Is there a role for micronutrient supplementation in European children to ensure optimal growth and development?

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Demands of child’s growth and development
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* Healthy diet gives a child a possibility to realize his genetic potential at different life stages
Demands of child’s growth and development

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Foods availability is a very important factor and key difference between adults and kids:

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* Kids of different age need adults to find healthy food for them
* Misbalance between the demand in food (energy) and its supply in children is followed by fast impairment of host’s functions
* The younger is a child, the less is his nutrients’ store and the shorter is the period of nutrients’ depletion
Vitamin and mineral deficiency in European children
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* Main causes
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- Limited availability of fresh foods and sunlight
Vitamin and mineral deficiency in European children

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  * Limited availability of fresh foods and sunlight
  * Inadequate intake of vitamins and minerals with foods
  * Improper care of mothers and children
  * Lack of access to adequate health services
  * Social factors (parents education, life’s level)
  * Diseases (acute or chronic) which cause the loss of vitamins and minerals or increase the need for them
Vitamin and mineral deficiency in European children

* Dietary intakes
Dietary intakes

For many nutrients sufficient data to define the objective risk of inadequate nutrient intakes in children living in Europe are not available.
Dietary intakes

- For many nutrients sufficient data to define the objective risk of inadequate nutrient intakes in children living in Europe are not available.
- Based on the data available, we can assume that dietary intakes of most minerals (Ca, P, Mg, Cu, Se, Zn, Mn, F) and vitamins (A, E, K, C, B complex, folate) in children living in Europe do not give rise to concern over the risk of inadequate intakes.
Vitamin and mineral deficiency in European children

* Critical nutrients
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Based on the data available, we can assume that dietary intakes of vitamin D, iodine and iron are low in children of different age in most of European countries.
Vitamin and mineral deficiency in European children

* Critical nutrients
  * Based on the data available, we can assume that dietary intakes of **vitamin D, iodine and iron** are low in children of different age in most of European countries
  * In view of the poor status of these micronutrients in some sub-groups of children living in Europe, particular attention should be paid to ensuring their appropriate supply
Vitamin D deficiency
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- Vitamin D metabolites regulate the concentration of calcium and phosphate in the blood and promote the healthy growth
- Early subclinical signs of vitamin D deficiency are decreased serum concentrations of Ca and P
- Later symptoms of vitamin D deficiency are rickets and osteomalacia
‘What is Rickets (English Disease) and how to fight against it?’

Soviet Russia’s Poster, 1925
In all studies in infants and young children, a prevalence of vitamin D deficiency of 10 to 30% was found (except Finnish and Dutch infants)

- Scientific Opinion on nutrient requirements and dietary intakes of infants and young children in the European Union. EFSA panel on dietetic products, nutrition and allergies. EFSA Journal 2013; 11 (10):3408
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For children aged 4-10 years the percentages of vitamin D intakes below the lower reference nutrient intake (LRNI) are high (from 28% in Dutch boys to 94% in French girls)
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For adolescents aged 11–17 years the percentages of vitamin D intakes below the LRNI are ranging from 17% for Dutch boys to 98% for Spanish girls

Vitamin D deficiency in European children

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Children living in the South of Europe develop adequate quantity of vitamin D, especially since April to October.

Children from the North of Europe may not have sun exposure at all for more than 6 mos.

Children at Northern latitudes need to obtain more vitamin D from their food or supplements than those on the Mediterranean.
Vitamin D deficiency in European children

- It’s not possible to define what is the adequate sunlight exposure for a given child, and in recent years concern about the risk of later skin cancer has led to recommendations against intensive sunlight exposure.
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Based on the exceptionally high proportions of children with low vitamin D intakes, we can assume that the total vitamin D supply originating from the diet and from endogenous synthesis is insufficient for most children living in some European regions.
Vitamin D deficiency in European children

* Vitamin D supplementation is especially needed if a child belongs to a risk group of vitamin D deficiency
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- Risk groups:
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Risk groups:

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- Poor maternal intake of vitamin D
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Risk groups:
* North latitudes
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* Children who are fully clothed most time of the year
* Children who have dark skin's color
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* Risk groups:
  * North latitudes
  * Poor maternal intake of vitamin D
  * Children who are fully clothed most time of the year
  * Children who have dark skin's color
  * Children who are weaned or switched to strict vegetarian diet
Iodine deficiency
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If untreated, congenital hypothyroidism can lead to cretinism (severely stunted physical and mental growth).
For children aged 1–3 years the proportion with iodine intakes below the LRNI is 10% in Poland and 1% in the UK

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For kids aged 4-10 years the proportion with iodine intakes below the LRNI is about 14-20% in Poland and Germany, and much less in Denmark (0%), France (1.9%) and UK (2.9%)
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For adolescents aged 11–17 years the proportion with iodine intakes below the LRNI are ranging between 0.4% in Denmark and 13% in Poland

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In Russia more than 60% of people live in iodine-deficient regions, and most of them have alimentary iodine deficiency (low consumption of seafood). Iodine deficiency is the most common cause of preventable mental retardation in the world. Particular attention should be paid to ensuring an appropriate supply of iodine in infants and young children with inadequate iodine status.
Iron deficiency
Iron deficiency

- Groups at risk of inadequate iron intake:
Iron deficiency

* Groups at risk of inadequate iron intake:
  * Pregnant women
Iron deficiency

* Groups at risk of inadequate iron intake:
  * Pregnant women
  * Preterm and low birth weight infants
Iron deficiency

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  - Preterm and low birth weight infants
  - Older infants and toddlers
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  * Teenage girls
Iron deficiency

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  * Preterm and low birth weight infants
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  * Teenage girls

* Different definitions of iron depletion, iron deficiency and iron deficiency anaemia and different cut-off values used make comparisons of the prevalence of iron deficiency in different populations difficult
Iron deficiency in European children

- The prevalence of iron deficiency:
  - 0 to < 6 months - 1 to 6%
  - 6 to < 12 months - 0 to 32%
  - young children (12-24 mos.) - from 3.1% (Belgium) to 27% (Poland)
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- The prevalence of iron deficiency anaemia
  - < 6 months of age - 0%
  - 6 to 12 months - 0.7 to 9.4%
  - young children – 0-10%
    - *Scientific Opinion on nutrient requirements and dietary intakes of infants and young children in the European Union. EFSA panel on dietetic products, nutrition and allergies. EFSA Journal 2013; 11 (10):3408*
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* In view of the poor iron status, an inappropriate supply of dietary iron may increase the risk of iron deficiency in some populations of children living in Europe
Vitamin and mineral deficiency in Russia (European part)
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In Russia vitamin and mineral deficiency (VMD) occurs in adults and children in different regions. There is no clear association with age, occupation, a year’s season or area of residence. According to different data, 30-70% of children with VMD have multiple deficiencies (three and more micronutrients).

VM deficiency in children of 5-17 years old from Moscow

VM deficiency:
- Vitamin C – 8-20%
- Vitamin A – 17-20%
- Vitamin E – 35%
- Vitamin B2 – 60%
- Vitamin B6 – 64%
- Iron – 50%
- Magnesium – 50%
- Calcium – 80%
- Phosphorus – 80%

VM deficiency in children of 8-12 years old from St-Petersburg

VM deficiency:
- Vitamin B1 – 66%
- Vitamin B2 – 32%
- Vitamin C – 56%

VM deficiency in children of 8-12 years old from Chuvashia

VM deficiency:
- Vitamin B1 – 33%
- Vitamin B2 – 93%
- Vitamin C – 75%
Prevention and correction of micronutrient deficiency
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* Increase of intake of natural food products rich in vitamins and minerals
Prevention and correction of micronutrient deficiency

- Increase of intake of natural food products rich in vitamins and minerals
- Fortification of foods and baby’s formulas by micronutrients
Prevention and correction of micronutrient deficiency

- Increase of intake of natural food products rich in vitamins and minerals
- Fortification of foods and baby’s formulas by micronutrients
- Vitamin and mineral supplementation which should help children with special nutrient needs or marginal intakes achieve adequate micronutrient intakes
Increase of intake of natural food products rich in vitamins and minerals
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* But, a diet having adequate energetic and macronutrient value and containing natural products only may be still deficient in some vitamins or minerals
Generally, healthy children should meet their nutrient needs by consuming foods providing a well-balanced diet. AAP recommends that healthy children older than 1 year who consume a varied diet should get all their nutrients from foods rather than vitamin supplements. But, a diet having adequate energetic and macronutrient value and containing natural products only may be still deficient in some vitamins or minerals. If a micronutrient deficiency is compensated by natural food only, the calories' intake will rise and a child may get overweight.
Fortification of foods with essential nutrients
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* Food row material or food products fortified (mandatory or voluntary) by vitamins (A, B, C, D, E, folate) and minerals (Ca, I, Fe)
  * Bread-stuffs or bread; Dairy products; Baby’s formulas; Juices;
  * Iodization of table salt
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- Fortification prevents or compensates the micronutrient deficiency if fortified food is included into daily diet
- Fortification regulations vary widely between countries
- Quantity of fortified foods is limited (e.g., in Russia only 11-15% of food products are fortified)
VM Supplementation
* Groups of VMS products:
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- With low amount of micronutrients (15-50% of RDA)
 VM Supplementation

* Groups of VMS products:
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  * With medium amount of micronutrients (100% of RDA what corresponds to a physiological need)
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* **Different forms of VMS products:**
  * Tablets, dragee, capsules, instant tablets, syrups, sprays, drops, etc.
VM Supplementation

* VMS products with low amount of micronutrients (15-50% RDA)
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  - Are usually used to prevent micronutrients deficiency in healthy children
  - May not cover the existing micronutrients deficiency for a short time period
  - If taken for 1-3 years, can effectively prevent the progress of the deficiency and improve the clinical status of a patient
* VMS with medium and high amount of micronutrients (100-300% of RDA)
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  * Can be used for the treatment of the existing micronutrients’ deficiency for a short period of time (2-6 weeks)
VM Supplementation

- VMS with medium and high amount of micronutrients (100-300% of RDA)
  - Can be used for the treatment of the existing micronutrients’ deficiency for a short period of time (2-6 weeks)
  - The length of the course depends on a micronutrient and a supplement’s dosage (the higher is a dosage the shorter is period of time needed to cover the host’s needs)
* Supplementation schedule

* 1\textsuperscript{st} stage:
  * A short course (3-4 wks.) in dosage 200-300\% of RDA, or a longer course (1-2 mos.) in physiological dosage (100\% of RDA) to cover the deficiency
* **Supplementation schedule**
  
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  * **2nd stage:**
    * Switch to long-term regular VMS intake in low dosage (30-50% of RDA) to provide adequate supply of micronutrients
VM Supplementation

* Child’s health status and existing VM deficiency should be examined before the supplementation course (personalized VM supplementation)
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Vitamin and mineral supplements have to be medically indicated in a given child

Care must be taken to ensure that supplements do not lead to excessive intakes
VM Supplementation

- Child’s health status and existing VM deficiency should be examined before the supplementation course (**personalized VM supplementation**)
- Vitamin and mineral supplements have to be medically indicated in a given child
- Care must be taken to ensure that supplements do not lead to excessive intakes
- Health care providers may be in a position to provide screening and counseling regarding dietary adequacy and indications for supplement use
Children at nutritional risk who may benefit from VM supplementation
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- Children with clinical or laboratory signs of micronutrient deficiency
Children at nutritional risk who may benefit from VM supplementation

- Children with clinical or laboratory signs of micronutrient deficiency
- Children with anorexia or inadequate appetite
Children at nutritional risk who may benefit from VM supplementation

- Children with clinical or laboratory signs of micronutrient deficiency
- Children with anorexia or inadequate appetite
- Children who participate in a dietary program for managing obesity
Children at nutritional risk who may benefit from VM supplementation

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- Children who consume exclusion diets (vegetarian, lactose free, gluten free, food allergy diets, etc.)
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- Children with anorexia or inadequate appetite
- Children who participate in a dietary program for managing obesity
- Children who consume exclusion diets (vegetarian, lactose free, gluten free, food allergy diets, etc.)
- Children with chronic diseases (liver dis., Crohn’s dis., metabolic dis., etc.)
- Children from deprived families
Additional intake from dietary supplements in Europe

- The Netherlands: young children - 5–10%
- Belgium (Flemish region): preschoolers - 30%
- Denmark: children 4-17 yrs. - 20%; adults - 5–12%
- Germany: children - 1-13%; adults - 33-47%
- Poland: children 6-12 yrs. - 40%
- Slovenia: adolescents - 20%
- Russia: children - 3%, adults - 10%
Additional intake from dietary supplements in Europe and USA

- The Netherlands: young children - 5–10%
- Belgium (Flemish region): preschoolers - 30%
- Denmark: children 4-17 yrs. - 20%; adults - 5–12%
- Germany: children - 1-13%; adults - 33-47%
- Poland: children 6-12 yrs. - 40%
- Slovenia: adolescents - 20%
- Russia: children - 3%, adults - 10%
- USA: infants - 8-19%; toddlers (1-2 yrs.) - 31%; children and adolescents (3-17 yrs.) - 34%; adults - 18-50%
Conclusions

* Despite the fact that an adequate amount of energy and nutrients can be supplied by a balanced and varied diet, dietary intakes of iron, vitamin D and iodine in some sub-groups of children living in Europe are critical
Conclusions

* Despite the fact that an adequate amount of energy and nutrients can be supplied by a balanced and varied diet, **dietary intakes of iron, vitamin D and iodine in some sub-groups of children living in Europe are critical**

* Particular attention should be paid to ensuring an appropriate supply of these micronutrients
Conclusions

* Despite the fact that an adequate amount of energy and nutrients usually can be supplied by a balanced and varied diet, dietary intakes of iron, vitamin D and iodine in some sub-groups of children living in Europe are critical.

* Particular attention should be paid to ensuring an appropriate supply of these micronutrients.

* Different supplementation strategies should be developed on a national level to improve the status of micronutrients in European children.
Conclusions

* The selection of the appropriate way through which essential nutrients are provided in the children’s diet (natural food, fortified food, or supplements) should depend on national dietary habits, health authorities’ regulations and caregivers’ preference.
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* The selection of the appropriate way through which essential nutrients are provided in the children’s diet (natural food, fortified food, or supplements) should depend on national dietary habits, health authorities’ regulations and caregivers’ preference.

* **Evaluation of the dietary intake on the population’s and personal level** should be included in any assessment for the need of micronutrient supplementation in a given child.