

NUTRITION
.....
AND
.....
NUTRIENTS
.....

Sight and Life

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STUNTING

> Globally,

162 million under-five year olds
were stunted in 2012.

> The global trend in stunting prevalence and burden continues to decrease. Between 2000 and 2012 stunting prevalence declined from

33% to **25%**

and the number of stunted children declined from

197 million to **162** million.

> In 2012,

56% of all stunted children lived in Asia

and

36% in Africa.

Source:

UNICEF-WHO-The World Bank: 2012 Joint Child Malnutrition Estimates – Levels and trends. www.who.int/nutgrowthdb/estimates2012/en/



Guest Editorial

The Right to Nutrients Should Be a Human Right

Welcome to this special issue of *Sight and Life* magazine with its focus on nutrients. This issue is very timely, given that the importance of nutrients – and crucially of **access** to nutrients – is clearer than ever before.

The world has seen significant developments in the field of nutrition since the formulation of the Millennium Development Goals (MDGs), to be reached by 2015, which included ending hunger and reducing underweight as part of the first goal.

In 2008, the Lancet published the first landmark series on nutrition, which summarized the magnitude and consequences of the nutrition problem, as well as a number of proven and low-cost solutions. Last year, the follow-up series was published. Four critical points made by these Lancet series are:

1. Chronic undernutrition or stunting is considered the main nutrition problem because it is a key obstacle to development;
2. The window to prevent stunting is very small: from conception to two years of age;
3. Stunting at two years of age is irreversible, with effects that are long-term and intergenerational, and it is associated with ill health, poorer school performance, an increased risk of obesity, diabetes, and other chronic diseases later in life; and
4. Economic analyses indicate negative impacts of poor nutrition in early life on the overall economic development of nations.

“Stunting prevention should feature in the post-2015 development agenda”

According to the latest report of UNICEF/WHO/World Bank (2012), 162 million, or 25%, of all children under five are stunted, and considering that the current prevalence of stunting is lower than it has been in recent decades (up to 40% in 1990), many school-age children, adolescents and adults today suffer

the consequences of stunting that they experienced during their early years of life.

Prevention of stunting is central to the Scaling Up Nutrition (SUN) movement, and there is wide recognition that stunting prevention should also feature prominently in the post-2015 development agenda.

Stunting: The most critical indicator for malnutrition

The first MDG, which was formulated in 2000, set two indicators for reducing hunger: the number of undernourished people, and the percentage of underweight children under five.

Since the 2008 and 2013 Lancet series identified stunting as the most critical indicator for malnutrition and the 65th World Health Assembly in 2012 set six global targets for nutrition – including as its first goal a 40% reduction of the global number of children under five who are stunted by 2025 – there is a strong push among many stakeholders to include stunting as a target in the post-2015 development agenda.

Undernutrition: Too great a problem for nutritionists alone to solve

Although child undernutrition has long been used as an indicator or proxy for poverty, the world has never united behind making the prevention of undernutrition a goal in itself. As stunting is now recognized as a detriment to development, the prevention of undernutrition, or stunting, should be recognized as a human right. As it has such multi-sectoral causes and widespread consequences, impacting on so many aspects of life, it should not be regarded as merely a ‘nutrition problem’ that nutritionists alone should solve.

Working together to prevent stunting

As thoroughly recognized by SUN, all stakeholders need to work together to prevent stunting, including Governments, United Nations, Donors, Civil Society and the Private Sector. These stakeholders must work together at national, regional and global levels, in order to ensure access to adequate nutrition for all, in particular women and young children, and to prevent disease – which, for example, requires action by the health care sector as

well as the implementation of hygiene and sanitation measures. The call for all stakeholders to work together is easily made, but it requires the laying out of a strong, localized roadmap that clearly identifies areas and responsibilities for action for the different stakeholder groups. Division of tasks within stakeholder groups should be done transparently. Monitoring implementation and progress are key to ensuring that countries stay on track relative to their roadmaps.

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“Nutrition is mentioned sparsely in the various ‘human rights’ documents”

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In the human rights documents, nutrition is only considered as a determinant of health, and the right to food only mentions access to “nutritious food”, but none of the “human rights” documents recognizes the importance of nutrients in the sense that all required nutrients should be provided in adequate amounts. The particular need of children aged 6–24 months for nutrient-dense foods is very specific, and the fact that, for large segments of the world’s population, these needs are difficult to meet from local foods calls for a discussion of the right to nutrients in order to prevent chronic undernutrition.

Nutrition has been mentioned as a component of the “right to food,” “right to health” and “convention on the rights of the child,” yet the prevention of chronic undernutrition has not been recognized as a right. In fact, nutrition is sparsely mentioned in the various ‘human rights’ documents. This is due to the fact that nutrition is not regarded as a right in and of itself, but as an element of health or an outcome of lack of access to food.

The Universal Declaration of Human Rights, article 25, mentions both health and access to food as rights:

“Everyone has the right to a standard of living adequate for the **health** and well-being of himself and of his family, **including food**, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.”

The International Covenant on Economic, Social and Cultural Rights, meanwhile, provides the most comprehensive article on the right to health in international human rights law. **Nutrition** is mentioned as one of the determinants of health:

Article 12 of the Covenant recognizes the right of everyone to “the enjoyment of the highest attainable standard of physical and mental health.” “Health” is understood not just as a right to be healthy, but as a right to control one’s own health and body (including reproduction). States must protect this right by ensuring that everyone within their jurisdiction has access to the

underlying determinants of health, such as clean water, sanitation, food, nutrition and housing, through a comprehensive system of healthcare, available without any discrimination and economically accessible to all.

.....

“The right to adequate food shall not be interpreted in a narrow or restrictive sense”

.....

The right to food

The UN Committee on Economic, Social, and Cultural Rights defines the “right to food” as follows:

“The right to adequate food is realized when every man, woman and child, alone or in community with others, has physical and economic access at all times to adequate food or means for its procurement. **The right to adequate food shall therefore not be interpreted in a narrow or restrictive sense, which equates it with a minimum package of calories, proteins and other specific nutrients.** The **right to adequate food** will have to be realized progressively. However, States have a core obligation to take the necessary action to mitigate and alleviate hunger as provided for in paragraph 2 of article 11, even in times of natural or other disasters.”

I hope that this issue of *Sight and Life* magazine will make an important contribution to the discussion of this crucial topic

With best regards,



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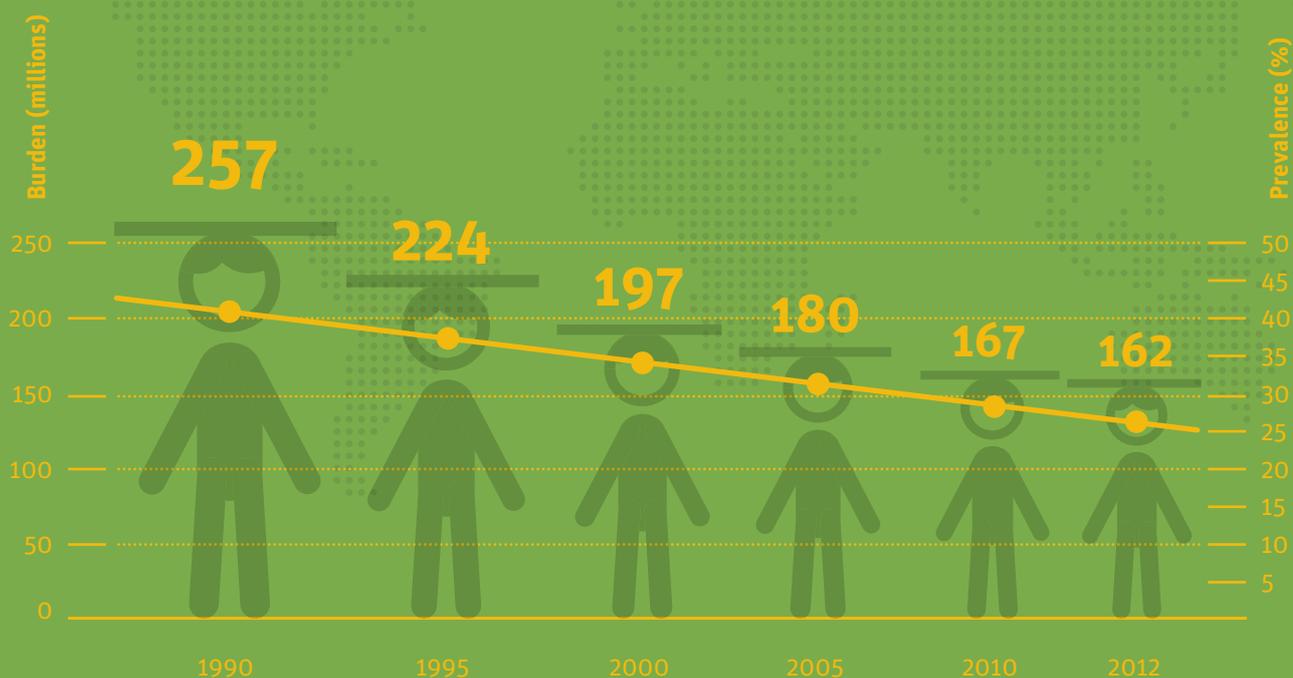
Martin Bloem

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GLOBAL TRENDS

The graph shows global trends (1990–2012) in child malnutrition indicators for stunting



Legend



Burden



Prevalence

Source:
see page 4

Klaus Kraemer, *Sight and Life*, Basel, Switzerland

Making the Food System Work for Food and Nutrition Security



Key messages

- > The food system is complex, dynamic and not fully understood – yet the conversation towards a sustainable food environment has to happen now.
- > Continuing as we are is not an option. We need to go back to fundamentals, rethink and plan with the future in mind.
- > Food and nutrition have to come together. Broad nutrition-specific and nutrition-sensitive interventions must complement each other in a repurposed food system.
- > We must think and act across the full life-course.
- > Everyone has to be part of the solution from the beginning; from design through implementation at scale. Everything we do is co-reliant.

Food systems

“Food systems produce, market, store, trade, process, retail, and promote food for consumers to acquire and use to feed their families. Food systems also provide livelihood and income to large amounts of the population around the globe, including many of the world’s poorest.”

Marie Ruel in *The Road to Good Nutrition*, 2013

The dictionary defines sustainable as “able to be maintained at a certain rate or level/able to be upheld or defended” and system as “a set of connected things or parts forming a complex whole.”

Our global food system is not sustainable; we need a dynamic, responsive food system to meet future challenges. A food system that prioritizes nutrition, recognizes the key roles of the public and private sectors, educates consumers, promotes nutrient-diverse agriculture and incorporates food fortification to fill inevitable nutrition gaps in diet. A food system where *nutrition* security is the ultimate goal.

Current global policies favor the production of staple crops at the expense of more nutrient-dense food. National policies that have subsidized cheap staple commodities (corn, wheat, rice) do not provide the right kind of food at the right time for the right people, and this has created the “triple burden” of malnutrition: 840 million people do not receive sufficient calories for their needs and go to bed hungry each night; more than 2 billion people suffer from micronutrient deficiencies or hidden hunger, making them vulnerable to diseases and premature death; and 2.1 billion people are overweight or obese, resulting in the increasing scourge of non-communicable diseases such as diabetes, heart disease and cancer.

Malnutrition is a multifaceted problem that requires action and interaction across sectors and disciplines on a scale we have never before contemplated. To address the multiple dimensions of malnutrition, the 2013 Lancet series on Maternal and Child Nutrition highlights the need for both nutrition-specific (breastfeeding, supplementation, fortification, etc.) and nutrition-sensitive interventions (social protection, education, agriculture with a central role in the production of safe and nutritious food and livelihood, etc.). Perhaps the ‘etc.’ is critical and we have not yet cast the net widely enough, focusing on just some of the known and easy (perhaps even safe!) interventions. There is no doubt that agriculture has a vital role to play and we should ensure that a nutrition goal is included in each element of the agriculture-food value chain. These goals include improved inputs such as nutrient-enhanced fertilizers and seeds for biofortified crops; avoidance of nutrient losses and contamination during storage and transport, food processing, and fortification.

These are important components, but they are not sufficient in themselves to address the global burden of malnutrition,

and they are certainly not sufficient to increase resilience to weather, food price hikes and other shocks. Over the past decades, we have even been misguided by the siloed agricultural objectives of increased yields and the term “*undernourishment*” in Millennium Development Goal 1. A mere record of the people living on less than 2,100 kcal per day (from FAO food balance sheets) is not the compass we should be using to guide us in addressing malnutrition. It is therefore good news that other, more nutrition-relevant targets such as stunting, overweight and dietary diversity (which must include fortified foods) are being considered for incorporation in the post-2015 Sustainable Development Goals.

But even so, we still have to look at a bigger, more complex, shifting and challenging environment.

Hunger in a world of plenty

“Every day, more than 840 million people go hungry in a world of plenty ... Two billion people suffer from the “hidden hunger” of malnutrition. Poor nutrition also means some 1.4 billion people are overweight, with about one-third obese and at risk of coronary heart disease, diabetes or other health problems. The key to better nutrition, and ultimately to ensuring each person’s right to food, lies in better food systems – smarter approaches, policies and investments encompassing the environment, people, institutions and processes by which agricultural products are produced, processed and brought to consumers in a sustainable manner.”

Secretary-General Ban Ki-moon on World Food Day 2013

Stuck in our silos

Without doubt, we have to address both food security (quantity) and nutrition security (quality) across the life-course. The agriculture-food value chain is just one component of a more extensive system. Food and nutrition security have been separated for many years without a major reduction in the global burden of malnutrition. A systems-thinking approach will be key to achieving food and nutrition security and increasing resilience, for each element of the food system is interdependent, and each is equally important. We remain too stuck in our silos. Ongoing competition between sectors for individual attention, influence, and funding makes it hard to come together in more than just words. This silo thinking is an obstacle to the implementation of nutrition-sensitive and nutrition-specific interventions using cross-sector platforms such as social protection. We therefore need an implementation science approach that assesses the local context, leverages and effectively uses local assets and infrastructure, and draws on multidisciplinary functions to design,

plan, implement, monitor and evaluate models that deliver the appropriate nutrition solutions to the right people in the right place at the right time.

A systems approach may appear a complex undertaking and difficult to operationalize, but this approach has been successfully applied in biology and medicine, and it holds great promise in the light of current innovations in real-time “big data” analyses and mobile technologies. Mobile technologies have been deployed for the early detection of influenza outbreaks, and have been used to identify the movement of displaced people in disasters such as the Haiti earthquake. Similarly, food prices mined from Internet information were found to closely match the official Consumer Price Index in six countries in Latin America. In addition, the number of tweets linked to the rice price in Indonesia were found to reflect food price inflation statistics. Thus, social media may have great potential as an early-warning system for food price shocks and could be used to identify areas susceptible to shocks, helping policy-makers to develop long-term solutions to increase resilience.

We should not shy away from the many dimensions of a nutritious food system which is inextricably linked to other sectors such as health, water, sanitation, education, and social protection. Rather, we should see this challenge as an opportunity to innovate, with novel models and technologies not yet anchored in our systems thinking and new iterations of modeling algorithms, in order to address malnutrition in a holistic and sustainable manner so that we address its complexity as a whole and not piecemeal.

Big data

“Big data is data that exceeds the processing capacity of conventional database systems. The data is too big, moves too fast, or doesn’t fit the strictures of your database architectures. To gain value from this data, you must choose an alternative way to process it.”

Edd Dumbill, *Big Data*, March 2013, 1(1): 1–2

An in-depth understanding of the food system in its totality should inform policy-making and programming and, importantly, it should incentivize the food industry/private sector to innovate, produce and distribute nutritious food. All actors in the food market – from smallholder farmers to local, regional and transnational food producers and retailers – have an important role to play in a modernized food system. To build this we need to create a fine balance between markets and their regulation, which has the ultimate goal of making the food system more nutritious, affordable, dynamic, responsive and sustainable. Key to framing this balance will be the creation of demand for

affordable, nutritious food, including fortified/biofortified food. It is unacceptable that many rural and urban markets in developing countries are dominated by foods that either provide empty calories or are not locally produced. A certain nutrient profile for different foodstuffs should be met, with fortification playing an important role, and small- and medium-sized local enterprises should be developed and mentored.

Yet the question remains as to who should take responsibility for the minimum standards for food quality.

Ensuring food and nutrition security

“Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”

World Food Summit Plan of Action, 1996

As this definition makes clear, addressing undernutrition is about the availability of, and access to, nutritious food. It is also, however, about awareness of the importance of nutritional choices, storage and cooking choices, and general health and hygiene – all of which fall within the scope of personal food preferences. Ensuring food and nutrition security is therefore about production, consumption, personal behavior, and supporting frameworks.

Creating demand for fortified food

Creating demand for nutrient-rich fortified food is challenging because its value for nutrition and health is not immediately recognized. This is why this kind of product is also called a “credence” good. Why would one take a micronutrient supplement or choose a fortified product if there is no immediate response to it in the body? Good nutrition does not result in instant improvement in health – in fact the benefits are often only seen over generations. The solution being offered has to be related to the local context and has to be appealing, even aspirational.

Creating this consumer ‘desire’ will require a deep dive into consumer preferences, income and cultural mores. We should be wary of the promotion of nutritious brands offered at a higher price, with price being leveraged by consumer belief in the health quality of the product. At great expense, impoverished families buy an imported and highly aspirational brand of a complementary food, share it among all children in the household in hopes of sharing nutrition among their family, and thus eliminate the benefit to the infant or young child for whom the manufacturer actually intended it. We need to focus attention on local food systems so that they can provide quality nutritious, affordable food which is easily accessible for regular use.

Market forces plus government interventions

Peter Timmer, Professor Emeritus Harvard University, an eminent food policy scientist, in the most recent edition of SCN News, wrote the following in response to the proposition “What if food is considered a common good?”

“Treating food as a human right or as a common good makes effective food policy analysis, design and implementation almost impossible. We will end up with levels of hunger, and low life expectancies, that were prevalent in the Middle Ages.” Timmer goes on, *“In all of the successful escapes from hunger over the past two centuries ... markets have done the heavy lifting ... At the same time, none of the escapes from hunger were driven entirely by market forces. Governments had to intervene in myriad ways, from stabilizing the economic environment to providing critical public goods such as transportation and communication networks, agricultural research and development, and access to quality health and education facilities.”*

We thus need public-private partnerships that go beyond the traditional technology or knowledge transfer to ones where private-sector partners lead together with public-sector entities to achieve backward and forward integration in product development, distribution, and marketing of food. In other words, we need to create transformative *partnerships* that are embedded in a context where culturally appropriate food products are developed that meet nutritional needs of consumers across the life-course.

Demand for nutritious food should be created through public-sector-driven awareness campaigns. Structured demand via vouchers or conditional cash transfer must be created by governments and development agencies to ensure access to nutritious foods by the most vulnerable. Market demand for nutritious food products, meanwhile, should be driven through commercial advertising, aspirational branding, sales strategies and mobile outreach.

This bottom-up approach leverages local resources for a more efficient use of natural, human, and financial assets. It anticipates potential problems, offers tailored solutions, and advances stakeholder management and relationship building. By gaining insight into each element of the food system – from local farmers and food producers through local wholesalers to marketing agencies, institutional buyers and consumers – we can ensure the safe production, distribution, and marketing of affordable, nutritious food. With this insight, we can invest in local entrepreneur relationships to create new businesses starting from, and designed to serve, the growing emergent consumer class who are beginning to exercise choice by demanding more for their money.

Impact of malnutrition on GDP

For countries already struggling with multiple issues that lead to constrained development potential, the additional loss to GDP

due to malnutrition underlines the importance of food and nutrition security. Africa and Asia lose 11% of GDP every year due to malnutrition. Reasons for this are numerous: The impacts of poor nutrition in a child’s first 1,000 days will go on to influence an individual’s full productive potential; inadequate nutrition for adolescent girls affects their birth outcomes and their long-term health; morbidity in the workforce due to poor nutrition leads to loss of production; and increasingly, poor nutrition among aging populations increases the risk of non-communicable diseases. Unless action is taken, malnutrition’s devastating impact on people and prosperity in Africa is expected to remain the same until 2050.

It is with this in mind that international policy-makers are increasingly underlining the importance of food and nutrition security to national government policy-makers. In the words of Danish architect Bjarke Ingels: *“Sustainability can’t be like some sort of a moral sacrifice or political dilemma or a philanthropic cause. It has to be a design challenge.”*

If the nutrition community is to take the lead in creating a sustainable food environment, we have to face the challenge and start designing the future.

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The Road to Food and Nutrition Security

.....
 To ensure a healthy plate of food,
 every day, every season, for everyone.

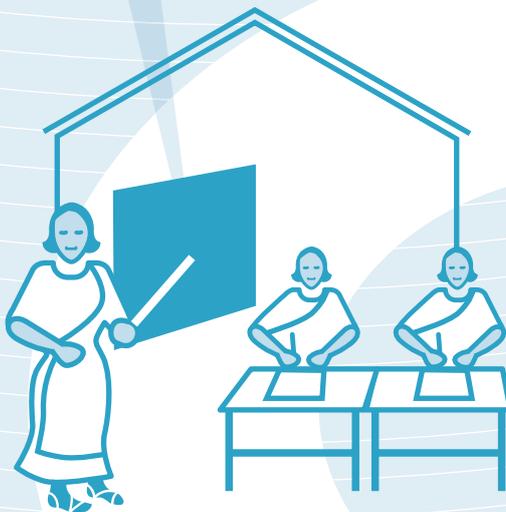
**Leveraging investments in the
 agriculture-food value chain and education
 to improve food and nutrition security.**

Investing in education

Food and nutrition security improves
 as women's level of education improves.

Household expenses

As a result of the food crisis in 2012, 44 million people
 were pushed into poverty. The poor are currently
 spending 50–80% of their income on food; food price
 spikes leave little money to spend on nutritious foods.



Household food utilization

Women are responsible for selecting and preparing food.
 The quality of the meals is critical for food and nutrition security.



1 in 8 go hungry

Hunger and malnutrition are the number one risk to health worldwide – greater than AIDS, malaria and tuberculosis combined.



Investing in agriculture

Supporting the work of farmers improves food and nutrition security and economic growth.



Fortification initiatives

Fortification of foods enhances micronutrient density.



Improvements over the years

From 1990 to 2010, rates of undernourishment fell from 24% to 15%. The poverty rate fell from 47% to 24%.

Policies that protect and promote nutrition along the food value chain can deliver significant improvements in dietary quality and diversity.

Determining Retinol Levels in Breast Milk

The effect of freezing and thawing samples on the consistency of rapid assay determinations using the iCHECK®FLUORO

Christine Whang, Odilia Bermúdez, Anne Marie Chomat, Noel W Solomons
 Centre for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM), Guatemala City, Guatemala

Key messages

- > Measurement of retinol concentrations in human milk can provide important public health insights.
- > The convenient measurement of vitamin A in foods is a boon to the field.
- > The iCHECK® FLUORO device offers user-friendly analysis of specimens, close to the site of the sample collection.
- > The ability to store milk samples for a prudent interval after collection has a number of practical imperatives.
- > The standard -20 °C freezer is the coldest alternative likely to be commonly available where surveys are conducted.
- > The iCHECK® FLUORO has proved its utility in the hands of several institutions in Guatemala.
- > This study seems to provide reassurance that samples can be stored in freezers for months without any important distortion of the values.

The value of measuring retinol concentrations in breast milk

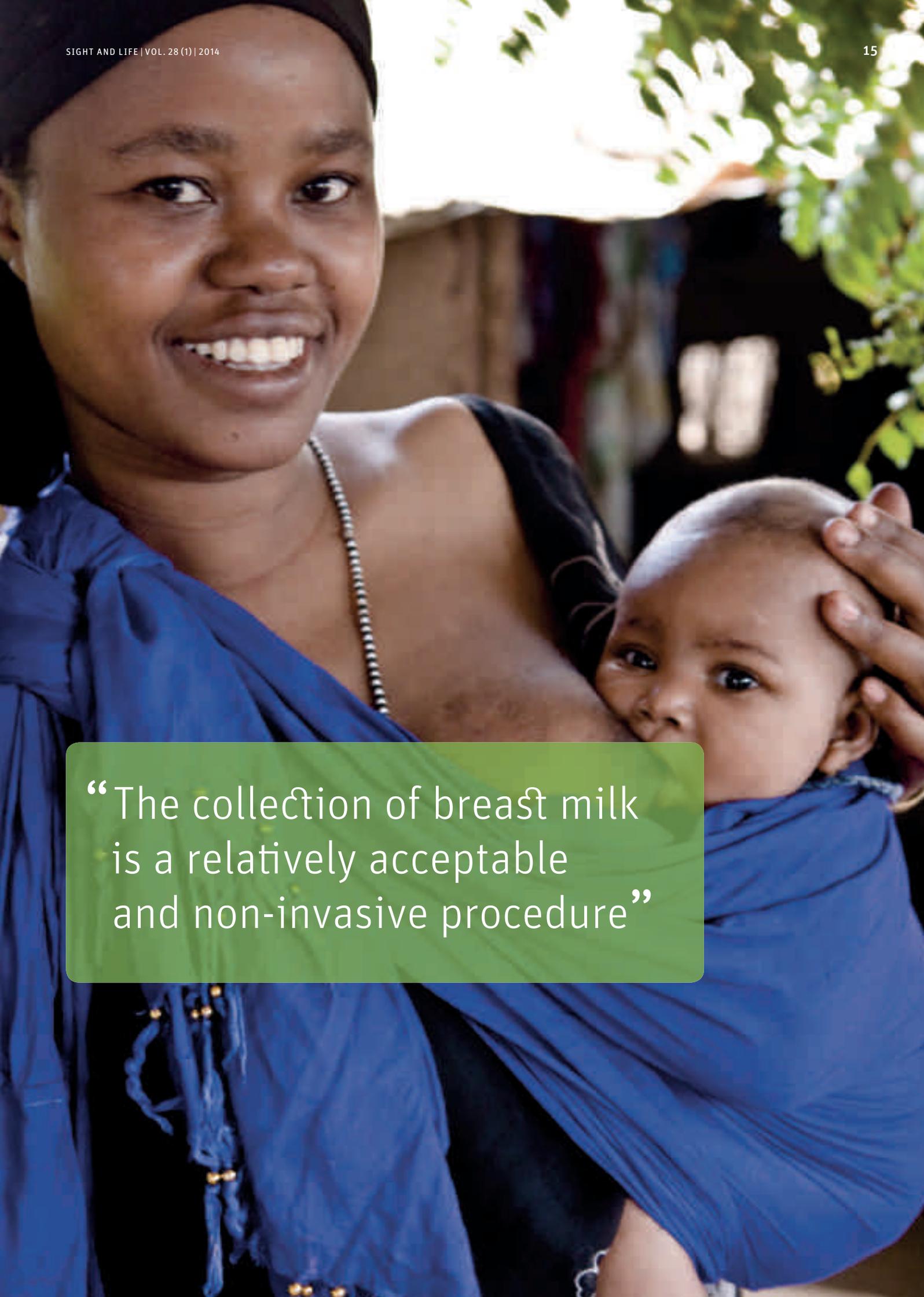
There are various important reasons why measurement of retinol concentrations in human milk can provide important public health insights, and where a rapid assay would be a useful sur-

vey tool. The collection of breast milk is a relatively acceptable and non-invasive procedure. Stoltzfus and Underwood in 1995¹ suggested that the concentration of retinol in samples of human milk could represent a non-invasive indicator of vitamin A status for a population. In 2003, Ross and Harvey² proposed international criteria for deficient (< 300 µg/L) and adequate (≥ 700 µg/L) vitamin A concentrations in human milk. On an individual level, an average and stable value for maternal milk's vitamin A content would provide an estimate of the intake of dietary vitamin A for an exclusively breastfed infant, in the 0 to 6 months age-range. Recommended Nutrient Intakes (RNI)³ are 400 µg RE/day and the Adequate Intake (AI)⁴ are is µg RAE/day in the first semester of life. One could use this tool on a case-by-case basis to evaluate the degree of adequacy of habitual intakes.

Convenient analysis on site

The iCHECK® FLUORO⁵ device is a compact, portable, battery-powered instrument designed to provide rapid quantitative assessment of vitamin A in foods including fortified sugar and human milk, manufactured by BioAnalyt GmbH of Teltow, Germany. It seeks to offer convenient, immediate, and user-friendly analysis of specimens, close to the site of the sample collection. The *Sight and Life* Magazine has been in the forefront of providing information about the iCHECK®.^{6,7}

In the former article,⁶ the authors injected the intriguing specification: "preliminary results suggest that this method works acceptably well in liquid and unfrozen samples of milk." They followed this up with the comment: "Additional experiments are ongoing ... for milk after freezing or drying." Given these existing doubts about an effect of freezing and thawing on the reliability of vitamin A analysis in milk planted by this phrasing of the developers, we sought independently to examine the stability of the system of iCHECK® FLUORO instrument vis-à-vis frozen conservation of samples over a short-term (days) and medium-term (months) time-frame.

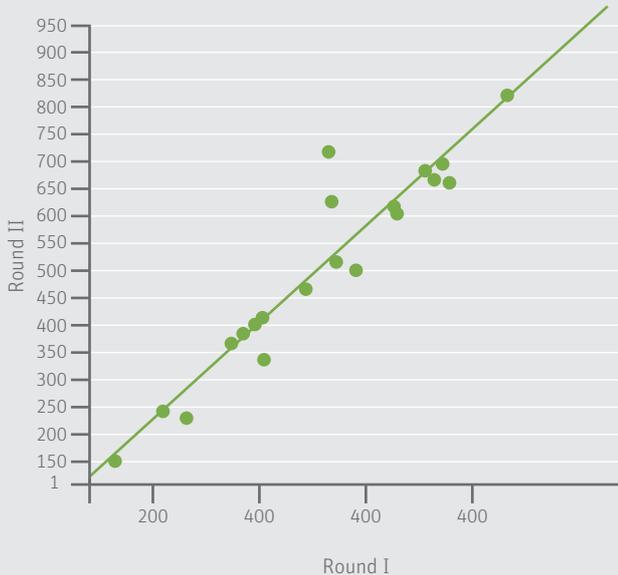
A close-up photograph of a woman with a warm smile, wearing a black headwrap and a blue wrap. She is holding a baby who is also wrapped in blue fabric. The woman is looking towards the camera, and the baby is looking slightly to the side. The background is softly blurred, showing some greenery and a wooden structure.

“The collection of breast milk is a relatively acceptable and non-invasive procedure”

TABLE 1: Quality control of triplicate readings for fresh (round I), short-term frozen (round II) and long-term frozen (round III) samples (n=21)

	Coefficient of variation		
	Round I	Round II	Round III
Mean	2.52%	2.24%	2.82%
SD	1.28%	1.39%	1.07%
Median	2.22%	1.99%	2.99%
Min	1.15%	0.55%	0.41%
Max	6.63%	7.47%	4.74%

FIGURE 1: Scattergram for unadjusted retinol concentrations



Methods

Study population

The present study was part of a larger survey inquiry into the average milk vitamin A concentration among lactating women in remote villages of Mam-speaking Mayan indigenous residents of the Western Highlands of Guatemala. Within a larger collection-frame of 60 women, aged 13 to 43 years and 4 to 6 months post-partum, we selected a subset of 21 specimens for serial analysis.

Data collection and chemical analysis

In order to standardize time since the last feed and extract the full breast, participants were asked to refrain from breastfeeding from the breast of their choice throughout the course of an hour-long nutrition workshop. The trained field team then collected breast milk with manual pumps from the full breast into sterile polypropylene containers. The fresh milk was stored away in an icebox, sealed away from light, and transported to a local labo-

ratory for analysis. Fat content was quantitated by estimating the sample's creatocrit, namely the percentage of the volume of milk fat in a capillary tube after microcentrifugation. Plain microcapillary tubes were used to draw up the sample, which was placed into a microcapillary centrifuge for three minutes of centrifugation. A microcapillary reader was used to read creatocrit measurement as percentage of the total volume of milk. The following equation was used to estimate fat concentrations in g/L, as outlined by Lucas, et al.⁸

$$\text{Fat} = (\text{Creatocrit \%} - 0.59) / 0.146$$

The iCHECK® FLUORO photometer and iEx Mila vials were used to analyze retinol concentration in the collected samples. Upon analyzing the fresh milk samples (round I), one-milliliter split-samples were prepared and stored in a -20 °C freezer for a short-term period of 20–26 days (round II) and retinol values were measured thereafter. Another set of one-milliliter split-samples were frozen in the same conditions for a long-term duration of 260–266 days (round III) and retinol values were subsequently obtained.

In response to Stoltzfus and Underwood's¹ conclusion that direct sunlight can destabilize milk retinol, all analyses were conducted in a dim room. The milk sample was first swirled to homogenize the aqueous and lipid components and 0.5 mL was injected into the vial using a syringe. The sample was shaken for 10 seconds and allowed to rest for five minutes. The vial was placed inside the photometer and after 30 seconds retinol values were determined in µg/L. These values were normalized for milk fat (µg/g). Without removing the vial from the well, three readings of the same vial were recorded to evaluate the coefficient of variation.

Statistical analyses

SPSS version 21 was used for all statistical analyses. Descriptive statistics were used to describe retinol (unadjusted and fat-adjusted) and milk-fat concentrations in each of the serial readings (mean, median, standard deviation, coefficient of variation).

TABLE 2: Unadjusted and adjusted vitamin A levels for fresh (round I), short-term frozen (round II) and long-term split-sample freezing (round III) experiment (n=21)

A.	Unadjusted retinol concentrations ($\mu\text{g/L}$)		
	Round I	Round II	Round III
Mean	543	528	495
SD	222	205	201
Median	449	509	530
Min	128	152	151
Max	1009	948	993
Mean I vs II	-	-2.8 ± 7.7	-
Mean I vs III	-	-	$-8.8 \pm 9.4\%$

B.	Estimated fat concentration (g/L)		
	Round I	Round II	Round III
Mean	51	57	57
SD	21	26	29
Median	47	58	58
Min	23	16	17
Max	99	106	126
Mean I vs II	-	$-11.8\% \pm 23.8\%$	-
Mean I vs III	-	-	$-11.8\% \pm 23.8\%$

C.	Fat-adjusted retinol concentrations ($\mu\text{g/g fat}$)		
	Round I	Round II	Round III
Mean	10.9	10.0	9.6
SD	3.6	3.1	3.7
Median	10.5	9	9.5
Min	5.4	6.8	4.4
Max	17.5	18.7	19.6
Mean I vs II	-	$-8.3\% \pm 11.4\%$	-
Mean I vs III	-	-	$-11.9\% \pm 5.7\%$

Differences in retinol concentration between serial measurements were assessed via paired t-test. Pearson correlation coefficients and Lin concordance correlations were assessed for milk retinol for round I vs round II, round I vs round III, and round II vs round III.

Results

Inter-reading coefficients of variation for retinol assay and milk-fat estimation

As stated, the reading of the retinol concentration in each prepared milk extraction in an iEX vial was recorded on three successive turns, without removing the vial from the well. **Table 1** provides the descriptive statistics for the coefficients of variations for serial readings. The quality control of repeat triplicates was $2.52 \pm 1.28\%$ for round I fresh sample readings,

$2.24 \pm 1.39\%$ for round II short-term frozen storage and $2.82 \pm 1.07\%$ for round III long-term frozen storage.

Descriptive statistics for milk retinol concentrations and milk-fat estimation

Shown in the **Table 2** are the descriptive statistics for the mean, SD and median retinol concentrations for the three serial rounds of iCHECK® assaying of the selected samples. The mean unadjusted retinol concentrations from the fresh full-breast collection series (round I) falls within the marginal range at $539 \pm 221 \mu\text{g/L}$, compared to a comparable mean of $528 \pm 205 \mu\text{g/L}$ after short-term frozen storage (round II).

Using the creatocrit procedure to estimate the fat content of the milk samples at each sequential assay occasion, we also

TABLE 3: Inter-assay Pearson correlation coefficients and Lin concordance correlations

A. Unadjusted milk retinol				
	Pearson Correlation Coefficient		Lin Concordance Correlation	
	r value	P value	r value	P value
Round I vs II	0.965	p<0.001	0.980	p<0.001
Round I vs III	0.963	p<0.001	0.967	p<0.001
Round II vs III	0.981	p<0.001	0.990	p<0.001

B. Estimated fat concentrations (g/L)				
	Pearson Correlation Coefficient		Lin Concordance Correlation	
	r value	P value	r value	P value
Round I vs II	0.776	p<0.001	0.857	p<0.001
Round I vs III	0.663	p=0.001	0.771	p=0.001
Round II vs III	0.944	p<0.001	0.970	p<0.001

C. Fat-adjusted milk retinol				
	Pearson Correlation Coefficient		Lin Concordance Correlation	
	r value	P value	r value	P value
Round I vs II	0.376	p=0.93	0.540	p=0.044
Round I vs III	0.306	p=0.177	0.458	p=0.083
Round II vs III	0.873	p<0.001	0.923	p<0.001

present the fat-adjusted concentrations of retinol in the specimens. Milk fat was in the expected 5–6% range. In specific terms, the median fat content of fresh milk was 47 g/L rising to and stabilizing at 58 g/L after both intervals of freezing.

Inter-rounds Pearson and Lin correlation coefficients

The inter-assay Pearson correlation coefficients and Lin Concordance correlations for milk retinol are shown in **Table 3** for round I vs round II, round I vs round III, and round II vs round III. As an example, **Figure 1** provides the scattergram for unadjusted retinol concentrations for rounds I vs II. Also illustrated are the corresponding data for percentage of milk fat, and fat-adjusted retinol concentrations. We find highly significant associations for both Pearson and Lin correlations for all comparisons, with r values consistently > 0.9. The inter-round associations for fat concentration are equally significant, with r values somewhat lower than for unadjusted retinol between round I and the subsequent rounds. Correlation coefficients rise to > 0.9 for the correlation of fat levels in rounds II vs III. The consequences of the slight drift in fat from the first to the subsequent rounds are magnified in the lower correlation coefficients between fat-adjusted retinol concentrations. However the r values approach or exceed 0.9 in the association of the final two rounds of freezing.

Sensitivity and specificity contingency-table analysis at selected cutoff criteria by round of analysis

Figure 2 presents a matrix of two-by-two contingency tables for the sensitivity and specificity estimates at the two diagnostic cut-off criteria selected: < 400 µg/L and ≥ 700 µg/L. For the lower cut-off criterion, respectively high values for both sensitivity and specificity were found between round I and II and round I and III, in which sensitivity reaches 100%. However, at the interface of below and above the Ross and Harvey² adequacy criterion, much lower specificity is seen, as this value includes most of the values obtained.

Discussion and conclusions

Whereas the rapid analysis device is simple and convenient enough to set up and employ on a same-day or next-day basis over the duration of a study, analytical good practice is better done in single assay runs with a single observer for situations in which samples will be compared to one another; these procedures tend to reduce instrumental drift and inter-observer variability as sources of analytical error. User-friendly as the iCHECK® FLUORO is, however, those who collect milk samples in the survey may not be the same individuals doing the analysis. So, the ability to store milk samples for a prudent interval after collection has a number of practical imperatives.

FIGURE 2: Matrix of two-by-two contingency tables

		Round I vs. Round II Fresh	
		Deficient (< 400 µg/L)	Not Deficient (> 400 µg/L)
Frozen (short-term)	Deficient (< 400 µg/L)	5	1
	Not Deficient (> 400 µg/L)	1	14
	Sensitivity	93.3%	
	Specificity	33.3%	
	(+) Predictive Value	77.8%	

		Round I vs. Round III Fresh	
		Deficient (< 400 µg/L)	Not Deficient (> 400 µg/L)
Frozen (long-term)	Deficient (< 400 µg/L)	6	1
	Not Deficient (> 400 µg/L)	0	14
	Sensitivity	100%	
	Specificity	93.3%	
	(+) Predictive Value	85.7%	

		Round I vs. Round II Fresh	
		Marginal or Deficient (< 700 µg/L)	Adequate (> 700 µg/L)
Frozen (short-term)	Marginal or Deficient (< 700 µg/L)	14	4
	Adequate (> 700 µg/L)	1	2
	Sensitivity	93.3%	
	Specificity	33.3%	
	(+) Predictive Value	77.8%	

		Round I vs. Round III Fresh	
		Marginal or Deficient (< 700 µg/L)	Adequate (> 700 µg/L)
Frozen (long-term)	Marginal or Deficient (< 700 µg/L)	15	4
	Adequate (> 700 µg/L)	0	2
	Sensitivity	100%	
	Specificity	33.3%	
	(+) Predictive Value	78.9%	

The comment on “unfrozen” samples in the earlier Schweigert et al⁶ article caught our attention at CeSSIAM as we were mapping out protocol ideas for the application of the iCHECK® FLUORO technology to the Guatemalan reality, and that motivated the short-term and medium-term frozen-storage inquiry reported here. As a seminal and primary finding, the stability of the analysis system for retinol with the same instrument and after freezing at -20 °C is almost absolute up to about one month (3.5 weeks) of storage in both a group and individual sense. There was only a $-2.76 \pm 7.66\%$ change within the first month. After 8.7 months (38 weeks) of total storage, however, we observe a $-8.84 \pm 9.46\%$ average decline. As a distribution, by contrast, the median actually rose from the first to the second round and then persisted to the end of the sampling.

Interestingly, we had milk fat estimation by the creamatocrit⁸ method in our protocol, and this serves us somewhat as an internal control on drift of milk constituents. In this experience, we also had substantial stability over the whole duration of the study; the drift of the median values followed the same pattern as for retinol. Moreover, we see a certain stability in the longitudinal fat-adjusted retinol concentration in the lowest panel of **Table 2**. The lesser unit value suggests an even greater stability at first glance, but performing the detailed analysis, the mean individual changes were $-11.8 \pm 23.8\%$ through round II and $-11.8 \pm 38.1\%$ at round III.

In theory – in fact in all probability – frozen storage at the freezing temperatures of -40 °C and -80 °C would provide better preservation of the retinol for prolonged storage, but since the iCHECK® FLUORO system is designed for rapid assessment in the field, the standard -20 °C freezer is the coldest alternative likely to be commonly available where surveys are conducted. In the perspective of criteria for analytical errors in a clinical chemistry laboratory, the CVs of 4.7 – 6.6% and the ~10% decline in means, counterbalanced by an increment in median values, can be taken as acceptable stability for the purposes of a field procedure.

The issue of freezing of milk samples was first raised in this magazine

Clearly, in Guatemala and Central America, in which vitamin A fortification is a unique and heralded aspect of public health policy, the convenient measurement of vitamin A in foods is a boon to the field. This extends to the food recommended for exclusive consumption by the young infant, and for continued consumption by older infants and toddlers: human milk. The iCHECK® FLUORO has proved its utility on a number of fronts in the hands of several institutions (DSM, INCAP, CeSSIAM) in

Guatemala. The issue of freezing of milk samples before rapid assessment of vitamin A was first raised in this magazine;⁶ it has now been joined by this small response study, which seems to provide reassurance that samples can be stored in refrigerator freezer compartments for months at a time without any important distortion of the values.

Acknowledgements

The authors would like to thank Alejandra Maldonado, Marta Escobar and Eleanor Platt for their assistance in the field activities related to the recruitment of subjects and sample collections. Rosario Garcia-Meza is acknowledged for her overall coordination of the Western Highlands investigation sites. Marilyn E Scott, Kristine Koski and Hilary Wren of McGill University in Montreal, Canada are kindly acknowledged for allowing the first author to work within the lactation component of the Mam-Mamás Project.

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James Allen Olson Memorial Lecture

Emerging Science on Lutein in the Brain

Elizabeth J Johnson

Jean Mayer US Department of Agriculture
Human Nutrition Research Center on Aging at
Tufts University, Boston, USA.

Key messages

- > Extensive research suggests that dietary lutein may be of benefit in maintaining ocular and cognitive health.
- > Among the carotenoids, lutein and its isomer, zeaxanthin, are the only two that cross the blood-retina barrier to form macular pigment in the eye.
- > In infants, lutein may also play a role in the maturation of cells in the developing macula. In adults, lutein status is related to a decreased risk of age-related eye diseases.
- > The sum of the scientific evidence also suggests that lutein may be uniquely important for cognitive health at all stages of life.
- > Although lutein is not an essential nutrient, efforts may be warranted to establish recommended intakes for this dietary component.

Lutein, zeaxanthin and cognition

Carotenoids are pigments synthesized by plants. Of the 600 carotenoids identified in nature, only about 40 are present in the commonly consumed fruits and vegetables and only about 25 are found in human serum and tissues.¹ Carotenoids can be broadly classified into two classes, xanthophylls (lutein, zeaxanthin and β -cryptoxanthin) and carotenes (α -carotene, β -carotene and lycopene). Only lutein, and its isomer zeaxanthin, which are oxygenated carotenoids or xanthophylls, preferentially accumulate in the macular region of the retina to form macular pigment.² The macula is unique to humans and higher primates and is

responsible for highly developed central visual acuity. Lutein and zeaxanthin protect the macula from short wavelength blue light and oxidative stress.³ In infants, lutein and zeaxanthin may also play a role in the maturation of cells in the developing macula.⁴ Therefore, lutein may be important for visual development as well as maintenance of ocular tissues.

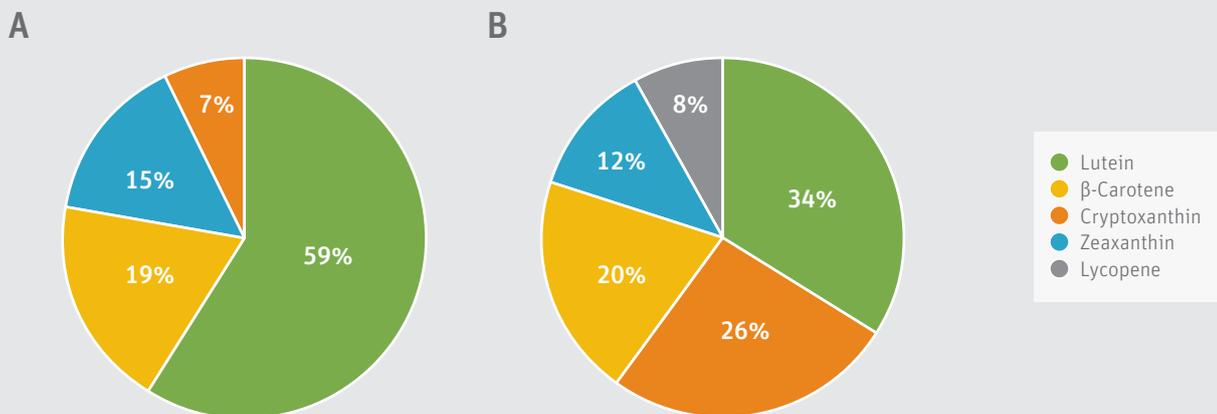
“Lutein may be important for brain function”

Scientific evidence is accumulating that lutein may be important for brain function as well. The brain is especially vulnerable to free radical attacks due to its relatively low antioxidant content, high polyunsaturated fatty acid concentrations, and its high metabolic activity.⁵ Increased lipid peroxidation and nucleic acid oxidation are found early in Alzheimer’s disease (AD), and increased levels of inflammatory markers and pro-inflammatory cytokines have been found in the central nervous system of individuals with early AD as well as with mild cognitive impairment.^{6–10} Increases in sensitivity to oxidative stress and inflammation in the aging brain lead to cognitive deficits, dietary antioxidant and anti-inflammatory agents may delay the extent of oxidative damage to neural tissues and may have an enormous impact on neural health. Lutein functions as both antioxidant and anti-inflammatory agent.^{11,12} Therefore, intake of this dietary component may be important for neural health across the lifespan.

Lutein is the dominant carotenoid in neural tissue

Lutein is found among body tissues but is the dominant carotenoid in the lens, retina, and brain.^{13–15} Lutein along with its isomer, zeaxanthin, are the sole carotenoids in the macula of the primate retina, and are referred to as macular pigment. In the macula, the concentrations of lutein and zeaxanthin are 500-fold higher than in other body tissues and are believed to be protective as blue light filters and antioxidants.¹⁶ In these roles, lutein and zeaxanthin are believed to be protective against age-related macular degeneration,¹⁷ a leading cause of visual

FIGURE 1: Carotenoid distribution in pediatric (0–11 months) (A) and geriatric (>98 years) (B) brain tissue. Adapted from ¹⁴ and ¹⁵. No α -carotene was detected in brain tissue.



¹⁵ Johnson EJ, Vishwanathan, Johnson MA et al. Relationship between serum and brain carotenoids, alpha-tocopherol, and retinol concentrations and cognitive performance in the oldest old from the Georgia Centenarian Study. *J Aging Res.* 2013 (Article ID 951786):1–13.

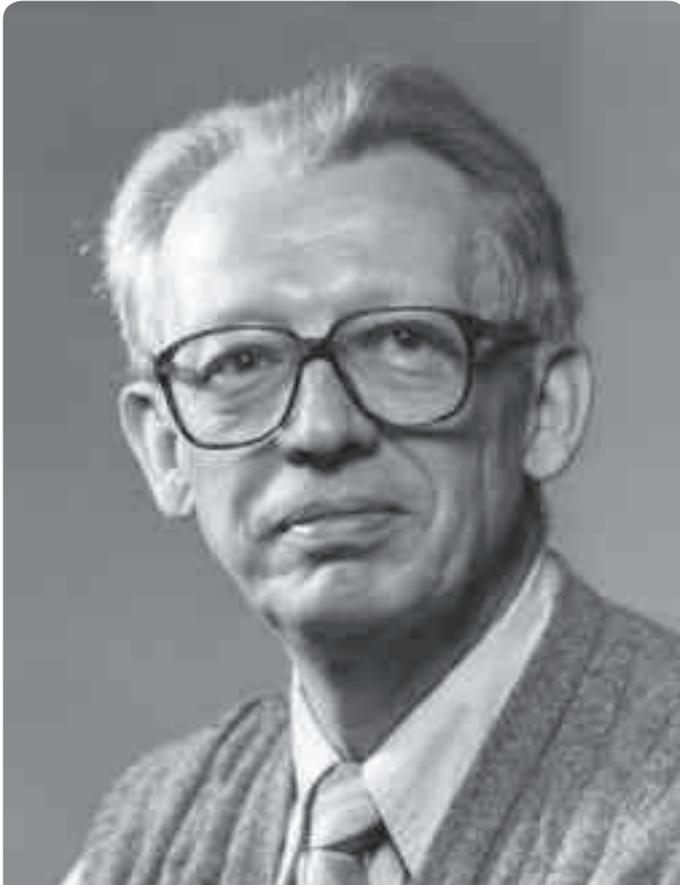
impairment and blindness in the United States.¹⁸ Increased intake of lutein is related to a decreased risk of AMD.¹⁹ Similarly, the dietary information from the Age-Related Eye Disease Study 1 (AREDS 1) found that dietary intakes of lutein and zeaxanthin were related to protection against developing AMD.²⁰ AREDS 2 (www.nei.nih.gov/areds2), a multicenter phase III randomized clinical trial, assessed the effects of oral supplementation of lutein + zeaxanthin (10 and 2 mg, respectively), and/or eicosapentanoic acid (EPA) + docosahexaenoic acid (DHA) (650 and 350 mg, respectively) as a treatment for AMD. In secondary analysis, lutein and zeaxanthin supplements on top of the AREDS 1 formula (500 mg vitamin C; 400 IU vitamin E; 15 mg β -carotene; 80 mg zinc; 2 mg copper) lowered the progression to advanced AMD in persons with low dietary lutein and zeaxanthin.²¹

As stated above, lutein is also the dominant carotenoid in human brain tissue.^{14,15} In a recent study evaluating the carotenoid content in infant brain tissue, lutein, zeaxanthin, β -cryptoxanthin and β -carotene were the major carotenoids found in the infant brain tissues. Lutein was the predominant carotenoid, accounting for 59% of total carotenoids¹⁴ (Figure 1). Lutein was higher than all other detected carotenoids in regions of the infant brain that are associated with memory, executive function, vision and hearing. Preterm infants had significantly lower concentrations of lutein in their brain compared to full-term infants despite similarity in postmenstrual age. Among formula-fed infants, preterm infants had lower concentrations of lutein and zeaxanthin compared to full-term infants. Brain lutein concentrations were not different between breast-milk-fed ($n=3$) and formula-fed ($n=5$) term decedents. In contrast,

term decedents with measurable brain β -cryptoxanthin, a carotenoid that is inherently low in formula, had higher brain lutein suggesting that type of feeding (breast milk versus formula) is an important determinant of brain lutein concentrations. These data suggest preferential accumulation and maintenance of lutein in the infant brain despite relatively lower intakes among the dietary carotenoids.²²

Lutein was also found to be the dominant carotenoid in various regions of geriatric brain tissue.¹⁵ On the contrary, carotenes (α -carotene, β -carotene, and lycopene) were predominant in matched serum, which more closely reflects dietary intake. These findings suggest that although not predominant in the diet, there seems to be a preferential uptake of lutein from the circulation into the brain, similar to what occurs in the macula. In infant brain tissue, the relative contribution of lutein to the total carotenoids is twice that found in adults, accounting for more than half the concentration of total carotenoids.¹⁴ Therefore, the greater proportion of lutein in the pediatric brain suggests a need for lutein during neural development.

The mechanism of a neuroprotective effect of lutein is not known. It has been suggested that lutein's actions involve decreased oxidative stress, activation of anti-inflammatory pathways,^{23–26} and modulation of functional properties of synaptic membranes along with changes in physicochemical and structural features. However, a protective effect of lutein may not be due to an antioxidant effect alone. α -Tocopherol, a major dietary antioxidant found in higher concentrations in the brain than those of lutein was not found to be related to cognitive function.¹⁵



Professor James Allen Olson (1924–2000)

Macular pigment is related to cognitive function in older adults

In an evaluation of a relationship between lutein and zeaxanthin status and cognitive function, healthy older subjects (70 yrs or older) in the Memphis, TN area were assessed for serum lutein and zeaxanthin, macular pigment (MP) density²⁷ and various measures of cognitive function.²⁸ MP density was significantly related to performance on a variety of indices designed to assess processing speed, accuracy, and completion ability ($P < 0.05$). These relations remained significant after adjusting for age, sex and ethnicity ($r = 0.23$ and 0.24 , $P < 0.05$). Interestingly, serum xanthophyll levels were not related to cognitive function. The relation between MP density and not serum may reflect that MP is a marker of longer lutein status than that of serum concentrations. A relationship between MP and cognitive function was also investigated in older adults ($n = 4453$, ≥ 50 yrs) as a part of the Irish Longitudinal Study on Aging.²⁹ Lower MP density was significantly associated with poorer performance on the mini-mental state examination and the Montreal cognitive assessment. Individuals with lower MP density also had significantly poorer prospective memory, took longer time to complete a trail-making task, and had slower and more variable reaction times on a choice reaction time task. The observed association

between MP and cognitive function suggests that xanthophylls embedded in neural tissue are capable of influencing cognitive function in the elderly.

Macular pigment density is a biomarker of brain xanthophyll concentrations

Lutein crosses the blood-brain/retina barrier to preferentially accumulate in the macula and brain tissue. To investigate whether MP density can be used as a biomarker of xanthophyll concentrations in the brain, Vishwanathan et al³⁰ evaluated the relationship between retinal and brain levels of lutein in non-human primates. Matched retina (4 mm punch) and brain sections from two groups of rhesus monkeys on a lifetime carotenoid-free diet, except for either lutein or zeaxanthin, were extracted for carotenoids. Lutein and zeaxanthin concentrations in the retina significantly correlated with lutein and zeaxanthin in the cerebellum. There was a trend for such a relationship in the occipital cortex ($P < 0.055$). Zeaxanthin levels in the frontal cortex and pons were significantly related to zeaxanthin levels in the retina. Therefore, MP density can be used as a biomarker of lutein and zeaxanthin contained in primate brain tissue. These results shed light on the observed relationships between MP density and cognitive function. That is, higher MP densities likely reflect higher brain xanthophyll concentrations which may function in cognition, as is discussed in the following section.

Brain concentrations of lutein are related to pre-mortem measures of cognitive function

Johnson et al evaluated the relationship between cognition and lutein and zeaxanthin levels in brain tissue of decedents > 98 yrs at death for whom pre-mortem cognitive function was assessed. Subjects ($n=29$) were from the Georgia Centenarian Study¹⁵ and agreed to donate their brains after death. Brain tissues (cerebellum, frontal, occipital, temporal cortices) were analyzed with standard lipid extractions and reverse phase HPLC. Cognition measures included: global cognition, primary degenerative dementia, delayed recall, delayed recognition, retention, intelligence quotient (IQ), and executive function.

Lutein and zeaxanthin concentrations in occipital and lutein levels in temporal cortices were significantly related to retention. Lutein levels with and without zeaxanthin in occipital cortex tended to be related to global cognition ($P < 0.066$) and with retention in cerebellum and frontal and temporal cortices ($P < 0.089$). Lutein in temporal cortex tended to be related to IQ ($P < 0.10$). Zeaxanthin in occipital lobe was significantly related to retention. There were no positive trends or significant relationships with primary degenerative dementia or executive function. These results suggest that higher levels of lutein and zeaxanthin in brain tissue may be important in cognitive func-

tion in the elderly. Among the carotenoids, lutein was the most consistently associated with a range of cognitive measures.

“Evidence suggests lutein is important to optimize neural health”

Lutein supplementation in older women improves cognitive function

A role for lutein in cognitive function was evaluated in a randomized, placebo-controlled double-blind study in healthy elder women.³¹ Forty-nine women (60–80 yrs) were randomized to receive DHA (800 mg/d) ($n=14$), lutein (12 mg/d) ($n=11$), a combination of DHA and lutein ($n=14$) or placebo ($n=10$). Subjects underwent cognitive tests measuring verbal fluency, memory, processing speed and accuracy, and self-reported mood at randomization and upon completion of the trial. Following supplementation, verbal fluency scores improved significantly in the DHA, lutein, and combined treatment groups ($P < 0.03$). Memory scores and rate of learning improved significantly in the combined treatment group ($P < 0.03$), who also displayed a trend toward more efficient learning ($P=0.07$). Measures of mental processing speed, accuracy and mood were not affected by supplementation. These findings suggest that DHA and lutein supplementation may work together in an additive/synergistic manner to improve cognitive functions in older adults.

Conclusions

Lutein is of particular interest among the carotenoids for its role in ocular and brain health because it is preferentially taken up into neural tissue. Recently, lutein has been suggested to play a role in neural development as well as age-related ocular and cognitive health. Although lutein is not an essential nutrient, evidence is accumulating to suggest that lutein is important to optimize neural health. Given this, efforts may be warranted to establish recommended intakes for this dietary component.

Acknowledgements and author declarations

Supported by USDA 58-1950-7-707. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the US Department of Agriculture. Author declaration: E J Johnson, no conflict of interest.

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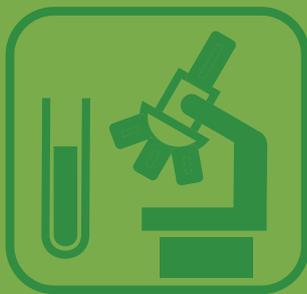
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Newborn Vitamin A Dosing is Feasible in Bangladesh

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- > NVAS is a promising new intervention that is feasible in Bangladesh where a high proportion of births take place in the home. Further improvements are needed, however, to reach a higher proportion of newborns within the first two days of life.

The urgent need to address mortality rates

There is an urgent need to address high neonatal and infant mortality rates in many developing countries. In Bangladesh, 104,000 infants die each year before their first birthday,¹ most of whom do not survive past six months.² A major public health challenge has been to reduce early infant mortality through effective and practical interventions. Vitamin A (VA) supplementation has been long known to reduce child mortality over six months of age, but it may similarly reduce early infant mortality if given at birth.

Newborn vitamin A supplementation (NVAS) is a promising new intervention in South Asia that involves supplementing infants shortly after birth with a single, large oral dose of vitamin A (50,000 IU). Evidence for intervention efficacy is available from three field trials in southern Asia (Indonesia, India, and Bangladesh), which show significant reductions of $\geq 15\%$ in infant mortality in the first six months of life.^{3,4,5} When combined, the results suggest that infant mortality can be reduced by approximately 18% in southern Asia by giving newborns a single, oral dose of vitamin A.^{6,7} Results from two other studies in the region, in Pakistan and India, have not yet been published.

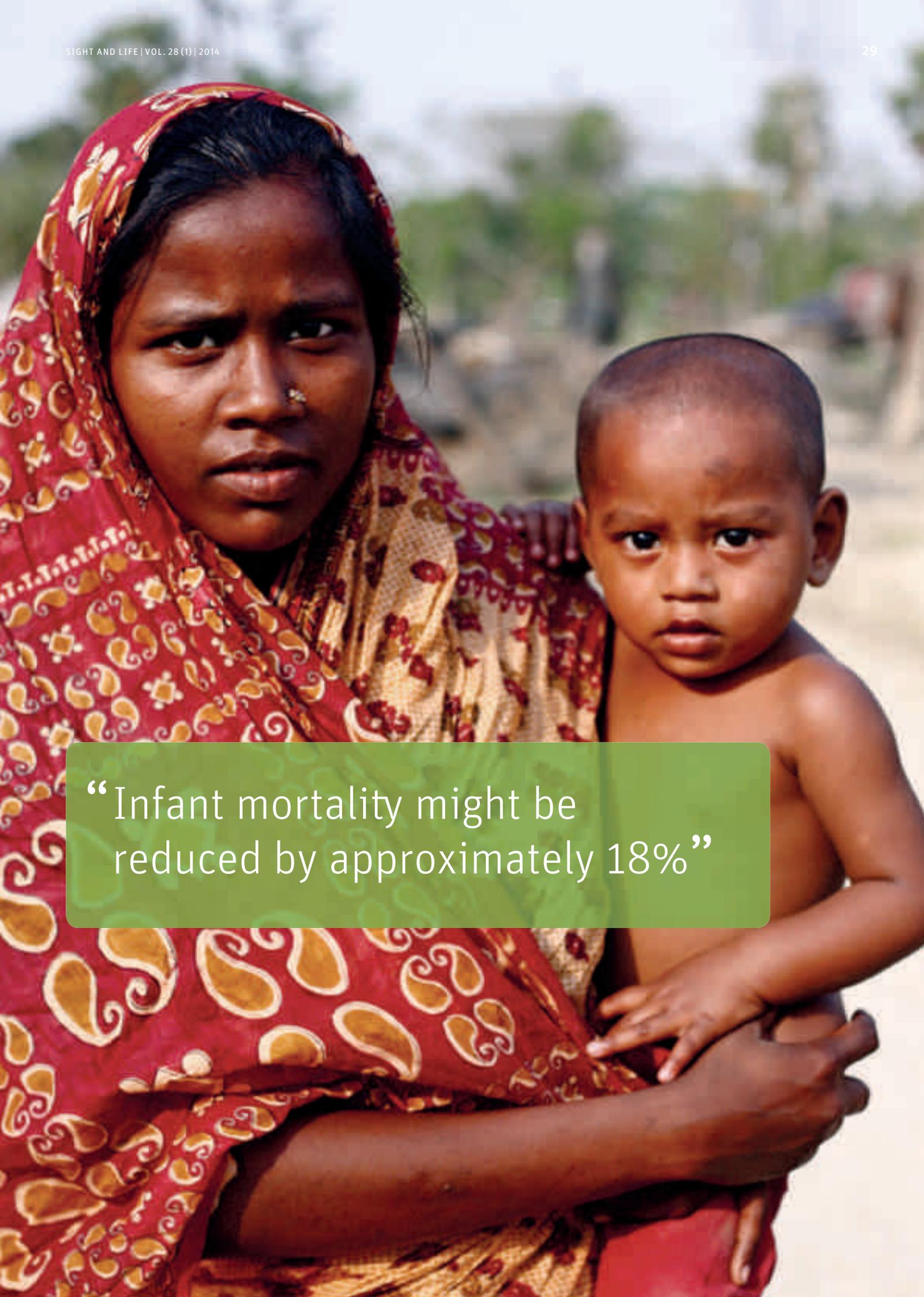
In an effort to explore the feasibility of NVAS as a life-saving intervention, the Government of Bangladesh approved pilot testing in three districts: Tangail, Pirojpur and Nilphamari.^{8,9} Micronutrient Initiative and USAID's A2Z project, in collaboration with Johns Hopkins Bloomberg School of Public Health and other country partners, set out to test feasible delivery models to reach newborn infants with vitamin A in the context of a high proportion (71%) of births occurring in the home and low (30%) postnatal care for mothers and newborns.¹⁰

Developing a feasible delivery model

The overall objective of the pilot was to identify, develop and evaluate a feasible delivery model for delivering newborn VA

Key messages

- > Newborn vitamin A supplementation (NVAS) may be a promising new intervention in contexts with moderate to severe maternal vitamin A deficiency in South Asia.
- > We tested the feasibility of integrating NVAS into two existing health contact points under existing health services in Bangladesh.
- > After five months of implementation, NVAS was delivered to 54.7% and 44.1% of newborns within 30 days of life.
- > Including NVAS as part of postnatal services appeared to significantly increase postnatal visits twofold in both models.
- > NVAS was well tolerated by infants, achieved reasonably high coverage, was easily integrated into existing health service delivery contacts within a five-month implementation time span, and increased postnatal visit coverage rates.

A photograph of a woman and a young child. The woman is wearing a red headscarf with a gold and white paisley pattern. She has a serious expression and is looking slightly to the left. She is holding a young child who is looking directly at the camera with a neutral expression. The background is a blurred outdoor setting with trees and a building.

“Infant mortality might be reduced by approximately 18%”

FIGURE 1: Counseling card given to pregnant women.



that could be efficiently integrated into existing community-based maternal and neonatal health services. Secondary objectives were to explore the acceptability of NVAS among intended recipients; the manner and practicality in which NVAS dosing could be implemented within existing health service contact points considering resource, time and other constraints; and the extent to which integrating this new intervention into existing health service contact points might change those services.

A Technical Advisory committee was formed consisting of the Canadian International Development Agency, UNICEF, Government of Bangladesh partners (Institute of Public Health Nutrition, Directorate General of Health Services, Directorate of Family Planning, the Revitalization of Community Health Care Initiative, and the Bangladesh Medical Research Council), the Micronutrient Initiative, Johns Hopkins University and the A2Z Micronutrient Project. Formative research was undertaken to explore feasible delivery platforms or health service contact points to reach newborns with a dose of vitamin A within the existing community-based maternal and newborn services and to understand the needs and types of communication required and materials to be developed.¹¹ Two health service contact points

were identified as potential platforms for NVAS integration: antenatal care (ANC) and postnatal care (PNC) visits. The ANC contact point had the potential advantage of providing the vitamin A dose to the mother during an ANC visit so that it would be available for her or a family member to squeeze into the mouth of the newborn at the time of birth. The PNC contact point had the advantage of a trained health worker visiting the newborn shortly after birth and delivering the NVAS dose directly to the newborn. To determine the feasibility and coverage of each delivery model, the models were pilot-tested in paired *upazilas* (sub-districts) from three districts.

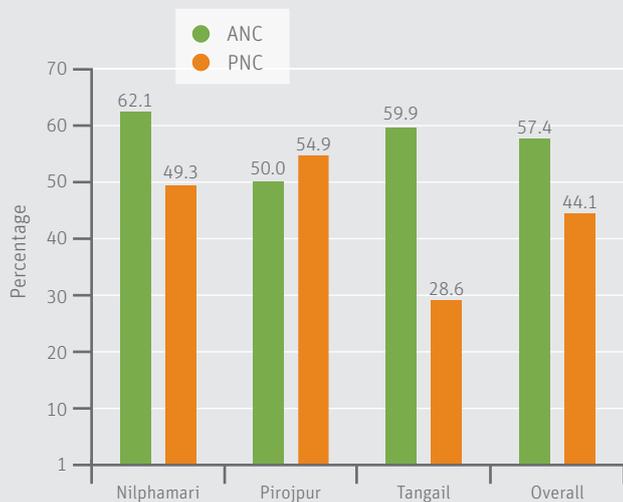
The *Antenatal Care (ANC) Model* consisted of usual ANC care to pregnant women, but health workers also gave expectant mothers an individually packaged dose of vitamin A (50,000 IU), instructions and counseling on why, when and how to administer the dose to their newborn, a counseling card (Figure 1), and a health worker contact card that included the worker's name, mobile phone number and address so that the mother or family member could notify the health worker about the birth. The *Postnatal Care (PNC) Model* required the mother or family member to inform the health worker about a birth so that the health worker could directly administer the vitamin A dose to the newborn. To facilitate birth notification, health workers informed pregnant mothers, during clinic or home visits, about the importance of early birth notification and provided women with a card containing the health worker's name, mobile phone number and address.

Methods

Two *upazilas* from three districts – Nilphamari, Tangail and Pirojpur – were selected and randomly assigned to either the ANC or PNC delivery model based on both *upazilas* having a reasonably comparable geographical setting, population size, and health worker-to-population ratio. A baseline survey in each *upazila* (n~900 per *upazila*) was conducted in December 2010, after which a six-month implementation phase commenced from January to June 2011, followed by an endline survey (n~566 per *upazila*) in August to September 2011. The baseline and endline surveys used a two-stage sampling procedure, with the first phase consisting of a random sample of 30 *mauzas* (i.e. clusters) based on population proportional to size, and the second phase consisting of a random selection of ~30 women in each cluster who had delivered a live-born infant in the previous six months. Both the baseline and endline surveys collected data on household socioeconomic status; previous pregnancy history; services and care received during the last pregnancy; use, timing and content of ante- and postnatal care received; and receipt, timing, acceptability, and perceived positive and negative effects of the newborn vitamin A dose.

In addition, 30 health assistants (HAs) and 30 family wel-

FIGURE 2: Percentage of newborns dosed with vitamin A within the first 30 days of life by district and delivery model.



ANC = Antenatal Care Model; PNC = Postnatal Care Model

fare assistants (FWAs) from each *upazila* were randomly sampled from a list of all HAs and FWAs and interviewed about the implementation procedures related to the NVAS delivery models and problems faced during implementation.

Ethical approval for the study was obtained from the Bangladesh Medical Research Council (BMRC) and the Academy of Educational Development Institutional Review Board (AED, IRB).

“NVAS coverage was significantly higher in the ANC model than the PNC model”

Results

After six months of pilot implementation, overall NVAS coverage across both delivery models within 30 days of birth was 50.8%, but it was significantly higher in the ANC model (57.4%) compared with the PNC model (44.1%) ($P < 0.001$) (Figure 2). The mean (SD) time of dosing was 2.4 (6.5) and 1.7 (3.7) days for the ANC and PNC models respectively ($P < 0.01$), with 88.5% and 85.6% of dosed newborns receiving vitamin A within the first two days of life, resulting in a 'first-two-day coverage rate of 50.2% and 37.3%, respectively. Although the ANC delivery model intended mothers or family members to administer the vitamin A dose, in actuality – and surprisingly – health workers dosed newborns at approximately similar rates in both delivery models: 65.1% in ANC and 72.7% in PNC model

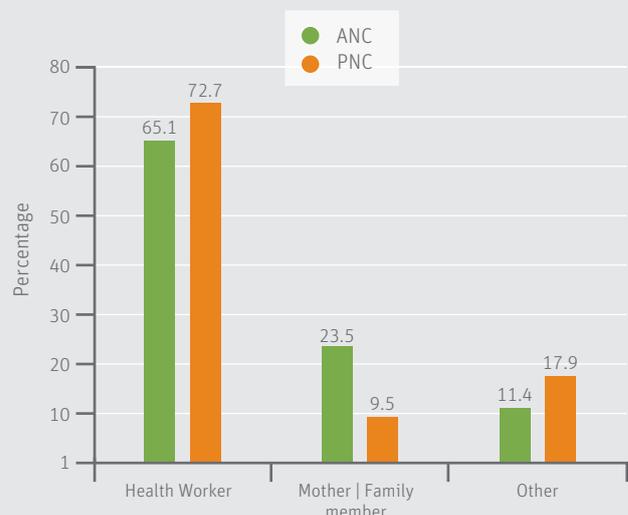
(Figure 3). Very few mothers reported side effects, and these were self-limiting.

As expected, integrating NVAS into ANC visits did not significantly or consistently affect antenatal care provision under either model, or change ANC coverage from baseline and endline (data not shown). On the other hand, we hypothesized that NVAS integration into postnatal care visits would improve both visit coverage and timing because the training, counseling cards and instructions to mothers emphasized the importance of reaching newborns within two days of birth. In addition, mothers were provided health worker contact cards which included the health workers' mobile phone number and address. Interestingly, PNC coverage increased across all six *upazilas* relative to baseline coverage (Figure 4). Overall, postnatal coverage increased more than twofold (28.4% at baseline to 60.5% at endline) in the PNC model and slightly less than twofold (38.4% at baseline to 65.9% at endline) in the ANC model.

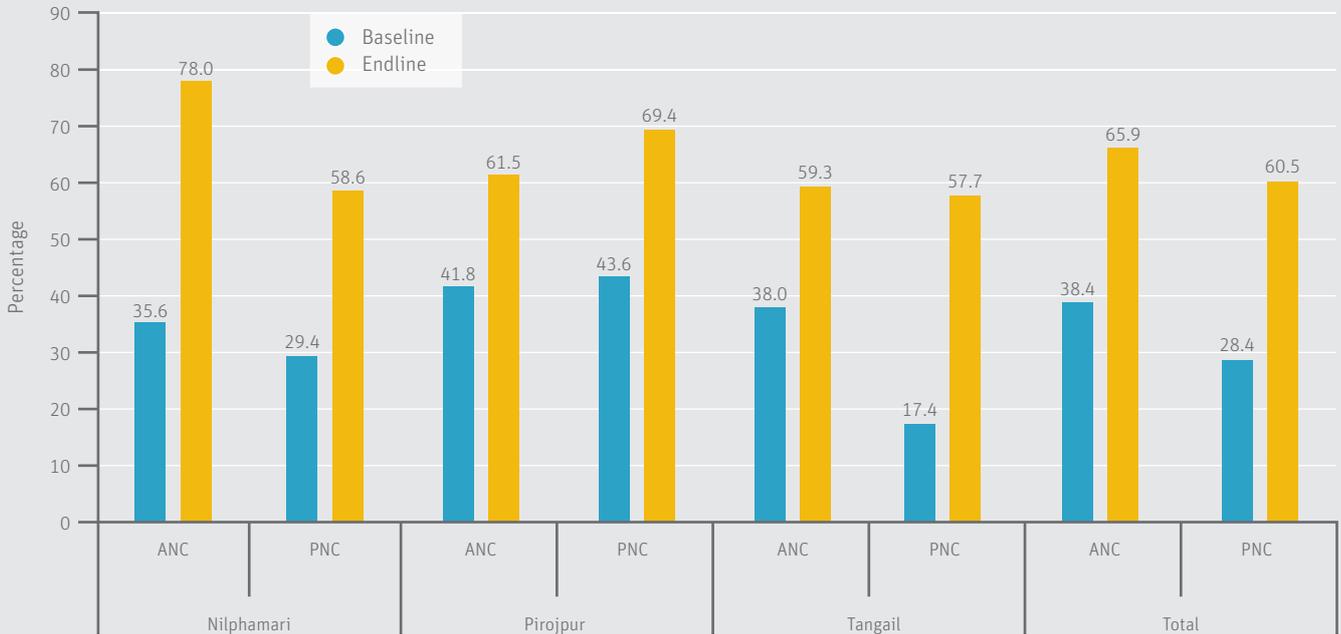
Health workers were notified about births via mobile phone (22.0%), by a family member visiting the health worker's house (18.9%), by the health worker making a routine visit to the house (16.6%), by giving birth in a hospital (16.1%), by the health worker being present at the time of delivery (11.4%), or by other means (15%).

“Health workers played an integral part in both delivery models”

FIGURE 3: Person who dosed the newborn by delivery model.



ANC = Antenatal Care Model; PNC = Postnatal Care Model

FIGURE 4: Baseline and endline postnatal care visits by district and NVAS delivery model.

ANC = Antenatal Care Model; PNC = Postnatal Care Model

As reported above, health workers played an integral part in both delivery models. Workers in the ANC model reported that 91.6% of women felt very confident in their ability to dose the infant, yet nearly 60% of workers said that “many” or “very many” mothers requested assistance in dosing (data not shown). Health workers in the ANC model most frequently felt that the program could be improved by making people more aware (53.1%) and increasing staff (15.4%) (data not shown). Less than 2% of health workers in the PNC model reported problems in dosing the newborns. Health workers’ confidence in reaching mothers within 48 hours of birth was variable in the PNC model, ranging between 18% and 86% (data not shown). Obstacles to reaching infants included working on a holiday, communication issues, or women going to their husband’s family home to deliver their baby.

Conclusions

In both models, health workers were a crucial component in NVAS dosing. The ANC model achieved a significantly higher coverage than the PNC delivery model, though mothers and family members waited for a health worker to assist with dosing. This finding may indicate that while women lack the confidence to dose their newborns themselves, they take on the responsibility for ensuring supplementation when the vitamin A capsule is given at the ANC visit and is in the home. Integrating NVAS into the ANC and PNC services increased PNC. This is likely due

to the perceived importance of reaching the child within two days of birth to complete a tangible task. During the six-month implementation period, the NVAS intervention was well integrated, implemented, and monitored within the government’s health services, and was well accepted by mothers and health workers. Mobile phones were the predominant means of birth notification, and mobile phone usage for this purpose increased significantly from baseline to endline, attesting to the value of providing expectant mothers with the mobile phone number of the catchment-area health worker. In light of these findings, the integration of NVAS into ANC and PNC services in Bangladesh seems reasonable and feasible. While reasonably high NVAS coverage levels were obtained in a short six-month pilot phase, further improvements are needed to ensure that a higher proportion of newborns are dosed within two days of life.

Acknowledgements

We gratefully acknowledge the collaboration, support and cooperation provided by the National Nutrition Services (NNS), Directorate General of Health Services (DGHS), Directorate General of Family Planning (DGFP), Revitalizing of Community Health Care Initiative, Bangladesh (RCHCI,B) and Bangladesh Medical Research Council (BMRC), Ministry of Health & Family Welfare (MoHFW), the Government of Canada, USAID, and UNICEF. We also thank Silvana Faillace (formerly AED), Robert Stanley (formerly Johns Hopkins), Shamim Ahmed (formerly MI), Alison

Greig (MI), Melanie Galvin (MI), Dr. Sakil (MI), Sk. Ali Ahmed (MI), and Mahbubur Rashid (formerly JiVitA). Finally, we gratefully acknowledge funding from the USAID A2Z Micronutrient and Child Blindness Project, and the Micronutrient Initiative.

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Opinion: Deficiencies of Critical Micronutrients

A Focus on Iodine, Iron and Vitamin A

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Key messages

- > The three most common forms of micronutrient deficiency are iron, iodine and vitamin A.
- > Dietary diversity is the best way to prevent micronutrient deficiency.
- > No staple food contains all the essential micronutrients.
- > In iodine-deficient regions, dietary diversity will not address iodine deficiency as all foods are likely to be low in iodine.
- > Seawater is a reliable source of iodine so seafood is a good source of dietary iodine.
- > Animal-source foods are the richest and most bioavailable source of most micronutrients.
- > Green leafy vegetables are the most widely available source of vitamin A in the form of β -carotene.
- > Phytate and phenolic compounds interfere with mineral absorption and goitrogens block iodine utilization.
- > Most vitamins are unstable and sensitive to light, heat, oxygen, moisture and pH.
- > Cooking (i.e., heat), however, can help release β -carotene from plant tissue and destroy some goitrogens.

- > Iodized salt improves iodine status of a population and reduces the risk of goiter.
- > In some European countries where salt iodization is not actively promoted, surveys are revealing evidence of mild/moderate iodine deficiency.
- > Mild iodine deficiency in pregnant women has been associated with cognitive impairment in their children.

Worldwide, the three most common forms of micronutrient deficiency are iron, iodine and vitamin A.¹ The essentiality of all the critical micronutrients means that a deficiency of one or another will impair health and development. Vitamin A deficiency affects more than 250 million people worldwide and severe deficiency causes blindness and death. Iron is one of the most prolific elements on the planet, yet iron deficiency is a major cause of anemia and anemia affects a quarter of the global population, including 293 million (47%) children younger than 5 years and 468 million (30%) non-pregnant women.² Iodine deficiency affects almost two billion (35%) of the world's population. It has substantial effects on growth and development and is considered by the World Health Organization (WHO) to be "the single most important cause of brain damage" (Table 1).^{1,3}

“Our senses are not good at influencing our intake of certain critical micronutrients”

We rely on the food we eat to supply the energy, protein, fatty acids and all the essential micronutrients needed for healthy living. Our senses guide us in selecting food to satisfy our ap-



“Seawater is a reliable source of iodine, so seafood is a good source of dietary iodine”

TABLE 1: Prevalence of the three major micronutrient deficiencies by WHO regions

WHO Region	Anemia ^a		Iodine Deficiency ^b		Vitamin A Deficiency ^c	
	Number of millions	%	Number of millions	%	Number of millions	%
Africa	244	46	260	43	53	49
Americas	141	19	75	10	16	20
SE Asia	779	57	624	40	127	69
Europe	84	10	436	57	No data available	
Eastern Mediterranean	184	45	229	54	16	22
West Pacific	598	38	365	24	42	27
Total	2030	37	1989	35	254	42

^aBased on proportion of population with hemoglobin concentration below established cut-off levels

^bBased on proportion of population with urinary iodine concentration below 100 µg/L

^cBased on proportion of population with clinical eye signs and/or serum retinol concentration <0.7 µmol/L

Reproduced with permission from reference⁷

petite but our senses are not very good at influencing our selection of food to meet our requirements for some of the critical micronutrients. In many parts of the world, soils are deficient in iodine, and salt iodization helps to prevent the clinical effects of iodine deficiency. The condition persists, however, in parts of the developing world where iodized salt supplies may be unreliable, dietary diversity is frequently poor and poverty restricts dietary choices. In the United Kingdom (UK) there is enormous dietary diversity, with foods imported from all over the world, and iodine deficiency has been largely ignored, as there is no overt evidence of clinical deficiency such as goiter or cretinism.

However, a few recent reports^{4–6} have suggested that iodine status may not be as satisfactory in the UK as previously thought. Furthermore, in two of these studies, the evidence does not

come from the poorer, more industrial or more remote parts of the country but from data collected in the more affluent southern counties of England.^{4,5} So the recently reported evidence of cognitive impairment in children of 8–9 years associated with poor maternal iodine status at the time of the children's birth needs to be considered carefully.⁵

Foods necessary to supply critical nutrients

The main risk factors for micronutrient malnutrition are listed in **Table 2** and will be discussed in this commentary. Poor diets and micronutrient deficiencies cause ill-health and have potentially grave economic consequences for the individual, the family, the community and, if the condition is widespread, for the entire country. The type of food available will often determine which nutrient deficiency is of greatest importance. Foods may not ac-

TABLE 2: Risk factors for micronutrient malnutrition

Monotonous diet, poor bioavailability, little opportunity for diversification
Low intake of animal-source foods
Low prevalence of breastfeeding; delay in initiation of breastfeeding; failure to maintain exclusive breastfeeding
Low micronutrient density in complementary foods
Increased demand for micronutrients due to frequent or chronic infections
Increased physiological demands due to need for catch-up growth, pregnancy and lactation
Malabsorption due to diarrhea or intestinal parasites
Seasonal variations in food availability and deterioration in food quality through poor storage facilities
Social deprivation; illiteracy; inadequate or no education
Poor economic status and poverty

Modified from reference⁷

TABLE 3: Factors affecting bioavailability of specific nutrients

Absorption modifiers		Nutrients affected	Mechanism of factors reducing or overcoming inhibition
Inhibitors	Promoters		
Phytate in cereals and legumes (phytic acid; inositol hexaphosphate)	Phytase	Phytate chelates iron and zinc in particular and blocks absorption but also affects other divalent cations	The enzyme phytase will break down phytate and release phosphorus. Phytase is present in yeast and wheat flour so during leavening in bread-making, phytate is broken down. Microbial phytase has been added successfully to cereals and legumes to release iron and zinc.
Phenolic compounds in coffee, tea, sorghum and millet		As above	
Calcium		Reduces iron absorption	Short-term inhibition which appears to resolve with time ⁴⁹
Vegetables		As above	Non-heme iron is poorly absorbed but vegetables reduce heme iron absorption as well ⁵⁰
	Vitamin C in vegetables and fruits	Iron	Vitamin C is a strong reducing agent which promotes formation of ferrous iron to facilitate iron absorption in the small intestine
Cyanogenic glycosides in cassava		Iodine	Tubers boiled in water to release cyanide and remove goitrogenic activity
Goitrogens in vegetables like brassicas, swedes and turnips		Iodine	Goitrogens block iodine absorption. Cooking destroys the goitrogenic activity ⁵¹
Cellulose cell structure in plants	Cooking oil	Vitamin A	Cooking (heat), mastication and oil promote breakdown of cell structure; oil dissolves the carotenoids and facilitates β -carotene absorption

Modified from reference⁷ and other sources

tually be deficient in certain nutrients but may contain antagonists such as phytate or polyphenols in whole cereals, tea, coffee etc. and block absorption of minerals such as non-heme iron and zinc (Table 3).² Thus, bioavailability affects dietary iron, but it is also a factor influencing vitamin A status. The main dietary source of vitamin A for most people in the world is β -carotene in green vegetables and fruits. β -Carotene is found within the cells of plant tissue, and to become available for absorption, the cellulose cytoskeleton needs to be broken up mechanically or by chewing and the β -carotene released by heat and oil. However, too much heat can destroy the carotene and other micronutrients^{7,8} so overcooking can be counterproductive. Furthermore,

there may be insufficient oil for optimal absorption in poor families. Iron and vitamin A deficiencies continue to exist as many factors need to be corrected to ensure satisfactory absorption.

In the case of iodine, goitrogens in some foods can interfere with the utilization of iodine (Table 3) but the main cause of deficiency is that the element has been leached from the soil by water in large areas of the world, so no food may be particularly rich in iodine.⁹ The sea is an important source of iodine ($\approx 50 \mu\text{g/L}$)⁹ so fish and animal-source foods will be the richest sources of iodine but availability of these foods may be limited where poverty is common. In contrast to iron and vitamin A, however, the supply and use of iodized salt in such areas will

successfully introduce iodine into the diet. Thus in the case of iodine deficiency, it is the logistics of maintaining and enforcing the continued supply, use and quality of iodized salt where most government activity has to be targeted.

In this respect, in a recent British television charity-appeal program, a Philippino mother and two children (~8–12 years) were interviewed who had lost their house and all their property as a result of the tidal surge at the time of the hurricane in 2013. They were living within viewing distance of the sea yet the mother had a large goiter. The goiter was too large to have been of recent origin and probably developed when the woman was pregnant. So in spite of the proximity of the sea, the availability of iodine for this woman was insufficient to prevent the goiter. In the Philippines, large-scale distribution of iodized salt began in 1996,¹⁰ but for some reason iodized salt in sufficient amount or quality was not reaching this area for the goiter to have been as large as it was. Recent figures suggest that in spite of salt iodization programs, in Southeast Asia as a whole 30% of the general population does not get sufficient iodine.⁹

“Children who are sick do not grow”

Interaction of iron and vitamin A deficiencies

Iron and vitamin A deficiencies occur widely and often together, and attempts to reduce the prevalence of these deficiencies are at the forefront of much research, worldwide. The main functions of these nutrients are ostensibly very different, but the effects of their deficiencies are closely linked through infection. Infection impairs dietary iron absorption and the endogenous re-utilization of iron, commonly causing anemia, especially if infection is frequent or chronic.¹¹ Iron is needed for the synthesis of hemoglobin and red blood cells, and anemia is a deficiency of hemoglobin. The criteria for hemoglobin deficiency are influenced by demographic and environmental factors, and therefore vary slightly.^{2,12} Although iron deficiency is a principal cause of anemia, several other essential nutrients are needed to support red cell synthesis – namely folate, vitamin B₁₂, riboflavin, and pyridoxine, to mention but a few.¹³ Globally, it is estimated that 50% of anemia is caused by iron deficiency while the rest may be due to infection.¹² The contribution to anemia made by the other micronutrient deficiencies is uncertain, but in the case of vitamin A, infection is exacerbated by vitamin A deficiency, which may therefore exert its effects on anemia indirectly. Vitamin A supplements can stimulate erythropoiesis even in the absence of additional iron,¹⁴ and the high prevalence of infection in poor communities no doubt contributes to the high prevalence of anemia in the developing world.¹¹ Vitamin A is important in the maintenance of membrane secretions and cell integrity, and has an important role in the regulation of immune functions and the

prevention of infection.¹⁵ Failure to produce secretions to wash the eye contributes to membrane damage and increases the risk of ulceration and blindness. However, the interaction between vitamin A deficiency and infection, the impact of infection on iron metabolism and the potential impact of so many other micronutrient deficiencies on the synthesis of hemoglobin is no doubt the reason why anemia is so widely distributed and found in both rich and poor countries.^{2,7}

In addition to the adverse health consequences, the social consequences of anemia and vitamin A deficiency can be serious. Hemoglobin is necessary to supply oxygen to all tissues for the generation of energy, so severe or chronic anemia can lower work efficiency and the economic effect of anemia on human capital results in the loss of billions of dollars annually.^{2,16} Anemia in childhood can impair cognition. Blindness through a lack of vitamin A robs individuals of their independence and they become a financial drain for the family. Fortunately the intense efforts to give children one or two high doses of vitamin A per year in early life has considerably reduced the prevalence of blindness, but poor vitamin A status is still widespread and the high prevalence of infection is still with us.¹⁵ Consequently iron supplements are not as successful in reducing anemia as vitamin A supplements have been in addressing severe vitamin A deficiency, as the presence of infection can block iron absorption, or the anemia may not be due to iron deficiency but to the presence of other micronutrient deficiencies and diseases. The high prevalence of infection in the developing world is a major impediment to progress in improving nutrition. Children who are sick do not grow, and if the quality of their diets is poor, they will not fully recover during convalescence. Failure to fully recover following infection increases the risk of stunting and can eventually lead to small adults who may not be able to make a full contribution to society (Table 2).

Other critical nutrients and the food we eat

The nutritional status of other critical micronutrients (e.g., zinc, selenium, folic acid and vitamin D) is also influenced by the food eaten as well as by social and behavioral factors (Table 2). Zinc homeostasis is inversely dependent on the presence of chelating agents such as phytate in the diet, in the same way as iron (Table 3). Severe zinc deficiency causes stunting in children and slow development of physical and sexual maturity, but zinc is also essential for the function of a large number of enzymes and the transcription factors involved in many aspects of metabolism. Its essentiality is such that growth is regulated by zinc status.^{17,18} Growth inhibition is an adaptation to insufficient dietary zinc to ensure the supply of zinc is adequate for its metabolic functions. That is, zinc status is conserved by reducing metabolic demands to that of the dietary zinc availability and, as a consequence, serum concentrations of zinc are poor indicators of status.

Selenium, together with vitamin E, plays an important role in protecting mammalian tissues from oxidation. Uncontrolled oxidation will destroy cell membranes, leading to the death of the cell, and there has been a lot of interest in the possibility that selenium-containing glutathione peroxidases may play a role in preventing cancer,¹⁹ although intervention studies with selenium have so far not demonstrated any benefits.²⁰ We depend on oxidation of foodstuffs to produce energy, but every cell in our bodies is surrounded by a fatty acid membrane that is vulnerable to oxidation, hence antioxidants are important to maintain tissue structure and function. Tissues that contain high proportions of polyunsaturated fatty acids, like the eyes, or are exposed to high concentrations of oxygen, like the heart and lungs, are particularly vulnerable to oxidation and are particularly rich in antioxidant micronutrients (vitamin E, vitamin C, carotenoids) and/or high concentrations of antioxidant enzymes dependent on selenium, zinc etc. Selenium also has an important function in the metabolism of the thyroid hormones (discussed later).²¹

Folate is needed for very different reasons to the antioxidant nutrients, and is in fact unstable and susceptible to oxidation.²² Folate provides single carbon units that are essential for the production of DNA and RNA²³ – that is, folate is necessary for the synthesis of every new cell in our bodies. So folate is of critical importance during gestation and the growth of the child; but folate is especially important in very early pregnancy to enable the proper development of the fetus. A failure to fully close the spinal canal can give rise to neural tube defects, e.g., spina bifida. After birth, clinical evidence of deficiency appears in those tissues where cell turnover is very rapid, e.g., the production of red cells.²³ Thus, yet another essential nutrient can give rise to anemia and, with folate deficiency, it is often the appearance of anemia that can signal the presence of the deficiency.

.....
“Anemia can often signal folate deficiency too”

I have included vitamin D in the list of critical micronutrients even though there is very little vitamin D in the diet and most vitamin D is produced endogenously in our skin by exposure to sunshine. The function of vitamin D is to allow healthy bone growth by controlling the absorption and utilization of calcium. Vitamin D is therefore very important in children during growth, and supplements during pregnancy and breastfeeding are important for women in communities where exposure to sunlight may be restricted.^{24,25} In addition, vitamin D also has a role in our innate immune system to prevent bacterial attack through epidermal tissues, and vitamin D receptors are also

widely distributed on many immune cells.²⁶ Vitamin D, like vitamin A, is a fat-soluble vitamin, and both vitamins exert their effects on metabolism through interaction with the DNA. In fact, for some metabolic activities, the functional forms of vitamin D and vitamin A jointly regulate at the level of the gene.²⁷ Low serum concentrations of the form of vitamin D in serum (25-hydroxy cholecalciferol; 25-OHD) are associated with a number of chronic diseases, but the low concentrations would appear to be a consequence of disease and not a cause.²⁸ Two recent meta-analyses have examined vitamin D supplementation studies and mortality associated with low concentrations of 25-OHD in chronic diseases.^{29,30} In the first paper, it was concluded that vitamin D supplementation of adults with chronic diseases and low concentrations of serum 25-OHD concentrations did not provide any evidence of benefit, and the only established clinical benefits obtained from supplements were by people with bone disease.²⁹ In the second, the authors concluded that mortality was significantly greater for heart disease, cancer and all causes in patients in the lowest tertile of 25-OHD concentrations. While such results may only confirm that low serum 25-OHD concentrations are a consequence of disease, the authors did find that supplementation with vitamin D₃ (but not D₂) significantly reduced overall mortality among older adults.³⁰

This brief summary of some of the functions of critical nutrients indicates their importance for growth, immune function and healthy metabolism. A reduction in the supply of one or more of the essential nutrients promotes adaptive responses; reduced nutrient excretion, reduced physical activity, restricted growth, impaired cognitive development etc. The adaptations may provide a short-term means of coping with dietary inadequacies, but the longer the restrictions continue, the greater becomes the vulnerability to disease and impaired recovery. Growth restrictions are especially difficult to reverse, as catch-up growth only occurs in the first 1,000 days of an infant’s life or during adolescence. Neural development may be even more sensitive to the duration of deficiencies, and where the metabolic demand for nutrients exceeds supply during critical periods of neural development, physical or mental catch-up may never occur.

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“Breast milk is the only food that gets close to being perfect”

Nutrient-rich foods and factors restricting nutritional benefit

We need food to ensure our bodies are fully functional and to supply critical nutrients that we cannot synthesize de novo. Unfortunately, no food is perfect and able to supply all the nutrients we need. Breast milk for a child under 6 months is the

only food that gets close to being perfect and able to meet the neonate's dietary requirements. However, even breast milk may lack some nutrients if the mother's nutritional status is poor.³¹ With the exception of a child below 6 months of age, the only way to achieve nutritional adequacy is through eating a mixed diet. Eating different kinds of foods – some rich in protein (meat, eggs, fish, legumes), some in carbohydrates (cereals) and some in fat – together with vegetables, fruits and nuts, will considerably minimize the risk of dietary deficiency. Food selection, however, is influenced by a variety of factors such as culture, religion, individual preferences, availability and cost, but when food is limited, the primeval drive is to satisfy appetite by meeting energy requirements. The foods that do this best are the dietary staples like bread, rice, pulses and corn products, and in some communities the word for 'eating' is synonymous with the consumption of one or other of these staple foods.

However, the reliance by men and women for dietary requirements on the staple alone has been associated with some of the major deficiency diseases. The dietary catastrophe of beriberi in the latter part of the nineteenth and early part of the twentieth centuries was associated with the consumption of white rice. The death rate was at times so high that one report from the Philippines stated that "there was insufficient earth to bury the corpses."³² Outbreaks of pellagra in the southern states of America and southern European countries around the same time were associated with the eating of corn (*Zea mays*, maize) without knowledge of traditional methods of preparation (see below). Both rice and corn are rich in carbohydrate and are highly nutritious as part of a mixed diet, but when consumed alone by impoverished families living under food-insecure conditions, nutritional inadequacies are revealed.

“One feature that vitamins have in common is instability”

Over the centuries, man's drive to find food to satisfy the innate need for calories to supply the energy for daily life changed from the 'hunter-gatherer' model to a more settled agrarian existence. The characteristic of both, however, was that food tended to be eaten fresh and only minimally processed, so it would contain its full content of critical nutrients. Fermented drinks such as beer and wine would have been minimally filtered and would therefore have contained the yeasts that brought about the fermentation. Such drinks were widely consumed to avoid ingestion of contaminated water, and would be a regular source of the water-soluble B-vitamins. Food deteriorates on storage, and one feature that vitamins have in common is instability, varying from niacin (the most stable) through to vitamin B₁₂ (the

least stable). The main factors responsible for instability are heat, moisture, oxygen, light and pH.³³ There was almost 90% loss of thiamin in millet stored 8–9 months under traditional thatch in the hot and humid conditions of a Gambian village.³⁴ Fortunately, freshness of a food will not affect the mineral or trace-element content. If the soil is deficient in an element such as iodine, plants growing on that soil and animals eating those plants will be low in iodine. In general, where food can be eaten fresh it may both satisfy the immediate need for energy and provide the less obvious organic micronutrients. Of course there are exceptions, such as corn or cassava (see Table 3). In subsistence farming, dependence on stored food can lead to seasonal fluctuations in nutritional status and the transient appearance of nutritional deficiencies. Generally, however, nutritional deficiencies were local and chronic and were not severe except under unusual circumstances, e.g., restricted food availability or diversity, adverse weather etc^{35,36} and did not become a national or international concern until there were major changes in food processing.

“Social conditions in 19th-century Asia prevented natural eating practices”

Food processing

Such a change is illustrated by the introduction of steam-powered, steel roller mills to produce white rice in the nineteenth century. At that time nothing was known of the presence of vitamins in the endosperm of the rice grain. Rice had been the staple food in South and SE Asia for centuries. Together with a little fish and green leaves, it generally provided a nutritionally complete diet. However, at the same time social conditions were changing and preventing natural eating practices. Bonded labor was common, with people living on work premises and being paid mainly in the form of rice of uncertain freshness. With little money to purchase any additional food, the deficiencies in rice as a sole food became widely apparent.³²

For good nutrition, a staple food needs to be supplemented with additional food. These additional foods function to make good the inadequacies in the staple. Inadequacies in the staple may also be reduced by various preparation methods. Parboiling of rice helps prevent nutrient losses of B vitamins such as thiamin by allowing the vitamins in the endosperm to diffuse into the body of the rice grain before milling takes place. Soaking of corn cobs in lime water in South American communities allowed mild alkaline fermentation to destroy niacytin and release the essential vitamin, niacin (nicotinic acid, vitamin B₃), and reduced the risk of pellagra. Unfortunately, the introduction

of corn into impoverished communities in the southern states of America and countries of southern Europe was not accompanied by the indigenous methods of preparation.

The importance of flesh foods to provide essential nutrients

The foods that are richest in the critical nutrients for man are meats and fish, but green vegetables also play an important role by supplying carotenoids, vitamins like C and E, a large number of antioxidant polyphenols and fiber. Flesh or dairy foods are our only dietary source of vitamin D, which is found in the livers of fatty fish and in dairy foods. Flesh foods are also an important source of minerals and trace elements like iron, zinc, iodine, selenium etc. Animals need minerals for optimal growth and development just as man does. Their advantage over man is that they often have large digestive systems that enable them to process large volumes of vegetable matter and extract the minerals and trace elements they require. The ultimate source of minerals and other trace elements in our diet is the soil in which plants grow. Minerals in plants are both within the tissues and as contaminants on external surfaces. Soils rich in minerals provide better growth for plants and, in the natural world, will attract foraging animals. Drinking water is also an important source of minerals, as rivers and streams and eventually the sea are the final deposit for the water that drains off the land.⁹ Both fresh- and sea-water fish have access to the minerals in the water in which they live and feed, and will concentrate them in their tissues. Minerals in flesh foods are usually more bioavailable than those in plant tissues; hence flesh food has provided an important source of critical minerals and nutrients in many communities over the millennia.

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“Minerals in flesh foods are usually more bioavailable than those in plant tissues”

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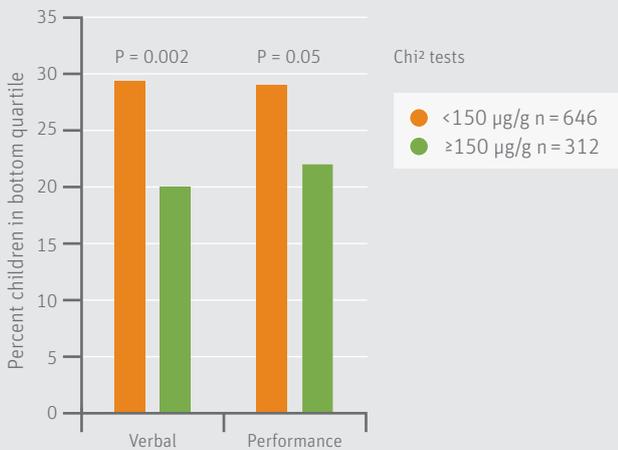
Food and iodine

The drainage of water off the land has had important consequences for one mineral in particular: iodine. Over time, water leaches trace elements such as iodine from soils and the cultivatable surface ground becomes depleted. This is particularly important in mountainous or hilly regions of the world. Terracing the ground to provide land for food cultivation slows water run-off, but eventually much will filter through the ground, carrying away the trace elements with it. If such regions are also land-locked, then recovery of the elements in the form of sea foods will be impossible. Fresh- or especially sea-water fish will be a good source of iodine if they are available and affordable, as the iodine will accumulate in streams, lakes and eventually the sea. Deficiencies of iodine revealed themselves in affected

populations by the presence of goiter in adults and cretinism in children. A goiter is an enlarged thyroid gland which is seen as a swelling in the neck and is an adaptation to increase the iodine-trapping efficiency for thyroid hormone production.³⁷ A goiter is often a feature well recognized in affected areas and has a local name. In the Derbyshire Peak District in the UK, goiter was known as ‘Derbyshire neck’ and was a consequence of subsistence agriculture. People lived, worked and died in the same areas in which they were born and ate the locally grown food all their lives. The Derbyshire Peak District, as its name suggests, is a hilly region, exposed to the leaching action of surface water over hundreds of years, and the ground had become deficient in iodine. As communications improved, affluence increased and importation of foods from other areas and other countries increased, the importance or effects of local nutrient deficiencies decreased and disappeared. However, for farm animals, some trace element deficiencies still remained important until the causes of certain animal diseases were realised.³⁸

Certain foods can also influence the utilization of dietary iodine, as they contain goitrogens (Table 3). Goitrogens are chemicals that are toxic to the thyroid, or that break down to produce toxic chemicals. Foods containing such chemicals include cassava, cabbage, and root vegetables such as swedes and turnips. Cassava is a staple in Africa and tropical areas in the Pacific basin. It contains cyanogenic glycosides, which are a source of cyanide. If cassava is not treated by boiling in water before human consumption, the cyanide is converted in the body to thiocyanate, which inhibits the activity of thyroperoxidase, the enzyme responsible for the uptake of iodine by the thyroid gland. The goitrogens in cabbage and related plants also inhibit thyroperoxidase. It is also reported that too much iodine can have antithyroid, goitrogenic effects. In Japan, the consumption of seaweed soup can supply 80 to 200 µg of iodine per day. An intake of 2.0 mg can impair the synthesis of the thyroid hormones, inducing the thyroid gland to enlarge.

Diets low in selenium will also interfere with iodine uptake by the thyroid gland and the synthesis of thyroid hormones. Reference nutrient intakes for selenium are 75 µg/day for men and 60 µg/day for women. Estimates of selenium intakes in the UK in 1994 suggested that intakes were around 34 µg/day. Evidence suggested that European intakes of selenium were similar due to the drop in imports of selenium-rich, high-protein wheat for bread-making flour from North America.³⁹ Selenium is essential for normal thyroid hormone metabolism, for it is a component of the deiodinase enzyme that controls the synthesis and degradation of the biologically active hormone T₃. However, work done in some Central African countries suggests that it is only where severe selenium deficiencies exist that T₃ production is impaired,⁴⁰ and that low selenium intakes in European countries probably have little effect on iodine metabolism.

FIGURE 1: Intelligence Quotient at 8 years.

Columns show the numbers of children in the bottom quartile of the whole sample expressed as a percentage of their respective maternal iodine status groups. Chi² tests compared the proportions of sub-optimum cognitive outcomes in each test between the two groups. Data from reference⁵.

“Iodine deficiency affects two billion people worldwide”

Metabolic importance of iodine

The metabolism of iodine is closely linked to thyroid hormone function, since the only known function for iodine is in the synthesis of thyroid hormones. The thyroid hormones are essential to regulate metabolic rate and heat production throughout life and for normal in-utero neurodevelopment.⁴¹ Iodine deficiency affects two billion people worldwide and is the main cause of preventable mental impairment.³ An iodine intake of 100–150 µg/day is considered nutritionally adequate. Urinary iodine concentrations are similar to intake levels and can be used to estimate iodine consumption. Urinary iodine concentrations indicative of mild, moderate and severe iodine deficiency are 50–99, 20–49 and < 20 µg/day, respectively. The risk of developing a goiter occurs at intakes below 50 µg/day, and goiter is almost always induced at intakes below 10 µg/day.²¹

Iodine in food occurs mainly as the iodide and to a lesser extent bound to amino acids. Iodine supplements take the form of potassium iodide or potassium iodate. Iodine is rapidly absorbed and sequestered by the thyroid gland, where it is bound to the amino acid tyrosine. The enzyme thyroperoxidase is involved in the binding of iodine to tyrosine in the thyroglobulin molecule as well as in the synthesis of thyroid hormones T₃ and T₄. The subscript numbers indicate the num-

ber of iodine atoms linked to the molecule. Thyroxine, or T₄, results from the coupling of two molecules of di-iodotyrosine, while tri-iodothyronine (T₃) is formed by the coupling of one mono-iodotyrosine and one di-iodotyrosine molecule. Most of the thyroid hormone released by the thyroid gland is T₄, with ~10% T₃. T₄ is in fact a pro-hormone, as T₃ is the key regulator of important cell processes. There is very little T₃ present in blood (~2%), and most of it is produced from T₄ through the action of a selenium-dependent enzyme deiodinase in the liver and kidney. This means that most of the T₃ entering target organs such as skeletal muscle is produced by the participation of the thyroid and the liver. Most thyroid hormone in blood is T₄ (~98%) and is carried by the binding protein transthyretin. Thyroid hormones have a lengthy lifespan in blood of several days, probably afforded by the protection of the binding protein. Transthyretin also forms a 1+1 complex with retinol-binding protein (RBP) – probably to protect the latter from loss in the urine, as the latter is a relatively small molecule.

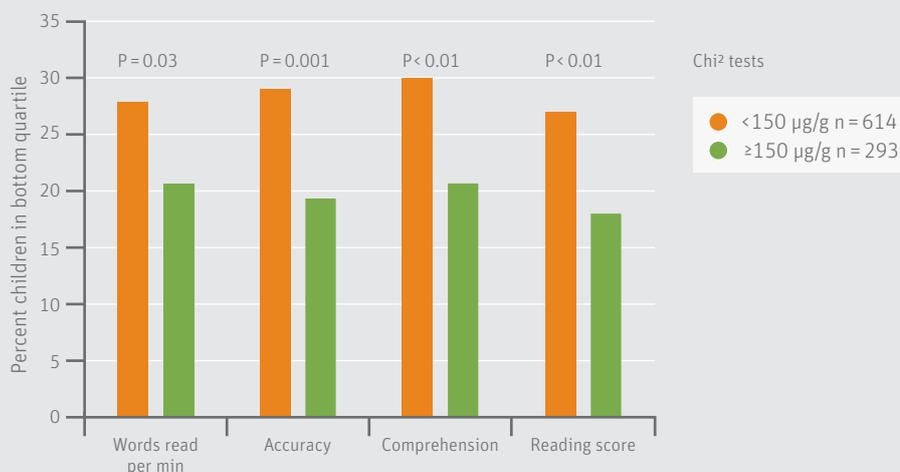
Regulation of the thyroid gland

Two hormones secreted in the brain by the pituitary and the hypothalamus are responsible for regulation of the thyroid gland. The pituitary gland responds to the concentration of T₄ in the blood. Low concentrations of T₄ induce the production of thyroid-stimulating hormone (TSH) which stimulates the thyroid gland. When dietary iodine is low, TSH increases the thyroperoxidase activity, and the net effect is to increase the binding capacity of the thyroid gland for iodine by enlargement. High concentrations of blood T₄ inhibit TSH production, as the sensitivity of the pituitary to the concentration of T₄ is regulated by another hormone released by the hypothalamus.

Low iodine intakes in the UK and Europe

Endemic goiter was widespread in Britain but has declined, most notably since the 1960s. Iodine intakes in the UK have always been low but the serendipitous use of iodophors in the dairy industry for cleaning purposes increased iodine intakes overall to an acceptable level.⁴² An iodophor is a mixture of iodine with a solubilizing agent which, when mixed with water, releases iodine into solution. Iodine and iodophors have very low toxicity by the oral, dermal, and inhalation routes of exposure, and when used correctly, the surfaces exposed to it do not require rinsing.⁴³ In recent years, the use of iodophors has been replaced by other substances, and iodine intakes have fallen.

Concern that the intake had fallen to an unacceptable level was raised by the study of Bush and colleagues,⁵ who carried out cognitive tests on children aged 8 to 9 years (intelligence quotient [IQ] and reading ability). The children were from the mother-child pairs from the Avon Longitudinal Study of Parents and Children (ALSPAC). Stored spot-urine samples from 1,040

FIGURE 2: Reading Ability at 9 years.

For details see Figure 1.

first-trimester pregnant women were measured for iodine and creatinine (to correct for volume) concentrations. Samples were selected on the basis of a singleton pregnancy, the availability of a urine sample from the first trimester and a measure of the IQ in the offspring at 8 years. On the basis of the urinary iodine concentrations, 51% of the women had a mild deficiency of iodine (n = 379), 16% moderate (n = 120) and 1% were severe (n = 8). Women's results were dichotomized to < 150 or ≥ 150 µg iodine/g creatinine, the criteria for insufficiency or sufficiency of iodine in pregnancy respectively.⁴⁴ There was a higher proportion of children born to women with an iodine status of < 150 µg/g creatinine who had suboptimum cognitive outcomes than there was in those born to women in the ≥ 150 µg/g group (Figures 1 and 2).

Two years earlier than the report on the ALSPAC study, a cross-sectional survey assessed iodine status in schoolgirls aged 14–15 years attending secondary schools in nine UK centers.⁶ Urinary iodine and tap-water iodine concentrations were measured during the summer of 2009. Urine samples were obtained from 737 of the 810 girls recruited. Median urine iodine excretion was 80.1 µg/L (inter-quartile range 56.9–109.0). Urinary iodine measurements indicative of mild iodine deficiency were present in 51% (n = 379), moderate deficiency in 16% (n = 120) and severe deficiency in 1% (n = 8) girls. Prevalence of iodine deficiency was highest in Belfast, in Northern Ireland (85%, n = 135). A multivariable general linear model analysis confirmed independent associations between low urinary iodine and sampling in summer (P < 0.0001), geographic location (P < 0.0001), low intake of milk (P = 0.03) and a high intake of eggs (P = 0.02). Tap water concentrations were low or undetectable, and did not associate with urinary iodine concentrations. So the data suggested that there was geographic variation in

iodine status and that low status was associated with low intakes of milk and high intakes of eggs. The association between milk and iodine status is often observed^{4,45} but the explanation for the link with eggs is currently not known. The authors suggested a comprehensive investigation of iodine status should be undertaken in the UK.

“Recent studies in Europe have raised concern about iodine status”

A number of recent studies in European countries have also raised concern about iodine status. A study in Rotterdam on 4,000 Dutch mothers found that autism was associated with a lack of maternal thyroid hormone, and the most common cause of thyroid hormone deficiency is a lack of dietary iodine.⁴⁶ In a study in 55 obstetric clinics in Belgium, 1 in 6 pregnant women were found to have thyroid dysfunction.⁴⁷ In a Danish study, in 2012 urinary iodine was measured in pregnant women in an area where iodine deficiency had previously been moderate. In those women taking iodine-containing supplements, median urinary iodine concentration was 109 µg/L, but in those not taking supplements it was only 68 µg/L. The authors concluded that iodine supplement intake during pregnancy in Denmark should be officially recommended.⁴⁸ Lastly, a study of 3,680 Portuguese schoolchildren aged 6–12 years found 47% and 12% had a urinary iodine concentrations < 100 and < 50 µg/L respectively. The authors suggested that the situation was borderline insufficiency but considerably improved in comparison with 30 years ago.⁴⁵

“More in-depth studies are needed”

Concluding remarks

Food comprises macronutrients, vitamins, minerals and trace elements, not to mention the components giving color, taste and odor that contribute to the eating experience. However, no single food will contain all necessary factors to support healthy nutrition and growth, so mixtures of different foods such as cereals, pulses, vegetables, fruits, oil or fat and especially animal-source foods are needed. That is, dietary diversity will minimize the risk of nutritional deficiency, but because large areas of the world have been so depleted in iodine, there is a risk of deficiency for many people that no amount of food diversity can overcome. Urinary iodine concentrations are an indication of iodine intake, and the recent studies in Europe and the UK indicate that there may be insufficient iodine in the diet. The situation is not critical and we are not likely to see the immediate reappearance of goiter or cretinism in affluent communities, but the marginally sufficient iodine status may be contributing to mild cognitive impairment in some schoolchildren which could be avoided. More in-depth studies are needed to determine the full extent of the situation.

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Opinion Response: Deficiencies of Critical Micronutrients. Making the eradication of micronutrient deficiencies a reality for all

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This decade has been a decade of paradoxes – over-consumption of food in many regions of the world, and food deprivation in others. Today, over a billion people are overweight or obese, and a billion others languish in poverty and hunger. Consumers are willing to pay US\$370,000 for a laboratory-grown beefburger while 2 billion people live on less than US\$2.00 per day.

Prof. David Thurnham's article *Food and Deficiencies of Critical Micronutrients: A focus on iodine, iron and vitamin A* is a timely reminder of how serious and widespread micronutrient deficiencies are, even in the 21st century. Although the article focuses on iron, iodine and vitamin A, Prof. Thurnham has also eloquently highlighted the additional importance of zinc, selenium, folic acid and vitamin D.

Interest in international nutrition is greater now than at any time in the past. This is to be celebrated. The 2013 Lancet series on Maternal and Child Nutrition has further consolidated our global interest in human nutrition. This interest must be harnessed and nurtured.

Micronutrient deficiencies are sometimes called “hidden hunger” for a very good reason: they are due not to a lack of calories but rather to a chronic lack of vitamins and minerals in the diet. Prof. Thurnham's article highlights several issues and challenges that confront the eradication of micronutrient deficiencies. It further demonstrates that micronutrient deficiencies are not merely confined to developing countries but also exist all over the developed world.

Micronutrient deficiencies may be due to:

1. The poor consumption of micronutrient-rich foods;
2. Inadequate absorption of micronutrients;
3. Enhanced excretion of micronutrients;
4. Elevated need for micronutrients during pregnancy and lactation; or
5. Specific diseases.

Each of these requires specific interventions and strategies, which have been highlighted in Prof. Thurnham's article. This article also provides several ideas and suggestions for eradicating micronutrient deficiencies. New and innovative ideas include biofortification; plant breeding to reduce polyphenols and phytates; the selection of enhanced bioavailable micronutrients; and modern techniques in food fortification. Although several nutrition gains have been made, much still remains to be done. It is time to turn rhetoric into action: we must translate theory into practice and scale up our nutritional interventions.

The proposed strategy to eradicate micronutrient deficiencies can be prescribed in three concentric circles:

1. Make key opinion leaders aware of the nature and magnitude of the micronutrient deficiency problem.
2. Examine various interventional strategies that are region- or country-specific, and which may be scaled up.
3. Synergize private-public partnerships in order to eradicate this scourge, which has been with us since the time of the pharaohs.

We have the means, knowledge and sense of purpose to achieve this; it now just needs all of us to join up these three elements and make the eradication of micronutrient deficiencies a reality for all.

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“First 1,000 Days of Life” Competition Deadline Extended



The First 1,000 Days offers a unique window of opportunity to shape healthier futures.

In issue 3/2013 we invited our readers to participate in “The First 1,000 Days of Life” Competition. The deadline for submissions has now been extended to **31 October 2014**.

For those still wishing to enter, there are four categories of submission: **Photographs** (color or black and white; digital); **videos** (max. length 90 sec); **infographics** (digital); and **drawings** (scan or hard copy).

To take part, please send an email to info@sightandlife.org with the subject line “Competition 2014” and include in the body of the email your full contact information, your current job title, why you would like to be involved, and up to three examples of work for each category you are entering.

Alternatively, you can send your entry via post. Along with your submission, please include your full contact details and current job title, along with why you would like to be involved, to:

DSM Nutritional Products Ltd.
Competition 2014
Sight and Life
Building 241/313
Wurmisweg 576
CH-4303 Kaiseraugst
Switzerland

Prizes

1st place > iPad



2nd place > Digital camera



3rd place > Book prize



We look forward to receiving your entries!

Commentary on the Maximum Acceptable Daily Intake of EDTA

Saskia de Pee

World Food Programme, Rome, Italy,
& Friedman School of Nutrition Science and Policy,
Tufts University, Boston, MA, USA

In February, the journal *Maternal and Child Nutrition* published a commentary by Carel Wreemann entitled “Reasons for raising the maximum acceptable daily intake (ADI) of EDTA and the benefits for iron fortification of foods for children 6–24 months of age”.¹

The maximum ADI of EDTA (ethylenediaminetetraacetic acid) was set by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in 1974 and puts a regulatory limit on the amount of EDTA that can be added to food. Wreemann explains why the maximum ADI of EDTA can be increased. Raising this limit would allow a higher daily intake of EDTA, including iron EDTA. Many diets are rich in phytate, inhibiting the due absorption of iron and zinc. Iron EDTA [ferric sodium EDTA; sodium iron (III) EDTA] has been identified as both safe and effective in overcoming this adverse effect of phytate.² The current ADI does not allow sufficient iron EDTA in foods for 6–24 month-old children, and a higher level can also improve zinc absorption.³

“Iron EDTA is both safe and effective in overcoming the adverse effect of phytate”

Both adults and young children aged 6–24 months need to absorb approximately 1 mg/d of iron. This is only a small fraction of the iron in food or supplements, but widespread iron deficiency attests to the fact that this requirement is not easily reached, especially from a plant-source-based, phytate-rich diet.⁴ However, when adults ingest 5 mg/d iron as iron EDTA from phytate-rich diets, most of them absorb the required 1 mg/d.² Although experimental data are still scarce, it is reasonable to expect that

5 mg/d iron as iron EDTA will also meet the requirement of absorbed iron for young children.

For 50 years, EDTA – in the form of calcium EDTA and disodium EDTA – has been added to enhance the shelf-life of food products. In all cases, the maximum ADI of EDTA set in 1974 was sufficiently high for this goal. However, this limit restricts the intake of iron EDTA to a maximum of 0.37 mg iron per day per kg bodyweight. For a 70-kg adult, this maximum equals 25 mg iron per day as iron EDTA, whereas for a 7-kg infant, it is only 2.5 rather than the desired 5 mg iron per day.

A maximum ADI is derived from multi-year animal studies. As documented by Wreemann, three such studies have been performed for EDTA. The current maximum ADI of EDTA originates from just one of these three. When taking into account the other two studies, a 1.4–11.4 times higher maximum ADI of EDTA could be justified.¹

Wreemann also reports that syrup containing iron EDTA (trade name Ferrostrane, see [Figure](#)) has been sold in France for half a century for the treatment of young children aged 1 month or older suffering from anemia. It provides up to 37 times more EDTA than the current maximum ADI, and during all those years, no adverse health effects have been reported as a result of this medicinal consumption of iron EDTA.

In conclusion

A maximum ADI of EDTA of 2–4 times the current value would not only allow meeting absorbed iron requirement through the use of iron EDTA for young children, but would also provide an opportunity to improve zinc status by simultaneously fortifying with e.g. zinc EDTA.



Ferrostrane, a common drug for small children in France that is based on iron EDTA.

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A Day in the Life of Shawn Baker

Shawn K Baker, Director of Nutrition, Bill and Melinda Gates Foundation

Sight and Life (S&L): Shawn, you recently joined the Bill & Melinda Gates Foundation after a distinguished career with Helen Keller International (HKI). What prompted this move?

Shawn Baker (SB): I could see that this role would give me the chance to have a very positive influence within the nutrition community and beyond, for I joined the Bill & Melinda Gates Foundation at a key moment. The nutrition community currently has an opportunity that has not existed for 30 years – a real chance to unite in the fight against malnutrition and all the misery it unleashes. This opportunity was initially triggered by the hard-hitting Lancet 2008 series on Maternal and Child Undernutrition, which correctly diagnosed the nutrition community as highly fragmented. The Lancet 2008 series, in combination with the food price crisis and the Copenhagen Consensus of that year, created the inspiration for the Scaling Up Nutrition (SUN) movement. SUN now has 50 member countries, and all major donors now have nutrition policies in place. Nutrition had a rather anemic position within the Millennium Development Goals (MDGs), but there is a new enthusiasm now to bring about real change using proven, evidence-based interventions. The Bill & Melinda Gates Foundation has always ascribed great importance to nutrition. Now is the time for a re-energized and reorganized nutrition community to deliver on its aspirations. This is recognized in the fact that my role is the first Directorship in Nutrition to have been created by the Foundation. I'm very excited about the possibilities.

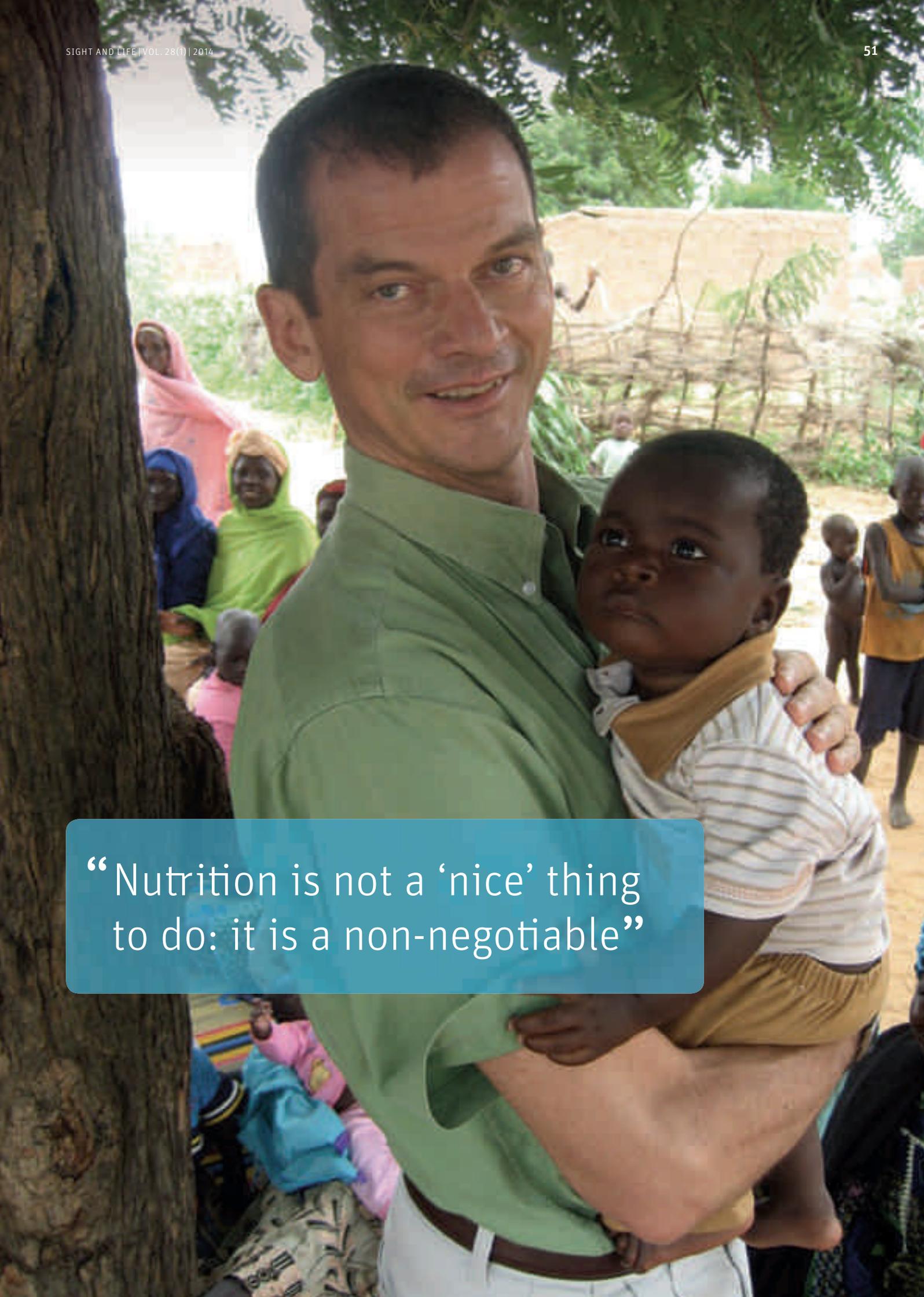
“We focus on research that can be translated into programs on the ground”

S&L: Warren Buffet – a friend of Bill and Melinda Gates and a co-trustee of the Bill & Melinda Gates Foundation – once gave Bill and Melinda Gates the following advice about philanthropy: “Don't just go for safe projects. Take on the really tough problems.” What tough problems are you taking on in your new capacity?

SB: Stunting is very high on our agenda. The Foundation has made significant research efforts across various program strategies into the question of what causes stunting and what can be done to combat it. If you look at the various challenges that the nutrition community faces, I would argue that stunting is one where our understanding is poorest and where our efforts to intervene have been least effective. We need to know more about a range of contributory factors such as environmental enteropathy, mycotoxins, and the gut microbiome. The Foundation is investing heavily in finding answers to these questions. Our approach is a very practical one: we don't support research for its own sake, but focus from the start on research that will eventually translate into programs that can be implemented on the ground.

Another tough problem we're tackling is the promotion of optimal breastfeeding – although one might not imagine that this would be a tough problem. The evidence of the beneficial effect of breastfeeding on child survival and development has been overwhelming for a long time now. However, there has been great skepticism about the possibility of scaling it up to meaningful levels because of its dependence on effective social and behavior change communication. We've been taking a multi-pronged approach to scaling up breastfeeding, and this is now translating into very positive results through the Alive & Thrive program and also our work in India. Repositioning an intervention that has been around as long as the human race and making it attractive to donors is quite an undertaking, but we're making good progress now.

S&L: Your last position with HKI was as Vice President and Regional Director for Africa, and a great part of your career has

A man with short dark hair, wearing a light green button-down shirt and white trousers, is smiling and holding a young child. The child is wearing a white and brown striped shirt and brown shorts. They are outdoors in a rural setting with a large tree trunk on the left and several people in the background, some wearing colorful head coverings. The background shows a simple structure with a thatched roof.

“Nutrition is not a ‘nice’ thing to do: it is a non-negotiable”

been associated with that continent. What are your hopes for Africa in the first half of the 21st century?

SB: My career started in what was then Zaïre (now the Democratic Republic of the Congo) in 1981, when I was a member of the United States Peace Corps. I’ve spent most of my adult life in Sub-Saharan Africa. I get very frustrated when I read purely negative news about Africa in the media. Africa is a vast and hugely diverse continent. An enormous amount of progress has taken place in the region: there’s a terrific willingness to take on big challenges, and great leadership has been demonstrated in putting programs into place to address those challenges. So although I’m not naïve about the challenges being faced, I have great faith in Africa’s future prospects.

S&L: *What are you most proud of when you look back on your career with HKI?*

SB: I’m most proud of some of the key programs that we supported via our partnerships. HKI doesn’t do direct program implementation; it works instead with partners – governmental organizations, NGOs and the private sector alike. HKI takes research and helps translate its findings into programs that can be scaled up in a sustainable way. Historically, HKI’s major regional focus was on Asia rather than Africa. During my time with HKI, however, by working with partners in 13 countries and many different regional organizations, we were able to take a number of key programs to quite impressive scale. Three flagship programs I’d like to mention are the vitamin A supplementation programs supported by the Canadian Government through HKI and other partners such as UNICEF and the Micronutrient Initiative. The programs supported by HKI are now reaching over 50 million children aged 6–59 months twice per year with life-saving vitamin A and other child survival interventions. Working with private-sector food companies and government partners, HKI has catalyzed vitamin and mineral fortification programs that reach over 130 million consumers every day. Work HKI has supported in control of neglected tropical diseases (NTDs) provides mass drug administration which reaches over 90 million people annually. Being able to take programs up to such a scale through these partnerships was incredibly rewarding for me.

“Niger has a very special place in my heart and my career”

S&L: *You were made an Officier de l’Ordre du Mérite du Niger by the Presidency and the Ministry of Foreign Affairs of the Republic of Niger. Can you tell us more about this distinction?*

What lies behind it, and what does it signify for you?

SB: Niger has a very special place in my heart and my career. I started working in Niger in 1985. I originally went there for a two-week consultancy during the heart of the Sahel-wide famine, and ended up staying for two years and two weeks. I was based out of the Ministry of Health, working on the Famine Early Warning System Project, whose aim was to predict food crises and monitor food security and undernutrition conditions. I returned to Niger later as a technical assistant working on the National Health Information System. My third long-term stay in Niger was when I moved from Bangladesh with HKI to Niger as Country Director for Niger and Regional Director for Africa. Several of the flagship programs just mentioned started in Niger. I’ve had the great privilege of living in Niger for a total of nine years, and I continue to keep up with my many contacts there. My work in Niger gave me very valuable insights into how one can work with governments to bring programs to effective scale. For me, Niger also represents some of the vulnerability of the African continent in terms of its erratic rainfall patterns and fragile food production systems. The leadership demonstrated by the Ministry of Health and the President himself in trying to address the country’s nutrition and health challenges is extremely impressive.

S&L: *Could you tell us something about your working life at the Bill & Melinda Gates Foundation?*

SB: My work falls into three main areas of activity. The first involves managing the Nutrition Team, which is composed of extremely experienced and well-known nutrition professionals. The second involves interacting with other programs within the Foundation, such as Agriculture, Water, Sanitation and Hygiene, reinforcing cross-sectoral collaboration and working with the Foundation’s leadership to ensure that Nutrition is receiving adequate attention. The third area is more externally facing, and involves activities such as site visits to grantees, attending conferences, and working within the SUN movement through the donor network.

S&L: *If you could change one thing about your current job, what would it be?*

SB: The Foundation has always been active in nutrition, and we’re doing even more nowadays. It’s important to push the cross-sectoral dimension of our work and to model this as the type of behavior that we would like to foster in the wider world. We need to show how non-nutritional sectors can be leveraged to help deliver on nutrition, because nutrition is dependent on such a multiplicity of different sectors.

Looking at the question from a personal perspective, I’d like

to be able to spend more time in the field. I'm very much a field person at heart, and I get my energy from being out in the field and understanding the reality of the people we're trying to serve there.

S&L: *You earned your Bachelor of Science degree in Biology from the University of Miami and your Master of Public Health degree from Tulane University School of Public Health and Tropical Medicine in 1989. What decided you on a career in nutrition?*

SB: I sometimes say that my present career is a hiatus, because my first degree was in Biology and Marine Science, so I'm actually supposed to be a marine biologist! I was planning to be the next Jacques Cousteau, but then volunteered for the United States Peace Corps in Zaïre. That experience changed everything for me. My first two years in Zaïre were spent working as a science teacher in an agricultural technical high school. Over the summer break, I also worked with the district hospital and local missionaries to organize the Well Baby Clinic, which focused on growth monitoring and promotion. Between agriculture and growth promotion, I got bitten by the nutrition bug, and I repurposed my career trajectory to study nutrition, in which Tulane University had great strengths.

“My work in Bangladesh gave me a completely new sense of what it means to work at scale”

S&L: *What has influenced you most in your career, Shawn?*

SB: Three things. First, my experiences with the Peace Corps, which transformed my career trajectory completely. Second, my experiences when I was working with the Ministry of Health in Niger, which taught me how people in government think, and how to work with the structures of government rather than against them in order to achieve results. Third, my work on Bangladesh, on account of the size and the density of the population there, which gave me a completely new sense of what it means to work at scale. The world is replete with very good program models that are running in a handful of villages, but if we want to have a real impact on nutrition outcomes, we need to be running programs that deliver results in tens of thousands of villages.

S&L: *What are your interests outside of work?*

SB: I've indicated my love of marine biology, but I do have another parallel life that is very important to me. For the past seven years, I've been on the Technical Review Panel of the Global

Fund to Fight AIDS, Tuberculosis and Malaria. The Technical Review Panel is a mix of disease specialists and “cross-cutters” who have a broad understanding of program implementation, and I belong to the latter category. I've been Chair of the Technical Review Panel for the past three years. This position gives me enormously valuable insights into the workings of the global donor community. I'm actually not obsessed with nutrition: I'm obsessed with ensuring that children survive and have the best conditions to thrive. Nutrition is an enabler, not an end in itself.

S&L: *The nutrition community is currently hard at work on the post-2015 nutrition agenda. What are the crucial components of that agenda, in your view?*

SB: We're in a very good place with nutrition globally at the moment, but it's essential to keep up the momentum and make sure that it stays on the agenda of high-level policy-makers. Solving nutrition issues requires a long-term commitment, and politicians usually think in terms of short-term election cycles.

I also feel that the positioning of nutrition within MDG1 was sub-optimal and that in the post-2015 development goals it should be positioned far more prominently, with food security and nutrition security much more tightly interlinked. Traditional views of food security, which involve simply growing more food to produce more calories, are not sufficient. We also need to ensure the role of nutrition is recognized within the other post-2015 development goals. The multi-sectoral nature of nutrition can be a great advantage, but it can also be a handicap. The advantage is that nutrition can motivate many different sectors to action. The handicap is that if the nature of the action required is not explicit and the relevant sectors are not held accountable, nutrition becomes everyone's problem and no-one's responsibility.

S&L: *The world is experiencing an epidemic of nutrition-related health conditions including hidden hunger and metabolic syndrome. It is often said that only multi-sectoral approaches are capable of addressing these problems. What, in your view, is the recipe for successful cross-sectoral collaboration in the nutrition space?*

SB: If we look at countries that have achieved significant results, such as Brazil and Peru, we can see that there has been a major commitment from politicians and that the various sectors involved have been held accountable for delivering change. There has also been a major investment of resources, both financial and human – and the importance of human resources is not to be underestimated. This has been accompanied by effective measurement, with close monitoring of progress and the readiness to correct course if necessary. It's also important not to be overwhelmed by the challenges involved but to break them down

into actionable steps that different sectors can implement in a meaningful way. If we say, for instance, that agriculture needs to be more nutrition-sensitive, we should have answers when ministries of agriculture ask us what this actually means.

S&L: *This issue of Sight and Life magazine is dedicated to the topic of nutrition. If you could give a single message to our readership about nutrition, what would it be?*

SB: If you look at where HIV is today, this is because the world shared a sense of outrage at the devastating effects of this disease. While the 2008 Lancet series was correct in its diagnosis of how disjointed the nutrition community was at the time, I sometimes think that we have over-corrected now and become too well behaved. Undernutrition is accountable for 3.1 million child deaths a year and is compromising the future of individuals and entire economies. This is an outrage, and is completely unacceptable in our day and age. To put this in context, pet food sales in the USA amounted to US\$21 billion dollars annually, and are projected to reach US\$24.7 dollars a year by 2017. Even the most expansive projections of what it would take to scale up nutrition are less than US\$10 billion a year. We have to let the world know that nutrition is not a “nice” thing to do: it is a non-negotiable.

S&L: *Thank you, Shawn.*

SB: Thank you.

Shawn Baker was interviewed by Jonathan Steffen

**Shawn Baker, Director of Nutrition,
the Bill & Melinda Gates Foundation**

Shawn Baker, Director of Nutrition, leads the Foundation’s work to deliver proven interventions and create new tools and strategies to ensure that pregnant women and young children receive the nutrition they need for healthy growth and development.

Prior to joining the Foundation he was with Helen Keller International, as Vice President and Regional Director for Africa. In that role he oversaw expansion from four to 13 country programs and an 80-fold increase in program funding. Flagship programs that he has shaped include vitamin A supplementation through child health days, reaching over 50 million children twice-yearly, and food fortification programs reaching over 130 million consumers. He led development of strategic regional relationships, particularly with the 15-nation West African Health Organization. In addition, he served as country director in Niger and Bangladesh.

Other responsibilities during Shawn’s 30 years career include: Co-Promoter of the Niger Health Information System, Coordinator of the Tulane University Center for International Health and Development, and Coordinator of the Famine Early Warning System in Southern Africa, and representative in Niger. He served as a US Peace Corps Volunteer in the Democratic Republic of the Congo (formerly Zaïre).

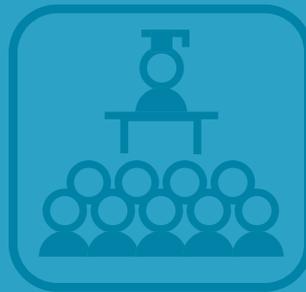
Shawn received a Master’s degree in Public Health from the Tulane University School of Public Health and Tropical Medicine in 1989 with concentrations in international health and nutritional epidemiology. He earned his Bachelor of Science degree in Biology from the University of Miami. He is the author or co-author of over 80 peer-reviewed publications, presentations at international conferences and monographs. Shawn received the “Officier de l’Ordre du Mérite du Niger” from the Presidency of the Republic of Niger and the Ministry of Foreign Affairs. He currently chairs the Technical Review Panel for The Global Fund to Fight AIDS, Malaria and Tuberculosis.

Source: www.gatesfoundation.org

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Sight and Life is a
humanitarian nutrition
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Fighting Hunger and Malnutrition

One Step at a Time

Matt Hackworth
Church World Service,
New York, USA



Participants in the 2013 CROP Hunger Walk in St. Joseph County, IN.

It's still dark when Stephen Southern begins his day at Dorothy Day House in Berkeley, California. The fluorescent lights hum when they are turned on at 5:30 a.m. as a wake-up call to around 50 men who stay at the men's shelter, signaling that breakfast is served.

"Breakfast is important because it's the first meal of the day," Southern says above the rattle of cooking and the steam-heat of a pot of oatmeal. "It's reliable."

Yet being a reliable source for food is a tough proposition in the era of growing demand. The global economic downturn has strained US community food banks, as more people line up for services. A survey by US-based NGO Church World Service (CWS) has reported increased demand, with some estimates indicating rises as high as 20 percent each year.

Connecting with US food banks

CWS connects with more than 2,200 food banks across the USA through its community fundraising effort, CROP Hunger Walk. Added demand, rising food prices and danger to safety-net programs are not lost on the estimated 150,000 annual participants

in CROP Hunger Walks. More than 1,600 US communities hold the annual Walks, which are the only US event-based fund raiser that focuses on fighting hunger locally and globally.

CROP Hunger Walk has also become a platform for the agency to promote the role that adequate nutrition plays in child development. Maurice A Bloem serves as the Executive Vice President of CWS, but once a year he walks 100 miles, helping connect CROP Hunger Walkers with the CWS programs they support by speaking at rallies and visiting food pantries.

"Everywhere I have been, people have responded to the idea that a child's first 1,000 days of life are important," Bloem says. "The people I've talked to in the last two years of my participation join in because they want to solve the hunger problem. It's important they understand the role that child nutrition plays."

Promoting nutritional programming

CWS promotes nutritional programming in its development and emergency work. For example, a recent program in rural Kenya helps drought-stricken communities construct greenhouses that boost community access to nutritious food while ensuring disaster resiliency. And Kenya's Ministry of Health used lessons learned by CWS in its feasibility study into implementing widespread micronutrient powder (MNP) distribution across the country.

Even the US public – living far removed from developing areas – is aware of the use of MNPs. CWS routinely elevates MNP application in its interpretative materials and offers the chance for anyone to purchase MNP supplements for a child in need in the agency's alternative-giving catalog, which can be found at www.cwsbestgifts.org.

"Nutritional programming can be a game-changer"

"People are beginning to realize how much of a game-changer nutritional programming can be," Bloem observes. "CROP Hunger Walkers genuinely want to fight hunger, and we help them understand that solving global hunger is far more complex than simply handing out food."



Esther waters tomatoes in a greenhouse that has just been set up at the Kadokoi community farm in Kenya by CWS.

Preparations are already under way for Maurice Bloem's third 100-mile CROP Hunger Walk. As a goal of CWS is to help women everywhere to realize their rights and to prosper, the focus of this year's 100-mile effort will be on women's empowerment. Representatives from several key partners of CWS have already committed to joining the journey, which will be across the US states of Michigan and Indiana, culminating in a gala benefit-

ing CWS work at Chicago's Adler Planetarium. Follow their journey by visiting Maurice Bloem's blog: <http://mauricebloem-100milehungerwalk.tumblr.com/>

About CROP

When CROP began in 1947 (under the wing of Church World Service, which was founded in 1946), CROP was an acronym for the Christian Rural Overseas Program. Its primary mission was to help Midwest farm families to share their grain with hungry neighbors in post-World War II Europe and Asia. Today, rather than thinking of CROP primarily as an acronym, we retain it as the historic name of the program. CROP Hunger Walks are interfaith hunger education and fundraising events sponsored by Church World Service and organized by CWS/CROP regional offices across the USA.

Source: http://hunger.cwsglobal.org/site/PageServer?pagename=crop_faqs

About CWS

Founded in 1946, Church World Service is an international relief, development and refugee resettlement agency. It began as an effort by US Midwestern farmers and churches who wanted to help those struggling to recover from WWII. Now nearly 70 years old, CWS strives to be a global leader in promoting lasting solutions to issues of hunger, poverty and protection.

To learn more about CWS, please visit www.cwsglobal.org.

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CWS is a member of the ACT Alliance (www.actalliance.org).

Gary Taubes in Conversation: Why is Nutrition so Confusing?

Gary Taubes

Gary Taubes is the co-founder of the Nutrition Science Initiative (NuSI.org) and an American science and health journalist. He is the author of *Nobel Dreams* (1987), *Bad Science* (1993), *Good Calories, Bad Calories* (2007) – which is titled *The Diet Delusion* in the UK – and *Why We Get Fat* (2011).

Gary has won the Science in Society Award of the US National Association of Science Writers three times, and is the recipient of a Robert Wood Johnson Foundation Investigator Award in Health Policy Research. He talks to *Sight and Life* about why he thinks nutrition is so confusing and what should be done about it.

Sight and Life (S&L): You founded the Nutrition Science Initiative (NuSI) in 2012, Gary. What was your objective, and what have been your experiences to date?

Gary Taubes (GT): Let me answer by providing the context in the form of my professional background. I've been an investigative science journalist since the early 1980s, focusing on controversial science and what physicists call "pathological science", or the "science of things that aren't so." In the early 1990s I began focusing on research in public health, in large part because it didn't live up to the strict requirements that I had learned from my previous investigations were absolutely necessary for the establishment of reliable knowledge – the key word being "reliable."

This led me into a series of investigations, first for the journal *Science* and then for the *New York Times Magazine*, and to my first book on nutrition research. One of my conclusions was that our dietary beliefs were based more on the preconceptions of influential researchers than on rigorous experimental evidence. In fact, many of these beliefs had arguably failed the experimental tests to which they had been subjected, yet nutrition authorities continued to treat them as facts. It was a field based on preconceptions, assumptions and faith, and while the guidance based on these preconceptions began to be promulgated widely,

it coincided with unprecedented increases in the incidence of obesity and diabetes.

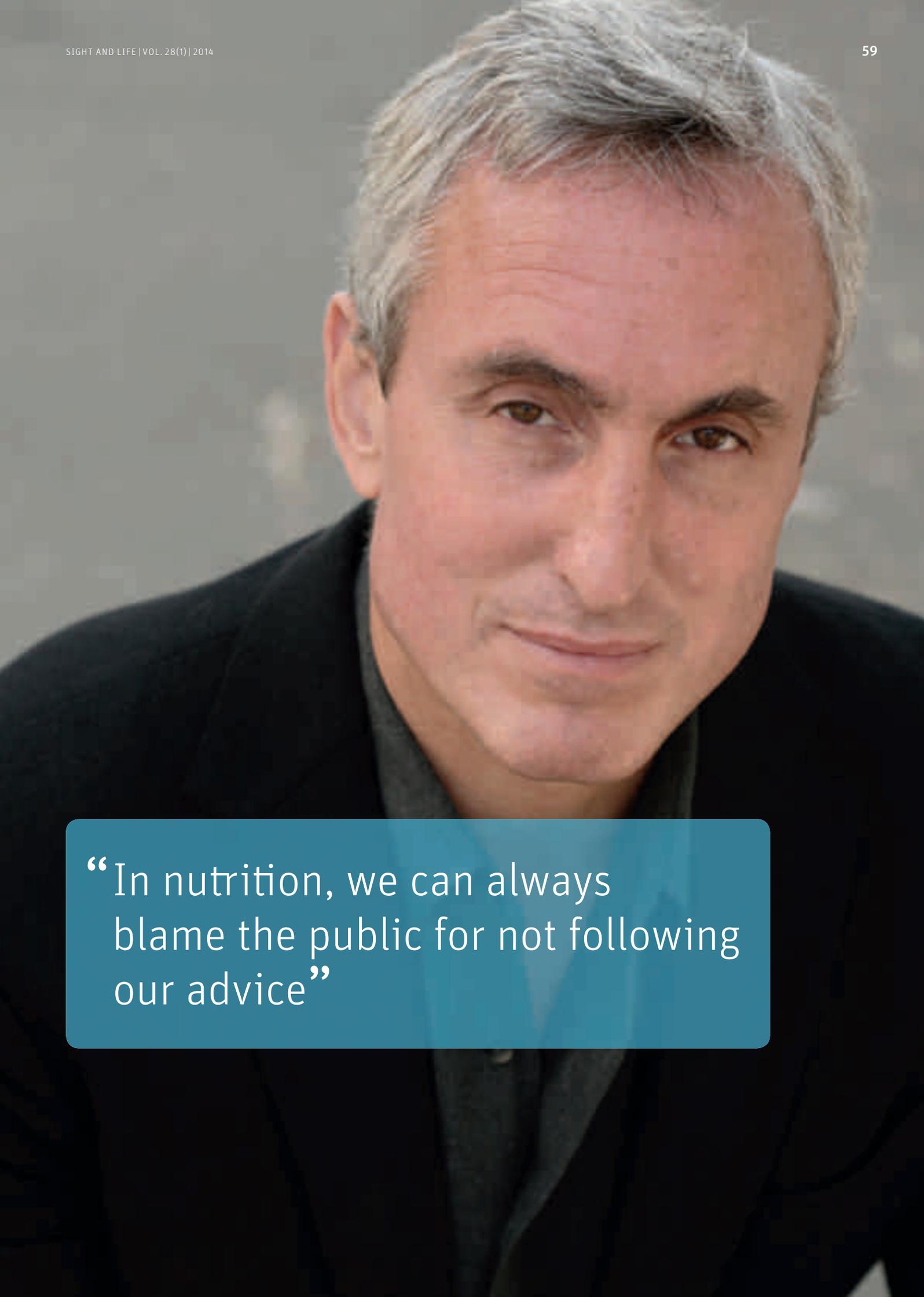
In other fields of medicine, a natural response would have been to question our understanding of these disorders. Governmental organizations would have established teams of researchers to figure out where we went wrong and why, and to put an end to these epidemics. But in nutrition, we can always blame the public for not following our advice and the food industry for making it too hard for the advice to be followed, and we never have to question our beliefs.

I co-founded the Nutrition Science Initiative with Dr Peter Attia to try and rectify the situation. NuSI's strategy is to fund and facilitate the experimental trials in humans that are necessary to establish reliable knowledge about the nature of a healthy diet, and to recruit the nutrition/chronic disease research community as allies in this endeavor. This requires convincing the research community of the need to do these trials; it requires raising the money for the trials and raising enough money so that the trials are rigorous and provide reliable results that answer the right questions; and it requires getting those studies done and applying the highest possible standards.

So far we've had success with recruiting leading members of the research community as allies. These researchers acknowledge the inherent uncertainty in their beliefs and welcome the opportunity to rigorously test them. We've raised the philanthropic funds necessary to support the first three critical trials, the details of which can be viewed on our website (<http://nusi.org>). We're now engaged in recruiting the researchers for the next phase of clinical trials and raising the money to fund them.

S&L: You are a prolific author, with recent book publications including *Why We Get Fat* (2011) and *Good Calories, Bad Calories* (2007). What drives you to publish so widely?

GT: "Prolific" is in the eye of the beholder. It took me five years to research and write *Good Calories, Bad Calories*, and that came after two to three years of research and writing. *Why We Get Fat*, as I explain in the book's introduction, is something of an airplane-reading, argumentative version of *GC, BC*. It was written to be

A close-up portrait of a middle-aged man with short, grey hair and a slight smile. He is wearing a dark suit jacket over a dark shirt. The background is a soft, out-of-focus grey.

“In nutrition, we can always blame the public for not following our advice”

read quickly by those who don't have the time for the 500-page, densely annotated tome of *GC,BC*, the subtext of which is "much of what you think you know about nutrition is likely wrong."

"To do science right requires the rigorous testing of our hypotheses"

S&L: On February 8, 2014 *The New York Times* published an opinion piece by you entitled "Why Nutrition Is So Confusing." The home page of *NuSI* asks, "Can we trust anything we think we know about nutrition?" Why is nutrition confusing, in your opinion, Gary, and why should we be mistrustful of what we are told about it?

GT: This isn't a simple question, and no short answer will do it justice. Still, I'll try. To do science right, to generate reliable knowledge about nature and the universe, requires a meticulous attention to detail and the rigorous testing of our hypotheses. This is doable in hard sciences like physics because physicists are not dealing with messy complicated subjects such as human beings, who happen to have minds of their own. Experiments might be expensive, but they can be reproduced numerous times, and variables can be controlled in such a way that the researchers can establish, beyond reasonable doubt, what is cause and what is effect. Nutrition, on the other hand, asks questions about how diet influences human health over the course of a lifetime. This means doing the studies in humans and following them for years or decades to get meaningful results.

This combination makes the experiments extraordinarily difficult, and they can appear prohibitively expensive. I believe that nutrition researchers have tended to respond to this by accepting a lower standard of evidence for what they are willing to believe and promulgate as advice. What's undeniable (to me, anyway) is that the evidence is ambiguous, and it then leaves the interpretation open to the preconceptions of the "experts" who are doing the interpreting. If you believe observational trials are capable of establishing cause and effect (I don't, with a few dramatic exceptions), then you interpret the evidence one way, and that informs your belief system on what constitutes a healthy diet. If you believe randomized controlled trials are necessary to establish cause and effect (I do, but acknowledge that these too can be done poorly), then you interpret the evidence another way.

We end up with today's news in health and nutrition contradicting yesterday's news, which contradicted the news from the day before, while the experts are content to disagree with each other. At the heart of the problem is a research community that never succeeded in the job of establishing reliable knowledge, and doesn't understand – or at least agree – that when the evi-

dence is ambiguous, you have to acknowledge this, even when you're trying to get the public to do what you think is best.

S&L: In an article published in the *BMJ* on April 17, 2013 entitled "The science of obesity: what do we really know about what makes us fat?" you question the received wisdom concerning the causes of obesity. Could you enlarge on this?

GT: Prior to World War II, when effectively all meaningful medical research was done in Europe, German and Austrian clinical investigators had mostly come to believe that obesity was indeed a hormonal/regulatory defect, just like any other growth disorder. This hypothesis vanished with the war and with the shift of the lingua franca of science from German, pre-War, to English, post-War. After the war, young American MDs and nutritionists decided obesity was obviously caused by gluttony and sloth – simply eating more calories than we expend – and that's the notion we've been living with since.

To get an idea of the problems with this thinking, ask yourself why it's any more meaningful to say that someone got fat because they took in more calories than they expended, than that someone got rich because they took in more money than they spent. In both cases, the statement is true, but only in a vacuous sense. Someone who gets rich takes in more money than they spend, but this says nothing about how they got rich – which is usually what we want to know. The same is true for someone who gets fat. Sure they take in more calories than they expend, but the question is why?

The pre-World War II Europeans thought the key would be in why the fat cells themselves might accumulate excess fat and why the oxidation of that fat as fuel might be inhibited. By the 1960s, biochemists and physiologists had established that the hormone insulin regulates fat accumulation in fat cells and inhibits fatty acid oxidation in mitochondria. When insulin levels go up, we store fat. When insulin goes down, we mobilize it and oxidize it. The catch is that we secrete insulin primarily in response to the carbohydrate content of our diet. So from this biological perspective – rather than the calories-in-calories-out physics viewpoint – what makes us fat is whatever serves to elevate insulin levels, and that's probably the quantity and quality of carbohydrates in our diet. This hypothesis was embraced by diet book doctors – Robert Atkins, most notably – and treated by the mainstream medical community as quackery. Since the 1960s, the diet books have advocated reducing carbohydrates, and the medical/public health establishment has insisted this is quackery and that "eat less, exercise more" is the only meaningful advice for obesity.

S&L: In the same article, you stress the importance of studying not only medicine but also the history of medicine. Why is history so important for our understanding of contemporary medical problems?

GT: My college education was in physics, and this is how physics is taught. You learn how the science evolved over centuries – what we once believed, how new evidence and new hypotheses shifted those beliefs, what the tests of the hypothesis did or didn't find – even who conducted the tests and who promulgated the hypothesis. You get a firm grounding in the methodology of science, and how science proceeds in fits and starts, and the role played by theorists and experimentalists. By leaving out the history, we teach dogma. Students accept what they're taught as the gospel truth without the necessary context to question it.

One of the fascinating aspects of my research was learning which clinicians thought up the idea that obesity was caused merely by taking in more calories than we expend (there were two in particular, Carl von Noorden in Germany and Louis Newburgh in the USA), and how this notion was challenged, and why. It was a hypothesis put forth by a couple of reasonably smart guys at a time when studying the caloric content of foods and caloric expenditures of humans and animals was the new big thing in research. It was accepted after World War II because an entire school of research that thought otherwise evaporated with the war. The question, of course, is whether it's actually right. I'd argue no.

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“We shouldn't fool ourselves into thinking we understand what's causing these disorders”

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S&L: *According to your article “Why Nutrition Is So Confusing”, obesity and its related diseases cost the US health care system alone more than US\$1 billion per day. Why has the global phenomenon of obesity developed so rapidly, in your opinion, what are its causes, and what can be done to combat it?*

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GT: I have a bias based on my research, but I think it's the spread of sugars, first and foremost – sucrose and high fructose syrups – and then the refining of the carbohydrates we consume. White flour. I don't think it's the amount we eat and exercise, but rather the change in the macronutrient composition of the diet. We eat unprecedented amounts of sugars, and I think this is reflected in unprecedented rates of obesity and diabetes. You can see this in microcosms as well – the south Pacific Atoll of Tokelau, for instance, which went from having virtually no diabetes and eating very little sugar in the 1960s to having the highest rates of diabetes in the world today and having a yearly sugar consumption of 100 pounds per capita. Yes, this is an association and it doesn't imply causality. But you see the same patterns in geographically diverse populations going back well into the 19th century. To me, it's compelling. But I also think that this can be

tested with the proper experimental trials, and I'm hoping we'll get that done within the next decade.

S&L: *At a time when nutrition is receiving a prominent place on the global development agenda, you are questioning the science on which many of our assumptions about nutrition are based. What are the reasons for your skepticism, and what would you propose by way of alternative approaches?*

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GT: As you noted, obesity rates are sky-rocketing around the globe, as are diabetes rates, and they're doing so during a period of time in which we think we understand the dietary triggers of these diseases. So we either **1)** blame the individuals for not taking our advice, or **2)** blame the food industries for making it too difficult to follow our advice, or else **3)** maybe our advice and our understanding are wrong. Anyone who doesn't entertain the possibility that the third answer is the correct one is someone, I'd argue, who doesn't comprehend the role that skepticism plays in a functional science. Richard Feynman, the Nobel laureate physicist, once said that the first principle of science is that you must not fool yourself, and you're the easiest person to fool. With the ongoing epidemics of obesity and diabetes in the world, I think it's incumbent on us not to fool ourselves into thinking we understand what's causing these disorders.

S&L: *If communications about nutrition are currently confusing, how would you improve them, Gary?*

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GT: I believe that the communication is confusing because the evidence on which we base our communications is ambiguous. I think there are a lot of nutritional authorities out there promulgating their beliefs as irrefutable facts. We can start by acknowledging that what we believe to be true is only what we believe to be true. Then we can work to develop the tests necessary to see if we're right. Yes, the public might get frustrated if nutritionists start acknowledging that they're more than occasionally speculating, but is that any worse than insisting that we know the truth when we don't, and possibly doing more harm than good?

S&L: *Thank you for sharing your views with us. I hope that some of readers will respond with their views in the next issue!*

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GT: Thank you.

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Gary Taubes was interviewed by Jonathan Steffen

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Meet the WFP Nutrition Team

The World Food Programme (WFP) is the only United Nations agency that works along the entire value chain, interacting closely with national governments, the SUN Business Network, the UN Network, the private sector, and civil society. This breadth of focus is reflected in the diversity of the Rome-based WFP Nutrition Team, which is headed by Martin Bloem, Senior Nutrition Advisor and UNAIDS Global Coordinator for WFP. We meet Martin's team and find out more about their work.

Sight and Life (S&L): *What motivated you all to become nutritionists in the first place?*

Quinn Marshall: Actually, we aren't all nutritionists. One of the great strengths of our team is that it is composed both of nutritionists and non-nutritionists. I'm not a nutritionist myself, but I was motivated to work in this field because it interlinks with so many other sectors. When you work in nutrition, you know you won't just be dealing with agriculture; you'll be dealing with health systems, social protection, climate change and so forth. The need to view things from this extremely broad perspective is a challenge, but it's also a great opportunity.

Anueja Gopalakrishnan: I'm not a nutritionist, either. My background is in law and in public health. From my earliest years, I wanted to work for the UN. I see things from an epidemiological perspective, which explains my role in the monitoring work we carry out. I use statistical analysis to evaluate our programs.

Nina Beretta Piccoli: As for me, I'm an economist, but nutrition is a fascinating field, and it's so complex that the challenges it poses can't be solved by any single approach. We need the combined expertise of many disciplines. So we all have the same goal in this team, but we address it from different angles, and that's very stimulating. I find the complexity of my work extremely motivating.

S&L: *And what made you want to join WFP specifically, rather than another agency?*

Divya Mehra: I would say that WFP is very special within the UN. WHO looks at things from a health perspective; FAO sees things in terms of agriculture and food security; and UNICEF focuses on

children. WFP, however, combines all these perspectives. It also has a very important engagement with the private sector, and is at the table in many important forums around the world. WFP can therefore play a very important brokering role. This makes it very special, and very attractive to work for.

Natalie Aldern: We're also a very operational organization, with a field presence in over 80 countries worldwide. We don't only work at the implementation level; we also work on advocacy, stakeholder engagement and policy, promoting both a nutrition-specific and a nutrition-sensitive agenda. WFP therefore has a uniquely comprehensive focus in terms both of breadth of activity and levels of engagement.

Quinn Marshall: Yes, and this makes us a very dynamic organization, working on the production side as well as the demand side, and tackling the barriers that prevent people having access to the nutrients they need.

Anueja Gopalakrishnan: And in terms of the breadth of our operations, we run from emergencies to development, which also makes us very special.

S&L: *So is there such a thing as a "WFP person"?*

Alexandra Ji Yen Tung: We're a very diverse group, as you can gather, but there are certain characteristics that we all share, I think. We have to be very flexible, reacting quickly to changing circumstances and working very hard to achieve common goals. I'd say that we all have similar values in combination with very diverse skill sets.

Divya Mehra: Yes, we all have a passion for what we do, and we really want to see results.

Quinn Marshall: Quick thinking is certainly a key selection criterion, and once you're here, it's essential to be able to see things from multiple angles.

Anueja Gopalakrishnan: Of course while this team is based here in WFP's headquarters in Rome, the majority of WFP's staff are actually based in the field. For many of our staff, working for WFP is a lifestyle choice, for it frequently involves living in remote parts of the world, those parts where the need for our services is greatest. And these often aren't the easiest places in the world to live!



The WFP nutrition team in their regular meeting place, March 2014, Rome. From left to right: Quinn Marshall, Natalie Aldern, Divya Mehra, Alexandra Ji Yen Tung, Nina Beretta Piccoli, Sara Bernardini, Anueja Gopalakrishnan.

S&L: *How, then, does one get to join the WFP Nutrition team? If a reader of this magazine were interested in joining, what should he or she do?*

Divya Mehra: That's a very difficult question to answer, for we've all taken different routes to get to where we are today. Some have come via the food security route, others via the public health route, and so on. Nina and myself, for instance, originally worked for Boston Consulting Group, which has a very strong partnership with WFP. But there are certain important characteristics that probably all successful candidates have to demonstrate. These include familiarity with the subject-matter, an awareness of key global developments in the field, flexibility, and problem-solving skills.

S&L: *Could you tell us a little more about the structure of your group, and how you work together?*

Anueja Gopalakrishnan: Our group works within two overarching sections: programming and policy. On the programming side, our team provides technical assistance and translates proven evidence into operational guidance; supports monitoring and evaluation of our nutrition programs; and coordinates the nutrition and HIV activities of our regional bureaus, with a specific focus on advocacy and capacity building.

Nina Beretta Piccoli: Yes, and on the policy side, we advise WFP's senior management on a daily basis regarding new scientific developments and up-to-the-minute trends in nutrition. This allows our senior management to make timely and well-informed decisions.

Divya Mehra: The external perspective is very important. We need to be aware of how we can best position WFP so as to be able to make the maximum contribution to the world around us. Although our team falls into two groups, we work very closely together, and there's no way we could do what we do with just one half of the team. We participate in discussions at the global level but ensure that these are very quickly disseminated to the field.

S&L: *So how do you interact with your key external stakeholders?*

Divya Mehra: We keep our eyes and ears open to everything that's going on in the world of nutrition, and we participate in all the major existing platforms. This involvement helps to guide our choice of research topics.

Quinn Marshall: This is a critical question when you consider how many different types of actors are participating in the nutrition space nowadays. WFP has to work with everybody, especially at this time, when the world is working on the Sustainable Development Goals and the post-2015 agenda. Our job is to ensure that everyone is at the table and that we have a unified vision for nutrition moving forward.

Sara Bernardini: Yes, as we've said before, nutrition is a complex and multi-sectoral issue, so we have to interact with key stakeholders – agencies, the private sector and civil society – and at every level. We have to think in a very integrated way that incorporates the global, regional and country levels.

S&L: *What is the essence of WFP's nutrition policy? What does WFP want to achieve in the world?*

Natalie Aldern: WFP focuses on ensuring that vulnerable populations have access to nutrients – whether we're talking about pregnant or lactating women, children under the age of two and five, or the chronically ill. We have four nutrition-specific interventions that directly treat and prevent undernutrition, but we also have nutrition-sensitive approaches. We do advocacy work, we provide technical assistance, and we work with national governments to help strengthen their capacity to reduce undernutrition in their own countries.

Quinn Marshall: The partnership aspect of our nutrition policy is very important. We strive not to set up lots of parallel systems but to work in ways that complement and support what is being done elsewhere.

S&L: *What is WFP's position on micronutrients and on food fortification specifically?*

Natalie Aldern: In partnership with DSM and other stakeholders, WFP has been working to ensure that age-appropriate, nutrient-dense complementary foods are widely available. Where the context suggests that this is the appropriate intervention, WFP supports governments with the distribution of micronutrient powders (MNPs). Our aim in all our nutrition programmes is to ensure vulnerable groups have access to a comprehensive range of nutrients to supplement the diet where local diets do not currently meet dietary needs. As regards fortification, we work with governments and other partners to support them in putting appropriate and sustainable fortification programs in place. Our aim is to ensure that all of our programs, whatever their specific objective, are platforms for improving the nutritional status of the populations we want to support. Providing access to nutrients is the key to everything we do.

Sara Bernardini: Indeed. Our work to develop and strengthen national capacities to address micronutrient deficiencies, including local fortification, is very important here.

S&L: *Martin Bloem argues very strongly that the right to nutrients should be a human right. What does WFP's Nutrition Team do to support this objective?*

Quinn Marshall: A lot of our activity involves working together with companies to develop nutrition interventions that meet specific dietary gaps for particular groups. This means ensuring not only that nutrients are provided where necessary, but that they are made available in a manner that is culturally appropriate for the relevant target population.

S&L: *A lot of discourse in the nutrition space currently refers to the post-2015 agenda. What is meant by this term?*

Quinn Marshall: The Millennium Development Goals (MDGs) are coming to their end, and we need to create a new agenda going forward. Hence the post-2015 agenda.

Divya Mehra: Yes, and you'll notice that we speak now in terms of "sustainable" development goals. Sustainability is much more central to considerations now, not least because of the growing awareness of the effects of climate change. I think that the focus of the world's efforts is also becoming clearer as we progress.

S&L: *Some observers say that the world of nutrition is very confusing. Is this criticism justified, in your view?*

Alexandra Ji Yen Tung: I think people are currently beginning to realize the complexity of the nutrition challenge faced by the world, and the need for action from many sectors. A single treatment, or a single product, cannot solve the issue. It's close interaction that is required – and that's inevitably complicated.

Quinn Marshall: Yes, you need a systems perspective for understanding these issues. Nutrition is indeed complex, as we have already indicated, but it needn't be confusing if approached in a systematic way. You need to break it down into its constituent parts and to strive to understand the interlinkages; then it becomes manageable.

Divya Mehra: That's right. The world is used to approaching nutrition problems in a vertical way, tackling one problem at a time, and in isolation from the surrounding context. We need cross-cutting, and multi-sectoral approaches. This may seem complex at first, but people are increasingly coming to realize that this is the only way forward. We must all work together. Experts can't just work in silos any longer!

S&L: *Thank you all, and the best of luck with your work together!*

WFP's Nutrition team was interviewed by Jonathan Steffen

The WFP team at a glance

Natalie Aldern

Natalie Aldern joined WFP in 2011 as a Program and Policy Officer in the Nutrition and HIV/AIDS unit. She holds a Masters in Food Security and Human Development from the Università degli Studi Roma Tre. Her work focuses on advocacy for nutrition, generating partner commitment, knowledge management, analysis and design of programs, and innovative delivery mechanisms for nutrition interventions.

Sara Bernardini

Since 2012, Sara Bernardini has been working in the HIV and Nutrition Unit at WFP in Rome, Italy, where she provides support to the Regional Bureaus and Country Offices to better align programs with Nutrition and HIV Policies and the Monitoring and Evaluation (M&E) Framework. Sara holds a Master's in Clinical Nutrition and Dietetics, and a Bachelor's and Masters of Science in Biology. She has been with WFP since 2009, when she began as a Program Officer in the Swaziland Country Office, supporting implementation of nutrition and HIV programs. After two years, Sara moved to the Johannesburg Regional Bureau, where she assisted WFP Country Offices in the Southern Africa Region during the Global Fund proposal development process.

Anueja Gopalakrishnan

Anueja Gopalakrishnan joined WFP in 2013 as a Consultant specialized in M&E within the Nutrition and HIV/AIDS unit. Her work has focused on providing technical guidance on nutrition-related M&E, concentrating in particular on the roll-out of the Organization's new nutrition measurement approach in the Strategic Results Framework (2014–2017). Prior to joining WFP, Anueja was seconded as a Program Officer to the Global Secretariat of United Nations REACH. Anueja previously worked for World Vision Australia as a Public Health Analyst responsible for health policy analysis and conducting program evaluations across multiple contexts in Asia and Africa. She holds a Masters in International Law from the Australian National University and a Masters in Public Health from Monish University.

Quinn Marshall

Quinn Marshall is a consultant in the Nutrition and HIV Advisory Office of WFP, based in Rome, Italy. Here, he supports WFP's objectives of fighting hunger and helping people living with HIV to achieve good nutrition by analyzing innovative

platforms and initiatives for delivering integrated interventions, as well as collaborating with WFP's partners. Quinn is a graduate of Columbia University's School of International and Public Affairs, where he earned a Master of Public Administration in Development Practice, specializing in multidisciplinary approaches to development. After completing his degree, he worked as a consultant for UNICEF. He spent two years working in Peru as a Small Business Development Volunteer in the US Peace Corps, where he coordinated with the local government and USAID to implement a sustainable pig-farming project

Divya Mehra

Divya Mehra joined WFP in 2012 as a consultant in the Office of the Senior Nutrition Advisor. In this capacity, she has worked on diverse topics and helped providing support to WFP's senior management and external stakeholders on understanding the global nutrition environment and operationalizing WFP's role. Trained in health policy and environmental health, she obtained her Master's and Doctoral degrees in Public Health from Columbia University. As part of her Doctoral thesis, Divya studied the epidemiology and toxicology of indoor air pollution on respiratory health outcomes. She has also managed clinical studies on treatment of breast and lung cancer and published in several peer-reviewed journals. Prior to joining WFP, Divya worked at the Boston Consulting Group in New York City, mainly in financial services, including banking and insurance.

Alexandra Ji Yen Tung

Alexandra Ji Yen Tung joined WFP in 2013 as a consultant for the Nutrition Advisory Office. She assists the Senior Nutrition Advisor in providing support and guidance to WFP's senior management and external partners in both public and private sectors in nutrition-related programming and policies. In her capacity as a nutritionist, Alexandra has worked in community clinics to educate pregnant and lactating women and children on nutrition, and in the food and beverage sector to provide technical guidance on health, nutrition and sustainability. She has worked with universities and think tanks including Columbia University, Worldwatch Institute and the Small Planet Institute on publications related to nutrition-sensitive agricultural development and environmental sustainability across various contexts. Alexandra holds a Master's of Science Degree in Nutrition from Tufts University Friedman School of Nutrition Science and Policy.

“Scientific Evidence is the Ultimate Benchmark”

Klaus Kraemer, Director of *Sight and Life* – DSM’s humanitarian nutrition think tank – was recently appointed Adjunct Associate Professor at the prestigious Bloomberg School of Public Health at Johns Hopkins University, Baltimore, USA.

The appointment honors Klaus’s work on “hidden hunger,” which affects 2 billion people in developing countries. We spoke to Klaus about his work, his new position, and what it can mean for *Sight and Life*, DSM, the School of Public Health, and the many people whose diet is deficient in micronutrients.

One of the main topics of *Sight and Life*’s work is how nutrition in developing countries can be improved. “The problem is that people may have enough to eat – in terms of calories – yet not be getting enough essential vitamins and minerals,” explains Klaus. “They may look well-nourished, but they’re not. This state is known as ‘hidden hunger’. It can have serious, lifelong consequences for health, productivity and mental development.”

Working together leads to more

Klaus has been working on this problem within *Sight and Life* for more than nine years, and in that time he has often collaborated with experts at the Johns Hopkins Bloomberg School of



Klaus Kraemer, Director of *Sight and Life*: “Companies that take a long-term approach are those that will be most valued.”

Public Health. This activity includes the recent development of the “hidden hunger” map. This map identifies those countries where micronutrient deficiency is most common, so that help can be directed there first.

A related project is in Bangladesh. “We’re exploring possible micronutrient interventions in pregnant women and young children,” says Klaus, “and our contribution has included helping to identify the best formulation and production methods for local manufacturing. Through such work, you come into contact with many experts from private and public organizations, and get invited to sit on international committees and advisory groups. I see all this – and now also this honorary position at Johns Hopkins – as recognition of our work at *Sight and Life*.”

Partnerships – a two-way street

Klaus is a firm believer in the importance of links between private sector, civil society, the academic world and other public sector organizations. “They bring benefits to all parties,” he says. “For example, since 2008, we’ve had a highly successful internship program. Students come to work with us, either at *Sight and Life* HQ or out in the field. We can also facilitate insights into DSM, the largest manufacturer of vitamins and nutritional premixes, including hands-on experience of how the nutrition industry works. These students can also get to understand the needs of the private sector, and how collaboration takes place within it.”

“We have the chance to further stimulate the interest in micronutrients of outstanding students,” says Klaus. “They form an important pool of future talent – in fact, we hired one of our first interns,” he recalls. “She worked with us for several years. She’s now in India with UNICEF, and I spoke with her just this

morning about what she’s working on.” Through *Sight and Life*, students also get chance to work on projects for the World Food Programme and other organizations.

“In such collaborations,” says Klaus, “*Sight and Life* functions as a nutrition science hub. Through it, students get new insights they can take back home and share, and we get to build an excellent network. It’s taken a few years to gain momentum, but it’s now taking off – it’s a really exciting development.”

Scientific credibility

Links with top institutions such as the Bloomberg School of Public Health also strengthen *Sight and Life*’s credibility and reputation. “Although we’re on the fringe of DSM, it’s important that we’re recognized for what we are: scientists, whose ultimate benchmark is scientific evidence. We should follow only science-based breakthroughs. Companies must not be seduced by quick marketing wins that lack any scientific basis. Rather, we need to challenge them. Of course, this is a difficult balancing act for publicly listed companies. But if the work is to be sustainable, you need to build the evidence and stand up for what you believe.”

Companies that take a long-term approach are those that will be most valued, says Klaus, a thought that was echoed by Britain’s Prince Charles recently, when he mentioned DSM in a speech, saying: “Sustainability and healthy profit margins are not mutually exclusive, but it does take vision and dogged determination.”

This is precisely what Klaus finds especially compelling about DSM. “It combines a long-term approach to sustainability with high science,” he says. “This is the way to go.”

“We have the chance to excite students to engage in micronutrient research”

Obituary: John Austin Milner, PhD (1947–2013)

Cindy D Davis

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Regan L Bailey

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Johanna T Dwyer

Office of Dietary Supplements, NIH, Bethesda, MD; and Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University and School of Medicine and Friedman School of Nutrition Science and Policy, Tufts University, Boston, MA, USA

Paul M Coates

Office of Dietary Supplements, NIH, Bethesda, MD, USA

John Austin Milner was born on 11 June, 1947, in Pine Bluff, AR, and died unexpectedly of a heart attack on 31 December, 2013. He was a dear friend to so many scientists that his passing is an irreplaceable loss to the nutrition community and to all those who were fortunate enough to know him. John had a formidable capacity for work and for multitasking on many different projects while never turning away requests for help from colleagues, never failing to ask provocative questions, and always answering every single e-mail. He had a great sense of humor and a unique ability to integrate science with humanistic considerations. Although most of his own research focused on the anticancer properties of garlic and associated allyl sulfur compounds, his interests gradually expanded to bioactives of all sorts. He was an internationally respected expert in all areas of nutrition and cancer prevention, including nutrigenomics, selenium nutrition, antioxidants and health, and functional foods. For 16 years, he chaired the popular sessions on Saturday mornings sponsored by the International Life Sciences Institute (ILSI) at the Experimental Biology meetings, and he edited several of them for publication.

Nutrition legend, treasured friend

Recognition by his peers of his accomplishments is evident from

the many awards he received, including, but not limited to, the ASN Kritchevsky Career Achievement Award, the Conrad Elvehjem Award for Public Service in Nutrition, and the American Association of Clinical Chemistry Garry Labbe Award for outstanding contributions to nutritional science. He was an elected fellow of the Institute of Food Technologists, the American College of Nutrition, the American Association for the Advancement of Science, and most recently, the ASN.

For 35 years, John and Mary Frances were a “nutrition power couple,” attending every Experimental Biology meeting together, as well as many others. Although they had separate careers and interests within the nutrition field, the professional friendships often overlapped. Their lavish entertaining, enhanced by Mary Frances’s gourmet cooking (with garlic!) and John’s jovial hospitality made invitations to join them in their home a great pleasure. Their personal kindness cannot be overestimated.

“John was a Colossus in the nutrition science community.”

John was a Colossus in the nutrition science community, a leader, a teacher, and an investigator. He contributed a great deal to raising the status of nutrition science by his dogged work to promote nutrition research in as many ways as possible with as much funding as possible. He will be long remembered for his broad, comprehensive understanding of our field in all of its complexity, and for championing the role of nutrition, nutrigenomics, and dietary bioactive components from the molecular level through to their place in nutrition policy. He will be sorely missed.

This obituary is an abridged version of one that appeared originally in The Journal of Nutrition. First published online February 5, 2014; doi:10.3945/jn.114.191064 (Ed).

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John A Milner (1947–2013): an internationally respected expert in all areas of nutrition and cancer prevention.

The 2014 CARIG Conference

San Diego, California

Noel Solomons

CESSIAM, Guatemala City, Guatemala

The 2014 CARIG Conference was held in San Diego on Saturday, April 25, as part of Experimental Biology 2014. It was co-chaired by Dr Earl Harrison of Ohio State University and Dr Loredana Quadro of Rutgers University. The keynote lecture was the James Allen Olsen Memorial Lecture “*Perspectives on Carotenoids*”, as it has been since 2002 (with the exception of 2013). The unfortunate circumstances in Boston, Massachusetts, precluded the speaker from getting to the meeting venue last year; so the 2013 scheduled awardee, Dr Elizabeth J Johnson, of Tufts University, was finally able to present the planned 2013 lecture, which was entitled “*Emerging science on lutein in the brain.*” The full lecture is published elsewhere in this issue of *Sight and Life*.

The body of the meeting consisted of four complementary talks centering on the topic of the biological actions of apocarotenoids.

“The color vision of birds is dependent on apocarotenoids”

Dr Matthew Toomey of Washington University was invited back to the Conference to give an encore presentation of the talk he had given in Boston in 2013, entitled “*Selective apocarotenoid metabolism facilitates avian color vision*” and previously reported on in a meeting report. This talk related closely to the day’s theme, as the much more acute and discriminating color vision of birds is dependent on apocarotenoids. Moreover, avian vision is very compound-specific, such that the conversion to the required apocarotenoids requires specific enzymes and transcriptional regulation. Avian species have four distinct retinal cones with sensitivity for red, yellow, green and blue. This allows greater spatial discrimination, which is important for food-

gathering, mating and reproduction, and avoiding predation. Specifically for the blue retinal cone, the light-filtering function in the oil droplet at the apical tip of the structure depends on its content of a specific apocarotenoid, present in a prescribed density.

Dr Ken Riedl of the Ohio State University addressed the challenges and accumulated successes in the chemical characterization of the huge array of cleavage products that can be generated from the extensive array of both carotene and xanthophyll carotenoids in a presentation entitled “*Picking up the pieces: Analysis of apocarotenoids by LCMS.*” Sequential application of liquid chromatography for separation and mass spectroscopy for molecular characterization (LCMS) is the approach used in the Ohio State collaborating laboratories. Dr Riedl lamented the lack of chemical reference standards for the apocarotenoids and illustrated how he and his colleagues seek to identify the cleavage products. Interest in these fragments is driven by their chemical similarity to retinoic acid (RA), and by the potential for these molecules either to mimic RA in its signaling action, or else to block the receptor sites to RA and antagonize its action, or both. Just as with the illustration of the enzymatic treatment of lycopene with the cleavage enzyme BCO2 in raw tomatoes versus tomato paste, one finds a different array of apocarotenoids from the reaction.

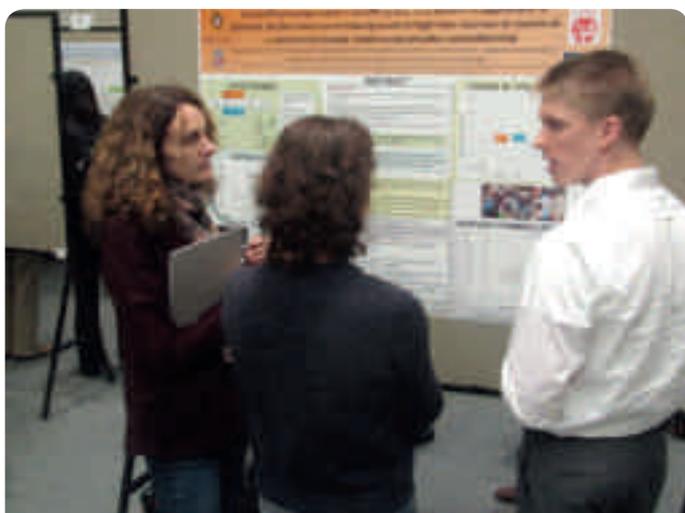
“*Substrate specificity and reaction mechanisms of vertebrate carotenoid cleavage oxygenases*” was the topic of the presentation by Dr Carlo dela Sena, also of Ohio State University. Dr dela Sena presented a series of experiments about specificity of the carotenoid substrate when applying human recombinant BCO1, the putative enzyme for the central cleavage of carotenoids at the 15,15’ position in the carbon chain. β -carotene was confirmed as the preferred substrate in kinetics experiments. Moreover, whereas β -carotene, various cryptoxanthins and lycopene underwent central cleavage with the recombinant enzyme, 9-*cis*- β -carotene was not cleaved to any extent. With BCO2, non-central (eccentric) oxidative cleavage of β -carotene, α -carotene, zeaxanthin and lutein was demonstrated. Most importantly (see



Dr Earl Harrison (left) of Ohio State University and Dr John Erdman Jr of University of Illinois at Urbana-Champaign.

below), isotopic exchange experiments provided new insights into the molecular nature of the oxidation.

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 “Isotopic exchange experiments
 provided new insights”



Dr Loredana Quadro of Rutgers University (left) with students.

Dr Johannes von Lintig of Case Western Reserve presented on the topic of “*Two carotenoid (di)oxygenases and provitamin A metabolism.*” He focused on the widely circulated hypothesis that post-intestinal oxidation by carotenoid oxygenases at the tissue level had an influence on the metabolism of provitamin A carotenoids, potentially “*resupplying*” the body with useful retinoids. Focusing on apo-10-carotenal as a cleavage product, Dr von Lintig illustrated experiments in an *in vitro* system showing that it could be esterified like retinaldehyde and also transported like retinaldehyde. He extrapolated to the *in vivo* setting, however, and suggested that BCO1 was located in the cytosol of the cells, whereas BCO2 is affixed to the inner membrane of mitochondria. He concluded, moreover, that the *in vivo kinetics* and the anatomic locations preclude any important generation of retinoids or any direct participation by the apocarotenoids in the signaling functions related to the retinoic acid receptor system.

It should be noted that the careful semantic labeling of the enzymes as BCO1 and BCO2 in the foregoing text had a purpose; the presentations of both Drs de la Sena and von Lintig reopened and readdressed the controversy as to the chemical nature of the enzymatic oxidative cleavage of carotenoids. In their original discovery in the 1980s, the mechanism for the cleavage enzymes requiring participation of molecular oxygen was termed a “*dioxygenase reaction*”. That would mean that both molecular



Dr Elizabeth J Johnson (left) of Tufts University and Dr Loredana Quadro of the Rutgers University.

oxygen and a water molecule would be involved in a two-stage reaction to release aldehyde (retinaldehyde) formed from the original carotenoid. Two decades later, a monooxygenase mechanism was advanced, in which molecular oxygen is inserted in a single-stage reaction. The ongoing experiments – presented in San Diego from the respective speakers' laboratories, in both Columbus and Cleveland, Ohio – would justify a return to the proposition that both central and eccentric cleavage processes occur via dioxygenase mechanisms. BCDO1 and BCDO2 are now proposed as the appropriate designations.

Finally, as usual, the annual VARIG/CARIG reception provided the opportunity to discuss themes of vitamin A and carotenoids and to view scientific posters from graduate students and post-doctoral students. Awards for the best free papers at each level of training were also given out.

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Bioavailability 2014

Understanding the Bioavailability of Micronutrients and Bioactive Compounds so as to Improve Public Health

Barbara Troesch

DSM Nutritional Products, Kaiseraugst, Switzerland

At the Bioavailability 2014 conference held from May 12–14, 2014 in Iguassu Falls, Brazil, experts discussed recent progress and current issues concerning the bioavailability of micronutrients and bioactive compounds.

The conference was opened by Silvia Cozzolino of the Organizing Committee and the Brazilian Society for Food and Nutrition, who encouraged discussions that would inspire the next generation of researchers to continue the efforts already made in the field of nutrition science. According to Richard Hurrell of the Organizing Committee, who is also Emeritus Professor at the ETH Zurich, the conference started out with a focus on food processing and the food industry in developed countries and moved towards a public health approach with emphasis on micronutrients in developing countries. While bioactive substances such as polyphenols received increasing attention in developed countries, given the scope of *Sight and Life* and my own area of expertise I will focus on issues related to the bioavailability of iron and other micronutrients most relevant in the fight against hidden hunger.

Is the iron going in?

Iron deficiency continues to be widespread in many parts of the world, irreversibly impairing physical and cognitive development and increasing the risk of maternal and infant and young child mortality. While fortification programs are promising tools to correct these deficiencies, a better understanding of the regulation of iron absorption and utilization has put a question mark over their efficacy in the presence of the widespread infection and systemic inflammation encountered in many developing countries. In addition, safety concerns were raised some time ago when a study in Pemba had to be ended prematurely due to increased risk of morbidity and mortality on the part of children receiving iron and folic acid, administered either alone or together with zinc.

Richard Hurrell reviewed the available evidence and concluded that iron fortification could be used cautiously and pref-



Left to right: Olga Maria Silverio Amancio, Richard F Hurrell, Silvia M Cozzolino and Sérgio A R Paiva at Bioavailability 2014.

erentially, with the lowest amount of iron still efficacious at improving iron status. One of the mechanisms for the detrimental effect of iron on morbidity and mortality might be its effect on the enhanced growth and virulence of pathogens in the gut. In Kenyan infants given iron supplementation, even doses as low as 2.5 mg iron caused an increase in pathogens and inflammation in the gut, according to data presented by Michael Zimmermann from the ETH Zurich. A promising approach to overcome this negative effect could be the addition of prebiotics to the micronutrient powder in order to selectively enhance the growth of lactobacilli and bifidobacteria.

A big, fat problem!

The epidemic of obesity was presented by Isabelle Aeberli (ETH Zurich) as a further complication in the fight against iron deficiency: a recent study showed that the low-grade inflammation found in this condition led to a decrease in iron absorption and appeared to limit the usefulness of ascorbic acid to enhance iron absorption. This has the potential to limit the current strategies for improving iron status, given the increasing prevalence of obesity and overweight.

Common pool or alternative pathway?

It has been shown that soluble non-heme iron, derived either from the diet or from fortification, forms a pool in the stomach and is absorbed at a similar rate. However, there are controversial views on whether this is the case for ferritin iron or whether a separate absorption pathway, possibly via endocytosis, allows this protein to be absorbed intact. Based on evidence from absorption studies, Janet Hunt – formerly with the International Atomic Energy Agency (IAEA) – believes that ferritin iron predominantly joins the common pool and enters the enterocyte via DMT1. Even though evidence from cell studies supports the idea of an alternative pathway, she thinks it is of minor relevance for the absorption of dietary iron. However, new compounds such as the ferrihydrite particles presented by Dora la Pereira from MRC in Cambridge might use this alternative pathway; this could provide interesting options once their safety and efficacy are demonstrated in animal, and eventually human, studies.

Growing instead of adding?

A promising approach that can contribute to improving nutritional status is biofortification, as long as the micronutrient content is increased without compromising agronomic targets such as drought and pest resistance or yield. HarvestPlus works with plants enriched in provitamin A (sweet potato, maize and cassava), iron (beans and pearl millet), and zinc (rice and wheat) at different stages of development. These three micronutrients can also be added to rice via the triple fortification of reconstituted rice grains, as Richard Hurrell demonstrated on the basis of a range of studies conducted in his group.

Iron replete or inflamed?

As inflammation affects not only iron absorption but also the biomarkers for iron status, Sean Lynch (Eastern Virginia Medical School) discussed the advantages and disadvantages of the indicators currently available. While they are all affected, in his opinion, using two abnormal levels out of three measured indicators (serum ferritin, transferrin saturation and zinc protoporphyrin) or body iron (ratio of serum ferritin to serum transferrin receptor) is the most accurate way to define the prevalence of iron deficiency. However, further research is necessary to evaluate the use of hepcidin, the key regulator of iron metabolism, as an indicator of iron status. Moreover, indicators predicting the risk of impaired cognitive, motor and emotional development as a consequence of iron deficiency are very desirable.

And what about zinc?

While less studied so far, serum zinc – the biomarker currently used for zinc deficiency – is affected by various other factors, including inflammation. Given its importance in both innate and adaptive immunity, Swapna Shenvi from the Children's Hospi-

tal Oakland Research Institute stresses that more sensitive and specific biomarkers for already moderate zinc deficiency are urgently needed.

Is proteomics the solution?

Keith West from Johns Hopkins Bloomberg School of Public Health, Baltimore argued that micronutrient deficiencies were inadequately assessed, as the currently used indicators often do not reflect the nutrient status, being influenced by other factors, either metabolically controlled or else responding to varying intakes of nutrients. His research results indicate that quantitative proteomics could be used to identify plasma proteins or protein clusters that correlate with specific micronutrients in undernourished children.

Let's not forget the B vitamins!

Lindsay Allen from UC Davis reminded the audience that, even though the absorption mechanisms were very different, breast milk levels of B vitamins were highly dependent on maternal intake and could generally be increased by maternal supplementation or fortification. The exception is folate, whose levels are known to be kept fairly constant in breast milk, decreasing maternal stores if supply is insufficient. She was concerned that folate fortification was frequently implemented without proper evaluation of the situation, especially as she felt that dietary folate intake did not necessarily reflect folate status accurately.

Discussion and conclusions

Research in recent years has greatly improved our understanding of the factors and mechanisms that determine the bioavailability of micronutrients. However, major obstacles to improving micronutrient status, such as the lack of accurate biomarkers, remain. While in the case of iron it was proposed to go back to using an approach that was put forward some four decades ago, innovative solutions using emerging technologies such as proteomics might open up new avenues. This is helped by emerging evidence on genetic factors affecting individuals' capability to make use of the available micronutrients. Even though there is still a long way to go, the beautiful setting in the vicinity of the Foz do Iguazú provided a great opportunity to look at problems from different angles and to identify opportunities by linking knowledge acquired in the past with emerging fields such as nanotechnology, proteomics and genetics.

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Insights from the 2nd International Conference on Nutrition and Growth

Report 1

Nimmathota Arlappa

Division of Community Studies,
National Institute of Nutrition, Hyderabad, India



The 2nd International Conference on Nutrition & Growth:
A major event that attracted delegates from 87 countries.

The second International Conference on Nutrition and Growth was held in Barcelona, Spain from January 30 to February 1, 2014. Some 409 scientific papers were presented during the conference, which brought together pediatricians, nutritionists, neonatologists, experts in child development and other specialists to discuss the interplay between nutrition and growth in the pediatric age group. Delegates from 87 countries participated in the scientific deliberations.

Complementary feeding

Mary S Fewtrell, from the Childhood Nutrition Research Centre, University College, London Institute of Child Health, presented the timing of complementary feeding. She presented the

background of WHO's changed recommendation of duration of exclusive breastfeeding (EBF) from the first 4–6 months to the first 6 months of life in the year 2001. The principal reason for this change was to provide optimal nutrition to young infants in low-resource countries where the available water and complementary foods may be nutritionally inadequate or contaminated. However, there is still some controversy as to whether the iron intake of infants exclusively breastfed for 6 months in these low-income countries is sufficient to cover their needs at the end of the first 6 months of life. At the request of WHO, a randomized controlled trial study was carried out in Iceland, a high-income country, with the objective of examining the effects of exclusive breastfeeding for 4 months versus 6 months on iron status and growth. The study concluded that in a high-income country, infants who receive a small amount of complementary food in addition to breast milk from 4 months of age had higher iron stores at 6 months compared with those exclusively breastfed for 6 months. However, no effect was found on the growth rate between 4 and 6 months. In her presentation, Prof. Fewtrell also recommended the inclusion of animal proteins in complementary foods to improve micronutrient status of children. It is very pertinent in the Indian context as complementary foods fed to infants and children are grossly deficient in micronutrients such as iron, vitamin A, zinc and B-complex vitamins.

“Complementary foods fed to infants and children in India are grossly deficient in micronutrients”

Raanan Shamir, from the Institute for Pediatric Gastroenterology, Nutrition and Liver Diseases, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel presented the scientific paper entitled *Safety of Complementary Feeding*. Initially he explained the importance of complementary feeding, which is required

around the age of 6 months, since exclusive breast feeding becomes insufficient to meet the nutritional requirements of the infant. However, one must recognize that diets of infants and young children in most populations in low-income countries are consistently deficient in some nutrients, including vitamin A, iron, zinc and vitamin B₆. Raanan Shamir went on to emphasize the importance of safety practices during the initiation of complementary feeding. Children should be fed using hygiene practices that will eliminate the risk of infection, with food that does not pose risks such as choking. Care should also be taken to ensure that the complementary feeding does not contain contaminants. He reiterated that it is important to remember that infants and toddlers have smaller bodies, a less diversified diet, and a higher sensitivity to contaminants than older children and adults. The threshold for contamination levels should therefore be much lower for infants.

Amy Brown from Public Health and Policy Studies, Swansea University, Swansea, United Kingdom presented *The Impact of Weaning Style in Infancy upon Weight and Eating Behavior: The role of a baby-led weaning approach*. She opined that a baby-led weaning approach may encourage greater satiety responsiveness and healthy weight gain trajectories.

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“Both macro- and micronutrient deficiencies are common during pregnancy”

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Nutrition and Growth

It is well established that both macro- and micronutrient deficiencies are common during pregnancy and are linked with adverse pregnancy-related health and birth outcomes including poor fetal growth. **Parul Christian** from the Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, USA, in her presentation entitled *Interventions Across Maternal and Pre-Pregnancy Scenarios*, reported that maternal protein-calorie, iron-folic acid, and multiple micronutrient supplementations are three interventions that have been rigorously tested in low- and middle-income countries and have been shown to significantly improve birth weight and reduce small for gestational age (SGA). Adolescent pregnancies which occur commonly in many contexts are likely to benefit from such interventions, with positive impacts for both the young mother and her offspring.

Jeffrey Baron from the National Institute of Child Health and Human Development, National Institutes of Health, Bethesda MD, USA, in his presentation *Regulation of Childhood Growth: Adaptation to an uncertain world*, highlighted the various factors influencing the growth pattern in children. The important

points in his presentation are that the growth plates are responsible for bone elongation and therefore for statural growth in children. Growth at the growth plate is subject to intricate regulation by hormones, nutritional factors, inflammatory cytokines, paracrine signals, and intracellular mechanisms. One of the important functions of this regulatory system is to restrict growth when nutrition is limited and thus to preserve nutrients for vital functions. During these times of adversity, however, growth is not completely lost but, to some extent, deferred to later times, when circumstances are more favorable. Some of the mechanisms that allow growth to be deferred are local to the growth plate. In addition, one systemic mechanism to preserve growth potential involves pubertal timing. Normally, pubertal increases in estrogen accelerate growth plate exhaustion, but malnutrition during adolescence slows puberty, thus relieving the negative effects of estrogen on the growth plate, allowing persistent growth. In contrast, nutritional deprivation in early life can provoke early puberty, which adversely affects adult height.

Moshe Phillip from Endocrinology and Diabetes, Schneider Children's Medical Center, Petach Tikva, Israel, in his presentation entitled *Catch-Up Growth: What limits it?* highlighted the important role played by nutrition in the growth velocity of children. The salient observations in his presentation include that longitudinal growth is a hallmark of childhood and continues from birth to puberty. This process is affected by both genetic and environmental factors. The most effective environmental factor is the nutritional status. Malnutrition-induced growth stunting is common in underdeveloped countries, but may also be present in developed countries due to certain diseases. Usually, when nutrient intake is corrected, spontaneous catch-up (CU) growth occurs. However, although in most children the growth pattern is corrected with no effect on final height, in many cases a permanent growth deficit ensues.

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“The discussion of the role of lipids in human nutrition is rapidly evolving”

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One of the plenary sessions held during the conference was *Nutrition and Lipids*. The discussion of the role of lipids in human nutrition is rapidly evolving, and the old paradigm claiming the concept of the absolute danger of lipids for our health is going to face unpredictable changes. During the main session on January 31, few concepts were detailed and scientifically challenged. **Carlo Agostoni** from the University of Milan discussed the scientific outcome that the amount of fat is not detrimental for the development of children, even if the diet has a high fat

content. No absolute indications concerning which kind of fat is better can be defined, with the exception of PUFA (DHA, the fatty acid of fish).

Furio Brighenti, Chair of Nutrition Department at Parma University, Italy outlined the worldwide structure of the fat market, explaining the need to find the right fat for any specific product, due to the driving power of taste in human food selection. In the past five to ten years, the fat composition of western diets has greatly improved, with reductions in the volumes of hydrogenated fats previously used in industrial food production. Meanwhile, **Mary Fewtrell** from University College, London discussed the importance and functional effects of palmitic acid in the newborn diet in the context of the large amount and stereospecific positioning of palmitate in human milk. The strong

wind in favor of a more rational evolution of fat effects and of the positive specific role of palmitic acid is the result of a more science-based analysis of human and infant nutrition.

Acknowledgement:

Sight and Life kindly provided travel support to participate in the conference.

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Report 2

Mahama Saaka

University for Development Studies,
Tamale, Ghana

I was one of the few African delegates who had the opportunity to participate, and this was my first attendance at an international conference of such magnitude. My participation was made possible by the generous award of a *Sight and Life* travel grant.

My conference contributions

I made two presentations at the conference: two posters and one oral presentation. The titles of the poster presentations were “*The Relationship between Uptake of Antenatal Care Services and Low Birth Weight in the Gushegu District Of Northern Ghana*” and “*The Relationship between Mothers’ Nutritional Knowledge in Child Care Practices and the Growth of Children Living in Impoverished Rural Communities.*” The oral presentation was captioned “*Patterns and Determinants of Essential Newborn Care Practices in Rural Areas of Northern Ghana.*”

“The nutritional status of pregnant women is receiving more attention”

In one of my presentations, I highlighted the fact that although the world is targeting a two-thirds reduction in under-five mortality rates by the year 2015, this expectation is unlikely to be met because there is little reduction in neonatal mortality

(NMR). Evidence from studies, including the one conducted in Northern Ghana, strongly suggests that the expected essential newborn care practices, including adequate neonatal feeding, are not reaching a substantial number of the newborns. These infants are therefore at greater risk of dying.

New ideas and take-home messages from the conference

I took home the following insights from the conference:

- The extent to which the nutritional status of a pregnant woman can influence the long-term growth and health of her child is receiving much more attention. Many of the conference presentations point to the strong positive link between maternal nutrition, child nutrition and growth. The pre-conception nutritional status of the mother – extending through pregnancy to early infant feeding – is fundamental to adequate child growth. Adequate intake of both macronutrients (proteins, carbohydrates and fats) and micronutrients (vitamins and minerals) is particularly important in the early months and years of life, when body growth and brain development are more rapid than during any other period.
- The delivery of interventions (e.g., micronutrient and protein/calorie supplementation) to improve maternal nutrition will break the intergenerational transfer of malnutrition from mother to child. This will enhance child growth, especially in developing countries.
- All infants need their own mother’s breast milk, even if the breastfeeding is partial. Breastfeeding leads to decreased infections during infancy, improved immune system functioning, optimal brain development, and the establishment of a healthy microbiome.



Mahama Saaka: "There were many important takeaways from this conference."

- > Exclusive breast feeding (EBF), which has been advocated for quite some time by WHO and other international bodies, is still not being practiced by most mothers.
- > Some research findings show that babies who receive breast milk when solids are introduced during this timeframe have a much lower risk of the later development of both food allergies and celiac disease.
- > Infant obesity is an emerging public health problem also in the developing world. Rapid weight gain during infancy should be discouraged. If a newborn infant gains too much weight during the first few months of life, he or she will have a much higher risk of obesity, type II diabetes, and metabolic syndrome as an adult.
- > Compelling research evidence presented at the conference indicates that everybody needs to eat more fish and green leafy vegetables; this is especially the case for pregnant women. The "good" fats in fish, such as salmon, play a huge role in the development of a fetus' immune system. Green leafy vegetables are full of micronutrients that are important for the development of fetal and infant brains.
- > At the main session of the Conference, **Prof. Carlo Agostoni** of the University of Milan argued that a diet with a high fat content is not detrimental to children's development, although absolute indications concerning the definition of

beneficial fats are lacking, with the exception of PUFA (DHA, the fatty acid found in oily cold-water sea fish).

- > **Prof. Mary Fewtrell** of University College, London, highlighted the importance and functional effects of palmitic acid in the newborn diet in the context of the large amount and stereo-specific positioning of palmitate in human milk.
- > A not totally hygienic environment might be good for children, as this strengthens their microbiomes. Having a healthy population of gut bacteria helps guard against the later development of allergies and celiac disease.

Thanks to *Sight and Life*

I am deeply grateful for the financial support from *Sight and Life* that made it possible for me to attend this important conference.

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Report 3

Fatima-Zahra Azzaoui

IBN TOFAIL University, Kenitra, Morocco



Healthy growth in the pediatric age group was the focus of the conference.

The program of this conference was very rich and interesting, and provided a major opportunity to discuss the interplay of nutrition and growth in children.

Due to the overlapping timing of some sessions, I chose to attend those most closely linked to my own research field. The program offered six interesting plenary sessions: “Outcome Measures of Nutrition and Growth”, “Nutrition and Growth in Underprivileged Communities”, “Yearbook on Nutrition and Growth”, “Nutrition and Lipids”, “Children’s Growth – Can we influence it?” and “Nutrition in the Premature Infant.” In addition, four sponsored industry symposia, four parallel sessions, seven oral presentation sessions, and two networking events took place, while more than 300 posters were presented.

I presented my poster on February 1. It was entitled “*Nutritional Status and General Intelligence among Moroccan Children,*” and was given within the thematic area “Childhood and Adolescence.”

While presenting, I received several questions from participants. These were extremely welcome, giving me an excellent opportunity to discuss some non-elucidated points in my research and encouraging me to develop new axes of research going forward.

Thanks to *Sight and Life*

I am very grateful for the grant from *Sight and Life* which allowed to me, as the only Moroccan, to attend this significant event. It was a great chance to present and discuss my research findings and to gather new inspiration and insights for my future work.

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The Micronutrient Forum 2014

Bridging Discovery and Delivery

Jane Badham

Sight and Life, Johannesburg, South Africa

After a gap of a number of years, the Micronutrient Forum is back, and the week-long meeting held in Addis Ababa, Ethiopia from 2 to 6 June was attended by more than 1,000 delegates from over 60 countries from around the world. The global participation illustrated just how important the Micronutrient Forum is in ensuring we continue to facilitate dialogue, foster collaboration, and disseminate up-to-date research to improve the design and implementation of scalable programs, as well as continuing to identify and fill key evidence gaps. The Forum had as its overall theme 'Bridging Discovery and Delivery' and included four sub-themes spread across the program that covered: **(1) measuring and interpreting information on micronutrient intake, status and program coverage;** **(2) effects of micronutrient interventions on indicators and functional outcomes;** **(3) scaling up micronutrient interventions: bridging the gaps between evidence and implementation;** and **(4) stakeholders and sustainability: elements of an enabling environment.** The program was designed in such a way that delegates were encouraged to step out of their specific area of specialty/interest and broaden their learning. Plenary sessions covered all four themes, and numerous concurrent sessions focused on the individual themes. In addition, there were posters, learning centers and sponsored symposia, making for a very full but fascinating program.

Sight and Life was proud to lead the **enabling environment** sub-theme. This included two plenary panel discussions that covered the critically important enabling factors of **innovative financing and political will, leadership and evidence-based policy.** During the week there were five other panel discussions, each of which addressed a specific component of the enabling environment, and a wrap-up session to pull it all together. The main objective of the sub-theme was to provide a global perspective on the stakeholders and associated enabling environment supportive of cohesive and sustainable interventions as well as to promote new ways of thinking and acting.

Below are some of the key take-home messages and tweets from each of the topics that are necessary to facilitate the elimination of micronutrient deficiencies.

Innovative financing – The need to look at new ways to raise money for nutrition and innovative ways to allocate funds to nutrition

Everything about this discussion was new to most of the audience – from the panel members to the content of the discussion – and highlighted just how many working in the nutrition space have neglected the all-important topic of financing the interventions that have to be taken to scale if we are to succeed in eradicating malnutrition. The session was chaired by Joel Spicer, the recently appointed President of the Micronutrient Initiative (MI), and included panelists from the World Bank, International Finance Corporation, Milken Institute, GAIN's Micronutrient Premix Fund, and an independent consultant. We learned that we need a new skill set, we need new partners, we need to learn a new language, and we need to start a new dialogue. Although nutrition has been able to convince 51 countries to sign up to the SUN movement, we now have to deliver costed plans and interventions in such a way that these attract financing and deliver programs that have impact. A big ask! The saying that "one size doesn't fit all" is applicable, and there are various exciting new types of funding mechanisms available today, including blended funding and results-based financing, and even options whereby donor money can be taken to the capital markets and generate a 6:1 return. In the words of Meera Shekar of the World Bank, "We need more nutrition for the money and more money for costed nutrition plans." We also have to stop seeing nutrition as a welfare issue and realize that investing in nutrition means investing in human capital.

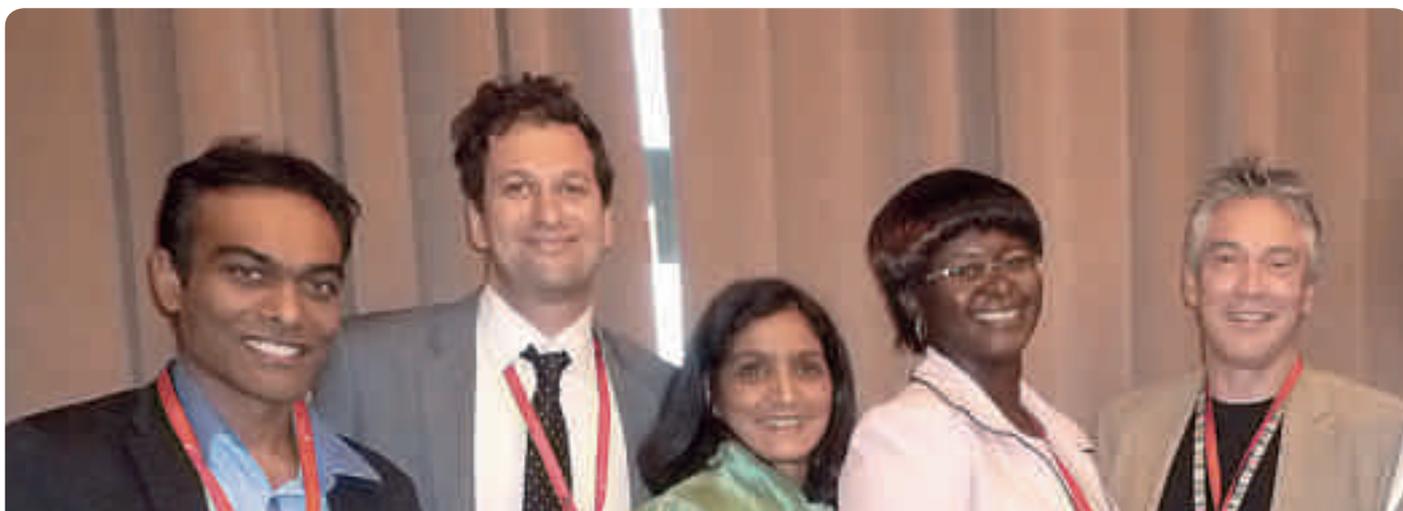
“We have to stop seeing nutrition as a welfare issue and realize that investing in nutrition means investing in human capital”



Innovative financing panel (left to right): Caitlin MacLean (Milken Institute), Chris Walker (GAIN – Micronutrient Premix Fund), CJ Jones (Independent Consultant), Joel Spicer (MI), Meera Shekar (World Bank), Niraj Shah (IFC).



Effective linkages panel (left to right): Eleni Asmare (FAOET), Stuart Gillespie (IFPRI), Klaus Kraemer (*Sight and Life*), Mesfin Teklu (WVI), Mag Gaynor (Irish Aid), Omar Dary (USAID).



Defining obligations and taking responsibility for stakeholder actions panel (left to right): Jerome Singh (UKZN), Thiago Luchesi (WVI), Purnima Mennon (IFPRI), Rachel Toku-Appiah (GMT), Martin Bloem (WFP).



Novel approaches to engaging the private sector panel (left to right): Kesso Van Zutphen (Asian Football Partnership), Matt Freeman (GAIN), Ronnie Pankhurst (DSM South Africa), Inge Kauer (ATNI), Stefan Germann (WVI).



Creating and supporting leadership panel (left to right): Venkatesh Mannar (formerly MI), Anna Lartey (FAO), Noel Zagra (UNICEF), Khor Geok Lin (IMU – Malaysia), Johann Jerling (ANLP), Marc van Ameringen (GAIN), Stefan Germann (WVI).



Political will panel (left to right): Chris Osa Isokpunwu (SUN Nigeria), Anna Taylor (DFID), Martin Bloem (WFP), Joel Spicer (MI), David Pelletier (Cornell University), Marc van Ameringen (GAIN), Banda Ndiaye (Transform Nutrition Champion).

Effective linkages – Moving beyond linkages and collaboration to true integration

This discussion was chaired by Klaus Kraemer, Director of *Sight and Life*, and included representatives from agriculture, civil society and donors. It showed that, although in our heads we have accepted the need for breaking down our silos and true integration, this is not yet being truly reflected in our actions, interventions and programs. One tweet during this session stated: “Economic growth & technical solutions are not enough – we need pro-nutrition actions from different sectors and to create synergies.” Although it seems that nutrition and agriculture are getting closer, much still needs to be done with other groups, such as social protection and education. It was clear that there needs to be more trust, a common understanding, tough discussions, and give and take from all involved.

Defining obligations and taking responsibility for stakeholder actions

A fascinating panel chaired by Dr Purnima Menon of IFPRI included an ethicist, a human rights and public health expert, the WFP, and the Graça Machel Trust (GMT). Multi-sectoral stakeholder engagement and setting the rules of that engagement has to happen from the very beginning and has to reach from the national to the community level. The fact that health and nutrition promotion frequently fails to reflect the latest science shows that there is often a disconnect between policies (national) and implementation (local). Two particularly striking comments were the fact that conflict of interest remains a hot topic but that it should not only include the private sector but also civil society, and that the industry and activists have to engage in a manner that is not counter-productive if we are to address malnutrition in all its forms. Take-home messages included that the law defines a minimum standard of what has to be done while ethics sets the standard of what should be done. If we apply a human rights approach to our obligations, then we must focus on the most vulnerable, consider the lifecycle, ensure we empower people, and provide valuable nutrition information. It was clear that multi-sectoral engagement has to reach from the national to the community level.

The words of Dr Martin Bloem of the WFP were powerful: “Stunting is not tolerable: it is a rights issue, and we have to look beyond the right to food and also consider the right to nutrients.”

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**“Stunting is not tolerable:
 it is a rights issue”**

Engaging the private sector – Not renovation but novelty

This panel was chaired by Stefan Germann of World Vision International (WVI) and tackled the elephant in the room: engaging the private sector. It was stressed that the private sector has a powerful role to play in the food system and that we cannot ignore this fact. If nutrition wishes to unlock the potential of business, then we have to address the profit issue, and we need to entice the private sector to invest in nutritious food. This might mean that we all have to be challenged and to engage in uncomfortable – even painful – conversations, but ultimately we all have to deliver nutrition solutions and so must leverage the unique skills that each party brings towards a common objective. Striking was the comment that nutrition is one of the only fields in which the private sector is not yet engaged. Ronnie Pankhurst, Managing Director at DSM South Africa, said: “It’s sad that we’re still having the same discussion about private sector engagement.” The lack of trust remains the major stumbling-block, but clear guidelines for engagement are necessary to move forward, and the private sector should not be viewed by the nutrition community as a homogenous group. The challenge was also put to the private sector that what we need is not renovation but real novelty.

Creating and supporting leadership – Vital in ensuring cohesive and sustainable scale-up

This dynamic and passionate panel and discussion pointed out that, in nutrition, we need to think more broadly and realize how important leadership skills are, both at the top level and at the community level. Without taking on leadership roles, “many nutritionists are wonderfully equipped for a world that no longer exists”, commented one panelist. Five key thoughts were:

1. Nutrition professionals can talk to each other, but we need to be able to talk to – and influence – governments and funders.
2. You first have to accept that you can be a leader.
3. Nutrition leaders need to mentor and develop others to take over, as otherwise we are creating an ever-widening gap.
4. Tweet: “Teams make programs successful & programs make countries successful, so nutrition needs to make successful teams – that takes leadership.”
5. Nutrition leadership training must lead to change agents able to take on the complex environment in which we try to implement complex nutrition programs.

What will it take? Political will, evidence-informed policy and implementation science

Nutrition has been placed high on the global agenda, but it is important that we ensure it remains there and is firmly entrenched in the post-2015 development agenda. The Global Nutrition Re-



Evidence-informed policy panel (left to right): David Pelletier (Cornell University), Aranka Anema (University of British Columbia), Jane Badham (*Sight and Life*), Roland Kupka (UNICEF), Francesco Branca (WHO), Jonathan Siekmann (GAIN), Emorn Udomkesmalee (Mahidol University), Stuart Gillespie (IFPRI).

port, ICN2 and the link to the next Olympics give us the chance to keep the dialogue going, but we as the nutrition community need to determine the narrative and deliver to the right people, in the right form, and at the right time. We also need to recognize that sometimes we don't have to take the lead ourselves but should ensure instead that we are aligned with other platforms that can assist us and which might have the necessary funds! This again points to the need to build new alignments/partnerships and makes a common dialogue essential.

Policy informed by evidence is a critical element, but must be understood as being a milestone in a process and not an end in itself. In addition, currently 97% of child health research is about discovery and efficacy, while only 3% is about how to deliver. It was suggested that, as we move forward, implementation science must become dominant if nutrition is to continue to take advantage of the window of opportunity before it closes.

Dr Anna Lartey, Director of Nutrition at the FAO and President of the IUNS, gave a stirring closing speech that ended with her saying: "As the Micronutrient Forum – and everyone here is part of the Forum – we have a charge. A charge to keep discovering. A charge to scale up delivery. A charge to build bridges between both. We have to make it happen. We cannot continue to condemn 2 billion people because together we did not act."

.....
**“We cannot continue to condemn
 2 billion people because together
 we did not act”**

The next Micronutrient Forum will take place in two years' time in Mexico – Watch this space for further information.

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For a world free of malnutrition.

share
best practices

We are committed to increasing
the knowledge of nutrition's value
in health and development.



Study Grant Report

“Building my capabilities to help the people of Zambia”

Halumba Munachonga

PO Box 71470, Ndola, Zambia

For the past 24 months, I have been pursuing a Bachelor’s degree in Consumer Sciences, majoring in Food and Nutrition, with the University of South Africa (UNISA) as a long-distance student. This course of study has been made possible through the generous funding of *Sight and Life*.

The public health situation in Zambia

About 67% of the population of Zambia fall below the national poverty line, earning less than K111,747 (USD23.77), with 46% living in extreme poverty. This situation has been compounded in the Luanshya and Ndola districts, whose populations are 163,111 and 495,000 respectively. HIV/AIDS prevalence in the two districts is estimated at 16%.

The Prevention of Mother to Child Transmission of HIV/AIDS (PMTCT) is a critical element in the fight against HIV/AIDS. The last representative survey carried out by the Ministry of Health shows that 16% of all pregnant women in Zambia were HIV-positive. Approximately 80,000 infants born annually are HIV-exposed, as their mothers were HIV-infected. Ninety percent of infections in children are a result of Mother to Child Transmission (MTCT) of HIV. Without interventions to prevent vertical transmission, 25% to 45% of the children born to HIV-infected mothers will become infected with HIV during pregnancy, childbirth or breastfeeding.

This situation has been exacerbated by a variety of factors: inadequate access to information on safe motherhood and PMTCT; inadequate community follow-up outreach programs on PMTCT, early infant diagnosis (EID), and infant nutrition (IN); and lack of adequate trained community volunteers.

In response to this need, Ndola Nutrition Organization & Hosanna Mapalo (local NGOs) have partnered to implement a community-driven PMTCT, EID, IN program. This program aims

to create community demand for PMTCT, early infant diagnosis and infant nutrition. It is being implemented in collaboration with the Ministry of Health systems with initial support from the UK’s Positive Action for Children Fund.

The progress of my studies

My passionate wish to enroll into this course sprang from the fact that 67% of the population of Zambia are living below the poverty datum line, surviving on less than a dollar a day. Many are dying from nutrition-related problems.

The solution to this situation is to have well qualified people among our own population who can positively impact the lives of these individuals. My personal goal is to build my capabilities so that I can help improve the nutritional well-being of the population of Zambia.

In line with the above objective, I have so far completed 13 modules of the 30-module course, my highest grades so far being in Food Preparation I, Practicing Workplace English, Introduction to Consumer Behavior, Advertising and Sales Promotion, Introduction to Nutrition & Energy Yielding, and Nutrients and Nutrient Deficiency Diseases, all of which I passed with distinction.

I have experienced certain challenges, in that the practical modules of the course require me to travel to, and lodge in, South Africa, and that UNISA has prescribed booksellers that are not based in Zambia, which increases the costs of these publications and also their delivery lead time. Nevertheless I am making good progress and plan to register for five more modules for the first semester of 2014 and another five for the second.

I would like to express my heartfelt gratitude to *Sight and Life* for their support. My study grant has given me the opportunity to understand nutrition in its professional context. I have already started making use of these skills in the context of helping pregnant mothers during their antenatal appointments, and I have encouraged health centers and clinics to follow WHO’s Ten Steps to Successful Breastfeeding.



Halumba Munachonga: “My goal is to help improve nutrition in Zambia.”

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“We need well qualified people who can positively impact the lives of individuals”

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Report from Australia

Supporting Each Other in Our PhD Journey: PhD tour to the University of Wollongong, Australia

Kujinga Prosper

Wageningen University, The Netherlands



Kujinga Prosper presenting at the University of Wollongong, Australia.

I am a PhD student at Wageningen University in the Netherlands. As part of our 2013 PhD tour, 25 PhD students from the university's Division of Human Nutrition, including myself, visited the Faculty of Health and Behavioural Sciences within the School of Health Sciences at the University of Wollongong (UOW) in Australia, on 18 October, 2013, to talk about nutrition-related global issues.

The PhD tour is held every two years and is organized not only for the purpose of scientific exchange but also to provide a cultural and social experience, to strengthen knowledge in nutrition research, and to establish new contacts between students.

The scientific event at UOW was held under the auspices of the Wollongong branch of the Nutrition Society of Australia (NSA). Karen Charlton, Associate Professor at UOW and Chairperson of the local NSA group, and Laura Trijsburg, a PhD student from Wageningen University, organized this nutrition meeting.

Lively debate

Senior researchers from UOW along with PhD students from both institutes, including myself, presented their research, and the

day ended with a lively and enthusiastic debate in which students from both universities participated, discussing whether food logos on packaging are worthwhile or not.

I gave a presentation on the use of correction factors to adjust for inflammation in prevalence studies. The study was conducted in Kenya in children aged 2–5 years, and attempted to use correction factors both study-specific and published to correct for inflammation and provide adjusted reliable results of the prevalence of zinc and iron deficiency.

The data showed high prevalence of inflammation, iron and zinc deficiencies in the studied population. Only study-specific correction factors were able to normalize distribution of biomarkers across the inflamed groups. The published correction factors could not be generalized to this population. Due to the high prevalence of low serum zinc status, a zinc intervention trial aimed at increasing zinc intake will start in 2014.

“An informative and inspiring day”

Some of the students present were surprised to learn that similar projects were being conducted at opposite ends of the world, and this led to discussions about how to compare findings and support each other on our PhD journey.

So all in all, it was an informative, inspiring and valuable day!

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Sight and Life is a
humanitarian nutrition
think tank of DSM



news

What's New?

Did you know? You can now visit the recently updated *Sight and Life* website www.sightandlife.org on a regular basis to get the latest news about what is happening in the field of nutrition. You can also follow us on **Facebook** and **Twitter @sightandlife**

01 1,000 days Resolutions Reminder

Although we are over halfway into 2014, we believe that the eight resolutions that the 1,000 Days Movement (www.thousanddays.org) urged us to strive for this year are worth remembering:

1. **Champion** better nutrition for women and children everywhere, as the need for good nutrition in the 1,000 day window from a woman's pregnancy to her child's second birthday is universal;
2. **Promote** action and investment in nutrition during the 1,000 day window of opportunity, building the evidence base for effective action and demonstrating impact at scale;
3. **Work** across communities to engage businesses, civil society and governments to take action on maternal and child nutrition;
4. **Strengthen** and support global platforms that seek to improve health and development outcomes by advocating increased attention to nutrition in the 1,000 day window;
5. **Invest** in programs that deliver measurable improvements in maternal and child nutrition;

6. **Advocate** better and more frequent data on maternal and child nutrition;
7. **Encourage** investments in other critical sectors, particularly maternal health, child survival, social protection, agriculture, water, sanitation and hygiene, and early childhood development, that deliver meaningful improvements in the nutritional status of women and children; and
8. **Enshrine** the focus on maternal and child nutrition within internal policies, programs and plans.

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*We'd love you to share your stories on how you are achieving any one or more of these. **Please write to us** at info@sightandlife.org and we may feature you and your work in a future edition of the magazine.*

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ICN2 Rome November 2014: Planning for Nutrition Beyond 2015

The FAO and WHO, in cooperation with IFAD, IFPRI, UNESCO, UNICEF, World Bank, WTO, WFP and the High Level Task Force on the Global Food Security Crisis (HLTF), are jointly organizing the Second International Conference on Nutrition (ICN2) that will take place at the FAO Headquarters in Rome, from 19 to 21 November 2014. The conference will review progress made towards improving nutrition since 1992 and reflect on nutrition problems that remain. It will also consider the new challenges and opportunities for improving nutrition presented by changes in the global economy and food systems, as well as by advances in science and technology, and it will identify policy options for improving nutrition. A key goal is to achieve coherence between food supply and public health policies, as they contribute to food and nutrition security.

“A key goal is to achieve coherence between food supply and public health policies”

The scope of the conference will be global, but will focus particularly on nutrition challenges in developing countries. Addressing all forms of malnutrition, it will recognize the nutrition transition and its consequences and will seek to improve nutrition throughout the life cycle, focusing on the poorest and most vulnerable households, and on women, infants and young children in deprived, vulnerable and emergency contexts.

This high-level ministerial conference, which will bring together senior national policy-makers from agriculture, health and other relevant ministries and agencies along with NGOs, CSOs, researchers, the private sector and consumers, is expected to propose a flexible policy framework to address today's major nutrition challenges and to identify priorities for enhanced international cooperation on nutrition.

ICN2 will build on ongoing global political processes and initiatives to contribute to the post-2015 UN development agenda. It will identify priority areas and nutrition development goals, as well as the policies that are required to achieve, measure and account for these.

Two documents are expected to come out of the ICN2: a political outcome document and a framework of action for its implementation. Discussion on the Draft Zero proposed text of the political outcome document is ongoing: online consultations have been undertaken, and the document will be further developed by a Joint Working Group (JWG) of regional representatives of FAO and WHO. This could be a defining moment for nutrition, and will certainly show if health and agriculture can really come together to talk and plan in terms of both food security and nutrition security.

To follow ICN2 developments, please search

ICN2 on either the WHO or the FAO websites.

A New Nutrition Workforce Workshop: Educating and Training for a Post-2015 World



Watch this space for updates on the work of this group!

Early March saw a number of key thinkers from a diverse range of nutrition and nutrition-related fields (economics, agriculture, and health) convene for two days in Castel Gandolfo outside Rome. Their brief was to begin discussing what competencies the future nutrition workforce will require if we are to deliver on the numerous promises and nutrition programs that are critical to secure plentiful, nutritious foods for all in an environmentally sustainable and safe manner.

The group focused on addressing four key questions:

- > What knowledge and skills will be needed to ensure that nutrition is adequately addressed in a post-2015 environment?
- > With which partners from other disciplines and sectors should those working in nutrition interact in tackling the challenges ahead?
- > What might a Master's, PhD or other training program in Nutrition for Development aimed at people from varying backgrounds look like?
- > How do you train people to influence and change policy-making?

“We cannot let the lack of nutrition leadership capacity be the reason for our failure”

Some of the hard-hitting comments during the workshop were:

- > “We cannot let the lack of nutrition leadership capacity be the reason for our failure”
- > “Nutrition is a partner science, and we need to engage with many other professionals”
- > “The post-MDG goals will be for the whole world, not just developing countries, and so we have to broaden our practice”
- > “We have to recognize and create the link between health systems and food systems” and
- > “We now need to think with people, not paper”

There is little doubt that a new cohort of nutrition thinkers and “doers” is necessary, and that we will have to do things differently using a systems approach and working across many dimensions to address the complexities that nutrition inherently involves.

Watch this space for updates on the work of this group. They are committed to ensuring that a future generation of nutrition experts will have the capacity to successfully lead and manage the implementation of nutrition programs through effective multisectoral teams, thereby ensuring improved nutrition for all.

04 German Food Partnership



The German Food Partnership (GFP) brings together public and private actors to implement projects and programs designed to put in place stable agricultural value chains and to expand agricultural production. The GFP aims to foster productivity and performance all

the way along the value chain to give local farmers and local people easier access to production inputs, markets and food. In this partnership, German companies cooperate with experts from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH to expand local agri-food value chains in developing and emerging markets, with the aim of enhancing food security in the developing world.

The two biggest projects are the Competitive African Rice Initiative (CARI) and the Better Rice Initiative Asia (BRIA). Their goal is to professionalize agricultural production in the rice sector in developing countries. Farmers will benefit from an improved agricultural extension service, better market access, and higher incomes. The projects intend to support various actors at different stages in the rice value chain. This includes rice production, processing and marketing.

To learn more about the German Food Partnership, please visit www.germanfoodpartnership.de/en.html.

05 Affordable Nutritious Foods for Women Project (ANF4W) Launched in Ghana



The launch of the Affordable Nutritious Foods for Women (ANF4W) pilot project in Ghana.

ANF4W in Ghana is a pilot project that will run from 2013 to 2015 and is co-financed by the Bill & Melinda Gates Foundation and the German Federal Ministry for Economic Cooperation and Development (BMZ). It is being coordinated by the German Society for International Cooperation (GIZ) together with *Sight and Life* under the umbrella of the German Food Partnership (GFP). Ajinomoto, McCann Health and GAIN are third-party partners in this exciting project, which aims to create a culturally appropriate, affordable food prototype for Ghanaian women of reproductive age based on a local food fortified with essential micronutrients.

The product will be developed and manufactured in Ghana by a local food company, and an unbranded social marketing strategy targeted at women of reproductive age will be used to increase overall nutrition awareness among the target group. The larger ANF4W project hopes to increase the local supply of, and demand for, affordable, nutritious foods presently lacking in markets around the world.

Listen to the George Graham Symposium Celebrating 100 Years since the Discovery of Vitamins

George Graham was the founding Director of, and first Professor in, the Division of Nutrition at Johns Hopkins Bloomberg School of Public Health. In 2013 the annual symposium in his honor celebrated the centenary of the discovery of vitamins.

Speakers included Bruce Ames on “Vitamin and mineral deficiencies accelerate age-related diseases”, Alfred Sommer on “Vitamin A at 100: Saving lives millions at a time”,

Klaus Kraemer on “Hidden Hunger around the globe”, and William Checkley on “Vitamin D and chronic disease prevention: The best century is yet to come”.

To listen to the talks, please visit

www.youtube.com/playlist?list=PLXJdKEt5vI2sIIGH1xclA7MXeKFIHGR1M

DSM Receives Bloomberg School of Public Health Dean's Medal



Stephan Tanda, Member of the Managing Board of DSM with responsibility for the company's Nutrition businesses (left) receives the Dean's Medal from Prof. Michael Klag.

The Dean's Medal recognizes significant contributions to the field of public health. This is the first time the medal has been awarded to an organization rather than an individual. DSM has a sustained collaboration with the Johns Hopkins Center in Human Nutrition. This involves supporting intervention trials to prevent micronutrient deficiencies in women and children in South Asia; providing overseas internships for masters' degree students; and awarding scholarships for doctoral degree research within the Department of International Health to advance the prevention of malnutrition in the developing world.

More Honors: WFP Hunger Hero Awards

During the 2014 World Economic Forum in Davos Switzerland, the WFP honored three individuals with the WFP Hunger Hero Award. This distinction recognizes their leadership in addressing the challenges of ending hunger.

The three awardees were Sam Dryden, Senior Fellow at the Bill & Melinda Gates Foundation, who has championed the Gates Foundation's massive contributions to increase agricultural production and reduce malnutrition; Marc van Ameringen, Executive Director of the Global Alliance for Improved Nutrition (GAIN), for his commitment to addressing malnutrition; and Dr Shenggen Fan, Director General of the International Food Policy Research Institute (IFPRI), who is described as a true champion of the hungry and malnourished.

After announcing the winners, Ban Ki-moon, Secretary-General of the United Nations, was the first to sign a Zero Hunger Declaration. This is a pledge to take action – within one's own sphere of influence – to eliminate hunger within our lifetime through sustainable, climate-smart food systems. Signatories also included the Executive Director of the WFP Ertharin Cousin; UN High Commissioner for Refugees António Guterres; USAID Administrator Rajiv Shah; Unilever Chief Executive Officer (CEO) Paul Polman; DSM CEO Feike Sijbesma; and many others.

Do You Know About the Zero Hunger Challenge?



This challenge was started by the Secretary-General of the United Nations, Ban Ki-moon, in the belief that hunger can be eliminated in our lifetime. The challenge strives for:

- > Zero stunted children less than 2 years;
- > 100% access to adequate food all year round;
- > Sustainability of all food systems;
- > 100% increase in smallholder productivity and income;
- > Zero loss or waste of food.

Please visit www.un.org/en/zerohunger/challenge.shtml for further details.

Sight and Life Expands its Support for Early Childhood Development Centers, Primary School and Care Centers in South Africa



Celebration of the launch of MixMe™ porridge in Limpopo Province, South Africa, together with www.bambanani.org.



MixMe™ beverage is launched in Langa, Cape Town, together with www.project-playground.org.

As part of our commitment to helping the world's most vulnerable, *Sight and Life* supports the provision of micronutrients in partnership with a number of charitable foundations across South Africa. Using a combination of multiple micronutrient powders added to existing school meals, and two innovative micronutrient products – an instant porridge to be used in six ECD centers in one of the poorest provinces and a micronutrient beverage to be used in two centers offering support to orphans and vulnerable children – *Sight and Life* has expanded its support to include an additional 2,000 children.

“There is much amazing work being undertaken by so many to improve the lives of children,” says Dr Klaus Kraemer, Director of *Sight and Life*. “Unfortunately, we cannot support them all, but we at *Sight and Life* are delighted that we are able to support these projects through our partnership with DSM South Africa.”



The launch of the MixMe™ beverage at the Tiyimiseleni Orphan Project in Mpumelanga, South Africa together with www.savannalodge.com/giving-back.

10 Nutrition Resources: Keeping You Up to Date and Developing Your Skills

There are some great resources available to those working in nutrition around the world. Some of these are general, while others are designed to serve the specific needs of those working in certain areas of nutrition. Here are a few that you might wish to explore.

Transform Nutrition: email newsletter

Transform Nutrition offers a newsletter sent by email that is a great resource for anyone working in nutrition in Asia and Sub-Saharan Africa. This organization, led by Stuart Gillespie of the International Food Policy Research Institute (IFPRI), is a consortium of five international research and development partners funded by the UK government. It uses research-based evidence to inspire effective action to address undernutrition. From 2012 to 2017, Transform Nutrition aims to transform thinking and action on nutrition and to strengthen nutrition-relevant evidence in order to accelerate the reduction of undernutrition in South Asia and Sub-Saharan Africa. **Please visit** www.transformnutrition.org to learn more about Transform Nutrition, explore the comprehensive website, and sign up for the newsletter.

Are you disaster-ready?

www.DisasterReady.org is a free, easy-to-use online training resource designed to help prepare aid workers for the demands they face in the field. The courses are created by experts in humanitarian assistance and staff development. Two nutrition courses are now available. The first addresses 'Basic Concepts in Nutrition', and covers basic concepts in nutrition, WFP's food commodities, and specialized nutrition products. The second is an introduction to WFP's nutrition policy and programming, and deals with nutrition situation analysis, guided by WFP's Food and Nutrition Security Framework.

Sight and Life supported the development of these modules with financial and technical assistance. **All you have to do is sign up and begin!**



New Appointments: Joel Spicer and Shawn Baker



Joel Spicer: "Working to achieve greater equity in the world."

Recently both the Micronutrient Initiative and the Bill & Melinda Gates Foundation have announced new appointments.

Joel Spicer – President of the Micronutrient Initiative

For Joel Spicer, the opportunity to take the helm as President of the Micronutrient Initiative (MI) was not just about the impact that could be achieved by increasing access to vitamins and minerals for the most vulnerable in the world. It was also about putting into practice his own driving philosophy of working to achieve greater equity in the world.

“Without the opportunity for everyone to meet their full potential, we all lose”

“The fight against poverty cannot be won while entire generations are being born stunted, malnourished, and with their development potential impaired because they don’t have access to good nutrition,” Spicer says. “This injustice is one of the greatest sources of inequity in the world. Undernutrition

keeps people locked in a poverty trap, holding back millions, perhaps billions, from reaching their full potential. And without the opportunity for everyone to meet their full potential, we all lose.”

Joel joins MI from the World Health Organization’s Stop TB Partnership, where he increased political engagement by global leaders and key influencers to tackle the greatest challenges facing the world with respect to tuberculosis. Spicer has worked as a donor, with the World Bank, with the UN at country level, and with global health partnerships. These different perspectives, complemented by graduate degrees from the Harvard School of Public Health and the London School of Economics and Political Science, will help him capitalize on opportunities for MI in the years ahead. We at *Sight and Life* wish Joel well and look forward to many continued years of the two organizations working together to improve the lives of the world’s most vulnerable.

Shawn Baker – Director of Nutrition in the Global Development Program

Earlier in the magazine you will have read an interview with Shawn Baker, previously of Helen Keller International, who has been appointed as the Director of Nutrition in the Global Development Program of the Bill & Melinda Gates Foundation (BMGF). Announcing his appointment, Christopher Elias, President of Global Development, noted “This is a key moment in time for nutrition because of the increased visibility and commitment to addressing malnutrition, the evolution of the knowledge base in the sector, and growing recognition of nutrition’s fundamental role in survival and development ... With Shawn’s leadership, the BMGF team is well positioned to take advantage of this moment and will build on an existing platform of research and delivery investments, engaging partners and other foundation program strategies that have direct links to nutrition outcomes, and leverage the rapidly changing external environment to accelerate global progress in nutrition.” We at *Sight and Life* congratulate Shawn and look forward to working with him and his team as we strive to ensure nutrition remains high on the global agenda and we head towards the Post-2015 development agenda.

Scaling Up Nutrition (SUN) Movement

The SUN Movement keeps growing, and now 51 countries are part of the drive to ensure that nutrition is placed at the center of their development plans. Togo, Guinea-Bissau, Costa Rica and the Philippines are the latest countries to sign up. Many other countries, together with global partners, are also moving forward. The Government of Rwanda and the European Union have signed a financing agreement worth EUR 30 million to support the country's goal of eliminating malnutrition, while the Government of Tanzania and the SUN Business Network have launched a multi-stakeholder consultation process to integrate business into Tanzania's National Nutrition Strategy (NNS).

In addition, this year's SUN Global Gathering will take place in the margins of ICN2, and there are plans to include a 'marketplace' design feature to showcase country experiences. Although participation in the SUN Global Gathering will be by invitation only, please keep up to date with all the Movement's news.

You can do this by signing up to SUN's regular and informative newsletter at www.scalingupnutrition.org or by looking out for updates in *Sight and Life!*

Did You Know?

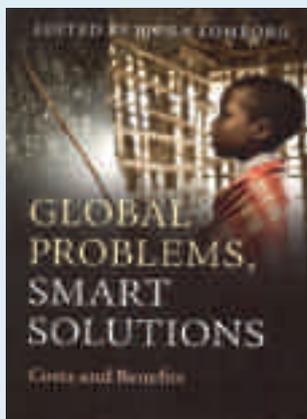
- > **Togo** is in fact officially called the Togolese Republic, and is one of Africa's smallest countries. It has a population of just under seven million people and uses French as its official language. Koutammakou is a UNESCO World Heritage site, where the local Batammariba people construct and live in unique Takienta "tower houses" made of mud and straw.
- > **Guinea-Bissau** has Portuguese as its official language, although it is situated in predominantly French-speaking West Africa and only 14 per cent of the population speaks Portuguese! This tiny republic has a population of under two million people.
- > **Costa Rica** is situated in Central America and has consistently been among the top-ranking Latin-American countries in the Human Development Index (HDI). It is known for its progressive environmental policies, being the only country to meet all five criteria established to measure environmental sustainability.
- > **The Philippines** were hit by the Typhoon Haiyan, known as Typhoon Yolanda in the Philippines, on November 8, 2013. It was one of the strongest typhoons ever recorded and it devastated significant parts of the country. It was the deadliest typhoon in the Philippines on record, killing a minimum of 6,268 people.

Editor's note: This section contains reviews of books, publications, and websites that, whether brand new or classic, we hope will be of interest to our readers. Notices of relevant new publications that do not actually constitute reviews will from henceforth be published on www.sightandlife.org.

Book Review

Global Problems, Smart Solutions: Costs and Benefits

Edited by Bjørn Lomborg
Cambridge University Press 2013



If you had a hundred dollars to make the world a better place, what would you do with it? Buy food for the hungry? Buy medicines for the sick? Buy schoolbooks for the young? Or should you perhaps think in less obvious categories? Should you use those hundred dollars to support research into infectious diseases, or perhaps into

non-communicable diseases, or perhaps into climate change? And what if you had not a hundred dollars to spend but a hundred thousand, or a hundred million? Would having more money make your choice harder or simpler? And what if you only had one dollar – one precious, hard-earned dollar that was all you could give to make the world a better place? Where would that one dollar go?

“This book serves to give everybody the opportunity to consider (and reconsider) their priorities”

While turning that dollar over in your pocket, you could do a lot worse than to beg, steal or borrow a copy of *Global Problems, Smart Solutions: Costs and Benefits* edited by Bjørn Lomborg. For this book is precisely about the value of spending. As Lomborg explains in his introduction, it is based on the Copenhagen Consensus approach, which is to look at global issues and to ask: how could economic science help us to improve decision-making? The Copenhagen Consensus “aims to put prices and sizes on the menu, making choices more informed.” In 2004, the Copenhagen Consensus Center first gathered research on ten key global challenges – from malnutrition to terrorism – and commissioned a panel of experts to consider what they would do to benefit humanity and the environment if they had an additional \$75 billion to spend over the next four years. This initiative was to give rise to the highly influential publications *Global Crises, Global Solutions* (2005), *Latin American Development Priorities* (2009), *Smart Solutions to Climate Change* (2009) and *Rethink HIV* (2011). *Global Problems, Smart Solutions: Costs and Benefits* is the continuation of this influential line of thinking, and presents the work of the Copenhagen Consensus 2012.

Lomborg makes it clear that good intentions are not enough: intelligent investments are also required. And intelligent investments are only possible if one can put a price on their value. “When it comes to global welfare projects,” he argues, “it is easy for decision-makers to pay lip service to prioritization, but to act as though the pool of money is infinite, that all that is lacking is willpower, and that everything should be tackled all at once ... We live [however] in a world with limited resources and even more limited attention for our biggest problems. This means we have to ask the crucial question: if we don’t do it all, what should we do first?” Lomborg argues that “Often, explicit prioritization is ignored altogether by policy-makers. The UN Millennium Development Goals (MDGs), which shaped much of this funding for the first decade of this century, consist of a laundry list of noble causes with no consideration given to relative costs or benefits.” He makes the point that “Relying on costs and benefits, as this project does, is a transparent and practical way to establish whether spending is worthwhile or not,” before coming to the

powerful conclusion: “Some will argue that it is impossible to put a value on a human life. Yet, refusing to put a value on human life does not save lives.” Using economic tools such as the “Disability Adjusted Life Year” (DALY) and discounting (which “allows us to balance our own needs against those of future generations”), the authors of *Global Problems, Smart Solutions* use a comparable economic framework to address a wide range of issues. “If each chapter is in the same ‘language,’” Lomborg explains, “then decision-makers – and you, the reader – will be able to establish what can be achieved with spending in different areas.”

The book is divided into two parts – *Part I: The Solutions* and *Part II: Ranking the Opportunities*. The Solutions cover the following thematic areas: Armed Conflicts; Ecosystems and Biodiversity; Chronic Disease; Climate Change; Education;

Hunger and Malnutrition; Infectious Disease, Injury, and Reproductive Health; Natural Disasters; Population Growth; and Water and Sanitation. Each chapter is complemented by two alternative perspectives, each written by a different author or combination of authors and interpreting the arguments of the main chapter from a different angle. Part II, meanwhile, ranks the ten proposals, which were originally put forward within the framework of the Copenhagen Consensus 2012. This panel of world-leading economic experts comprised Finn E Kydland, University of California, Santa Barbara (Nobel Laureate); Robert Mundell, Columbia University in New York (Nobel Laureate); Thomas Schelling, University of Maryland (Nobel Laureate); Vernon Smith, Chapman University (Nobel Laureate); and Nancy Stokey, University of Chicago. Their rankings were as follows:

TABLE 1: Prioritization of solutions: Expert Panel

Challenge	Solution
01 Hunger and Education	Bundled Interventions to Reduce Undernutrition in Pre-Schoolers
02 Infectious Disease	Subsidy for Malaria Combination Treatment
03 Infectious Disease	Expanded Childhood Immunization Coverage
04 Infectious Disease	Deworming of Schoolchildren
05 Infectious Disease	Expanding Tuberculosis Treatment
06 Hunger and Biodiversity and Climate Challenge	R&D to Increase Yield Enhancements
07 Natural Disasters	Investing in Effective EWS (Early Warning Systems)
08 Infectious Disease	Strengthening Surgical Capacity
09 Chronic Disease	Hepatitis B Immunization
10 Chronic Disease	Acute Heart Attack Low-Cost Drugs
11 Chronic Disease	Salt-Reduction Campaigns
12 Climate Change	Geo-Engineering R&D
13 Education	CCTs (Conditional Cash Transfers) for School Attendance
14 Infectious Disease	Accelerated HIV Vaccine R&D
15 Education	Information Campaign on Benefits From Schooling
16 Water and Sanitation	Borehole and Public Hand Pump Intervention
17 Climate Change	Increased Funding for Green Energy R&D
18 Population Growth	Increased Availability of Family Planning
19 Chronic Disease	Heart Attack Risk Reduction Generic Pill
20 Water and Sanitation	CLTS (Community-led Total Sanitation)
21 Water and Sanitation	Sanitation as a Business
22 Chronic Disease	Increasing Tobacco Taxation
23 Natural Disasters	Community Walls Against Floods
24 Water and Sanitation	The “Reinvented Toilet”
25 Biodiversity	Protecting All Forests
26 Natural Disasters	Retrofitting Schools to Withstand Earthquake Damage
27 Hunger	Crop Advisory Text Messages
28 Biodiversity	Extension of Protected Areas
29 Natural Disasters	Strengthening Structures Against Hurricanes and Storms
30 Natural Disasters	Elevating Residential Structures to Avoid Flooding

TABLE 2: Expert Panel's allocation of \$75 billion

Solution	Amount allocated p.a., in \$US billion
Bundled Interventions to Reduce Undernutrition in Pre-Schoolers	3.0
Subsidy for Malaria Combination Treatment	0.3
Expanded Childhood Immunization Coverage	1.0
Deworming of Schoolchildren	0.3
Expanding Tuberculosis Treatment	1.5
R&D to Increase Yield Enhancements	2.0
Investing in Effective EWS (Early Warning Systems)	1.0
Strengthening Surgical Capacity	3.0
Hepatitis B Immunization	0.12
Acute Heart Attack Low-Cost Drugs	0.2
Salt-Reduction Campaigns	1.0
Geo-Engineering R&D	1.0
CCTs (Conditional Cash Transfers) for School Attendance *	1.0
Accelerated HIV Vaccine R&D	0.1
Information Campaign on Benefits From Schooling *	1.34
Borehole and Public Hand Pump Intervention	1.89
Total	\$18.75

Note: * Estimate.

Readers of *Sight and Life* may be particularly interested in the chapter on Hunger and Malnutrition, which is co-authored by John Hoddinott, Mark Rosegrant and Maximo Torero. “The planet creates more than enough food to meet everyone’s needs,” writes Lomborg in his introduction. “But there are still around 925 million hungry people in the world, and nearly 180 million pre-school children do not get vital nutrients. In 2008, the global Copenhagen Consensus project focused attention on the problem of hidden hunger. The Expert Panel found that micronutrient interventions – fortification and supplements designed to increase nutrient intake – were the most effective investment that could be made, with massive benefits for a tiny price-tag. In Chapter 6, the authors once more propose that decision-makers prioritize micronutrient interventions, and they update the analysis of the costs and benefits of doing so. They find that for a relatively small amount of money – less than \$700 million annually – it would be possible to eliminate vitamin A deficiencies in pre-school children, eliminate iodine deficiency globally, and dramatically reduce maternal anemia during pregnancy. But they also offer new solutions, including bundling nutrition interventions, increasing global food production, and improving market functioning through better communications and increased competition in fertilizer markets.”

Plenty of good ways of spending that dollar in your pocket, then. And you would even have change out of a hundred million, should you dispose over such funds.

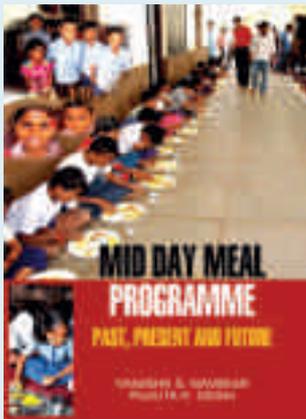
.....
 “The framework presented here provides a way for you to consider investments side by side ... Crucially, what are you going to do about it?”

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Global Problems, Smart Solutions: Costs and Benefits is available from Cambridge University Press.

Date published: November 2013
Format: Paperback
ISBN: 9781107612211
Length: 760 pages
Website: www.cambridge.org

Book Review

The Mid Day Meal Programme: Past, present and future



India has the dubious distinction of having one of the highest rates of undernutrition in the world: over fifty per cent. Such high prevalence of undernutrition among schoolchildren not only undermines educational attainments and productivity, but also has adverse implications for the economic growth of the nation.

The Mid Day Meal Programme: Past, present and future by Vanisha S Nambiar and Rujuta K Desai is the first in the series *Advances in Public Health Nutrition* published by Discovery Publishing House Pvt Ltd. It discusses various developmental programs initiated by the Government of India, including the National Programme of Nutritional Support to Primary Education (NP-NSPE), commonly known as the Mid Day Meal Programme (MDMP). The world's largest school-feeding program, the MDMP aims to promote improved enrolment, school attendance and retention. Simultaneously, it also aims to improve the nutritional status of primary school children.

The book highlights the journey of the MDMP and focuses on the program's numerous advantages if implemented in line with the NP-NSPE norms. Drawbacks such as poor logistics, inadequate political support, lack of awareness and lack of training of grassroots-level functionaries are also reflected in the book, which additionally includes the program's detailed methodology for monitoring and evaluation. This publication will be useful for academics, development workers and policy-makers involved in public health and nutrition.

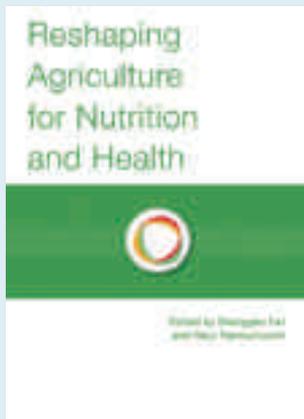
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Publication Notice

Reshaping Agriculture for Nutrition and Health

Shenggen Fan and Rajul Pandya-Lorch (Eds),
International Food Policy Research Institute (IFPRI)



Most people would say that agriculture is about growing food; they are right. The purpose of agriculture, however, does not stop there. At a deeper level, agriculture is also about growing healthy, well-nourished people.

In the preface to this timely publication, the authors state that “What happens in the agriculture sector

– a supplier of food and essential nutrients, a source of income and employment, and an engine of growth – has important implications for nutrition and health.” This is true, and it is one of the key reasons why we need to break down the silos within which nutrition and agriculture have traditionally operated. We need to see the entire value chain from farm to fork to fortification – and even to supplementation – as interlinked and interdependent.

This book is intended to identify knowledge gaps, foster new thinking, and stimulate actions for leveraging agriculture in order to improve nutrition and health. It serves a variety of audiences, from academics through practitioners to policymakers. The book is based on the papers written by a wide range of experts that were given at the IFPRI conference “Leveraging Agriculture for Improving Nutrition and Health,” which took place in New Delhi in February 2011.

The sad reality is that, contrary to what one might expect, market prices do not provide an adequate incentive to produce nutritious food. And even if prices did reflect the nutritional value of food, they might put nutritious foods out of the reach of poor people. This means that public interventions are needed to correct market failures (when prices fail to reflect the nutritional value of foods) or to improve affordability (for poor people). So, while some people are getting too little food, others are getting too much of the wrong food, and the double burden of malnutrition is on the increase.

The links between agriculture and nutrition and health are numerous and complex, but this publication sets them out in a logical and easy-to-read sequence. The broad themes addressed include conceptualizing the links between the three sectors; looking at the food system and the interaction with nutrition as well as the disconnects; the need to turn economic growth into nutrition-sensitive growth; and the issues of gender and farm laborers. All these must be considered in addressing poverty and malnutrition.

Nourishing the world’s population sustainably so that all people can lead healthy, productive lives requires closer collaboration. It involves ensuring that agriculture, nutrition and health do not work at cross-purposes but instead create an environment for cooperation. This publication is highly recommended, and is essential reading for everyone working in public health nutrition.

To download this publication or purchase it in hard copy, please visit www.ifpri.org/publication/reshaping-agriculture-nutrition-and-health

“Market prices do not provide an adequate incentive for producing nutritious food”

A world
free of
malnutrition.

Sight and Life is a
humanitarian nutrition
think tank of DSM



Imprint

Sight and Life Magazine

Incorporating the Xerophthalmia Club Bulletin and the Nutriview Newsletter

Publisher: *Sight and Life*

Editor: Klaus Kraemer

Editorial team:

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transparent Language
Solutions, Berlin, Germany

Opinions, compilations, and figures contained in the signed articles do not necessarily represent the point of view of *Sight and Life* and are solely the responsibility of the authors.

Design concept, layout, and graphics:

S1 Communication Design,
Augsburg, Germany

Illustration: Pages 12/13

Robert Pfeiler,
Augsburg, Germany

Printer: Burger Druck, Waldkirch, Germany

Photo credits:

Cover:

Marizilda Cruppe/EVE, 2012

Pages 15, 29, 47:

Mike Bloem Photography

Pages 08, 66:

Christopher Gmuender
Photographie

Page 24:

The Journal of Nutrition
jn.nutrition.org

Page 49: Mr. Jan Hasselman, AkzoNobel

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is a trademark of Royal DSM

ISBN 978-3-906412-74-0

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A world free of malnutrition.



Sight and Life is a humanitarian think tank. Inspired by a vision of a world that is free from malnutrition, it helps to improve the lives of some of the world's most vulnerable populations. It does this by supporting innovation that aims to eradicate malnutrition.