
NUTRITIONAL DEFICIENCIES

AMONG YOUNG CHILDREN - Prof. P. Tounian

In parallel with the 23rd Rencontres de Pédiatrie Pratique (Pediatrics Practical Seminars) held on 25th and 26th January, 2019 in Paris, more than 160 pediatricians gathered for the Novalac symposium. During this event, Prof. Patrick Tounian, Head of Pediatric Nutrition and Gastroenterology unit at the Trousseau Hospital in Paris, delivered a presentation on nutritional deficiencies among young children.

1 IRON DEFICIENCY

Role

Iron is a fundamental micronutrient involved in the formation of haemoglobin, myoglobin and various oxygen-carrier enzymes to transport oxygen in all cells in our bodies. Thus, iron plays a crucial role in the body, especially for muscle, brain and immune system function. Iron is particularly important during child's growth and development.

Deficiency

Iron deficiency is **the most prevalent deficiency** in the world¹. Iron deficiency in children may lead to several consequences such as:

- **Anaemia**: it is affecting 2-8.5% of children from 1 to 3 years old and 7-10% of teenagers in Europa, and 3-21% of children from 1 to 5 years old developing countries¹⁻³.
- **Increased susceptibility to infections**⁴⁻⁷.
- **Cognitive development disorders** which can be irreversible⁵⁻⁹.
- **Neuropsychiatric disorders** during teenage years^{5-8, 10}.
- **Behaviour disorders** such as hyperactivity^{5-7, 11}.

Requirements

There are two different types of iron:

- **Heme iron**, only found in meat, poultry, seafood, and fish, is more easily absorbed (20-30% iron bioavailability) by the body than the non-heme iron (2-5% iron bioavailability).
- **Non-heme iron** coming from plant sources like legumes, vegetables, cereals, and from milk and eggs.

Iron recommendations

Before 6 months :

- **Breastfeed** as long as possible (a 0-6 month-old baby would theoretically need 1100 ml/d of breastmilk to cover his needs but iron stocks *in utero* are important).
- **For non-breastfed babies**, 200 ml/d of infant formula are sufficient to cover the baby's needs.

From 6 and 12 months :

- If the baby is exclusively breastfed, give him iron supplement. Adjust the iron supplementation once the baby starts solid foods, especially if he eats meat products.
- **For non-breastfed baby**, 730 ml/d of follow-on formula cover his needs.
- **For non-breastfed infants older than one year**, 360 ml/d of growing-up milk cover all his needs in iron, but one feeding bottle is enough if he eats one meat product the same day. Growing-up milk should be continued until they are able to eat at least 100-150 g/d of meat products, i.e. until infants are 3 to 6 years old.
- **Give meat products** to the child, especially red meat products rich in heme-iron. If the child does not consume any growing-up formula, give him meat products twice a day.
- Cow's milk is very poor in iron. Giving the child growing-up formula instead of cow's milk help covering his nutritional needs.

2 CALCIUM DEFICIENCY

Role

Calcium is the most abundant mineral in the body mainly involved in bone mineralisation. Bone mineralization occurs only during growth, until the age of 20 years.

Deficiency

Calcium deficiency during the first 20 years of life increases the risk of fractures in all adulthood¹². Reduced consumption of milk and dairy products during childhood and adolescence increases the risk of fracture throughout life¹³⁻¹⁷.

Requirements

Age (years)	Recommended calcium intake
1-3	500 mg/d
4-6	700 mg/d
7-9	900 mg/d
10-19	1200 mg/d

Calcium recommendations

- **Breastfeed** as long as possible or feed the baby with infant formula.
- **Give dairy products** (milk, yogurt, cheese, etc.) 3 times daily as part of a diversified diet.
- **Supplementation in calcium** may be necessary for infants or children with cow's milk protein allergy, depending on their formula intake, since their dairy consumption is low.

3 LIPID DEFICIENCY

Role

Dietary lipids are key nutrients for infants not only to meet their high energy needs (human milk lipids provides 50% of energy intake) but also to fulfil numerous metabolic and physiological functions critical to their growth, development, and health.

Quality and quantity of lipids are especially important for neuro-cognitive development since the brain contains more than 60% of lipids.

Deficiency

There is no risk of lipid deficiency during the first 6 months of life if the baby is breastfed or fed with an infant formula.

Linoleic acid (omega 6 fatty acid) and **α-linolenic acid** (omega 3 fatty acid) are essential fatty acids that need to be brought in the diet.

DHA (omega 3 fatty acid) is considered as semi-essential fatty acids. Its deficiency can affect brain development, intellectual and visual functions¹⁸⁻²⁰.

Requirements

Age (months)	Recommended lipid intake
0-6	50% total energy intake
6-12	40% total energy intake
12	35-40% total energy intake

Lipid recommendations

- **Breastfeed** as long as possible. Breastfeeding is the best way to meet essential fatty acids and DHA requirements. Breastfeeding mothers should however eat enough fatty fish (at least 2 portions per week) and a mix of vegetable oils since linoleic acid, α-linolenic acid and DHA composition of breast milk is partly affected by mother's diet. DHA concentration in milk of vegan breastfeeding mothers is low²¹.
- **For non-breastfed babies**, 470 ml/d of infant formula cover the needs of essential fatty acids of babies 0-6 months old and 720 ml/d of follow-on formula cover the needs of babies 6-12 months old.
- **From 6 to 12 months**, in addition to lipids from infant formula, lipids must also be present or added in baby's solid food to meet lipid requirements. Add 2 to 4 teaspoons per day of butter or oils to home-made baby's diet.
- **For non-breastfed infants older than one year**, 850 ml/d of growing-up formula are required to cover the infant's need. Most children do not drink enough growing-up milk to cover their needs, oils or butter (4 teaspoons/d) to infant's diet should therefore be added. Choose oils especially rich in DHA such as rapeseed, soy or walnut oil if intake of DHA is low.
- **Important sources of DHA** come from fish products (especially fatty fish such as salmon, sardine, mackerel). Give 1 to 2 portions of fatty fish per week to ensure nutritional needs of DHA²².

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