

# NUTRITION IN CHILDREN AND ADOLESCENTS IN EUROPE: WHAT IS THE SCIENTIFIC BASIS?



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Summary Report of a Workshop held in May 2003

Organised by the ILSI Europe  
Nutritional Needs of Children Task Force

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IN EUROPE: WHAT IS THE SCIENTIFIC BASIS?***

*BY E.L. KRAUSE and J.F. DESJEUX*

**REPORT**

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**PREPARED UNDER THE RESPONSIBILITY OF THE ILSI EUROPE  
NUTRITIONAL NEEDS OF CHILDREN TASK FORCE**

**OCTOBER 2004**

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*Printed in Belgium*

ISBN 1-57881-185-6

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## OBJECTIVE OF THE WORKSHOP

**T**he objective of the ILSI Europe Workshop “Nutrition in Children and Adolescents in Europe: What is the Scientific Basis?” held from the 14 to 16th of May in Rome was to look at the scientific information and knowledge related to nutrition in healthy children and adolescents in Europe. The main purpose was to highlight and understand the discrepancies in dietary recommendations and intake between European countries. The Workshop focused on children between 2 years of age and the end of their growth period (18 years).

Two expert groups critically reviewed the available data and methodological approaches relating to the current dietary recommendations, dietary intake and nutritional status in children and adolescents in Europe. Based on presentations of the data collected by the expert groups, reasons for discrepancies in dietary recommendations and intakes were analysed by individual expert researchers and working groups. The following issues were discussed: methodological limitation, identification of conflicting or lacking data, diversity of scientific background for consensus, significance of dietary intake in terms of metabolism and, more importantly, physiological functions.

## SUMMARY OF THE PRESENTATIONS

**L**ogically, the first question proposed was child specificity: 'Why is it necessary to make specific dietary recommendations for children?' Prof. Yvan Vandenplas (Free University of Brussels, B) clearly identified the following factors: gender differences, metabolic needs involving turn over, growth development and differentiation, physical activity and eating patterns and finally changing body composition with age including a special dynamic period at puberty. He highlighted that 'a child is not a small adult, but a future adult' and that this needs to be considered when making dietary recommendations for children.

The concept of recommended nutrient intakes was then critically analysed by Dr. Francesco Branca (National Food Research Institute, I). Several different concepts are used throughout the world and harmonisation is required for common definition of nutrition policies (Prentice *et al.*, 2004).

Dr. Barbara Livingstone (University of Ulster, UK) critically reviewed studies of food habits and dietary intakes. She stressed a number of unique respondent and observer considerations at different stages of a child's life. In those studies there is a need for critical data examination on dietary intake in children and a need to improve the method to take underreporting and bias towards a selective reporting of foods into account (Livingstone *et al.*, 2004).

Dr. Ann Prentice (UK) reported on behalf of the Expert Group One (EG 1) "Energy and Nutrient Dietary Reference Values for Children in Europe: Methodological Approaches and Current Nutritional Recommendations". The data compiled by EG1 are a comprehensive computation of all the available data in Europe. The work outlines the diverse methodological approaches used to establish the nutritional needs. The dietary reference values are derived from several sources including extrapolation from adult data, extrapolation from intakes of breastfed infants, a factorial approach with allowance for growth and balance studies in children, the functional outcome specific to children and interpolation between infant and adult. There is a significant disparity between reference values and a comparison is made difficult by the difference in definition of age bands and the onset of puberty and a lack of gender differences. Thus, the results of the EG1 group will contribute to the ongoing discussion about the harmonisation of dietary reference values in Europe. In addition, they raised the question as to whether a harmonisation is a desirable or achievable goal. Rationale to improve Reference Values highlights an improvement e.g. in the assessment of food intake, adequacy of dietary intake, food labelling, need for upper limits, food for specific groups of children and food development for specific conditions (Prentice *et al.*, 2004).

Dr. Janet Lambert reported on behalf of the Expert Group Two "Dietary Intake and Nutritional Status in Children and Adolescents in Europe". The data compiled by this group are a comprehensive collection and evaluation of dietary intake and status data for children and adolescents. The data show that an accurate assessment is difficult to obtain because of flaws and discrepancies in the available data and methodologies. However, trends on dietary intakes with increasing age were clearly identified. The main conclusions of the report were the necessity of improved and harmonised methodologies for dietary intake assessments and the establishment of a European nutrient database in order to be able to directly compare food intake (Lambert *et al.*, 2004).

## SUMMARY OF THE WORKING GROUPS

**F**our specific topics were then discussed in working groups by participants to evaluate how these influence nutrient intake and status of children in Europe:

1. Food habits and cultural traditions
2. Specific food components with potentially new physiological roles
3. Fluids – Water as the most essential nutrient
4. Nutrients handling/Bio-availability

### ***Food habits and cultural traditions***

The working group 'Food habits and cultural traditions' considered the availability of data on the effect of eating habits and traditions on the nutrient intake of children in Europe. Although some studies addressing the question were published for a few European countries, both the aims and the methods of these studies vary to such an extent that any overview is rendered difficult. The working group concluded that a systematic review on the basis of the available evidence might represent an effective first step in clarifying the discrepancies.

The working group felt that eating habits and meal patterns are changing rapidly and to a great extent in Europe, and the changes appear to result in diminishing differences in food habits among European countries. This "globalisation" of European nutritional habits may be both beneficial and disadvantageous at the same time. On the one hand, the ready availability of exotic fruits and vegetables as well as fish and seafood offers a substantially wider choice of important nutrients (vitamins, dietary fibres, essential fatty acids, etc.) to children whose choice of locally produced fruits and vegetables might be limited. On the other hand, the more uniform palette and continuous availability of foods might lead to increasing popularity of food items with a less desirable nutritional profile. For instance, the rapidly increasing prevalence of childhood overweight and obesity in some Mediterranean countries suggests that, among other lifestyle factors, changing nutritional habits may exert untoward influence to the health status of the community. However, the very limited amount of scientific data on the changes of eating patterns renders it practically impossible to conclude on the net effect of changes over time on the quality of nutrition in children and adolescents in Europe.

The working group further pointed out that changing eating habits in combination with economic status, price, image and availability of certain foods might result in unfavourable outcomes. For that reason, local food guides (food pyramids) should take the available and affordable foods into account while trying to approach the dietary reference intakes (based on the biologic requirements) as close as possible. Future research on the effect of nutritional habits and traditions on health status of children and adolescents in Europe should include not only the traditional approaches for collecting data on nutrient intakes but should utilise the methodology of qualitative research and social sciences as well. Combined efforts of paediatricians, nutritionists, epidemiologists and sociologists are clearly needed for a better understanding of the influence of changes in the style of nutrition within the society on the nutritional status of children and adolescents.

### ***Specific food components with potentially new physiological roles***

The second working group identified and critically reviewed food components, which have the potential to affect positively the health and well-being of children and adolescents. The aim was to make recommendations to include specific beneficial food components in dietary guidelines. The group succeeded in producing a table of food components grouped according to their effect on an identified target function or health benefit, such as bone health, cardiovascular function, gut function, immune function, weight management, cancer, mental development and cognition. (Table 1). This was based on information available to participants at the time of the workshop.

The table also provides a perspective on the evidence of such a health benefit and ranked it from 1 to 5 (1: valid hypothesis based on animal or *in-vitro* studies; 2: epidemiological observational study in adults; 3: epidemiological observational study in children; 4: randomised controlled study in adults; 5: randomised controlled study in children).

Safety considerations concerning the use of some of the listed food components are also given in the table.

For the food components to be included into dietary guidelines for children, the working group formulated two prerequisites: a demonstrated beneficial effect and a dose-response relationship. The working group concluded that a general recommendation is at present impossible for anti-oxidative compounds, as these substances need a case-by-case evaluation. Non-digestible carbohydrates should be an integral part of the diet; these are already included in most dietary guidelines, but recommendations for specific compounds are not possible currently. Recommendations for the specific inclusion of soy phytoestrogens or plant stanols and sterols into the diet of young children need to be substantiated with risk assessments. For folic acid, the recommendation for dietary intake should be followed. For all other food components no specific dietary guidelines can be given due to the lack of scientific data.

Overall, the working group concluded that there are several substances which may have particular benefits for the health of children between 2 and 18 years of age. However, only few controlled studies in children proving a beneficial effect for functional food components were known to participants at the time of the workshop. Safety aspects need further consideration, particularly for young children.

Table 1: Food components which have the potential to positively affect the health and well-being of children and adolescent

Food Component	Function or Health Benefit	Evidence 1-5	Comments	Gaps	Safety
<b>BONE HEALTH</b>					
Prebiotics	Calcium absorption	2 (5)		More controlled intervention studies in children on long-term effects	Diarrhoea dose-dependent
Phytoestrogens	Bone Health	1			Suggestions for adverse effects. Proper risk assessment needed
Bioactive Peptides	Calcium absorption	1	Some evidence - mixed	Intervention studies needed	
<b>CARDIOVASCULAR FUNCTION</b>					
Soy Protein	Cholesterol reduction	4	Not 2-5 yrs. Only 4 studies in children		Allergy risk
Plant Sterols	Cholesterol reduction	4	At what age is active cholesterol reduction desirable? – Not 2-5 yrs.	Additional longer term studies in children needed	Need dose response data. Safety review for children
Anti-oxidative food components (carotenoids, selenium, tocopherols)	Atherogenesis	4			Consumption as part of food: no adverse effects expected Consumption of isolated substances: adverse effects in high doses possible (Vit. E, selenium)
Folic Acid	Cardio vascular Disease (CVD) via Homocysteine reduction	4	Need to establish the link to CVD	Intervention studies needed in children	Upper Limit
Phytoestrogens	Cholesterol reduction	4			Risk assessment needed
Psyllium	Cholesterol reduction	4			
Bioactive Peptides	Blood pressure	1			
<b>GUT FUNCTION</b>					
Probiotics	Gastroenteritis (treatment)	5	Strain specific/ dose dependent		Bacterial translocation
Probiotics	Gastroenteritis (prevention)	5	Strain specific		Bacterial translocation
Non-digestible carbohydrates	Gastroenteritis	2		More controlled intervention studies in children	Diarrhoea constipation

Table 1: Food components which have the potential to positively affect the health and well-being of children and adolescent (cont.)

Food Component	Function or Health Benefit	Evidence 1-5	Comments	Gaps	Safety
<b>GUT FUNCTION</b>					
Prebiotics	Constipation	2 (age 2-10) 5 (age>10)			Diarrhoea
Prebiotics	Gastroenteritis				Diarrhoea
<b>IMMUNE FUNCTION – INFECTION &amp; ALLERGY</b>					
Probiotics	Allergy prophylaxis	5	1 study	More data needed	Bacterial translocation
Probiotics	Other infections	2			Bacterial translocation
<b>WEIGHT MANAGEMENT</b>					
Non-digestible carbohydrates	Energy balance / Appetite	4	Not for age 2-5 yrs	More controlled intervention studies in children	Diarrhoea, constipation
Calcium as a signalling substance	Obesity	4	Promising area. Merits further work in children.	Intervention studies needed in children	Upper Limit
Conjugated Linoleic Acid	Obesity	2	Good animal data; some human studies		Need safety data in children, insulin resistance
Low Glycemic index – Carbohydrates	Obesity	3	Studies in diabetic and obese children	Intervention studies needed in children	
Thermogenic Compounds	Weight control	2	Some evidence in adults of thermogenesis	Intervention studies needed in children	Need safety data in children
Structured triglycerides	Weight control/ Energy intake	4	Interesting area. Needs further study		
Non-digestible carbohydrates	Glucose kinetics	2/4 in adolescents		Evidence on long-term protection	Diarrhoea, constipation
<b>CANCER</b>					
Anti-oxidative food components	Cancer	4		Evidence on long-term protection	
Extracts from tea, cocoa, berries and wine	Cancer	2		Evidence on long-term protection	Diarrhoea, constipation
Non-digestible carbohydrates	Colon cancer	1		Evidence on long-term protection	
Phytoestrogens	Cancer	2			Risk assessment needed
<b>MENTAL DEVELOPMENT</b>					
Long chain Poly unsaturated fatty acids	Attention Deficit Disorder	1	Special patient groups	Controlled studies in healthy children	Pro-oxidative; balance n-6/n-3

### **Fluids – Water as the most essential nutrient**

The third group discussed 'water as the most essential nutrient'. As there are a number of definitions of "fluids" in the research literature, the working group defined the term 'total water intake' comprising "water in beverages + water in food (intrinsic water) + metabolic water' as a working definition.

The working group highlighted the functional role of water in the human body such as the transport medium for blood components, metabolic products and its importance for the regulation of metabolism in general. For healthy children and adolescents water is needed to maintain hydration status, and this water may come from a variety of sources.

Regular fluid intake replaces losses that take place via the kidneys, the skin and the lungs. Losses vary considerably, depending on climatic conditions (temperature, humidity, wind and altitude), on the surface area to volume ratio of an individual, the clothes worn and physical activity levels. Food and fluid intake can restore glycogen and the glycogen-bound water pool as well as the sodium pool and sodium-bound extra-cellular water volume without changing hydration status characterized by a constant functional water volume. Food ingredients may alter intestinal water absorption, functional water volume, renal solute excretion, metabolic water production, diuresis and natriuresis.

If conditions are extreme, such as in prolonged intense physical activity during high environmental temperatures, severe dehydration can lead to overheating and even death. Mild dehydration in adults is or may be associated with an increased risk of development of kidney stones, constipation, cardiovascular disease and stroke. It has been suggested that in children mild dehydration is related to reduced alertness and ability to concentrate as well as tiredness and headaches.

Total water requirement varies depending on climate, physical activity and renal solute load. Therefore it is difficult to set reference intakes for total water intake. If in a particular life style and gender group mean minus 2 SD of actual maximum urine osmolality is accepted as a physiological criterion of water requirement, a theoretically adequate 24h total water intake value can be calculated and should ensure euhydration in 97% of the subjects.

The methods to assess water intake and hydration status in children were critically reviewed. (Table 2)

Actual hydration status may be characterised by functional water volume; and 24 h hydration status, by free water reserve (Manz F *et al.*, 2002; Kampmann B *et al.*, 2003). Total water intake, serum parameters, urine volume, urine osmolality, change in body mass and water turnover rates are indirect indices of hydration status.

Table 2: Methods used to assess water intake and hydration status

Parameter	Marker	Comment
Water balance	Body mass	Acceptable for acute losses as during short-term exercise.
Water input Water in: beverages, food metabolic water	Total water intake	Difficult to measure with any degree of precision. Not necessarily related to hydration status.
Water losses Respiration Perspiration Urine Faeces	Urine volume	Urine volume is easily measured, but other losses are not.  Not necessarily related to hydration status, but low urine volumes indicate hypohydration
<b>Water turnover</b>	Labelled water	Not related to hydration status.
Hydration status	Serum parameters Urine osmolality Functional water volume Free water reserve	Relatively invasive and require laboratory measurements. Urine colour, volume and frequency may be easily assessed surrogate measures. Urine osmolality is a concentration and not a measure of water deficit/surplus volume.
Adequate total water intake	Total water intake in the subject with the 3rd percentile of free water reserve and urine osmolality corresponding to – 2 SD value of maximum urine osmolality	If in a particular age and gender group 97% of the subjects show a total water intake above adequate total water intake value, euhydration is ensured.

In most EU countries there are no recommended dietary allowances or adequate intake values for water. Exceptions are Austria, Germany, Switzerland, Belgium and the Netherlands. For Austria, Germany and Switzerland a range of total water intake between 1300 ml/day for 2-3 year olds and 2800 ml/day for 15-18 year olds is recommended. In Belgium a range of 75-100 ml/kg/day for 2-6 year olds and 45-60 ml/kg/day for 15-18 year olds is recommended. The Netherlands makes a recommendation for 5 year olds of 83 ml/kg/day.

There are very few data on total water intake and markers of hydration status in European children. In addition, differences in the methodology of dietary assessment (e.g. weighed, household measures (calibrated), standard volumes) and difference in 'beverages/drink' definition make an interpretation and comparisons of the available data difficult.

From the data that are available it is clear that there are big differences in drinking habits between populations (Table 3). Germany appears to get around 10% more of its fluid intake from intrinsic sources compared to the Netherlands, which obtains more of its total water intake from beverages (Table 4).

Table 3: The total consumption of beverages (ml/d) in some European Countries

	United Kingdom	Netherlands	Germany	France
1-3 years		843		
1.5-4.5 years	1055			
2-3 years			614	
2-4 years	1018			
3-5 years				937
4-8 years			693	
5-7 years	941			
6-8 years				1012
7-9 years		943		

Table 4: The contribution (%) of beverage types to average daily beverage consumption

	NL 1-3 years	UK 1.5-4.5 years	D 2-3 years	F 3-5 years
Milk	49	28	31	36
Water	25	29	28	43
Fruit juice	10	3	19	19 fruit juice and soft drinks
Soft drinks	11	35	9	
Coffee, tea	5	5	13	2

The working group pointed out the following areas for future research:

- In order to establish population reference intakes for adequate total water intake more data are needed on health outcomes (e.g. physical and mental performance as well as disease states) given different hydration states and water intakes.
- Urine volume and osmolality in validated 24h urine samples should be determined in groups of healthy children to determine free water reserve. This parameter may be a useful marker in epidemiology to investigate health effects of different states of euhydration and mild states of dehydration and to calculate population and life stage specific adequate total water intake values.
- The physiological and clinical consequences of the intake of fluids with a similar increase of total water intake but different effects on functional water volume or thirst and free water reserve should be established.

- Scientists analysing the aetiology of urolithiasis, urinary tract infection, dental diseases, broncho-pulmonary disorders, constipation, cardiovascular disease, stroke, diabetic ketoacidosis, salt sensitive hypertension, chronic renal failure, headache and inability to concentrate in children and adolescents should investigate hydration status of the subjects as a possible further aetiological factor.
- In populations in which 24h urine samples show more than 3% of subjects in the range of risk of hypohydration, preventive measures to increase the level of water intake should be considered.

### ***Nutrient handling/Bio-availability***

The fourth group considered nutrient handling and bioavailability, which is the fraction of the ingested nutrient that is absorbed and utilised physiologically. In the establishment of recommendations, it is essential to consider the functional utility of each nutrient and its effect on specific organs. Thus, for each nutrient several factors need to be considered, these include endpoints and (bio)markers, adaptation to varying nutrient supplies, nutrient interactions and identification of the rate-limiting step(s) in the bioavailability.

The working group agreed that the term “absorption” was too narrow and established the working definition of bioavailability as the ‘fraction of the ingested nutrient that is absorbed and utilized physiologically’. The functional utility of each nutrient, and its effects on specific target organs, are paramount considerations.

Endpoints, i.e. criteria of adequacy, need to be judged in terms of adequate or appropriate physiological function for each nutrient individually. The ultimate criterion is a reduction of risk of disease. Nutrient concentration indices may be useful as intermediate markers. Appropriate endpoints and reference ranges need to be defined, for future studies and surveys of children.

In addition to genetically-determined (i.e. gene-polymorphisms) primary metabolic variations in nutrient requirements, there are also key phenotypic or environmental factors affecting nutrient availability, which include age, gender and adaptations to varying food patterns and nutrient supplies. Also, the timeframe is part of the adaptation equation. In general, adaptation of nutrient handling processes in response to environmental variations needs further research, especially in children.

Nutrients frequently interact with each other, especially within the gut lumen, but also within the tissues and body fluids. For instance, within the gut, haem iron in food is more readily available for absorption than non-haem iron. The availability of non-haem iron is enhanced by protein and vitamin C, but is inhibited by phytate, polyphenols and certain other metal ions.

A framework for dissection of the integrated processes of nutrient handling is needed, to identify the rate-limiting step(s) in the bioavailability of each individual nutrient.

Confusion in terminology has often arisen because the rate-limiting steps in the processes of nutrient handling differ between different nutrients. Therefore, a single descriptive term such as “nutrient handling” needs to encompass many different steps. For instance, the main rate-limiting step for iron occurs early in the sequence, at the level of intestinal mucosal transfer, whereas the most important rate-limiting steps for vitamins A and C occur later, in the subsequent processes of nutrient-handling. The working group suggested that, for future DRV committees, a framework for the different elements of nutrient handling could usefully be developed by subdivision into the following steps:

- Dietary intake (of foods or nutrient mixtures); impact of processing and preparation.
- Milieu within the gastrointestinal tract (matrix effects, intra-luminal nutrient interactions, gut transit time).
- Mucosal binding.
- Mucosal cell uptake.

- Mucosal export (portal circulation or mesenteric lymphatic transport).
- Hepatic uptake.
- Organ (including liver) clearance.
- Biliary clearance and excretion.
- Systemic circulation and peripheral distribution.
- Renal clearance and excretion.
- Peripheral tissue utilisation (e.g. metabolic/catabolic use, structural roles) and deposition.

Each nutrient can then be individually assigned one or more of these key steps, as being rate-limiting for its utilisation.

The working group did not address the harmonisation of existing DRVs or of existing dietary intake data-sets. However, the outcome of the discussion is relevant to future DRV committees and to the future interpretation of survey data-sets. Consideration of nutrient handling and nutrient interactions, as well as total nutrient intakes, is essential. The working group therefore recommends:

- Clarification of the key steps in the processes of handling of individual nutrients in children, especially those that are critical for DRV revision and harmonisation, and for the robust interpretation of dietary intake data.
- Development of new, more informative and predictive functional markers to reflect nutrient availability and handling, especially in children.
- New studies of key adaptive processes in children, particularly in relation to nutrient availability and handling.

Prof. Peter Aggett (University of Central Lancashire, UK) reviewed the current knowledge on the functional effects of food in children. He again stressed that the functionality of food has physiological, pharmacological and toxicological dimensions, which should be considered in preparing recommendations. The optimisation of the functionality of foods for children will depend very much on the identification and validation of appropriate markers. Such a topic presents strong research opportunities. One good example is how diet can affect cognition and behaviour in children and adolescents (Aggett, 2004).

Dr. France Bellisle (INSERM, F) stressed that beneficial effects are primarily visible from the correction of sub-optimal nutritional status both short term and long term. This is e.g. the case for breakfast omission that deteriorates mental performance, or micronutrient supplementation that can improve intelligence score. Good regular dietary habits are the best way to insure optimal mental and behavioural performance at all times (Bellisle, 2003).

Finally, Dr. Ben van Ommen (TNO – Nutrition and Food Research Institute, NL) presented nutrigenomics as a new way of studying biological systems in the nutrition and health area. He highlighted that it is now time to consider health effects of food components through specific interactions at the molecular level, including DNA, RNA, protein and metabolites. The complexity of nutrition can now be considered in its different components: the diet consists of complex mixtures of many potential bioactive compounds, chronically administered in varying composition, with a multitude of biological effects. Such an approach combines the development of transcriptomics and proteomics that allow for the simultaneous determination of thousands of genes at the mRNA and protein level, together with appropriate statistical methods allowing for a complete description of biological systems. Recent examples indicate a new way to define biomarkers or biological targets in nutrition (Van Ommen, 2004).

## CONCLUSIONS AND RECOMMENDATIONS

Considering the main objective of the Workshop, which was to highlight and understand the discrepancies in dietary recommendations and intake between European countries for children between 2 years of age and the end of their growth period, it is possible to identify four main outcomes:

First, the target population requires special attention and this has not been fully addressed until now. Both the first two years of life and the adult period are covered by a large part of knowledge and recommendations, while the period in between still lacks a sustained and comprehensive approach. From the physiological point of view, a child requires less absolute quantity of food but more per body weight. Many specificities characterise this period of life, including change in body composition, gender differences, variability in metabolic needs, physical activity and eating pattern, dependence of genetic background and environmental context, including family, school and socio-cultural context. Puberty represents the most dramatic change. Thus the main area for research for that age period is the definition of reference values.

Second, current nutritional recommendations across European countries cannot be properly grouped together at a European level. Thus the main question is, whether the present recommendations can be used in their diversity in different parts of Europe or whether it is more appropriate to harmonise them at the European level. Harmonisation is clearly favoured with the intention to use common scientific and methodological approaches to propose recommendations taking into account the many parameters, including regional specificity. Harmonised recommendations are required both for industrial and research activities. These include proper food labelling, assessment of dietary intake, search for upper limits, evaluation of the reasons for regional differences, food selection for communities and, possibly, designing new food.

Third, both dietary intakes and nutritional status are the main sources of data to build reasonable dietary recommendations. However, data in this age group are scarce (for example at puberty), difficult to compare in their methodology and uncertain in relation to immediate and future quality of life.

Fourth, some limitations in the current recommendation are clearly identified: 1) Paucity of information on total water intake in the nutrients considered. 2) Energy and metabolism are not the sole nutrient characteristics to be considered. In addition, nutrients have functional utility that depends both on absorption and utilisation, and needs to be evaluated by proper end points or markers. 3) Nutrients interact with each other. This interaction is in part under genetic control. It would be useful to evaluate the efficacy of methods that can take into account those interactions. 4) Nutrients intake is not only influenced by food availability but also by eating habits and tradition.

To sum up, information on nutrient dietary reference values and intakes for children between 2 years of age and the end of their growth period in Europe has been gathered and evaluated. The workshop identified discrepancies and reasons for those discrepancies. The workshop furthermore highlighted specific biological and functional targets for this period of life, and new methods of investigation. It is now time to propose a European network to improve the nutritional recommendations. Harmonisation of the methods may help in providing proper recommendations, taking into account the specificity of the children and adolescents in the different regions of Europe.

## ***Acknowledgements***

ILSI Europe and the Nutritional Needs of Children Task Force would like to thank the expert groups and the Organising Committee for their commitment to this project. In particular, they would like to thank Dr. A. Prentice and Dr. J. Lambert, chairs of the expert groups, for their active contribution.

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