Nutriview

2010/4

A quarterly newsletter on the role of micronutrients in nutrition and health for health-care professionals and science communicators

Editorial:
1000 days that can change the future

Malnutrition is one of the world's most serious and least addressed problems. More than a third of child deaths and 11% of the total disease burden worldwide are due to maternal and child undernutrition. By scaling up early and proven life-saving interventions in the first thousand days of life (the period beginning at conception and continuing until the child's second birthday) we can create a healthier and more prosperous future for everybody.

The consequences of malnutrition during the first thousand days of life are irreversible; but they are preventable. By starting life adequately nourished, children have a better chance of growing to reach their full cognitive and economic potential. Realizing this, a wide range of organizations has answered the call to action "1000 Days: Change a Life, Change the Future" (http://www.thousanddays.org/). By supporting international experts and advocating greater efforts to improve early nutrition, they are sharing information and coordinating effective, evidence-based actions to ensure that children get a healthy start in life. It has been estimated that, by investing in nutrition, a country can increase its GDP by at least 2–3% annually.

Children who are well nourished for the first thousand days of life will be less likely to die prematurely, more likely to stay in school and learn, more likely to earn more as an adult, and more likely to produce healthy offspring themselves.

In recent months, more than a hundred donors, developing country governments, civil society organizations, development agencies and members of the private sector have created "Scaling Up Nutrition (SUN): A Framework for Action", which outlines a short list of actionable priorities to improve infant and child nutrition. (PDF files accessible at: http://www.unscn.org/files/Announcements/Scaling_Up_Nutrition-A_Framework_for_Action.pdf and: http://un-foodsecurity.org/sites/default/files/SUNRoadMap.pdf). Successful action on these priorities requires country-specific implementation approaches customized to meet the unique needs of communities.

A focus on effective, evidence-based interventions targeted to support healthy growth, optimal early feeding/breastfeeding practices and reduction of micronutrient deficiencies, will have a significant and lasting impact on global health and development. All nutrition stakeholders have a role to play in supporting SUN. Nutrition must be prioritized and adequately funded, and targets must be clearly set and monitored at the international, national and local levels. To add your name to the list of supporters for this effort, please go to the web page at: http://www.thousanddays.org/act/.

A. Bowley

Feature:
Fighting hidden hunger in Latin America

People whose diets consist mainly of cereals, roots, tubers and legume seeds may eat enough to satisfy their hunger, but, because their intake of micronutrient-rich foods (such as meat, fish, poultry, eggs, dairy products, fruits and vegetables) is extremely limited, they may develop dietary deficiencies of vitamins and minerals, and use energy and protein sources inefficiently. This form of malnutrition, sometimes called "hidden hunger" because affected individuals do not experience typical hunger symptoms, is a major public health problem and an important barrier to socio-economic development worldwide.

Hidden hunger can be avoided or eliminated by eating a balanced diet (dietary diversification) or fortified foods, or, if this fails, by taking supplements. To change dietary habits, nutrition education, as well as public health and food safety measures, may be required. Fortification of staple foods can make an important contribution to the reduction of micronutrient malnutrition. It is a socially acceptable and cost-effective way to reach large at-risk populations; it requires no change in food habits, uses already existing distribution channels of the food industry and local commercial systems, and can produce nutritional benefits quickly.

The fortification of flour with B vitamins has been applied successfully in industrialized countries since the 1940s. Switzerland and the USA introduced salt iodization as early as the 1920s, and various countries currently add vitamins A and D to milk and margarine.

Fortification pioneer

As a pioneer in the fortification of staple foods within the developing world, Latin America has made great steps towards the prevention and eradication of hidden hunger. Fortification of wheat flour with iron and B

vitamins is commonplace in the region, while fortification of sugar with vitamin A is mandatory in all Central American nations, and is being considered by many other countries. Nowadays, every country in the region has at least one widely consumed staple, in addition to salt, that is fortified [see table on page 4].

Chile already fortified wheat flour with vitamins B1 and B2, niacin and iron in 1951. The low prevalence of anemia in the country in 2001 (schoolchildren and adolescents: 1%; pregnant adolescents in the first trimester: 2%; women of childbearing age: 10%) has been attributed in part to this initiative. Children under two years of age, however, whose consumption of wheat flour is insignificant, did not benefit until after 1999, when a complementary food program based on the fortification of milk was started. Following the introduction of flour fortification with folic acid in 2000, Chile has also seen a marked reduction in the incidence of neural tube defects (NTDs), a life threatening and crippling birth defect [Figure 1], and a lowering of blood levels of homocysteine, a marker for cardiovascular diseases.

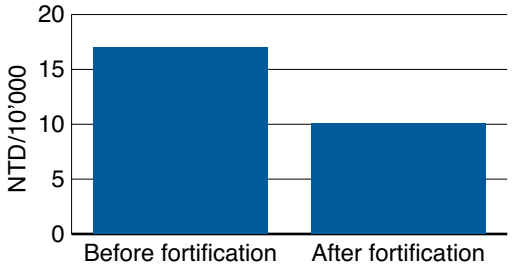

Figure 1: Rates of neural tube defects fell by 40% in Chile following flour fortification with folic acid. Hertrampf E. et al. Nutr Rev 2004; 62, June supplement: 44–48

In 1993, Venezuela started fortifying precooked corn flour and wheat flour, two cereals that accounted for 45% of the caloric intake of the target population. This measure dramatically improved the micronutrient adequacy of the Venezuelan population. [Figure 2] and lowered the prevalence of iron deficiency and anemia in poor children in the capital city Caracas [Figure 3].

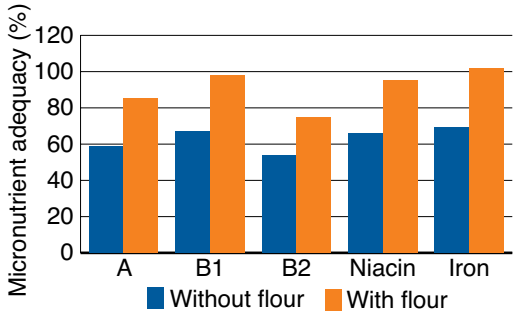

Figure 2: Micronutrient adequacy of the lower socio-economic strata of the Venezuelan population improved significantly following fortification of precooked corn flour and wheat flour. Chavez JF. Satellite Conference of the 16th ICN, Montreal, 1997

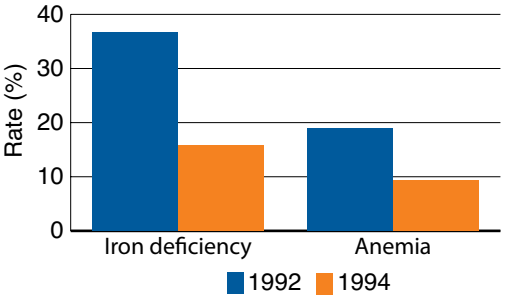

Figure 3: Fortified wheat flour and corn flour halved iron deficiency and anemia in 307 children of lower socio-economic groups in Caracas. Layrisse M. et al. AJCN 1996; 64: 903–907.

In the 1990s, Central America revised the mandate for wheat flour fortification to include folic acid as well as vitamins B1 and B2, niacin, and iron, at the same time switching from reduced iron to ferrous fumarate. A Central American regional standard was then enacted in 2002. Colombia, Bolivia, and Ecuador started fortification of wheat flour with vitamins B1 and B2, niacin, folic acid and iron in 1996. In 2010, after many years of a successful "gentlemen's agreement" between government and industry, Mexico has finally introduced a mandatory program of wheat and corn flour fortification.

Leaders in sugar and rice fortification

Costa Rica and Guatemala initiated the fortification of sugar with vitamin A in 1974, because vitamin A deficiency was clearly established by intake and biochemical surveys, and sugar was the only staple food consumed by all the target groups in those countries. Within two years, the prevalence of deficient retinol plasma levels (less than 10 µg/100 ml) in Guatemalan children fell from 3.3% to less than 0.2% [Figure 4].

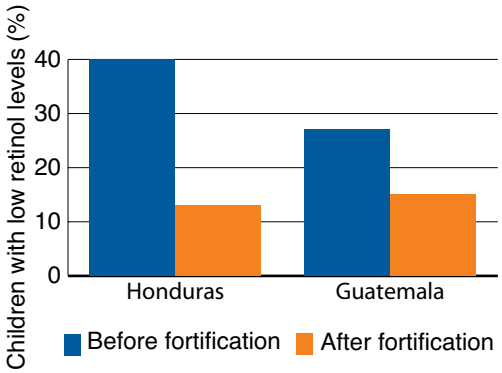

Figure 4: Sugar fortification lowered prevalence of retinol levels <20 µg/dl in preschool children. Dary O. Satellite Conference of the 16th ICN, Montreal, 1997.

Lactating mothers who ate fortified sugar passed on adequate amounts of the vitamin to their infants in their milk. A surprising discovery that followed the fortification of sugar with vitamin A was that it improved

iron nutrition as well [Figure 5]. It is now widely accepted that iron cannot be absorbed, transported and metabolized optimally if there is a deficiency of vitamin A and other vitamins.

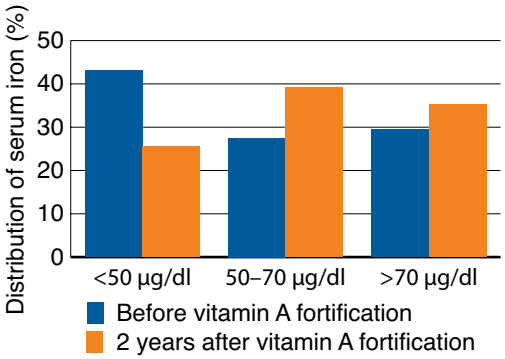

Figure 5: Fortification of sugar with vitamin A improves iron status of preschool children in Guatemala. Meija LA, Arroyave G. Am J Clin Nutr 1982; 36: 87–93.

Costa Rica was the first country in the world to mandate a nation-wide rice fortification program. Since 2006, it requires that the vitamins E, B1 and B12, folic acid, niacin, zinc and selenium be added to rice using an extruded kernel technology. Panama followed this example, and the congress passed a law requesting official funds to start the program in 2009. Ecuador and the Dominican Republic are implementing or considering the possibility of introducing several fortification programs.

Open to novel approaches

Realizing that complementary foods can be excellent vehicles for micronutrients, Latin America has implemented a vast complementary feeding system over the past two decades. In the Peruvian School Lunch Program, started in 1993, children receive a daily ration of 100 g biscuits fortified with vitamins B1 and B2, niacin and iron, and 250 mL milk substitute fortified with vitamins A, C, B1, B2, B12, niacin and folic acid, as well as iron, zinc and iodine. In Huancayo, one of the regions covered by the program, the prevalence of anemia (defined as a hemoglobin below 13 g/dl, because of its high altitude: more than 3000 m above sea level) was reduced from 68% to 18% in six months [Figure 6].

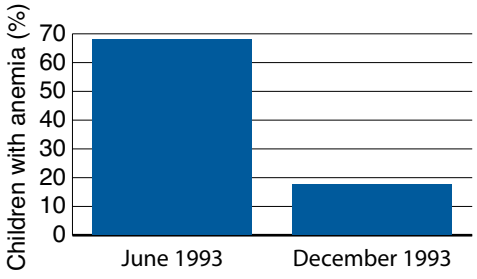

Figure 6: School breakfast program in Huancayo, Peru, lowered prevalence of anemia. FONCODES 1993.

Fortification programs in Latin America

Country	Staple fortified*		Micronutrients added
Argentina	M	Wheat flour	B1, B2, folic acid, niacin, iron
Bolivia	M	Wheat flour	B1, B2, folic acid, niacin, iron
Brazil	M	Wheat flour	Folic acid, iron
	M	Corn flour	Folic acid, iron
Chile	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Margarine	A
Colombia	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Margarine	A
Costa Rica	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Corn flour	B1, B2, folic acid, niacin, iron
	M	Sugar	A
	M	Rice	E, B1, B12, folic acid, niacin, zinc, selenium
	M	Milk	A, iron, folic acid
Cuba	M	Wheat flour	B1, B2, B6, folic acid, niacin, iron
Dominican Rep.	M	Wheat flour	B1, B2, folic acid, niacin, iron
Ecuador	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Margarine	A
El Salvador	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Corn Flour	B1, B2, folic acid, niacin, iron
	M	Sugar	A
	V	Margarine	A
Guatemala	M	Wheat flour	B1, B2, folic acid, niacin, iron
	P	Corn flour	B1, B2, folic acid, niacin, iron
	M	Sugar	A
Honduras	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Sugar	B1, B2, folic acid, niacin, iron
Mexico	M	Wheat flour	B1, B2, folic acid, niacin, iron
	M	Corn flour	B1, B2, folic acid, niacin, iron
	M	Milk	A, D
Nicaragua	M	Wheat flour	B1, B2, folic acid, niacin, iron
		Corn flour	B1, B2, folic acid, niacin, iron
	M	Sugar	A
Panama	M	Wheat flour	B1, B2, folic acid, niacin, iron
	V	Corn flour	B1, B2, folic acid, niacin, iron
	M	Rice	B1, B6, B12, folic acid, niacin, zinc, iron
Paraguay	M	Wheat flour	B1, B2, folic acid, niacin, iron
Peru	M	Wheat flour	B1, B2, folic acid, niacin, iron
Uruguay	M	Wheat flour	Folic acid, iron
Venezuela	M	Wheat flour	B1, B2, niacin, iron
	M	Precooked corn flour	A, B1, B2, niacin, iron
	M	Milk powder	A, D

* M = mandatory; V = voluntary; P = pending

Another pioneering effort in novel fortification programs with public health impact is the Purita Mamá program introduced in Chile in 2008 (see Nutriview 2009/2). In this program, docosahexaenoic acid (DHA; a long-chain polyunsaturated fatty acid important for visual and cognitive development of the infant) is added to the dairy drink that is provided free of charge to over 100,000 pregnant and lactating women. The product is already showing an impact in the infants of mothers in the program (higher DHA levels in breast milk, 74% reduction in rate of premature births, better psychomotor development at four months of age).

Hector Cori, DSM

Feature:

Workshops move food fortification forward in Sub-Saharan Africa

During 2010, stakeholders in Sub-Saharan Africa have made considerable progress in their efforts to encourage countries to introduce food fortification. On April 19–22, 2010, the Flour Fortification Initiative (FFI) sponsored a meeting to discuss micronutrient formulations for wheat flour fortification in the region. The meeting was held in Nairobi, Kenya, and organized in collaboration with the East, Central and Southern African Health Community (ECSA-HC) Secretariat. It featured an analysis centered round the WHO Interim Consensus Statement (see Nutriview 2010/2) and the ECSA guidelines on fortification standards. More than a hundred specialists from fifteen African countries (Burkina Faso, Cameroon, Ethiopia, Kenya, Malawi, Mozambique, Namibia, Rwanda, Somalia, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe), as well as micronutrient premix suppliers and international development partners attended. Institutions that participated were Smarter Futures (a partnership with the Ministry of Foreign Affairs of the Netherlands, the Dutch NGO BOSK, AkzoNobel, Helen Keller International and FFI), UNICEF, USAID-East Africa, the A2Z Project, the Micronutrient Initiative, World Bank and the World Food Program.

Sharing experience

Many countries in the ECSA region started fortification efforts in 2004 after the ECSA Conference of Health Ministers had passed a resolution on food fortification in 2002. They aimed to fortify sugar and edible oil with vitamin A, and maize and wheat flours with iron, zinc, vitamin A, B1, B2, B12, niacin and folic acid, as well as ensuring that more than 90% of households in the region have access to iodized salt. During all these years, the USAID-EA has supported the initiative through its micronutrient projects MOST and A2Z, with support from UNICEF, MI, GAIN and other partners in the region.

As a result of this interinstitutional effort, fortified oil has become universally available in Uganda, and is offered by several suppliers in Kenya and Malawi. Malawi, Kenya and Uganda have already conducted trials of sugar fortification, with Malawi becoming the second African country (after Zambia) to initiate a national sugar fortification program. A sugar mill in Kenya has also started to prepare for fortification. Kenya, Tanzania and Uganda have implemented or are about to start wheat and maize flour fortification. Recently, Kenya has reduced the content of iodine in salt from the earlier, excessive levels, and neighboring countries have followed its example. Malawi, Kenya, Uganda and Zambia are using the food control manuals for each fortified food prepared by the ECSA Secretariat. More than 10 laboratories involved in food quality control and assurance participate in the annual proficiency-testing scheme that ECSA organizes as the Laboratory Proficiency Testing Network.

In West Africa, the Economic and Monetary Union of West Africa (Union Economique et Monétaire Ouest Africaine: UEMOA), a subdivision of the Economic Community of West African States (ECOWAS), started its 'Fortify West Africa' commitment together with HKI and the Clinton Global Initiative in 2007. To reach the goal of this effort UEMOA has entered partnerships with the milling and edible oil industries.

Workshop participants in Nairobi try to find sensory differences in bread made with different types of iron fortificant

Testing the theory

The WHO guidelines propose four levels of nutrients to be added to wheat flour based on the average daily flour consumption of the target population. To help countries decide where to obtain this information, Janneke Jorgenson of the World Bank presented five potential sources of food consumption data (national food consumption data, household income and expenditure surveys [HIES], panel surveys, fortification rapid assessment tools and food balance sheets from the Food and Agriculture Organization) and discussed the limitations of each. Carol Tom, the A2Z Food Fortification Advisor in the ECSA region, told the participants that nutrient intakes have already been assessed in some ECSA countries, and the results should be used to review their standards, because they constitute more robust data for this application. Additionally, the ECSA Secretariat, in collaboration with USAID/A2Z, is helping countries analyze data from HIES to estimate the consumption of 'fortifiable' foods.

In a cost-benefit analysis of food fortification in Tanzania, Dominic Haazen of the World Bank showed that the country loses at least US$517 million annually due to nutritional deficiencies. At an annual cost of US$13.8 million (0.07% of GDP), food fortification would avert costs of more than US$126 million (0.65% of GDP), and save almost 7'000 lives every year.

In other sessions, participants were encouraged to develop monitoring systems to ensure quality and effectiveness, to develop social mobilization tools to create awareness and acceptance of fortified products, and to advocate for governments to provide durable and enabling environments for fortification programs.

Throughout the workshop, participants worked in country teams to determine how the material being disseminated was useful in their setting. In the final session, each team presented a 100-day action plan to outline its next steps for moving ahead with flour fortification. At a follow-up meeting, regional leaders of FFI partner organizations outlined how they could help country leaders achieve their 100-day plans.

A detailed version of this report with links to the individual presentations can be accessed at: http://www.sph.emory.edu/wheatflour/Africa/Nairobi_Summary.pdf

Guidelines reviewed

Two months later, on July 5–9, 2010, the ECSA-HC Secretariat organized two workshops in Kampala, Uganda for government, civil and private sector representatives from Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia, as well as Ethiopia. The first meeting was dedicated to an analysis of the dietary, nutritional and food trade conditions of the countries in order to take regional decisions about the ECSA fortification guidelines. Representatives from local universities and research institutions, the National Bureau of Statistics, Directors of the Nutrition Departments and Heads of the Food Fortification Committees of the involved countries attended this activity. At the second work-

National food fortification programs in Sub-Saharan Africa

Country	Staple fortified*		Micronutrients added
Côte d'Ivoire	M	Wheat flour	Folic acid, iron
	M	Edible oils	A
Ghana	V	Wheat flour	A, B1, B2, B6, B12, folic acid, niacin, iron, zinc
	V	Edible oils	A
Guinea	V	Wheat flour	B1, B2, folic acid, niacin, iron
Kenya	V	Wheat flour	A, B1, B2, B3, B6, B12, iron, zinc
	V	Maize	A, B1, B2, B6, folic acid, niacin, iron, zinc
	V	Edible oils	A
Lesotho	V	Wheat flour	A, B1, B2, B6, folic acid, niacin, iron, zinc
	V	Maize	A, B1, B2, B6, folic acid, niacin, iron, zinc
Malawi	V	Maize	A, B1, B2, B6, B12, folic acid, niacin, iron, zinc
	V	Sugar	A
		Edible oils	A
Mali	V	Cottonseed oil	A
Mauretania	M	Wheat flour	B12, folic acid, iron, zinc
	M	Edible oils	A
Namibia	V	Maize	A, B1, B2, B6, folic acid, niacin, iron, zinc
Niger		Edible oils	A
Nigeria	M	Wheat flour	A, B1, B2, B6, B12, niacin, iron, zinc
	M	Maize	A, B1, B2, B6, iron
	M	Edible oils	A
	M	Sugar	A
Senegal	M	Wheat flour	folic acid, iron
	M	Edible oils	A
South Africa	M	Wheat flour	A, B1, B2, B6, folic acid, niacin, iron, zinc
	M	Maize	A, B1, B2, B6, folic acid, niacin, iron, zinc
Sudan	V	Wheat flour	folic acid, iron
Togo		Edible oils	A
Uganda	V	Maize	A, B1, B2, B6, folic acid, niacin, iron, zinc
	V	Wheat flour	B1, B2, niacin
Zambia	V	Maize	A, B1, B2, B6, folic acid, niacin, iron, zinc
	M	Sugar	A
Zimbabwe		Margarine	A, D

* M = mandatory; V = voluntary.

This table is not complete. Food fortification programs are also introduced or under development in other African countries. If you are able to supply details, please send them by email to nutriview@bluewin.ch. Thank you.

In 19 African countries iodized salt reaches at least 70% of households (source: International Council for the Control of Iodine Deficiency Disorders: http://www.iccidd.org/pages/protecting-children/global-efforts/africa.php)

shop, officials of the Bureau of Standards and Nutrition Departments collaborated to translate the policy and epidemiological recommendations from the previous meeting into food standards of fortification following the Codex Alimentarius Guidelines. Delegates from regional economical initiatives (EAC, COMESA), and international representatives of UNICEF, the World Bank, USAID-EA, MI, GAIN, FFI/CDC and the A2Z Project were also present.

The workshop participants reviewed the 2007 ECSA guidelines for food fortification with reference to the results of the nutrient intake survey recently concluded in Uganda, and Household Income Expenditure Surveys (HIES) of other countries. From this information, they were able to estimate the percentage of users, extension of use and intake distribution, based on the concept of adult equivalence (i.e. intake proportional to the energy requirements of each individual per age, gender and physiological stage). According to the survey, the main micronutrient inadequacies in Uganda were of vitamin A, vitamin B12, iron, zinc and calcium. It might be speculated that this also reflects the situation of its neighbors. The survey also found mild inadequacies of the vitamins B1, B2, niacin and folate in some inhabitants of the capital city, Kampala, but not in rural populations free of drought and hunger. Populations under dietary stress, such as in the North of Uganda, also had inadequate intakes of some B vitamins (mainly B2 and B6).

Based on the available information, the workshop participants' recommendation was to fortify wheat and maize flours with the vitamins A, B1, B2, B12, niacin and folate, and the minerals iron and zinc. Compared with the 2007 guidelines, they proposed to raise the levels of vitamin B12 and zinc, to lower the level of folic acid, and to eliminate vitamin B6, because the status of these last two nutrients appeared to be adequate in most populations. Nevertheless, vitamin B6 should be added to foods used in famine and other emergency situations, and serum folate should be assessed to confirm that women achieve the levels needed to prevent neural tube defects. The meeting suggested that NaFeEDTA might replace ferrous fumarate as source of iron for wheat flour, pending confirmation that it is technologically compatible; otherwise, ferrous fumarate is preferred.

Workshop participants in Kampala review the guidelines for food fortification

To ensure that intakes from all the fortified foods combined would be safe (below the Tolerable Upper Intake Level) and effective (above the Estimated Average Requirement) for all age groups 3 years or older, the participants analyzed the impact of the suggested fortification levels. They then translated the nutritional policies in food fortification into technical specifications in the ECSA model for fortification standards. Important parameters were: level of addition, expected (target) factory level, tolerable analytical ranges at factory and retail stores, and possible micronutrient content of each fortified food to be claimed on the labels. The Food Fortification Formulator (see Nutriview 2009/1) helped in the calculation of these values for each parameter. The ECSA-HC Secretariat plans to place its model standards on the ECSA website soon (http://www.ecsa.or.tz/).

FFI and
ECSA-HC Secretariat

News in brief:

New micronutrient information services

NUTRI-FACTS, a new information service from DSM Nutritional Products Europe Ltd, is dedicated to providing customers, healthcare professionals, health authorities, the general public and the media with non-commercial, balanced, scientific information about essential micronutrients in English, German, French and Spanish. The initiative is supported by an external Scientific Advisory Board of international nutrition experts.

The aim of the service is to increase awareness and understanding about the requirement, efficacy and safety of micronutrients, and about the complex relationships between nutrition and health, as well as to provide a balanced interpretation when results of scientific studies appear to contradict current evidence. On its website (http://www.nutri-facts.org) it offers basic information about vitamins, carotenoids, essential fatty acids and other micronutrients, as well as the latest news on their health impacts.

DSM Nutritional Products, Inc. USA, launched the new communication vehicle TalkingNutrition.dsm.com (http://TalkingNutrition.dsm.com) at the Institute of Food Technologists annual meeting (IFT10) in Chicago this year. It uses new communication tools to disseminate the latest nutrition science on vitamins, carotenoids and new nutritional ingredients for humans, and to provide

perspective on single studies. It has three separate sections, which can be independently subscribed:

1. "Perspectives on Micronutrients". This regular column adds context and perspective to show the relevance of individual scientific publications within the body of the scientific literature. It can be followed using RSS feeds, Twitter (http://twitter.com/dsmnutrition), Facebook, or other social media tools.
2. A "Calendar of Events".
3. A "Newsletter" that provides subscribers with a list of abstracts (and hyperlinks) to human studies published in the previous month pertaining to the HNH (human nutrition and health) portfolio of vitamins, carotenoids and new nutritional ingredients.

Fortified orange juice enhances vitamin D status

In this double-blind study in healthy adults, Biancuzzo et al. compared the bioavailability of vitamin D from fortified orange juice with that from a vitamin D supplement [1]. All participants were assigned to one of five groups (15–20 persons per group), and instructed to drink a glass of calcium-fortified orange juice every morning and to take a capsule every evening for eleven weeks, beginning at the end of winter. Four of the groups received 1000 IU vitamin D daily, either as D3 or D2 in orange juice or a capsule. In one group (placebo) both juice and capsules were without vitamin D. As an indicator of vitamin D bioavailability, the authors measured the area under curve of serum 25(OH)D (25-hydroxyvitamin D) concentrations against time in blood samples taken at weekly intervals.

At the beginning of the study, 64% of the participants were deficient in vitamin D (25(OH)D <20 ng/mL). The final analysis showed the following average changes (ng/mL) in the 25(OH)D concentrations of the respective groups: –1.7 (placebo); +12.8 (D3 in orange juice); +10.6 (D2 in orange juice); +9.3 (D3 in capsules); +10.8 (D2 in capsules). These results show that vitamin D2 and vitamin D3 from fortified orange juice are as effective in increasing vitamin D status as vitamin D capsules.

The authors recommend the fortification of orange juice with vitamin D2 or D3 as a resourceful way of enhancing vitamin D status in children and adults.

1. Biancuzzo RM, Young A, Bibuld D et al. Fortification of orange juice with vitamin D2 or vitamin D3 is as effective as an oral supplement in maintaining vitamin D status in adults. Am J Clin Nutr 2010; 91: 1621–1626.

Vitamin D policy changes needed

Over the last four decades it has been learned that the vitamin D endocrine system, as defined by the presence of the vitamin D receptor (VDR), operates in at least 38 tissues of the body. Current evidence shows that vitamin D is not only essential for calcium homeostasis, but also has many biological actions affecting immunity, glucose and fat metabolism, the heart and cardiovascular system, the brain, muscles and intestine, as well as cancer development.

At least a third of the world's population lives at latitudes where there is little or no synthesis of vitamin D from sunlight during much of the year. Many others avoid sun exposure because of the perceived skin cancer risk.

1. Norman AW, Bouillon R. Vitamin D nutritional policy needs a vision for the future. Exp Biol Med 2010; 235: 1034–1045. The original paper can be accessed at: http://ebm.rsmjournals.com/cgi/reprint/235/9/1034

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