analytical methods, and facilitating the development of nutrition software by SMEs. The involvement of national and regional nutrition societies across Europe, as well as of the Federation of European Nutrition Societies (FENS), is an important aspect of EURRECA.

Another organisation important for EURRECA is the United Nations University (UNU) Food and Nutrition Programme's Standing Committee on Nutrition (SCN). In collaboration with the International Union of Nutritional Sciences (IUNS), a UNU/SCN Network for Capacity Development in Nutrition for Central and Eastern Europe (NCDN-CEE) was established in 2006 to support CEE countries in developing research and training in public nutrition ([www.srb-nutrition.info/?page=Network](http://www.srb-nutrition.info/?page=Network)). This network is involved in EURRECA activities, and a customised EURRECA nutrition and epidemiology course, based on their specific needs, has been developed for them (Warsaw, September 2008).

## 13. Spreading the excellence

EURRECA hands on, shares and utilises the expertise and experience generated to the benefit of policy, professional, consumer and industry stakeholders. This will contribute to the network's sustainability. Spreading of excellence includes training, dissemination and exploitation, which increasingly engage parties initially outside the network.

Training initially focuses on the needs of network members by sharing the wide range of internal expertise. It will be opened up to external parties at appropriate points. A EURRECA training programme is being developed as a recognised and accessible resource for all working in the field of micronutrients. Dissemination includes both internal and external communications utilising web-sites, newsletters, databases, checklists for stakeholder groups and consumer engagement activities. Exploitation of network results will be facilitated not only for food producers and retailers, but also for policy-makers and consumer groups. Work groups, seminars, web-based discussion groups and newsletters facilitate this.

Particular attention will be paid to the inclusion and involvement all other EC funded projects (completed, on-going, future) relevant for EURRECA, in order to maximise information exchange and to share resources. This includes the Early Nutrition Programming Project (EARNEST; <http://www.metabolic-programming.org>), European Food Consumption Validation (EFCOVAL), European Food Information Resource Network (EUROFIR; <http://www.eurofir.net>), Health Lifestyle in Europe by Nutrition in Adolescents (HELENA; <http://www.helenastudy.com>) and European NutriGenomics Organisation (NuGO; <http://www.nugo.org>). EURRECA will align with EFSA, embrace the full spectrum of potential SME interest, and involve organisations and channels of communication that address ethnic, religious and minority sectors among the people of Europe.

## 14. Sustainability

EURRECA partners are committed long-term, beyond the five years of EC funding. This includes a commitment to strategic planning by aligning, synchronising and coordinating their activities. Sharing activities, such as tasks and responsibilities related to infrastructure access and use, as well as knowledge and intellectual property, will be mutually beneficial to partners. EURRECA aims to become a sustainable entity; as such policy makers will be able to draw on it at any time.

## 15. EuroFIR and EURRECA: the perfect couple

The notion that what we eat influences our health is as old as mankind. About 100 years ago the paradigm of nutrients was introduced, which entails that it is not so much specific foods that have health effects, but rather certain components (referred to as nutrients) that occur in various amounts in certain (types of) foods. So from then on foods have been analysed and food composition data developed. By combining such data with estimates of food intake one can estimate nutrient intakes. This has facilitated further research on the effects of (the levels of) nutrient intakes on aspects of health. We learned more and more about the optimal levels of nutrient intakes, which we translate to nutrient requirements and recommendations. Food composition data are also crucial in translating recommended nutrient intakes back towards recommended food (group) intakes. The complementarity between EuroFIR and EURRECA lies in both networks' core areas, to be expressed mainly in the eventual uses and applications of the outcomes of both networks.

An important strategic analogy exists between EuroFIR and EURRECA: both develop a durable but flexible framework to identify and to keep up-to-date food composition data or nutrient recommendations, respectively. Both go far beyond producing a single snapshot of values at one point in time (e.g. at end of EC funding period), which renders their value into one that is large and lasting.

## Acknowledgement

The EURRECA Network of Excellence is largely funded by the European Union within the Sixth Framework Programme for Re-

search and Technological Development, contract number FP6 036196-2 (FOOD).

## References

- Ashwell, M., Lambert, J., Alles, M., Branca, F., Bucchini, L., Brzozowska, A., et al. (2008). EURRECA – European micronutrient RECommendations Aligned. An EC network of excellence producing the sustainable scientific evidence-based EURRECA toolkit to support food and health policy. *European Journal of Nutrition*, 47(Suppl. 1), 1–16 [on behalf of the EURRECA network].
- Doets, E. L., Wit, L. S. de., Dhonukshe-Rutten, R. A. M., Cavelaars, A. E. J. M., Raats, M. R., Timotijevic, L., et al. (2008). Current micronutrient recommendations in Europe with special focus on vitamin A and vitamin D. *European Journal of Nutrition*, 47(Suppl. 1), 17–40.
- Fairweather-Tait, S. J., & Harvey, L. J. (Eds.). (2008). Micronutrient status methods: Proceedings of the EURRECA workshop and working party on new approaches for measuring micronutrient status. *British Journal of Nutrition*, 99(Suppl. 1).
- German Nutrition Society, Austrian Nutrition Society, Swiss Society for Nutrition Research (2000). Reference values for nutrient intake (D-A-CH). In *Frankfurt am main* (1st ed.) [Internet].
- Health Council of the Netherlands (2001). *Dietary reference intakes: Energy, proteins, fats, and digestible carbohydrates*. The Hague: Health Council of the Netherlands. [Publication no. 2001/19E].
- Institute of Medicine (IOM). 2007. *Dietary reference intakes research synthesis – Workshop summary*. Washington, DC: The National Academies Press.
- Institute of Medicine (IOM). 2008. *The development of DRIs 1994–2004: Lessons learned and new challenges – Workshop summary*. Washington, DC: The National Academies Press.
- King, J. C., & Garza, C. (2007). International harmonization of approaches for developing nutrient-based dietary standards. *Food and Nutrition Bulletin*, 28(Suppl. 1), S3–S153.
- Koletzko, B., de la Guéronnière, V., Desjeux, J. F., Krause, E. (Eds.). (2004). Nutrition in children and adolescents in Europe: What is the scientific basis? *British Journal of Nutrition*, 92(Suppl. 2).
- Nordic Council of Ministries (2004). *Nordic nutrition recommendations 2004* (4th ed.). Nord: Copenhagen.
- Nordic Council of Ministries (2004). Nordic nutrition recommendations. *Scandinavian Journal of Nutrition*, 48(4), 178–187.
- Otten, J. J., Hellwig, J. P., & Meyers, L. D. (Eds.). (2006). *Dietary reference intakes (DRI). The essential guide to nutrient requirements*. Washington DC, USA: National Academies Press [Institute of Medicine].
- Pavlovic, M., Prentice, A., Thorsdottir, I., Wolfram, G., & Branca, F. (2007). Challenges in harmonizing energy and nutrient recommendations in Europe. *Annals of Nutrition and Metabolism*, 51, 108–114.
- Pijls, L. T. J. (2007). EURRECA essentials. *Annals of Nutrition and Metabolism*, 51(Suppl. 1), 39.
- Scientific Committee for Food (1992). Nutrient and energy intakes for the European community (Opinion expressed on 11 December 1992). In *Luxembourg, office for official publications of the European communities. Reports of the scientific committee for food (thirty-first series) 1993*, (pp. 1–248). Available at: <http://europa.eu.int/comm/food/fs/sc/scf/out89.pdf>. Accessed 26 November 2006.
- Spaaij, C. J. K., & Pijls, L. T. J. (2004). New dietary reference intakes in the Netherlands for energy, proteins, fats and digestible carbohydrates. *European Journal of Clinical Nutrition*, 58, 191–194.