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How we will produce the evidence-based EURRECA toolkit to support nutrition and food policy

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Abstract *Background* There is considerable variation in the recommended micronutrient intakes used by countries within Europe, partly due to different methodologies and concepts used to determine requirements and different approaches used to express the recommendations. As populations become more mobile and multinational, and more traditional foods become available internationally, harmonised recommendations based on up to date science are needed. This was recognised by the European Commission's (EC) Directorate-General (DG) Research in their 2005 call for proposals for a Network of Excellence (NoE) on 'nutrient status and requirements of specific vulnerable population groups'. EURopean micronutrient RECommendations Aligned (EURRECA), which has 34 partners representing 17 European countries, started on its 5-year EC-funded programme in January 2007. The programme of work was developed over 2 years prior to submitting an application to the EC. The Network's first Integrating Meeting (IM) held in Lisbon in April 2007, and subsequent consultations, has allowed further refinement of the programme.
Aim This paper presents the rationale for the EURRECA Network's roadmap, which starts by establishing the *status quo* for devising micronutrient recommendations. The Network has the opportunity to identify previous barriers and then explore 'evidence-based' solutions that have not been available before to the traditional panels of experts. The network aims to produce the EURRECA 'toolkit' to help address and, in some cases, overcome these barriers so that it can be used by those developing recommendations.
Results The *status quo* has been largely determined by two recent initiatives; the Dietary Reference Intake (DRI) reports from the USA and Canada and suggestions for approaches to international harmonisation of nutrient-based dietary standards from the United Nations University (UNU). In Europe, the European Food Safety Authority (EFSA) has been asked by the EC's Directorate-General for Health and Consumer Protection to produce values for micronutrient recommendations. Therefore, EURRECA will draw on the uniqueness of its consortium to produce the sustainable EURRECA toolkit, which will help make such a task more effective and efficient. Part of this uniqueness is the involvement in EURRECA of small and medium-sized enterprises (SMEs), consumer organisations, nutrition societies and other stakeholders as well as many scientific experts. The EURRECA toolkit will contain harmonised best practice guidance for a more robust science base for setting micronutrient recommendations. Hence, in the future, the evidence base for deriving nutrient recommendations will have greater breadth and depth and will be more transparent.
Conclusions The EURRECA Network will contribute to the broader field of food and nutrition policy by encouraging and enabling the alignment of nutrient recommendations. It will do this through the development of a scientific toolkit by its partners and other stakeholders across Europe. This will facilitate and improve the formulation of micronutrient recommendations, based on transparently evaluated and quantified scientific evidence. The Network aims to be sustainable beyond its EC funding period.

Key words EURRECA – Network of Excellence – micronutrients – nutrient recommendations – nutrient requirements – food policy – nutrition policy – health – EURRECA toolkit – harmonisation

Introduction

This paper represents an overview of the EURopean micronutrient RECommendations Aligned (EURRECA) Network of Excellence (NoE) together with a summary of the most important issues discussed during its initial stages (for further details please see the project website [10]).

About micronutrient recommendations

How are they devised?

For growth, maintenance and to promote overall good health, the human body needs certain amounts of many different micronutrients. The minimum amount of a nutrient needed by an individual to avoid deficiency is traditionally referred to as the nutrient *requirement*, and is defined by the body's physiological needs. Nutrient deficiency can be defined by clinical, physiological and biochemical criteria and these may all give different values for *requirements*.

For an individual the *requirement* for any nutrient depends on a variety of factors such as age, gender, genotype, physical activity, health status and factors such as the efficiency with which an individual absorbs and metabolises micronutrients. Among older people, for example, vitamin B12 absorption can be relatively poor and some women of child bearing age have high requirements for iron due to greater blood losses. Additionally, the intake and status for one

nutrient can impact on the absorption and utilisation of another and thus influence dietary requirements, a phenomenon generally referred to as nutrient interaction.

The requirement for a certain nutrient can thus vary both within and between individuals. Traditionally, the nutrient *recommendation for a group of people* is derived statistically and is the amount judged necessary to avoid deficiency in *virtually all individuals* within that group. It is generally calculated as 2 SD above the estimated average requirement and is set using the best currently available information about both the average and the inter-individual variation in *requirements* within the group for that micronutrient. In many cases data on the average requirement, and in particular on the inter-individual variation of requirements, are limited and so judgements need to be made. As a result differences can arise according to who makes the judgements. As populations become more multi-national and more traditional foods become available internationally, harmonised recommendations based on the most up to date science are needed to compare populations on basis of their intake.

A more recent concept, which is finding favour for some micronutrients, is to define the requirement as the intake at which health and functioning is optimal. As well as the prevention of deficiency disorders, this takes into account amounts, which have been shown to reduce the risk of developing other chronic disorders and to promote optimal growth and bodily functions (as far as influenced by the nutrients concerned).

What are their uses?

Nutrient recommendations may be used to assess the adequacy of the diets of healthy populations and to plan diets for groups of people. Their use to assess the diets of individuals has traditionally been discouraged [3, 14] due to the inter-individual variability in requirements. One of the aims of EURRECA is to consider this issue through evaluating inter-individual variability and its determinants. Nutrient recommendations are important for population nutritional planning and have food policy applications such as the development of food-based dietary guidelines and food fortification and enrichment programmes. They are also used in nutrition labelling because the amount of micronutrient contained in a portion or in 100 g is expressed as a percentage of a nutrient recommendation. In this way, it is possible to assess the contribution the micronutrient in an individual food can make to the overall diet.

Why do recommendations need to be aligned?

Current diversity of micronutrient recommendations across Europe

There is considerable variation in the recommended micronutrient intakes used by countries within Europe since different concepts (e.g. definitions and standards), and sometimes different data, are used to produce them [5].

Table 1 shows examples of different concepts and ways of expressing recommendations used in Europe and North America, and those recommended more recently by the United Nations University (UNU) [28]. The most commonly given values are for average requirements of groups and for the average + 2 SD. The latter cover most of the population (97.5%, assuming the distribution of individual requirements is statistically normal) and are the most generally used recommendations. In France, 130% of the average requirement is used for population recommendations [1].

The process of defining nutrient recommendations involves judgemental elements such as the opinions of the selected experts on the quality of the available research papers, potential bias towards national research and the need to consider any local health issues. As a consequence, various expert committees across Europe and elsewhere have produced a variety of values. The European Commission's (EC) former Scientific Committee on Food (SCF) published a collation of European micronutrient Recommended Daily Allowances for adults (i.e. the average requirements + 2 SD) in 2003 [34]. In addition to European population reference intakes (PRI), recommendations at national levels continue to be developed. Although some groups of countries have harmonised their recommendations (the Nordic countries [30] and the German speaking countries—D-A-CH [13]), there are still wide disparities between many other countries (Table 2).

Within each set of recommendations, values are generally given for different population groups such as adult men, adult women, pregnant and lactating women, different age groups of infants and children, and the elderly. However, these groups are often classified differently, in particular the age bands for infants, children, adolescents and the elderly vary between countries. An expert group, supported by the European Branch of the International Life Sciences Institute (ILSI Europe), has highlighted the main methodological and technological issues for producing nutrient recommendations for children and adolescents, which will need to be resolved to achieve harmonisation [33].

Table 1 A selection of concepts and acronyms used for micronutrient recommendations across the world

Source	Mean	Mean + 2SD	Mean − 2SD	Definition used in absence of information on distribution of requirements	Upper limit of intake	General term to encompass all values
EC Scientific Committee on Food (1993,2000/01/02/03), [34]	Average requirement (AR)	Population reference intake (PRI)	Lowest threshold intake (LTI)	Acceptable ranges	Tolerable upper levels (UL)	
UK Department of Health (1991) [3]	Estimated average requirement (EAR)	Reference nutrient intake (RNI)	Lowest reference nutrient intake (LRNI)	Safe intake	Safe upper levels	Dietary reference values (DRV)
Nordic Council of Ministers (2004) [30]	Average requirement	Recommended intake (RI)			Upper limit of intake	
DACH (2000) [13]	Average requirement	Recommended nutrient intake (RNI)		Estimated value		Reference values
Health Council of the Netherlands (2000) [14]	Average requirement	Recommended dietary allowance (RDA)		Adequate intake (AI)	Tolerable upper intake level	Dietary reference intakes (DRI)
US Institute of Medicine (1997) [15]	Estimated average requirement (EAR)	RDA		AI	Tolerable upper intake level (UL)	DRI
United Nations University (2007) [28]	Average Nutrient requirement (ANR)				Upper nutrient level (UNL)	Nutrient intake values (NIV)

Table 2 Variation in recommended daily allowances for micronutrients for adults: between different countries and organisations in Europe as given by Scientific Committee on Food, 2003

	Folate (mcg)	Vit. B_{12} (mcg)	Vit. C (mg)	Vit. A (mcg RE[a])	Vit. D (mcg)	Calcium (mg)	Iron (mg)	Selenium (mcg)
EC Scientific Committee on Food, 1993	200	1.4	45	700/600	0–10	700	9/20	55
France, 2001	330/300	2.4	110	800/600	5	900	9/16	60/50
Germany, Austria, Switzerland, 2000	400	3.0	100	1000/800	5	1000	10/15	30–70
Italy, 1996	200	2	60	700/600	0–10	1000	10/18	55
Netherlands, 1989, 2000, 2003	300	2.8	70	1000/800	2.5–5	1000	9/15	50–150
Nordic countries, 1996	300	2.0	60	900/800	5	800	10/18	50/40
United Kingdom, 1991	200	1.5	40	700/600	-	700	8.7/14.8	75/60

When there are two values, the left-hand side value is for adult men and the right-hand side for adult women
[a]Retinol equivalents
Adapted from: Scientific Committee on Food 2003 [35]

Comprehensive collations of recommendations for vitamin A and vitamin D illustrate some disparities between European countries [5]. Although some recommendations, such as vitamin D, may need to differ between countries due to differences in sunlight exposure, the simple alignment of age bands across Europe would be a huge step forward for public health nutrition and would simplify evaluations and comparisons of dietary adequacy.

Need for harmonisation recognised by the EC

The need for the harmonisation of micronutrient recommendations across Europe was recognised by the EC in their call in 2005 for proposals on 'nutrient status and requirement of specific population groups' (see "Box") under the Food Quality and Safety Area of 'Epidemiology of food related diseases and allergy'.

Box. EC Call T5.4.2.1: 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.

Subsequently, funding was given for the EURRECA NoE from the beginning of 2007 until the end of 2011. The first Integrating Meeting (IM1), held in Lisbon in April 2007, reviewed the state of the art for micronutrient recommendations and defined in more detail how EURRECA can contribute significantly to improving the methods for aligning recommendations over the next 5 years, and beyond.

What can be learned from recent initiatives to produce recommendations and to consider related issues?

Dietary reference intakes for the USA and Canada

The earlier experience of the USA and Canada provides useful insights into the challenges and opportunities for EURRECA. These two countries worked together to produce several comprehensive technical reports, some of which covered a large number of micronutrients. The 'Dietary Reference Intakes' (DRI) were published in a series of volumes between 1997 and 2005 and contained reference values for each sex and for 12 different physiological and life stages [15–25]. Some of these volumes cover the recommended values for micronutrients and also some guidance on their use in planning and dietary assessment.

Recommendations were based on comprehensive overviews of the science and expert judgement, since systematic, evidence-based reviews were not possible at the time due to lack of resource. Expertise was limited to the USA and Canada, and only selected experts could be invited to work on each nutrient. Although over 400 experts participated, non-invited experts might of course have had different insights and opinions.

Time constraints meant that there was limited opportunity to investigate more basic issues or to include the wider issues such as consumer and stakeholder involvement and suitability for end users until the very end of the process, when a guide for users was produced. New concepts that were possible to incorporate included novel statistical models, chronic disease endpoints and excess intakes. The

work was co-ordinated by a steering committee, who asked the experts to use the evidence base to produce comprehensive reviews, including new experimental data from human and animal studies.

The use of voluntary scientific expertise to undertake evidence-based reviews and further review by a steering committee had the effect of extending the time to complete the process to over 15 years. The process for developing the DRIs was not self-sustaining—they may not be reviewed again for a considerable time, depending on the science and funding.

Professor Johanna Dwyer, who was a member of the Food and Nutrition Board of the Institute of Medicine when the DRI concept was developed, and also served on several DRI committees, shared her experiences with the EURRECA Network at the IM and identified some future needs:

- Better ways to incorporate or produce systematic comprehensive evidence-based reviews and a process to follow up on research gaps and recommendations [26].
- Valid methods to estimate dietary intakes so that knowledge can be developed on how to act on apparently low intakes relative to recommendations. There is a particular need to evaluate consumption of bioactive ingredients other than traditional micronutrients.
- Data on good biomarkers for the intake of some nutrients, as well as markers for physiological and other health effects. Chronic disease endpoints were rarely available to the DRI committees and functional indicators were difficult to agree upon in a consistent manner.
- Less extrapolation and interpretation of data.
- Better scientific basis for recommendations in groups, which are particularly complex to define or study, for example healthy older people and breast fed infants.
- Clarification of the terminology and concepts used to derive recommendations. The DRI committees made judgements based on the experimental literature to Estimate Average Requirements (EAR). However, the definition of Recommended Dietary Allowance (RDA) as 2 SD above the EAR, whilst traditional in the USA, was to some extent arbitrary. The concept of Adequate Intake (AI) was unclear and its applications were limited.
- More involvement of risk managers in shaping and setting recommendations without compromising the important scientific independence and integrity of the process.
- A system which can revisit problems arising when the concepts/recommendations are applied to policy. The current 'sunset' system, where the committees have disbanded before any problems become apparent, has considerable disadvantages. A better system might help to overcome the dilemma when public health problems arise—do they indicate real deficiency or are they due to inappropriately set or applied DRIs?
- Better communication about the uses of the DRIs at the time they are being developed. Public and professional awareness is still quite low some years after publication of the North American recommendations.
- Practical tools to assist the users of the recommendations. The Canadian Dietetic Association produced a web-based course [4] and the Institute of Medicine, in partnership with Health Canada, has recently published a user-friendly version of the DRIs after consultation with the intended users such as dietitians, nutritionists and other health professionals [27, 31]. However, more needs to be done.
- More rapid adoption and use of the new DRIs. Health professionals have been slow to use them for assessment and planning, many journals still do not insist on using appropriate techniques and reviewers are often unaware of what the DRIs are and how to apply them.

All these identified needs can be considered as opportunities for the EURRECA Network to address. We hope to provide solutions for several of them as components of the EURRECA toolkit (see section on "comprehensive toolkit" below).

International harmonisation proposed by the UNU

The UNU, in collaboration with the Food and Agricultural Organisation (FAO), World Health Organisation (WHO) and the United Nations Children's Emergency Fund (UNICEF), has published an expert committee report on the international harmonisation of approaches for developing nutrient-based dietary standards [28]. The report recommends that the term nutrient intake values (NIV) should be used to encompass all nutrient-based data derived from primary data. NIVs are analogous to umbrella terms developed by other countries such as the DRIs of the United States, the DRI and DRV of the Netherlands and UK, respectively, and the reference values of Germany, Austria and Switzerland (see Table 1). The UNU report suggested that, globally, there should only be two values for recommendations, the average nutrient requirement and the upper nutrient level of intake. Other values would be derived from these and should be flexible. For example RDA, typically set at average nutrient requirement + 2 SD and covering the needs of 97.5% of the population, might in some cases be set at a level where it covered the needs, for example, 75, 80 or 90% of the population.

How will the comprehensive EURRECA toolkit complement the mandate of the EFSA?

The mandate of EFSA to set values for nutrient recommendations

Previously the EC's Scientific Committee for Food have provided Europe-wide micronutrient recommendations [34]. These PRIs have been used for the list of labelling values (EC Nutrition Labelling Directive, 90/496/EEC). In 2005 the EC's Directorate-General for Health and Consumer Protection asked EFSA to review existing PRIs for energy, macronutrients and dietary fibre as well as to advise on PRIs for micronutrients. Recommendations for carbohydrate, dietary fibre and water are expected in the first instance and work on micronutrients will be initiated in 2009. In addition, EFSA has been asked to provide guidance on the translation of nutrient recommendations into food-based dietary guidelines and held a colloquium on this topic in March 2006 [9].

In the light of this, the EURRECA Network has an excellent opportunity to develop tools, which should help EFSA when addressing its mandate, providing timescales are favourable. Further, EURRECA hopes that its comprehensive toolkit will be useful to any organisation charged with producing recommendations, thus extending the use of the toolkit globally. The toolkit will facilitate and improve the formulation of micronutrient recommendations, based on transparently evaluated and quantified scientific evidence.

The EURRECA goal is to produce a comprehensive toolkit for those developing recommendations

As EURRECA progresses, barriers which were apparent during previous attempts to set recommendations will be identified and tools, to help to address some of these barriers, will be developed for wide dissemination and exploitation throughout the EC funding period and beyond. The EURRECA toolkit will provide harmonised best practice guidance for a more robust science base for assessing nutrient requirements and hence for devising nutrient recommendations which can be used for evidence-based food/nutrition policies in their widest context (see section on "general framework and food and nutrition policy" below).

The EURRECA toolkit is expected to consist of a series of consensus criteria out of which 'gold standard' methods and, in some cases, decision trees will be developed. The early EURRECA activities will identify the most useful components of the toolkit and preferred formats. Later activities will develop and refine them.

Some examples of possible toolkit components are:

- Guiding principles on best methods to provide practically usable evidence for deriving nutrient requirements and recommendations;
- Consensus on indicators of micronutrient status and best methods for their measurement;
- Best practice guidelines for the involvement of consumers and other stakeholders to help scientists express and explain nutrient recommendations in a consumer friendly format.

What is the EURRECA Roadmap?

The EURRECA Roadmap will allow EURRECA to reach its overall goal. This is to create a sustainable collaborative network, which will produce an evidence-based toolkit to develop quality assured and aligned nutrient recommendations across Europe.

Most panels producing micronutrient recommendations have no opportunity to commission new research to answer the questions that arise during their deliberations. The essence of the EURRECA network is that the (desk) research activities can be channelled into addressing urgent questions at the appropriate time. This is why sequential phases of research activities are planned during the initial 5 years of EURRECA (the EURRECA Roadmap—see Fig. 1) and why the remits of each research activity are only determined once the outputs from the previous phase have been assessed at IMs. The fluid nature of the Roadmap means that the participants in EURRECA can be reactive to the results and conclusions, which are derived as the network progresses. EURRECA will investigate various aspects of the steps required to define micronutrient requirements and set recommendations, and recommend future research needs for developing new methods and approaches.

The initial phase of research activities (RA1) is focussing on quality assurance to ensure that nutrient requirements (the basis for recommendations) are only derived from best practice for assessing dietary intake and on the best markers of status, assessed by the most robust methodology. During the first IM, concepts of deficiency and sufficiency were discussed and a list of micronutrients most relevant to public health were drawn up and agreed for the initial focus of the Network (Table 3).

At its second IM, the EURRECA Network will agree the standards of excellence from RA1. It will also start to identify possible/probable barriers for assessing

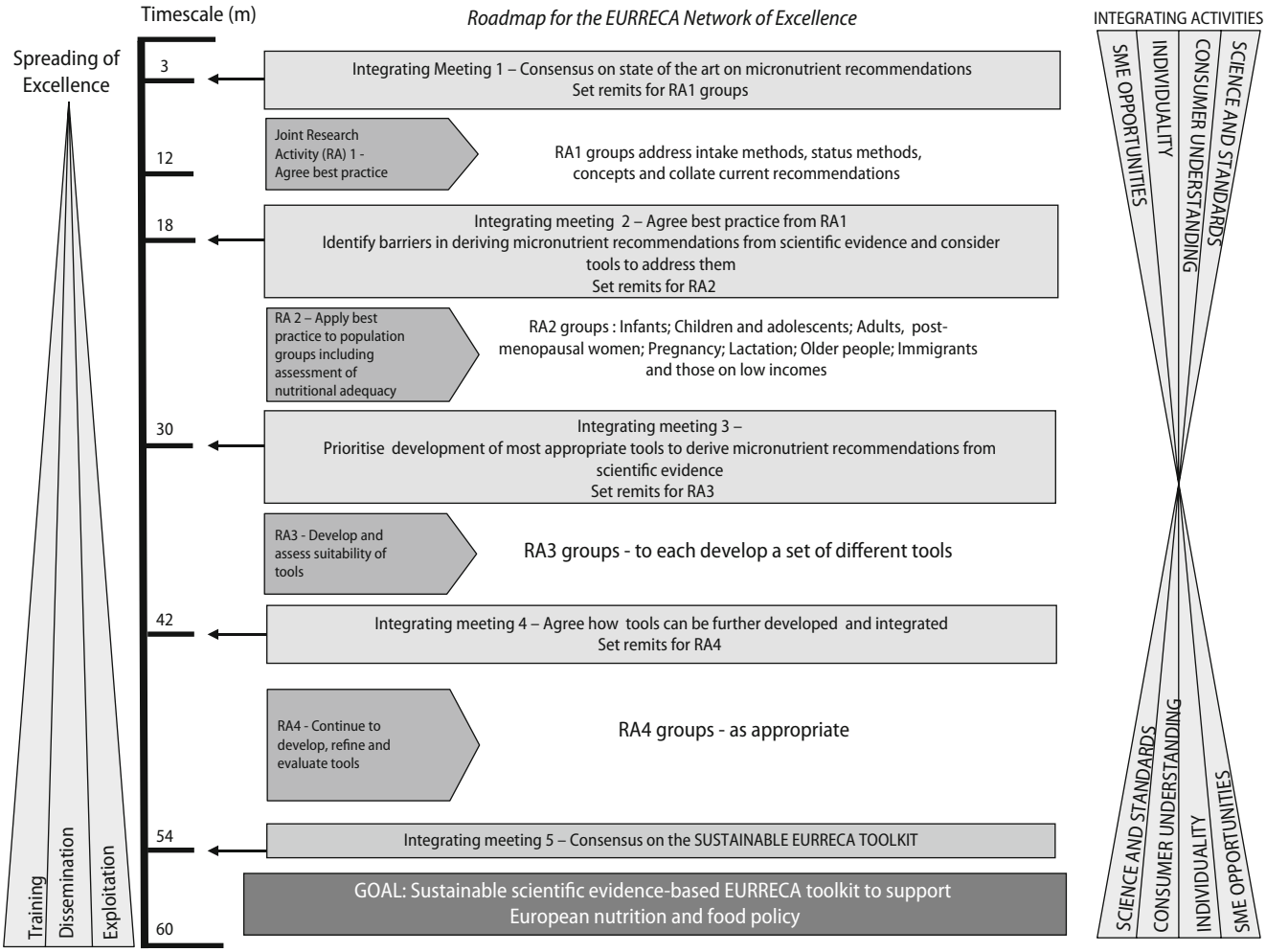

Fig. 1 The EURRECA Roadmap: overview of activities and the development of the EURRECA toolkit

requirements and devising recommendations and will therefore explore ideas for Toolkit components to address some of these.

The second phase of research activities (RA2, 18–30 months) will apply best practice developed in the first phase to various population groups in order to extract the more robust data from the literature and other available surveys. Each working group will assess which of the best markers of status and best intake methods are most suitable for their group and evaluate the extent to which compromises have to be made for practical reasons. Nutritional adequacy in the different groups will be assessed, if there is sufficient robust data available, and knowledge gaps will be identified. From this, it should be possible to compare the performance of common approaches to all population groups and nutrients and to identify where approaches should differ.

Table 3 Micronutrients agreed for the initial focus of the Network

Calcium	Riboflavin
Magnesium	Vitamin B12
Iron	Folate
Zinc	Vitamin D
Copper	n-3 fatty acids
Iodine	Phytochemicals (specific classes to be decided)
Selenium	

At the third Integrating Meeting (IM3), the components of the toolkit which are considered most useful and which are feasible and practical to produce will be agreed. Development work will begin in RA3, can be considered at the fourth IM (IM4) and then further developed during RA4.

Some of the components of the toolkit, such as those relating to consumer understanding and to the roles of SMEs will be produced by partners working on the integrating activities. They will be refined as EURRECA progresses and, in RA4, can be tested by

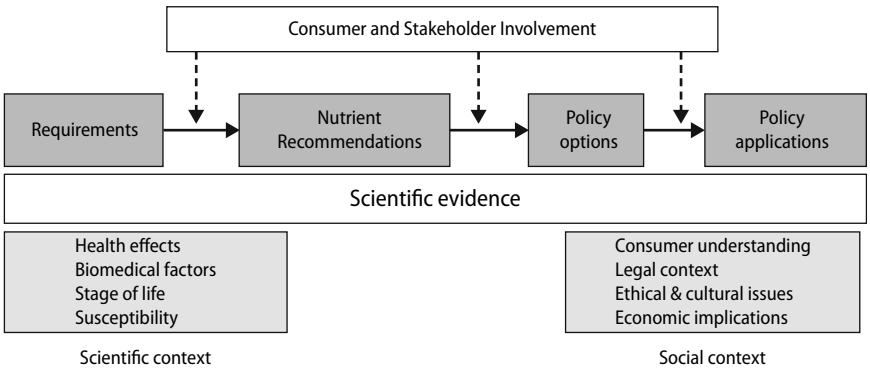

Fig. 2 A general food and health policy framework to show the broader context of the possible applications of EURRECA toolkit: from requirements to policy

the most appropriate EURRECA partners, sometimes in joint tasks between partners in research activities and those in integrating activities.

Finally, a consensual toolkit for the development, use and dissemination of recommendations for the various population groups can be discussed at IM5 and disseminated at the end of the EU funded part of the project. It will contain sustainable evidence-based scientific tools for use in the broad context of food and health policy.

What will be different about EURRECA?

The EURRECA toolkit will be developed within a general framework to show how it relates to food and nutrition policy

A general framework (Fig. 2) for establishing the wider context of nutrient requirements and recommendations, their adaptation into dietary guidelines and their dissemination, incorporating relevant aspects of science, policy and practice at each stage, has been developed. Stakeholder involvement is crucial at all stages.

For consumers there is a direct (but often unconscious) short-term feedback loop from intake to physiological and mental functioning as well as social well-being, affecting food consumption. For policy makers there is a much longer term feedback loop, based on the ultimate effects of dietary habits and nutrient intake on population health and associated costs. Development of nutrient recommendations is one essential element of nutrition policy, but for its application in policy, the framework should include food.

Thus, although evidence-based nutrient recommendations are central to the feed back loop for both consumers and policy makers, a logical framework should not be limited to scientific evidence on nutrient requirements. It should evolve in such a way that evidence on food (patterns) and health fits naturally into a transparent process of making evidence-based nutrition and food policy.

At present policy advice is partially evidence-based, but the process of translating the evidence into degrees of (un)certainty and the subsequent formulation of nutrition and food recommendations largely remains a matter of valuable eminence-based logical reasoning and agreement by the responsible committees. In future, this part of the process will gain further confidence and transparency through the development and use of tools that have been subjected to scientific scrutiny.

EURRECA will consider a greater breadth of recommendations

EURRECA will consider a wider range of population groups than is normal for panels setting nutrient recommendations, focusing on vulnerable groups. Initially 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, the elderly) will be included. Further, as well as the traditional vitamins and minerals, other dietary components with demonstrable health benefits, such as n-3 fatty acids and phytochemicals, will also be included.

One of the early activities is the use of a standardised questionnaire, by partners working in the research activity looking at current recommendations for population groups and the integrating activity on consumer understanding and stakeholder interaction. The purpose of this is to:

- Collate all micronutrient recommendations currently existing from each European country and from those non-European countries where they are the most elaborated. Also to determine how these recommendations have been set [5].
- Discover how micronutrient recommendations have been applied in nutrition-related policy pro-

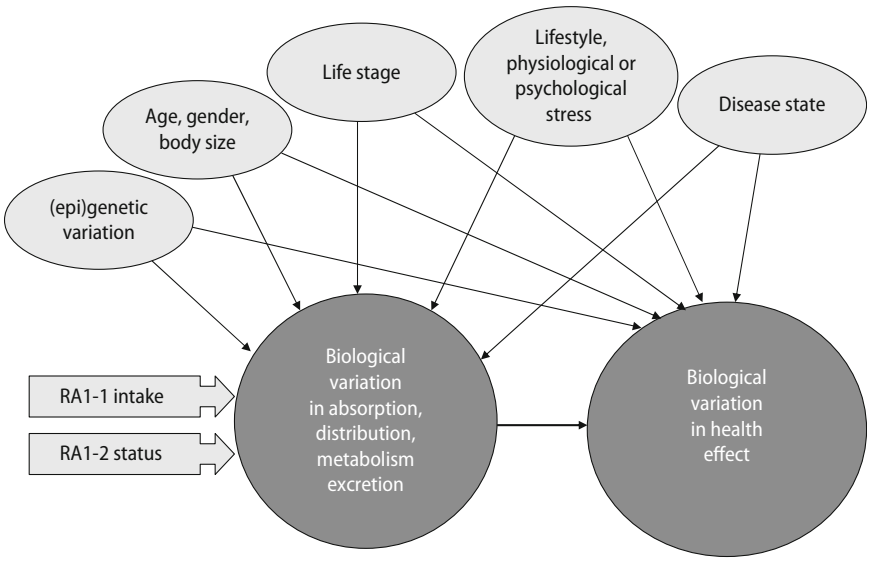

Fig. 3 Sources of biological variability of individual nutrient requirements

cess across Europe. Questionnaire respondents are asked to report on two further dimensions of this process: statements of options for action for identified problem nutrients, and policy applications.

EURRECA will consider a greater depth in recommendations; the nutrigenomic approach

Previous sets of recommendations have not usually attempted to go beyond those for population groups based on gender and age. However, EURRECA will investigate whether recommendations could, or should, be given according to a person's nutritional phenotype. Indeed one of the integrating activities ongoing for the full 5-year term is devoted to this objective.

Variation in metabolism between individuals is complex, and so has been difficult to study. However, in addition to clinical biochemistry, classical nutrition and biomedical sciences, recent technological developments (especially plasma and urine metabolic profiling and metabolomics) has the potential to be used for evaluating the relationship between micronutrient status and a wide range of metabolites (including macronutrients, micronutrients and other micro-components of the diet). This information would then be able to help give both an accurate description of the nutritional phenotype of an individual and a quantitative analysis of the food they consume.

First, the origins of variation in micronutrient requirements, and what makes some individuals more vulnerable to poor nutrition, will be explored and defined. The biological variation in absorption, distribution, metabolism and excretion leads to variations in the health benefits of a given intake of a nutrient (Fig. 3). These variations are due to a number of factors such as age, gender, body size, lifestyle, physiological or psychological stress and genetic variation, but our current knowledge about them is poor. To be able to better quantify how nutrition relates to health, EURRECA will collate information on 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 interact to determine the nutritional phenotype.

Eventually, EURRECA will be in a position to create a database of 'nutritional phenotype' characteristics (age, gender, body size, lifestyle, physiological or psychological stress linked to the above described metabolomic approach) and provide correlations between the two. Phenotype will be correlated with micronutrient status. The task 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. The ultimate objective is to ascertain whether it is appropriate to provide personalised nutrient recommendations, based on capturing and quantifying the nutritional phenotype.

EURRECA will engage with players outside the scientific community so that recommendations are in suitable formats for the stakeholders and end-users

The involvement of many stakeholders and end-users will help EURRECA produce tools, which ensure that recommendations are in formats, which are in accordance with the needs of the users. The next

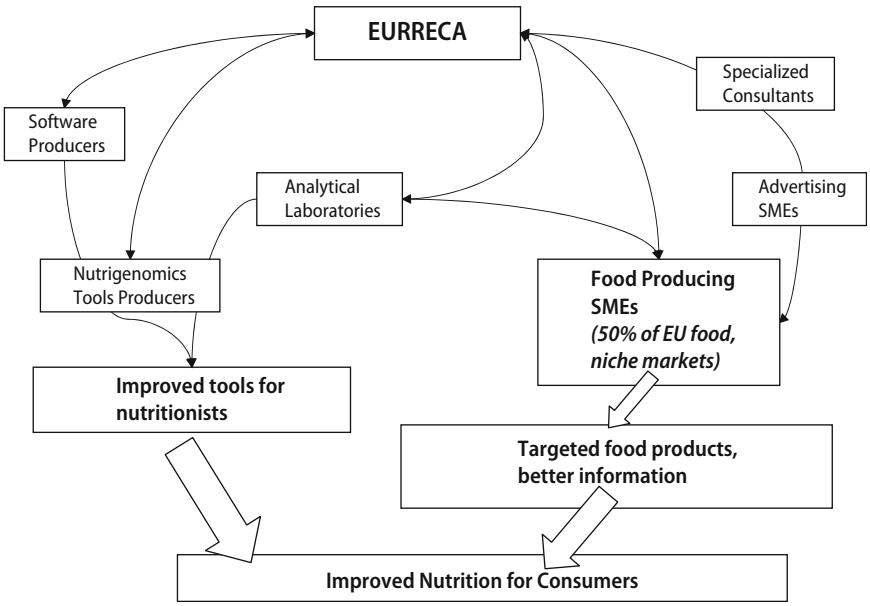

Fig. 4 The role of small and medium enterprises in EURRECA

section outlines why these players are important and how they are involved.

Stakeholders can be defined as those willing to invest resources and accept some responsibility for maintaining the viability of nutrient recommendations because of their own interest in the recommendations. Users include any organisation that uses or employs nutrient recommendations as a means to fulfil a task. Stakeholders may also be users of nutrient recommendations and vice versa.

These two groups include consumers, research scientists, nutrition societies, government sectors (health, food, agriculture, fisheries, consumer protection, education, transport, urban planning and housing, environment, labour, social policy, research), the European Union institutions, WHO, United Nations (UN) organisations and other international actors, non-governmental organisations (health professional organisations, consumers' organisations, non-profit charitable organisations, patients' associations, sport and outdoor recreation organizations, trade unions) and the private sector (primary producers, food manufacturers, food retailers, caterers, media and advertising, the leisure and well being industry).

Consumer groups

Consumer involvement, through their representative groups, is essential in the process of developing nutrient recommendations. In the past this has either been non-existent or not transparent. Since one of its ongoing integrating activities is focussed on consumer issues, EURRECA will provide a better understanding of consumer involvement in the process of nutrition policy making. It will also show how public opinion on nutritional matters is affected by exchanges between the various actors.

During the first 18 months there will be several studies, covering eight to ten countries representing a geographical spread across Europe, which will help to determine the most useful toolkit components. These include:

- A study to identify criteria for assessing the direct and indirect impact of the involvement of consumers and other stakeholders that represent consumer interests in nutrition policy making;
- An evaluation of current forms of consumer and other stakeholder involvement (e.g. consultative groups, advisory committees, surveys, focus groups, citizens' juries). The objective will be to assess the impact of different forms of consumer involvement on the quality of decision-making and of outcomes in specific policy formulations.
- A 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.

Small and medium-sized enterprises

Small and medium-sized enterprises (SMEs) will collaborate with the other EURRECA partners to realise their overall goal of identifying opportunities for exploitation in diverse fields. There is a challenge

for them to integrate with the scientific research leading to nutrient recommendations. Research has the potential to make a big impact on development, and hence marketing, as well as some impact on manufacturing and sales in many sectors. In turn, the availability of appropriate products can facilitate the achievement of nutritional goals by contributing tools for scientific work and by providing more nutritious foods for the European population (Fig 4).

SMEs will be able to develop and exploit new methods as they work alongside the research groups. At the same time, they will be able to help the scientific community by providing customised tools, such as assays for metabolic markers, kits for metabolomics studies, nutrient assessment methods and the development of dietary computer programmes.

SMEs already involved in EURRECA are software producers, analytical laboratories, biotechnology and food safety and nutrition consultancies. Small and medium-sized food producers are responsible for about 45% of the total food turnover within the European Community [2]. Thus, it is important to involve them into the Network to realise the great potential for utilising the results of EURRECA in the production of tools for food reformulation. This would enable them, or others, to manufacture food products with nutrient content and nutrient function claims which fall within the scope of the recent EC Regulation on Nutrition and Health Claims made on Foods [12].

During the first 18 months there will be several activities, which will help to determine the most useful toolkit components and the preferred formats:

- SMEs experiences and training needs related to nutrient recommendations will be assessed through a survey. Key food, catering, food supplement and food marketing/health claim consulting SMEs will be identified. Their attitudes to nutrition and the use of dietary guidelines will be assessed in a sample of selected EU countries through interviews, with the cooperation national trade organizations. SMEs that market products to vulnerable population groups will be specifically sampled.
- The framework for supporting the development of food products or menus informed by the results of the network will be developed, tested and promoted through the NoE website, through national organisations and through the survey described above.
- A survey of leading laboratories in the EU will be conducted, taking into account work at standardisation organisations to identify relevant protocols. Protocols used for the analysis of vitamins, minerals, phytonutrients, essential fatty acids and amino acids will be collated and reviewed to identify gaps, advantages and deficiencies. A program for SMEs leading to standardisation will be promoted through a website, which will include posting of a list of available protocols and laboratories.
- Key computer programs used for dietary assessment in Europe and North America will be identified, collated and reviewed. Their use will be assessed within partners of NoE, through the software producers, and through a limited user survey. A list of specifications that brings together the survey information, gaps in current programs and results of research within the NoE will be produced.

National and International Nutrition Societies

The involvement of nutrition societies across Europe, both through the Federation of European Nutrition Societies (FENS) and national societies, is an important aspect of EURRECA [32]. The societies have varying influence on the development of nutrient recommendations and food-based dietary guidelines, either through individual members or as a society. Some, such as the German, Austrian, Swiss and Italian nutrition societies, are responsible themselves for developing recommendations. In some countries such as the UK and Netherlands, government departments and advisory boards rather than the nutrition societies have been responsible for reviewing recommendations, relying on the expertise of panel members.

Other nutrition societies, such as the Polish Society of Nutritional Sciences, can use the EURRECA outcomes for dissemination and education as well as reference points in discussion with policy makers. For example, outcomes can be used for developing guidelines for food donation programmes for the unemployed and other vulnerable groups such as older people.

One group, represented within EURRECA, is the UNU Food and Nutrition Programme's Standing Committee on Nutrition (SCN), a working group on capacity development set up in collaboration with the International Union of Nutritional Sciences (IUNS). The 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 [37]. This network will be involved in EURRECA dissemination and, based on their specific needs, will develop a customised EURRECA nutrition and epidemiology course.

Conclusions

Through the integrating activity on science and standards, all this experience will be harnessed during the initial phases of the project to identify common problems. These will be addressed by the develop-

ment of appropriate components in the EURRECA toolkit. In this way, the stakeholders and end users can contribute fully to the process, while leaving the evaluation and interpretation of evidence as a secured scientific process.

Spreading of excellence

The EURRECA Network and all individual partners involved are committed to ensuring that the expertise and experience generated through and by the Network will be handed on, shared and utilised to the benefit of all policy, professional, consumer and industry stakeholders. The Spreading of Excellence (SoE) will contribute to the on-going sustainability of the Network and its area of work.

SoE will be achieved through specific Training, Dissemination and Exploitation programmes of work involving all partners and will increasingly engage a wider range of external interested parties.

Training will initially focus on meeting the needs of Network members, by identifying clear gaps and needs, sharing internal expertise and delivering a wide range of training opportunities on agreed priority areas. Training will be opened up to external parties at appropriate points. A EURRECA Training Programme will be developed as a recognised and accessible resource for all working in the field of micronutrients and nutrient recommendations.

Dissemination activities will focus on both internal and external communication utilising internal and external websites, newsletters, dissemination databases, checklists for stakeholder groups and consumer engagement activities.

The exploitation potential of EURRECA's outcomes will be explored in policy development (by policy-makers, professional organisations and consumer groups) and in products and services (by food producers, manufacturers, marketers, retailers and health professionals). Work groups, seminars, web-based discussion groups and newsletters will facilitate this work.

Within the SoE programme of work, particular attention will be paid to:

- Including and involving all appropriate EU Framework Projects (completed, on-going and future) and Networks to maximise information exchange and to share resources.
- Aligning programmes of work with those of EFSA and ETP Food for Life.
- The inclusion and involvement of contacts and organisations across the whole EU Community, particularly Central and Eastern Europe and Accession countries.
- Embracing the full spectrum of potential SME interest (computer software and laboratory assays to food producers).
- Involving professionals, organisations and other channels of communication that address ethnic, religious and minority sectors of the EU population.

SoE activity will align with the integrating activities to deliver synergy and cost-effectiveness, using material generated (backgrounders, scientific papers and consensus statements) as the collateral to drive the timing and precise nature of the work programmes delivered.

Sustainability

Partners in a NoE are committed long-term, beyond the 5 years of EU funding. This includes a commitment to strategic planning for the future by aligning, synchronising and co-ordinating their activities. Sharing activities, such as tasks and responsibilities related to infrastructure access and use, human resources management, as well as knowledge and intellectual property management, will be mutually beneficial to partners.

After 5 years, EURRECA aims to become a sustainable entity so that the research, which relates to recommendations can continue in a structured format so that policy makers will be able to draw on it at any time. This ongoing process will also mean that non-scientific partners within EURRECA will be able to develop and exploit new methods as they work alongside the research groups over and beyond the 5 years and, at the same time, help the scientific community.

Meeting EC expectations

As a NoE, EURRECA is expected to provide Europe with world leadership in the field of micronutrient research, human nutrient requirements and translation into recommendations. In particular, European research on nutrient recommendations will become harmonised and structured through:

- the integration of a critical mass of resources and expertise;
- the provision of a supportive platform for the collaboration of research entities;
- the development of joint approaches for methodologies and training schemes;
- the development of joint strategy and operational approaches as exemplified by EURRECA Codes of Practice.

- The creation of a visible and autonomous entity which is appreciated by the entire research community and is a self-sustainable structure beyond the EC funding period.

EURRECA will strengthen and spread the science and technology (S&T) excellence in the area of nutrient recommendations by considering all relevant stakeholders and establishing strong links to related European projects, such as Early Nutrition Programming Project (EARNEST) [36], European Food Consumption Validation (EFCOVAL) [7], European Food Information Resource Network (EUROFIR) [8], Health Lifestyle in Europe by Nutrition in Adolescents (HELENA) [29] and the European Nutrigenomics Organisation (NuGO) [11] and other national projects. It should be able to act as a 'starting block' for innovation and new technologies in existing food and other companies, and possibly in new 'spin off' companies.

As well as supporting science-based harmonised nutrient recommendations, the work of the Network should also support other science-driven regulation and nutrition policy in the EU such as nutrition and health claims. In addition, it will be able to contribute to the EC's White Paper 'A Strategy for Europe on Nutrition, Overweight and Obesity related health issues' [6] and the EU's research strategy against malnutrition and nutrition-related disorders.

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Conflict of interest none

References

1. Agencie Francaise de Securite de Sanitaire des Aliments (AFFSA) (2001) Apport nutritionnels conseilles pour la population Francaise. Lavoisier Tec et Doc, Paris
2. Confederation of the Food Industries of the EU (CIAA) (2007) 2006 Data and Trends Report of the EU Food and Drink Industry Brussels
3. Department of Health (1991) Dietary reference values for food energy and nutrients for the United Kingdom. Report of the panel on dietary reference values of the Committee on Medical Aspects of Food Policy. HMSO, London
4. Dietitians of Canada (2001) Dietary reference values—learn about these important nutrition reference values online. Canadian Dietetic Association, Toronto
5. Doets EL, de Wit LS, Dhonukshe-Rutten RAM, Cavelaars AEJM, van 't Veer P, de Groot LCPGM (2008) Current micronutrient recommendations in Europe with special focus on vitamin A and vitamin D. Eur J Nutr 47(Suppl 1): 17–40
6. European Commission (2007) A strategy for Europe on nutrition, overweight and obesity related issues Brussels
7. European Food Consumption Validation (EFCOVAL). http://www.efcoval.org
8. European Food Information Resource Network. http://www.eurofir.net
9. European Food Safety Authority (2007) Development of food-based dietary guidelines, EFSA Scientific Colloquium 5 Summary Report. EFSA, Parma
10. European Micronutrient Recommendations Aligned (EURRECA). http://www.eurreca.org
11. European Nutrigenomics Organisation (NuGO). http://www.nugo.org
12. European Parliament and Council (2007) Regulation (EC) No. 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods. Official Journal of the European Union OJ L 404, 30 December 2006. Corrigendum OJ L 12 18 January 2007, pp 3–18
13. German Nutrition Society, Austrian Nutrition Society, Swiss Society for Nutrition Research (2000) Reference values for nutrient intake (D-A-CH). Frankfurt am Main
14. Health Council of the Netherlands (2001) Dietary reference intakes: energy, proteins, fats, and digestible carbohydrates. Health Council of the Netherlands, The Hague
15. Institute of Medicine (1997) Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. National Academy Press, Washington
16. Institute of Medicine (2000) Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B_6, folate, vitamin B_{12}, pantothenic acid, biotin and choline. National Academy Press, Washington
17. Institute of Medicine (2000) Dietary reference intakes for vitamin C, selenium, and carotenoids. National Academy Press, Washington
18. Institute of Medicine (2000) Applications in dietary assessment. The National Academies Press, Washington
19. Institute of Medicine (2001) Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. National Academy Press, Washington
20. Institute of Medicine (2001) Proposed definition of dietary fiber. The National Academies Press, Washington
21. Institute of Medicine (2002) Dietary reference intakes for energy, protein, carbohydrate and fat. National Academy Press, Washington
22. Institute of Medicine (2003) Applications dietary planning. The National Academies Press, Washington
23. Institute of Medicine (2003) Guiding principles nutrition labeling and fortification. The National Academies Press, Washington
24. Institute of Medicine (2004) Dietary reference intakes for water, potassium, sodium, chloride, and sulfate. The National Academies Press, Washington
25. Institute of Medicine (2005) Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids (Macronutrients). The National Academies Press, Washington
26. Institute of Medicine (2006) Dietary recommendations research synthesis: workshop summary. The National Academies Press, Washington

27. Institute of Medicine (2006) Dietary reference intakes—the essential guide to nutrient requirements. The National Academies Press, Washington
28. King JC, Garza C (2007) International harmonization of approaches for developing nutrient-based dietary standards. Food Nutr Bull 28(suppl):S3–S153
29. Moreno LA, Gonzalez-Gross M, Kersting M, Molnar D, de Henauw S, Beghin L, Sjostrom M, Hagstromer M, Manios Y, Gilbert CC, Ortega FB, Dallongeville J, Arcella D, Warnberg J, Hallberg M, Fredriksson H, Meas L, Widhalm K, Kafatos AG, Marcos A, on behalf of the HELENA Study Group (2008) Assessing, understanding and modifying nutritional status, eating habits and physical activity in European adolescents. The HELENA Study. Public Health Nutr 11:288–299
30. Nordic Council of Ministries (2004) Nordic nutrition recommendations, 2004, Copenhagen
31. Otten JJ, Hellwig JP, Meyers LD (2006) Dietary reference intakes: the essential reference for dietary planning and assessment. National Academy Press, Washington
32. Pavlovic M, Prentice A, Thorsdottir I, Wolfram G, Branca F (2007) Challenges in harmonizing energy and nutrient recommendations in Europe. Ann Nutr Metab 51:108–114
33. Prentice A, Branca F, Decsi T, Fleischer Michaelsen K, Fletcher R, Guesry P, Manz F, Vidailhet M, Pannemans D, Samartin S (2004) Energy and nutrient dietary reference values for children in Europe: methodological approaches and current recommendations. Br J Nutr 92:S83–S146
34. Scientific Committee on Food (1993) Opinion of the Scientific Committee on Food on nutrient and energy intakes for the European Community. http://ec.europa.eu/food/fs/sc/scf/out89.pdf
35. Scientific Committee on Food (2003) Opinion of the Scientific Committee on Food on the revision of reference values for nutrition labelling. SCF/CS/NUT/GEN/18
36. The Early Nutrition Programming Project (EARNEST). http://www.metabolic-programming.org
37. UNU/SCN Network for Capacity Development in Nutrition for Central and Eastern Europe (NCDN-CEE). http://www.srbnutrition.info/?page=Network