Staple food fortification to improve public health

How food fortification turns a simple staple into nutritious food
Improving public health is a wise investment in the future of any society, because a healthy population is not only happier, it is more productive. At DSM we are fully committed to improving public health, supporting food producers and suppliers, regulatory authorities and other stakeholders with our unique competencies and innovative solutions. Our scientific, technological and regulatory expertise, together with our top-quality, customized micronutrient blends, mean we are ideally placed to add value to our customers’ products, giving them a competitive advantage and enabling them to make their own important contribution to improving public health in their communities.
Improve public health and life is brighter for everyone

In developing countries hidden hunger – the lack of essential micronutrients in a person’s diet – places a heavy burden on societies, and not just in terms of immediate health care costs. Eradicating deficiencies and improving nutritional status makes people healthier and therefore better able to contribute to their own development. In particular it can ensure the proper mental and physical development of children, who then grow up to become productive members of the community. It also reduces the burden of health care costs and has an impact on the economic development of a country.

Micronutrient deficiencies affect not only the poor. Perhaps less obvious but nonetheless important are the effects of today’s lifestyles in the developed world on nutritional status. The hectic pace of life in these countries can lead to inadequacies in the diet, so that here, too, people are increasingly looking to fortified foods to make up the shortfalls.

Staple food fortification – safe, effective and affordable

Food fortification has been shown to be one of the safest and most cost-effective measures to improve the nutritional value of a diet. It has already been applied for decades to improve the nutritional status of target populations in various countries by adding value to simple, affordable staple foods. Indeed, in many countries fortification of staples such as wheat flour is mandatory, to replace nutrients lost through food processing or to reduce the prevalence of identified deficiencies.

Add value to basic commodities...

More and more staple food producers are recognizing that fortifying their products voluntarily can add value and give them a competitive edge. Through fortification they are also actively contributing to sustainable public health improvement and thus bringing long-term benefits to the communities to which they belong.

...and make the world a brighter place

At DSM we are convinced that improving public health is an imperative, because we can only succeed in a successful world. Improving public health is an investment that will sustainably improve the lives of people everywhere, offering them a healthier, more productive future for themselves and the societies they live in. We want to help you make the world a brighter place.

DSM Nutritional Products leads the world in the manufacture and supply of micronutrient blends for staples fortification. We offer a complete portfolio of quality vitamins and nutritional ingredients with high safety standards as well as formulations tailored to your requirements and those of your consumers. Because we control our sources, we can monitor what goes into our blends to ensure that your customized formula meets not only your market requirements and trends but also the relevant regulatory requirements.
Wheat and maize flour fortification

Wheat and maize (corn) are important elements of the human diet almost everywhere in the world. While wheat is the most widely produced cereal and the most important staple food globally, in many parts of the world the staple crop is maize. In Central America, for example, almost one-half of people’s energy intake is from maize flour. Flour from both sources is relatively simple to fortify with almost all micronutrients, giving it the potential to substantially improve public health.

DSM and flour fortification

Flour fortification is mandatory in many countries, and is having a major impact on public health. Through the Nutrition Improvement Program we offer a complete range of support services and tailor-made products.

For example:

In the USA and Chile mandatory fortification of wheat flour with folic acid has reduced the incidence of neural tube defects (NTD) and spina bifida. Since its introduction, neural tube defects in Chile have declined by 40% at a cost equivalent to treating only one child with NTD (Hertrampf et al. Nutrition Reviews, Vol. 62, No.6).

When in January 2000 the Chilean Ministry of Health decided to mandate the fortification of wheat flour with folic acid, the Technical and Scientific Director of DSM’s Nutrition Improvement Program was on hand to help. DSM provided samples and technical expertise, as well as performing the assays prior to the implementation.

In Venezuela the fortification of wheat flour and pre-cooked corn flour became mandatory in 1992. Two years later the authorities there found evidence of a significant decrease in iron deficiency and anemia by 59% and 47%, respectively. (M. Layrisse et al. Am J Clin Nutr. 1996; 64:903-7)

DSM’s experts provided samples and assays as well as advocating for the development of the food fortification program.

In South Africa the fortification of wheat flour and maize meal with essential micronutrients has been mandatory since 2003.

DSM’s contribution was to support all key stakeholders with scientific information and food technology expertise over a 5-6 year period.

The science behind the policies

DSM is a leading expert in nutrition science and technology of wheat and maize flour fortification. Our global team of specialists can help you to fortify wheat and maize flour in the best and most effective way possible, keeping the process simple and ensuring the correct concentration and even distribution of micronutrients to meet your specific regulatory requirements and quality standards.

And if flour fortification is not mandatory where you are, upgrade your products voluntarily to add value and gain that all-important competitive edge.

With our products and support you can make a major contribution to improving the health of consumers in your community.
Rice provides more than a fifth of the world’s food calories and is the major staple food for millions of individuals, particularly in Asia where people eat about 150 kg of milled rice per year. However, milled rice is not a rich source of micronutrients, because most of them are lost during the milling of the kernels.

Rice fortification is therefore one of the best solutions to providing people whose diet consists mainly of rice with essential micronutrients. It offers an important advantage for rice millers in their highly competitive environment. Moreover, rice fortification is increasingly on the political agenda of governments as a public health measure.

The challenges of rice fortification

There are numerous rice fortification technologies, including extrusion, coating and dusting. The advantage of extrusion technology is that it prevents traditional soaking and rinsing with water prior to cooking from removing most of the added micronutrients. In addition, extrusion technology allows shaping kernels that cannot be distinguished from regular rice.

DSM – your full service provider for rice fortification

We are one of the global experts and technology pioneers in rice fortification and can offer you our experiences and technical know-how and the right products to develop fortified rice according to your needs and those of your customers.

**Micronutrient blends:** We deliver ready-to-use micronutrient blends for any rice fortification technology and we can assist you in the development of the right micronutrient composition, support you with technical knowledge and continue to work on improvements.

**NutriRice™ fortified rice kernels to be mixed with regular rice:** DSM uses high quality cold, warm and hot extrusion technologies. NutriRice is composed and designed according to the individual requirements of our customers. These technologies offer the best solution available today, because the micronutrients are embedded into an extruded kernel made of natural rice flour. They are protected from external influences during washing and cooking and look, feel, cook, taste and behave like ordinary rice. To ensure an adequate intake of the vitamins and minerals, fortified kernels are mixed with normal rice in a ratio of 0.5 – 2%. This results in a product with excellent physical stability in which the embedded nutrients are retained in adequate amounts during storage, washing and cooking.

NutriRice extrusion technology:

Extruded rice kernel made of natural rice flour

Vitamins and minerals embedded in kernel for optimal protection from outside influence
Sugar is another important staple for many people around the world. It is produced in over 100 countries and production is increasing. Sugar is a particularly suitable vehicle for fortification with vitamin A.

This vitamin is essential for the process of vision (especially night vision), growth and development, immune function (it helps to protect against infections) and for male and female reproductive organs.

Conventional sugar fortification technology uses vitamin A beadlets that adhere to sugar crystals with the help of oil. Now, DSM has developed innovative AP50 technology, which uses a water-dispersible vitamin A emulsion. This is sprayed on to the surface of sugar crystals and then dried, resulting in a vitamin A coating that does not rub off. The particle size, shape, density, and mixing properties of the coated sugar kernels are similar to those of untreated sugar crystals. The advantage is excellent miscibility and no risk of separation or dust formation.

DSM’s newly developed product form gives sugar producers a unique competitive advantage and a viable opportunity to support public health improvement.

Fortification of vegetable oils and margarine with fat-soluble vitamins

Oils and fats, like carbohydrates and proteins, are major components of the human diet. Depending on the source, oils provide not only energy but also the essential fatty acids required for human growth and development. The fat-soluble vitamins – vitamins A, D and E – mix uniformly with oils, making them an excellent, cost-effective vehicle for fortification with these micronutrients.

DSM offers various solutions for the fortification of oils and margarine, including custom-made premixes. Our experts support you in the development of a fortified product which meets the highest quality standards to ensure that vitamins reach the consumers intact.
Milk is a very nutritious food, rich in high-quality protein and providing all ten essential amino acids as well as immunoglobulins. The micronutrient profile of whole milk shows that it is an excellent source of calcium and vitamin B2, a good source of vitamin A, and a fair source of vitamin D. However, industrial processes destroy some nutrients, especially the vitamins naturally present in milk – but nutrients lost during processing can be replaced through fortification.

Fortification of skimmed milk with vitamins A and/or D is already mandatory in several countries. In the USA, some dairies voluntarily fortify milk with vitamins C and E and calcium, in addition to vitamins A and D, and dried milk and flavored milk powders are often fortified with vitamins A and D, calcium, and iron.

Importantly, milk and milk product fortification can be modified to meet the nutritional requirements of specific target groups like children or the elderly.

**DSM can support you in the development of products that are nutritious, of high quality and respond to consumer demands, putting you ahead of the competition. Milk and milk products are suitable for fortification with almost all vitamins and minerals and DSM offers a broad portfolio of micronutrients and micronutrient blends in dry powder form and oily form for the fat-soluble vitamins. To effectively and easily fortify milk and milk products, DSM provides tailor-made premixes.**

**Instant noodles**

Convenience and affordability are major factors in the increasing popularity of a variety of instant noodles, which are now produced in over 80 countries. In Asia, especially, they have almost become a staple.

Instant noodles represent an excellent opportunity for public health improvement. At present, while cheap and convenient they lack nutritional value and often consist only of “empty calories”. Fortifying instant noodles offers a solution that does not require people to change their eating habits in order to improve the micronutrient content of their diet.

Fortifying this popular meal with valuable micronutrients responds to the consumer desire for better quality yet affordable food and can strengthen the producer’s position in this highly competitive and growing market. Vitamins A, D, E, K1, B1, B2, B6, B12, C, folic acid and niacin can all be added to the noodles, as well as the minerals calcium, zinc and iron.

**DSM not only provides ready-to-use micronutrient blends for instant noodle fortification, but can assist you to choose the right vehicle, whether fortified noodles or fortified seasoning.**
Our company

Royal DSM is a global science-based company active in health, nutrition and materials. By connecting its unique competences in Life Sciences and Materials Sciences DSM is driving economic prosperity, environmental progress and social advances to create sustainable value for all stakeholders. DSM delivers innovative solutions that nourish, protect and improve performance in global markets such as food and dietary supplements, personal care, feed, pharmaceuticals, medical devices, automotive, paints, electrical and electronics, life protection, alternative energy and bio-based materials. DSM’s 22,000 employees deliver annual net sales of around €9 billion. The company is listed on NYSE Euronext. More information can be found at www.dsm.com

Who we are

Who we are as a company is the result of strategic choices that we have made. These in turn are based on our mission and our core value; they define what we believe in and how we go about our business.

Our mission

Our purpose is to create brighter lives for people today and generations to come. We connect our unique competences in Life Sciences and Materials Sciences to create solutions that nourish, protect and improve performance.

Our core value

Our mission is supported by our core value: Sustainability. Everything we do should contribute to a more sustainable world. To us, achieving sustainability means simultaneously pursuing economic performance, environmental quality and social responsibility. In other words, we strive to create value on the three dimensions of People, Planet and Profit simultaneously.

Our brand promise

Bright Science. Brighter Living™. This sums up who we are, what we stand for and what we aim to achieve.

These four words are the shorthand for our mission, our beliefs and our behaviors — a promise that we make to the world in which we operate.

Bright Science refers to the unique way in which we combine Life Sciences and Materials Sciences disciplines, technologies and talents. We partner with customers and other stakeholders – then we share ideas, insights and inspiration to create innovative and sustainable solutions that address the key challenges facing society today.

Brighter Living refers to our commitment to creating products and solutions that make a positive difference to people’s lives. We are constantly seeking new ways to improve quality of life, and we seek to make a positive contribution to the lives of people today and generations to come.
DSM Nutritional Products

DSM Nutritional Products is organized around three market-facing entities:

- Animal Nutrition & Health
- Human Nutrition & Health
- Personal Care

Human Nutrition & Health largely addresses the nutritional ingredients part of the food market. Animal Nutrition & Health addresses the nutritional additives segment of the feed market. Personal Care is focusing on the actives and ingredients in the sun care, skin care and hair care industries.

DSM is the only producer who can supply the complete range of vitamins, carotenoids and nutritional lipids in the most suitable forms for all possible human and animal uses. DSM is working from its strong basis as a global market leader in key value-added ingredients offered through an international infrastructure and reach unequaled by any competitor.

DSM is uniquely positioned in all three main steps of the value chain: the production of pure active ingredients, their incorporation into sophisticated forms, and the provision of tailored premixes. Being the only fully integrated player allows DSM to differentiate itself all the way through the chain.

Managing the interdependencies between active ingredients, forms and premixes, which have important implications for innovation, logistics, and value delivery, is a core competence of DSM.

Innovation is a survival skill. DSM Nutritional Products fosters this skill to the benefit of both the customers’ future and that of the company. Lateral thinking and innovative attitudes are valuable tools with which to secure that future. These lead to discoveries that DSM then links to customers’ needs, extending the range of offering and creating new business opportunities.

Starting in 1935 with the chemical synthesis of vitamin C, Roche had always been a pioneer in the industrial synthesis of vitamins and carotenoids.

Today DSM’s Nutrition cluster, which includes DSM Nutritional Products, maintains this tradition and invests more than 5% of its sales value in R&D, which is significantly higher than peers in the industry.

DSM’s Research & Development activities are concentrated in the regions of Switzerland, the Netherlands, China and the United States in six Research Centers: Human Nutrition & Health, Animal Nutrition & Health, Personal Care, Process Research and Development, Product Form Development and Analytics.

A pioneer in innovation
Global operations

With ten large production sites (excluding premix) in Europe, the United States and China, six R&D centers in Europe and China, over 45 premix plants for animal or human nutrition and over 40 sales offices across the globe, DSM Nutritional Products is never far away from its customers and can make products in response to specific customer needs.

Our Customer Focus

The customer is at the center of all our activities. Everything we do – and this not only in our Marketing & Sales organization – we do for our customers. Customer intimacy is a key word at DSM Nutritional Products: it means that we listen to our partners and develop solutions that add value to their businesses.

Customer intimacy

The basis for all activities for and with our customers involves sustaining our established products while boosting the full growth of our new business. Apart from applying the strategy to interactions with customers, we also attach great importance to certain behaviors and values, in particular customer intimacy. This is based on mutual trust and respect. We strive to build relationships with our customers in which all issues can be openly addressed. This is the foundation for jointly developing solutions which benefit our customers and add value to their business. Key Account Management and regularly updated Customer Action Plans ensure that we can anticipate our customers’ ever-changing needs.

Quality Management and Regulatory Affairs

DSM Nutritional Products constantly strives to maintain and advance its own high quality standards. Our aim is not only to be the benchmark for the industry but also to give our customers the peace of mind that only comes with quality.

We apply industry-appropriate Good Manufacturing Practice to our production operations worldwide. Every part of the process – from sourcing through production, quality assurance and storage to delivery – is managed so as to ensure the highest levels of process safety and product quality. All processes are designed to anticipate customer requirements and market trends. Beside product specification, DSM Nutritional Products provides clear statements concerning, for example, GMO ingredients, BSE/TSE, residual solvents limits, and the absence of allergenic potentials. In many cases, Kosher and Halal certificates issued by highly reputed international organizations are available.

These efforts are complemented by strict change control procedures and ISO 9001 certification.

Our dietary and food ingredients are manufactured following the HACCP concepts. DSM Nutritional Products produces vitamins for use as active pharmaceutical ingredients, operating in compliance with the worldwide accepted GMP standard ICHQ7a. CEP (Certificate of Suitability to the European Pharmacopoeia) are available for our full-range of vitamin straight portfolio.

Visit our new website for full details on our products, health benefit solutions, services and more.

www.dsm.com/human-nutrition
Quality for Life™

A seal of excellence for our products and services

As the world’s leading manufacturer of ingredients for health and nutrition, quality is at the heart of everything we do. This supports our ambition to fully understand our customers’ needs, and runs from product conception through manufacturing, all the way to after-sales support.

For us at DSM, quality is a way of life. This is the core of our Quality for Life™ initiative.

It means you are getting the very best ingredients, you know where they come from and you know you can depend on their safe source. It symbolizes our commitment to our environment, our business partners, our people and the regulatory framework that governs our operations.

*With our Quality for Life™ seal, we aim to ensure quality for you and for your customers.*

The following trademark logos are part of the Quality for Life™ initiative and can be licensed to use on your end products:

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DSM Quali®-Blends. Our expertise at your service.

Quali®-Blends

Because you need more than single ingredients to support your challenges in responding to consumers’ changing attitudes towards health and nutrition, we offer Quali®-Blends – our premix service which helps you to identify, assemble and incorporate the right ingredients into your products and brands. Supporting your challenges and innovation needs is our priority. With Quali®-Blends we put our vast and large experience and superior quality entirely at your service so you can reduce complexity in your value chain, increase efficiency, focus on your consumers and grow your brands. Via eight human nutrition premix plants, five application laboratories and more than 40 sales offices you can rely on technical and analytical support globally. Moreover, our sales and marketing teams are organised around an industry segment approach with a strong end market focus in order to offer brand positioning support and technical expertise.

DSM’s dedicated Quali®-Blends teams work globally and in your region to identify, assemble and incorporate the right combination of quality ingredients into your products. The result? Added value and reduced complexity for our customers.

- Over 40 strategically placed sales offices
- Eight human nutrition premix plants worldwide
- Five high-tech application labs
- Presence on five continents
- One DSM – drawing on our expertise in Health, Nutrition and Materials to offer you cutting edge solutions

ADDED VALUE

REDUCED COMPLEXITY
Quali®-Blends in your business

From the initial product concept stage to sales and brand management, DSM offers individual support at every stage of the value chain.

Idea generation and strategy
With a bank of product and application success stories and extensive consumer and market insights, we can help you create new products to meet consumer demand in the markets you serve.

Quality management
From source to shelf, DSM takes quality very seriously. Each Quali®-Blends premix goes through an extensive set of analytical tests before it reaches you.

Markets we serve
Working in a wide and ever-growing number of markets, our Quali®-Blends teams partner with our customers to find nutritional solutions for any product.

Beverages
Whether you want high quality nutritional ingredients or coloration-specific carotenoid formulations, Quali®-Blends contain everything you need for the perfect beverage.

Dairy
As the only nutritional ingredients manufacturer to supply complete ingredient solutions to the dairy industry, DSM understands the needs of producers at every stage in the development process.

Dietary supplements
DSM delivers tailor-made formulations, consumer insights and dietary supplement application expertise to meet the changing health interests of today’s consumers.

Infant and maternal nutrition
From pre-pregnancy and pregnancy to birth, lactation and early infancy, Quali®-Blends help to ensure that infants get the best start in life with ingredients that adhere to the highest standards of quality control.

Staple food fortification
A simple, safe and cost-effective way to add essential micronutrients to food, Quali®-Blends are helping to reduce ‘hidden hunger’ through DSM’s Nutrition Improvement Program.

Oils and fats
Backed by strong science, DSM has a broad portfolio of nutrients and our team of technical experts offer formulation advice and regulatory support.

Bakery and Cereals
Quali®-Blends contain vitamin, mineral and nutritional ingredients to boost the consumer appeal of cereal products.
Vitamin A
Deficiency is a leading cause of blindness and contributes to high rates of childhood mortality from infectious diseases. Deficiency during pregnancy can cause serious birth defects. β-Carotene is a plant compound that the body can convert to vitamin A, and is a common source of this vitamin in the diet.

Vitamin B12
This is provided mainly by foods of animal origin, and may be lacking in poor diets. In younger adults and in socioeconomically disadvantaged populations, low vitamin B12 status usually corresponds to low intakes of these foods; in the elderly, poor absorption is more often the cause.

Vitamin C
This is widely available in fruits and vegetables, fortified foods and dietary supplements, yet low vitamin C intakes and low blood levels have been found among one-third to one-half of adults in the US and Canada. Smoking is one risk factor that robs the body of vitamin C.

Vitamin D
The “sunshine vitamin” is both obtained from the diet and formed in the skin during exposure to sunlight. Recently it has become clear that about half the world’s people have inadequate vitamin D status, particularly the elderly, women, obese people, people with darker skin, and those who cover up to avoid sun exposure.

Vitamin E
This is the fat-soluble antioxidant vitamin. It defends cell membranes and lipoproteins from oxidative damage. Even though overt deficiency is rarely found, recent reports show that this vitamin is lacking in large-scale nutritional surveys. Supplements or fortification can fill this critical gap in otherwise well-nourished populations.

Folate (Folic acid)
This supports DNA and RNA replication in new cells, protein metabolism and the health of red blood cells. Mild deficiency produces tiredness, irritability and appetite loss; severe deficiency leads to anemia that leaves a person weak and short of breath. Deficiency during pregnancy can cause premature birth, low birth weight, or birth defects.

Vitamin K
Vitamin K plays an essential role in blood clotting and also supports bone health. Reports around the world show that about half of adults do not meet dietary intake guidelines mainly due to their low consumption of green leafy vegetables.

Other vitamins
There are six B vitamins in addition to folate and vitamin B12. Most of the B vitamins are involved in the release of energy from carbohydrates; thus, people with higher energy expenditures – such as those active in sports – may have higher requirements. Other B vitamins are involved in fat and protein metabolism. However, use of oral contraceptives, alcohol intake, dieting and other lifestyle factors can cause marginal B vitamin deficiencies.

PUFA long chain omega-3 and 6 fatty acids
There are two classes of PUFA: omega-6 and omega-3. Primary dietary sources of omega-6 are corn oil, soybean oil and safflower oil. Dietary sources of omega-3 include oily fish such as salmon, tuna and herring, as well as a few plant oils including canola and flaxseed. While both types of PUFA are needed, shortfalls in the diet tend to be in long chain omega-3 because of low fish consumption and an overabundance of omega-6 in the food supply. Omega-3 PUFA (DHA and EPA) provide multiple health benefits – support of heart health, mental health, immune function and fetal development, to name just a few. DSM is the worldwide leader in omega-3 solutions with both fish (Meg-3) and algal (life’s DHA) sources available.

Minerals
Minerals are essential for healthy bones, muscles, heart, brain and nerves, fluid balance and many aspects of metabolism. The minerals most likely to be low or deficient in large population segments are calcium and iron, and to a lesser extent, potassium, iodine, magnesium, selenium and zinc. Iron deficiency anemia is considered a major public health problem and is usually compounded by other nutrient deficiencies such as nutritional anemia. The most vulnerable population groups are pregnant women, women of childbearing age and young children. Inadequate calcium intakes are prevalent worldwide, especially in children and teenagers, women and the elderly, potentially causing poor bone development in the young and osteoporosis in the old.
DSM Nutritional Products

To find out more about our ingredients for staple food fortification, please visit www.dsm.com/human-nutrition or send an email to info.dnp@dsm.com, or contact your nearest DSM office.

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For DSM, quality is a way of life. This is the core of Quality for Life™.

Quality for Life™ is the mark of quality, reliability and traceability. It means that DSM customers are getting the best 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.

With the Quality for Life™ seal, we aim to ensure peace of mind for you and for your customers.

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