

Infant nutrition for healthy development

Sensitive consumers need the safest solutions



Unlimited. **DSM**



Giving infants the best start in life

Breast milk sets the nutritional standard for feeding infants around the world. For many reasons, however, it may not be possible to provide every baby with breast milk. In such cases, alternative solutions must be found.

Integrated Vitamin and Premix Producer

Our global network, in combination with our uniform standards, allows us to deliver the same premium quality across all regions. Wherever you are, you can always be sure that you are sourcing the top products from the world's leading producer of nutritional ingredients.

We ensure full traceability along our entire production chain from acceptance of incoming raw materials to final quality release and delivery to our customers. Through careful facility design and quality programs, we mitigate the risk of cross-contamination in our production process. We guarantee that our ingredients and premixes are of the highest purity meeting the following quality standards: GMP, HACCP and ISO.



Quali®-Blends for Infant Nutrition

DSM Nutritional Products leads the world in the manufacture and supply of micronutrient blends. We offer a complete portfolio of quality vitamins and nutritional ingredients with high safety standards as well as custom-made blend formulations made to your requirements and those of consumers. With control of our sources, we can be sure of what we are putting into our blends and you can be sure of what you will be getting in your own customized formula to meet your market requirements, regulatory environment and trends.

In order to ensure the safety of your baby food products, we have launched a new baby food grade within our Quali®-Blends portfolio.

As the result of cutting-edge science in combination with best-in-class manufacturing, our baby food grade sets a new worldwide standard in product and process safety and guarantees we offer:

- Full traceability
- Strict microbiological purity levels covering especially *Enterobacter sakazakii*, *Salmonella* and *Bacillus cereus*
- Strict specific constituents levels
- Assurance of global regulatory compliance
- Reliability of supply
- Solutions supported by expertise and scientific know-how
- Quality assurance with integrated and validated systems
- State-of-the-art-production that is acceptable from the perspective of the environment

Quality for Life™

Quality for Life™ is a seal of excellence for our products. It is the mark of quality, reliability, traceability and sustainability. It means you are getting the very best ingredients, you know where they come from and you can depend on their safe source. It also symbolizes our commitment to our environment, our business partners, our people and the regulatory framework that governs our operations.

With the Quality for Life™ seal, we guarantee quality for you and for your customers.





Growth & Development

Vitamins and minerals support energy metabolism, while nucleotides support the growth and repair of body tissue.

- Vitamins
- Minerals
- Nucleotides
- DHA
- Choline
- Taurine



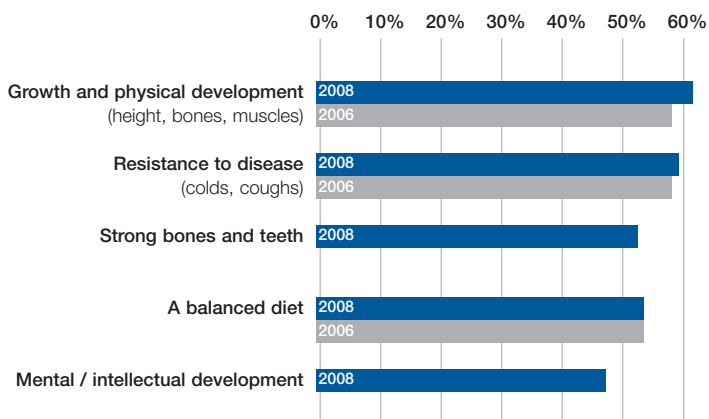
Brain Development

Vitamins, minerals, trace elements and long-chain polyunsaturated fatty acids (LC-PUFA) are essential for neurological development.

- Vitamins
- Minerals
- DHA
- Choline
- Taurine

At the forefront of science, DSM Nutritional Products can help you stay ahead of scientific and market developments in infant nutrition. We identify consumers' concerns, understand their needs and translate these into innovative marketing solutions.

Parent's major concerns on infant health
Source: Health Focus 2008





Immunity

The right mix of nutritional ingredients supports the immune system.

- Vitamins
- Minerals
- Nucleotides



Healthy Bones

Calcium and vitamins B₆, C, D and K help to build and maintain adequate bone mass during early childhood.

- Vitamins
- Minerals
- LC-PUFAs



Eye Health

Carotenoids, which are present in breast milk, help to protect the retina from oxidative damage. Lutein and DHA are essential for maintaining eye health.

- Vitamins
- Minerals
- Lutein
- DHA

Product Applications

Our premixes can be used in the following product applications to achieve a wide range of health benefits. Local legislation for ingredients, levels and claims must be checked.

- Infant formula
- Specialty formula
- Follow-on / growing-up formula
- Cereals for infants
- Cereal-based products
- Baby food in jars
- Fruit and vegetable juices
- Biscuits
- Baby meals

Growth & Development

Essentials for life

Parents are increasingly looking to provide their children with a long-term platform for a healthier life. At DSM we understand the role formulas and foods play in infant development. In a recent study of parents' concerns, 62% felt nutrients to support growth and development were essential ingredients in infant nutritional products*. We produce a full range of the essential nutrients that contribute to healthy growth and development for infants.

The importance of growth and development

The major nutrient groups positively promote healthy growth in a pure and natural way by replenishing cells, promoting optimal gastrointestinal function and ensuring normal skeletal development.



*Source: Health Focus

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DSM's nutritional solutions:**Nucleotides**¹⁻⁷

- Nucleotides play a major role in almost all biological processes.
- Infants fed on formula with nucleotides are more like breast-milk fed infants, particularly in relation to fecal flora, immune response and lipid patterns.
- High demand situations like rapid growth (during pregnancy and in newborns) increase the need of nucleotides in tissues with fast turnover (gut and immune system).

Choline⁸⁻¹¹

- It is important during perinatal period, especially for spinal cord development.
- Choline is important for synthesis of phospholipids in cell membranes, metabolism, neurotransmission, trans-membrane signaling, lipid-cholesterol transport and metabolism.

Taurine¹²⁻¹⁵

- Taurine helps maintain cell volume by keeping potassium and magnesium in the cell and keeping excessive sodium out. In this way it functions as an endogenous antioxidant.
- Taurine is necessary for normal skeletal muscle functioning.

DHA^{16,17}

- DHA plays important roles in vision and nervous system functions.
- It is the most abundant omega-3 fatty acid in human breast milk.

Vitamins^{18,19}

- Optimal vitamin status (Vitamin A, C, D, E) improves postnatal growth.

Minerals²⁰

- A well-balanced blend of minerals is important for growth and development (e.g., iron, calcium, magnesium, zinc, iodine, copper).

Did you know?

- Early nutrition, beginning during pregnancy and extending throughout infancy, is well known to influence linear growth and mental development.²¹⁻²³
- Latest research expands early nutrition impact also to long-term health and chronic diseases (CVD, allergies, autoimmune diseases, bone health, obesity).²⁴
- Current studies on early nutrition show:²⁵⁻²⁶
 - a correlation between excessive weight gain during pregnancy and children's increased obesity risk.
 - that supplementing fish oil during the last trimester of pregnancy can help reduce the risk of asthma later on.



Brain Development

Empower their mind

Ensuring that infants meet the recommended levels of micronutrients is essential for many different areas and the brain is no exception. The brain requires LC-PUFAs known as ARA and DHA. While ARA and DHA are transferred to the fetus through the placenta and also through breast milk, babies do not have the ability to convert enough of it to meet the necessary levels. At DSM, recognizing how crucial healthy brain development is, we provide the full range of essential micronutrients to bridge the gap and to fully supplement an infant's needs.

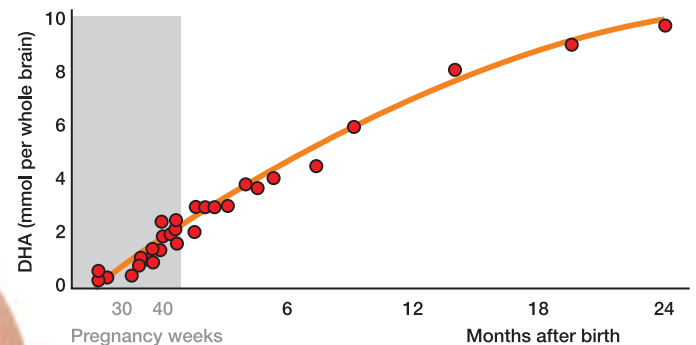
The importance of brain development

Optimal nutrition during pregnancy and the first three years of life is most crucial. Infants need a wide range of micronutrients for the production of several enzymes and to develop metabolic pathways.



Accumulation of PUFA during pregnancy and infancy

Source: Martinez M. (1991) Development profiles of polyunsaturated fatty acids in the brain of normal infants and patients with peroxisomal diseases: Severe deficiency of docosahexaenoic acid in Zellweger's and Pseudo-Zellweger's syndrom. World review of nutrition and dietetics, 66:87-102.



Substantial amounts of DHA need to be deposited in the brain during pregnancy and the first years of life to ensure age-based brain development.

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DSM's nutritional solutions:**LC-PUFAs – DHA** ^{27, 28}

- LC-PUFAs increase plasma and red blood cell fatty acid status that are beneficial to visual acuity.
- They are also important for the improvement of visual attention and cognitive development.

Vitamins ^{29, 30}

- B-complex vitamins (B₁, B₂, B₆, B₁₂, folic acid) are needed for synthesis of several neurotransmitters.
- Antioxidant vitamins support immune function and help reduce the susceptibility to infections.³¹⁻³³

Minerals ³⁴⁻³⁹

- Iron is essential for normal brain development, supporting the neurotransmitter system by producing dopamine, serotonin and GABA (Gamma-Aminobutyric Acid).
- Zinc is a component of a large number of metalloenzymes and is found in high concentrations within the brain.
- Copper is present in the brain as a key component of cytochrome-C oxidase and superoxide dismutase.

Choline ^{40, 41}

- Choline is important during perinatal period, especially for spinal cord and brain development.
- Choline supports a lifelong proper memory function.

Taurine ⁴³⁻⁴⁵

- Taurine is found in high concentrations in the newborn and neonatal brain.
- As a sulphur containing compound it is assumed to function as an endogenous antioxidant.

**Did you know?**

- Seventy percent of the human brain develops during fetal life, the remaining 30% of development occurs during pre-school years.⁴²
- In the fetus and infant the metabolic conversion of PUFA-precursors to ARA and DHA is not sufficient to meet adequate levels.
- In a recent research among parents nearly 50% cited nutrients benefiting brain development as a key factor in choosing infant products.*

Immunity

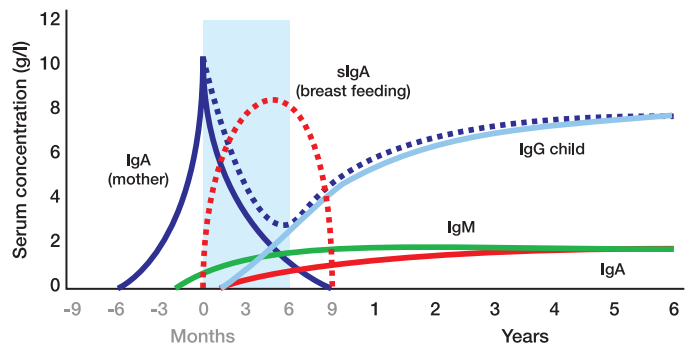
Protect their health



Being able to fight off disease is essential for adults and children alike. At DSM we are mindful of how important it is for infants to have the inner capacity to be strong and healthy, fighting infection and harmful bacteria that exist naturally in the environment. While much of our immunity is genetically determined, there is also a significant boost we can benefit from through diet. In a recent study 59% of parents felt immunity was a key factor in choosing formula for their infants.

Contribution of breast milk to infant's defense system

Source: Niers L. et al. (2007) Nutritional Support for the Infant's Immune System. *Nutrition Reviews*, 65:347-360



The immune system begins to develop in the womb and it continues after birth, especially in the first two years of life.

The importance of immunity

Birth signifies a fundamental change in demand put upon the infant immune system as it moves from a relatively sterile environment into a world teeming with bacteria. While immunity is transferred through the placenta in pregnancy many of the key antibodies disappear completely within three months. There is a level of passive immunity from breast milk but ultimately it is important to supplement the infant diet.⁴⁶⁻⁴⁹

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DSM's nutritional solutions:**Nucleotides** ⁵⁰⁻⁵⁸

- Nucleotides support the immune system by enhancing vaccine response and reducing incidence of diarrhea.
- They also boost development and optimize the function of rapidly dividing tissue.
- Nucleotides are essential when the endogenous supply is insufficient.

Vitamins

- Ample supply of vitamin D has a positive impact on protecting the respiratory tract from infections.⁶¹ Vitamin D helps with the regulation and differentiation of immune cells, making it a crucial micronutrient for strengthening the immune system.⁶²
- Vitamin A is increasing the immune function by its immunomodulatory capacity.⁶³
- Vitamin C is a well-known nutrient in immunity. Low levels of vitamin C in the blood are associated with a reduction in bacterial killing efficiency of white blood cells.⁶⁴
- The major lipid-soluble antioxidant in cell membranes is vitamin E, which explains why it is also important in the immune system.

Minerals

- A well balanced blend of minerals is important to support the immune system (e.g., iron, calcium, magnesium, zinc, iodine, copper).

LC-PUFAs

- PUFAs are used by the body to make the molecules that promote or control inflammation, an important part of the immune response.⁶⁵

Did you know?

- Infants do not have a mature immune system although they can handle infections and respond appropriately to immunization.⁵⁹
- Pregnancy, breast feeding and bottle feeding, as well as periods during which solid foods are introduced, might influence the immunological development of the fetus and the infant.⁶⁰
- Nutrition:
 - is a source of antigens the immune system needs to learn to tolerate
 - provides factors which might modulate immune maturation and response
 - influences intestinal flora and thereby affects antigen exposure as well as immune maturation and response.



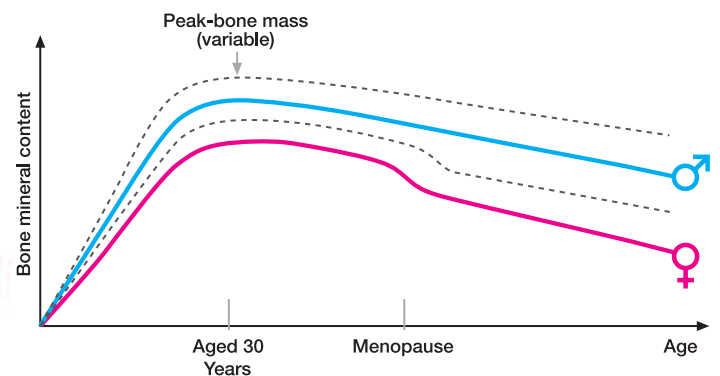
Healthy Bones

Strength from the outset

Developing and maintaining healthy bones during infancy sets our path for adulthood. We need to provide infants with all the right micronutrients to maximize their peak bone mass, which is the highest level of bone mass achieved through normal growth. It is important because it determines resistance and susceptibility to fracture that we have through the rest of our adult lives. Parents are mindful of providing the appropriate diet and supplementation for their infants and it topped the list of concerns about normal development with 52% saying nutrients to support strong bones and teeth was particularly important.

Increase and decrease in bone mass with age

Source: DSM Nutritional Products



The importance of healthy bones

Strong bones matter which is why DSM provides all the micronutrients necessary for infants to have the healthiest start. Micronutrients such as vitamins (e.g. Vitamin C, B₆, D and K) as well as minerals (e.g. calcium) are crucial for bone formation. A lack, especially of Vitamin D, can expose infants to rickets.



Healthy Bones

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DSM's nutritional solutions:

Vitamins

- Vitamin D is derived from the diet as well as via synthesis in the skin. Supplementation of Vitamin D in infants is associated with higher bone mineral mass in adolescence. It is important for calcium absorption and bone mineralization, leading to healthy bone formation.⁶⁶
- Vitamin K is important for the carboxylation of osteocalcin, a protein found in bone, which plays an important role in mineralization and calcium homeostasis.⁶⁷
- Vitamin C and B₆ are necessary for collagen synthesis and, therefore, support bone formation.⁶⁸

Minerals^{69, 70}

- Calcium is the essential mineral for bone development and bone formation. Calcium intake is positively associated with increases in bone mass and bone structure in children.
- Other essential minerals for healthy bones are magnesium, zinc, fluorine and phosphorus.

LC-PUFAs

- Long-chain omega-3 fatty acids are anti-inflammatory, and can block the effects of oxidative stress, possibly increasing bone formation.

Did you know?

- Bone health is linked to healthy growth and development.
- Peak bone mass is the "bone capital" that is used through the rest of adult life.
- Well balanced levels of vitamins and minerals are necessary to support bone formation at its different stages.



Eye Health

Upgrade their vision

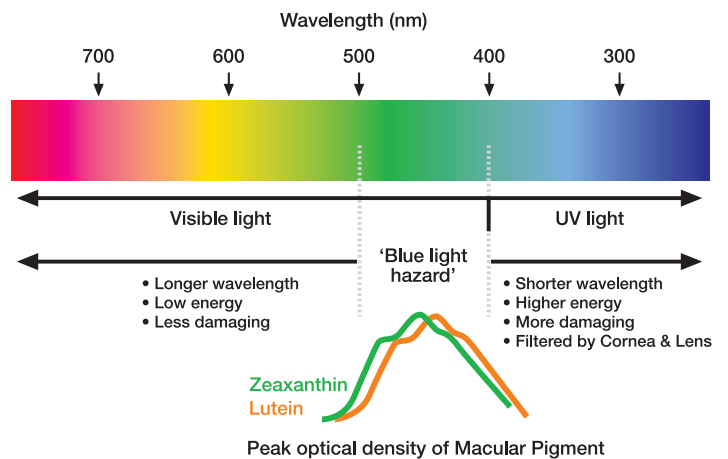


Our dedicated focus on infant nutrition means we want to make sure that infants receive the nutritional input that will ensure healthy eyes. We provide the right combination of vitamins, minerals and carotenoids in the right levels to ensure that infant eyes are better protected from the damage that can be caused by the environment – for instance, by shortwave light.

Within the central region of the retina, in a specialized depression called fovea, mostly cone photoreceptors are found. As the cones are densely packed here, this is the area with the best acuity. Area around fovea (macula) is of special clinical interest as disease here can cause severe visual loss.

Lutein & Zeaxanthin – Their role as optical filters

Source: Bone R. and Landrum J. (1992.) *Distribution of macular pigment components, zeaxanthin and lutein, in human retina. Methods in Enzymology, 213:360-366*



Wavelengths between 400 nm (blue) and 700 nm (red) pass through the cornea and the lens, finally reaching the retina.

Visible light, especially between 400 nm and 500 nm, can damage retina also depending on intensity and length of exposure:

Macular pigments selectively absorb the portion of visible spectrum from about 400-520 nm, therefore reducing this damage.

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DSM's nutritional solutions:**Lutein and Zeaxanthin (L&Z)** ⁷¹⁻⁷³

- L&Z are the only two carotenoids found within tissues of the eye, located within several areas of the eye (lens, retina, photoreceptors).
- The highest concentration of lutein and zeaxanthin found in the human body is within inner layers of the central retina.
- Lutein is found in association with Zeaxanthin; it is one of the major carotenoids in breast milk and originates from diet only.
- L&Z help prevent oxidative damage to the eye.
- Protection of developing retina by L&Z can contribute to prevent much of ageing occurring during early life, thus presumably retarding development of age-related diseases later in life.

Long Chain Polyunsaturated Fatty Acids (LC-PUFAs) ⁷⁴

- ARA and DHA are the major LC-PUFAs in the retina. They are transferred from mother to fetus in the womb via the placenta.
- There is evidence that LC-PUFA levels, and specifically levels of ARA and DHA, are directly linked to visual development.

Vitamin A ⁷⁵

- Vitamin A is needed for black and white differentiation and, therefore, for an accurate vision at night-time.

Vitamin E

- Vitamin E works in parallel with Vitamin C as an antioxidant.
- Vitamin E is the most important lipid-soluble antioxidant, which protects cell membranes from oxidation.
- It helps, especially in context with vitamin C, to significantly reduce retinopathy of prematurity (ROP) complications in VLBW (very low birth weight) infants.⁷⁶

**Did you know?**

- Some anatomical structures of the eye (retina, fovea) are poorly developed at birth: Newborns only discern vague shapes at high contrast to surroundings.
- There are some visual capabilities (e.g. dark adaptation thresholds) which reach adult levels as early as three months.
- By four years of age, a child's visual acuity improves to near adult levels.

To find out more about our products, our unique baby food grade and applications, please visit www.dsm-infantnutrition.com, www.quali-blends.com, send an email to infant.nutrition@dsm.com or contact your nearest DSM Nutritional Products office.

EUROPE

DSM Nutritional Products Europe Ltd.

P.O. Box 2676
4002 Basel
Switzerland

Phone: +41 61 815 7777
Fax: +41 61 815 7860
Email: marketing.dnpe@dsm.com

NORTH AMERICA

DSM Nutritional Products, Inc.

45 Waterview Boulevard
Parsippany, NJ 07054
United States of America

Phone: +1 800 526 0189
Fax: +1 973 257 8675
Email: hnh-marketing.dnpna@dsm.com

CHINA

DSM (China) Ltd.

No. 476 Li Bing Road
Zhangjiang High Tech Park
Pudong Area, Shanghai 20/203
P. R. China

Phone: +86 21 6141 8188
Fax: +86 21 6141 8088
Email: china.vitamins@dsm.com

ASIA PACIFIC

DSM Nutritional Products Asia Pacific Pte Ltd.

78 Shenton Way
#21-01 Lippo Centre
Singapore 079120

Phone: +65 6325 6200
Fax: +65 6220 1976
Email: marketing.dnpap@dsm.com

LATIN AMERICA

DSM Produtos Nutricionais do Brasil Ltda.

Av. Engº Billings, 1729 Prédio 9 1º andar
Jaguará – São Paulo – SP – Brasil
05321-900

Phone: + 55 11 3719 4604
Fax: + 55 11 3719 4990
Email: america-latina.dnp@dsm.com



® For DSM, quality is a way of life.
This is the core of Quality for Life™: a seal of excellence for our products.

Quality for Life™ is the mark of quality, reliability and traceability. It means that DSM customers are getting the best nutrition & health ingredients, knowing the source on which they depend. Quality for Life™ means sustainability. It symbolizes our commitment to our environment, consumers, our business partners, our people and the regulatory framework that governs our operations.

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