Positioning Nutrition at the Center of the Development Agenda: The Malawi Experience

The Vice President of Malawi, The Right Honorable Joyce Banda, recently gave the keynote address at a roundtable meeting on ‘Hidden Hunger – the missing link between health and food’, jointly hosted by the Commonwealth Secretariat and SIGHT AND LIFE, ahead of the 2010 Commonwealth Health Ministers’ Meeting in Geneva in May. Read more on page 50
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<td>Chittaranjan S. Yajnik</td>
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Iron: Nutrition's Two-Edged Sword
As expressed in the title, iron is a two-edged sword. On the one hand, it is an essential nutrient. On the other hand, it is a highly reactive element and the basis of all oxidation processes within living organisms.

Should Organically Produced Foods be Healthier than Conventionally Grown Foods?
A recent systematic review to compare the nutrient quality of organic with conventionally produced foodstuffs found no evidence of any difference that might have an impact on health.

2009 CHNRI International Essay Competition Winners

Infant Vitamin A Supplementation: From Research to Policy
Introducing Sprinkles™ in Kyrgyzstan: From People's Mandate to National Policy

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Publications
Real Leadership is Required if the Millennium Development Goals are to be Attained

In my previous editorial, I spoke about the need to make better nutrition for the world’s poor a reality, particularly in light of the commitments made by world leaders in September 2000 to reduce extreme poverty and attain the United Nations Millennium Development Goals (MDGs) of reducing poverty, hunger and mortality by 2015. As the MDG target date draws ever nearer, in this issue I would like to address the ongoing discussion on how to achieve this in practice. It is time not just to talk the talk, but to walk the walk.

Much effort has been made by a wide range of organizations to make real progress in meeting these international goals. Yet, while a number of targets have been met, or almost met, other MDGs are still far from being attained. Such uneven progress across the globe, where some but not all regions have achieved substantial success, weighs heavily on those countries that lag behind. If we are to obtain concrete and lasting results by 2015, we need real leadership and the full engagement of everyone involved.

Leadership not only creates a vision, it also encourages and empowers people to buy into that vision. Translating a vision into reality, however, requires defined roles and responsibilities with clear operational structures. This is where good governance comes into play.

A successful nutrition system depends on the creation of a new global governance structure

A system out of balance

As spelled out in the Lancet series on Maternal and Child Undernutrition paper 5 in 2008, the global food and nutrition system is currently out of balance. The series argues that effective international action against malnutrition has proven difficult, is often splintered, and that progress needs to be accelerated. “The international nutrition system – made up of international and donor organizations, academia, civil society, and the private sector – is fragmented and dysfunctional,” wrote authors Saul S Morris, Bruce Cogill and Ricardo Uauy. “Reform is needed so that the nutrition community can perform key stewardship functions, mobilize resources, provide services in emergencies, and strengthen capacity in low-income and middle-income countries,” they continued. Among other areas, the authors argued that a successful international nutrition system depends on the identification and creation of a new global governance structure by the international community. “[This] can provide greater accountability and participation for civil society and the private sector,” they concluded.

A global food and agriculture system in disarray

Joachim von Braun, the director of the Center for Developmental Research and Professor for Economic and Technological Change at the University of Bonn, supports this argument in the June 2010 edition of Nature. Here, Dr von Braun argues that an independ-
ent strategic body should be set up that has the authority to empower existing organizations to take action based on proven evidence and mobilize the necessary resources for implementation. It should also have the power to make quick decisions in the face of crises and to tackle fundamental problems that currently fall between the gaps of global governance. Furthermore, this body should be prepared to tackle food crises effectively, given that in the last food crisis the number of undernourished people in the world unacceptably jumped from 923 million in 2007 to more than a billion in 2009.

“The world food and agricultural system is in disarray,” he says. “This [is] largely due, I feel, to poor global governance of agriculture, food and nutrition.” However, if there is no leadership in the field of nutrition, establishing a functioning structure of governance is a difficult challenge.

According to von Braun, a good candidate would be the Committee on World Food Security (CFS), which currently sits within the UN’s Food and Agriculture Organization (FAO). At the recent Policies Against Hunger VIII conference in Berlin, the German Federal Minister Ilse Aigner pointed out that the European Union would support the CFS as the global platform for the coordination of national, regional and local strategies promoting food security and a healthy diet. My concerns are, however, that such an authority could lack independence and might focus on food rather than nutrition security.

With this in mind, it is very encouraging that a Task Force with a number of Working Groups to address specific topics was recently established under the chairmanship of David Nabarro, UN Secretary-General Ban Ki-moon’s Special Representative on Food Security and Nutrition. The aim is to move the Scaling-Up Nutrition: A Framework for Action (SUN) document into a clear roadmap with concrete and practicable recommendations for the wider group of SUN stakeholders on how to scale up nutrition in the short, medium and long term. The roadmap will be used in the drive to ensure that nutrition is highlighted as being a central concern on the global development agenda when the world leaders meet again in September to revisit progress on the MDGs.

Leadership, involvement and consensus are required

As part of its goal to see the SUN Framework result in real and sustained improvements in nutrition within communities that are most burdened by undernutrition, key spheres where increased activity is required are ensuring significant inspirational leadership, widening involvement and building consensus. In light of the work being carried out by Dr Nabarro and his team, we should also ask ourselves who is truly responsible for leading us towards the achievement of the MDGs?

Rather than relying on one form of leadership alone, perhaps we should recognize the fact that a broad range of leadership functions exists, each of which demands our respect and attention and perhaps even involvement. While some leaders live at center stage, others – for example, leaders in research, or in program implementation – may be less obvious to the public at large. This is not to say that their efforts are any less important.

Governance, too, ranges from the work of formal global organizations to the input of what Dr von Braun calls a web of informal networks, in which nation states communicate through heads of state, ministers, parliamentarians, and non-governmental organizations worldwide. Regardless of their differences or relative visibility, such multitudinous forms of leadership and governance can nonetheless be mutually complimentary.

I firmly believe that we are all in the same boat, a boat which has enough wind in its sails to make better nutrition for the world’s poor a reality – before the current window of opportunity closes. This window may not be reopened in the near future, or could well be closed for ever. My concern is that we do not yet have the civil society and activist support that is needed for the nutrition movement to gain the momentum we need.

Inspirational leadership and commitment have already reaped benefits

In this issue, we shine a light on one way in which inspirational leadership and commitment have already reaped concrete benefits. Since his election as the President of the Republic of Malawi in 2004, Ngwazi Professor Bingu wa Mutharika has championed the recognition of the importance of nutrition, placing it at the core of his government’s development policy. To date, his clear leadership has been supported and amplified by good governance. It has likewise been nurtured by the governmental processes and structures he has put in place and through the clearly allocated
roles and responsibilities of all the partners involved. As a result, Dr Bingu wa Matharika’s approach signposts the benefits of governance that is supported by the clear segregation of roles and responsibilities. It also marks the need for the highest political will to place nutrition under the auspices of the President’s office, making the President and Ministers directly accountable for nutrition and thus also responsible for improving the lives of the very people that voted them into power.

Ultimately, I believe that leadership and governance need to go hand in hand. Leadership is nothing if unsupported by governance; in turn, governance is without value if it is not inspired by leadership.

What makes a good leader?

“Management is doing things right; leadership is doing the right things.”
Peter F Drucker

“The task of the leader is to get his people from where they are to where they have not been.”
Henry Kissinger

“The task of leadership is not to put greatness into humanity, but to elicit it, for the greatness is already there.”
John Buchan

“The final test of a leader is that he leaves behind him in other men, the conviction and the will to carry on.”
Walter Lippmann

With best regards,
Lessons Learned From β-Carotene Supplement Trials
James A Olson Memorial Lecture – 2010

John W Erdman, Ann G Liu, Krystle E Zuniga
Division of Nutritional Sciences, University of Illinois, Urbana, IL 61801, USA

Correspondence: John Erdman, Division of Nutritional Sciences, University of Illinois, 455 Bevier Hall, 905S Goodwin Avenue, Urbana, IL 61801, USA
Email: jwerdman@illinois.edu

Introduction
It was indeed an honor to have been asked to present the 2010 James A Olson Memorial Lecture at the CARIG Symposium, Experimental Biology Meeting, Anaheim, California, in April 2010.

In 1986–87, the senior author and his family spent a joyful nine-month sabbatical leave in the Department of Biochemistry and Biophysics at Iowa State University, hosted by the Olson lab. Much was learned from Jim Olson, Harold Furr, Arun Barua, Sherry Tanumihardjo, and many others. Dr Olson’s teachings were incredibly influential for my own laboratory’s development. The goal of this paper is to reflect upon the impact of four β-carotene supplement trials that were designed and initiated near the time of my sabbatical. These trials were terminated about a decade later, but the results continue to influence how the scientific and public health communities around the world view β-carotene supplement use.

The background
Vitamin A has been of interest for the prevention and treatment of cancer for decades due to its role in promoting the normal differentiation of cells. However, therapeutic use of natural and synthetic retinoids has been hindered by the extremely toxic nature of these compounds. Pro-vitamin A carotenoids, such as β-carotene, are generally non-toxic alternatives to retinoids. Moreover, 24 out of 25 epidemiological studies reported that high consumption of fruits and vegetables rich in β-carotene were related to reduced risk of lung cancer.¹ A 1981 review by Peto et al. in Nature, is regarded as initiating the enthusiasm among the research community for β-carotene and cancer intervention trials. While these authors outlined evidence linking dietary β-carotene and reduced cancer rates and presented several key research needs in the β-carotene and cancer field (such as animal and cell culture studies), they also called for randomized intervention trials to begin as soon as possible due to the lengthy nature of the studies.² By 1987, nine long-term clinical chemoprevention intervention trials with β-carotene, mostly in high risk disease patients, were underway in the United States alone.³

Epidemiological evidence suggests a decreased risk of lung cancer with high consumption of β-carotene rich fruits and vegetables


SIGHT AND LIFE Magazine 2010;2:7–12
Clinical intervention trials with β-carotene began without pre-clinical work to establish efficacy or safety.

However, in the rush of enthusiasm for β-carotene intervention trials, several key points were overlooked. First, consumption of diets high in β-carotene rich fruits and vegetables is not the same as consuming purified β-carotene supplements. The reduced cancer rates seen with fruit and vegetable consumption may have also been due to a number of protective compounds in those foods or to specific dietary patterns. Secondly, reducing the risk of cancer development with foods is not the same as preventing cancer in high-risk subjects with high-dose supplements. Thirdly, the dose level and the bioavailability differences between foods and supplements can be dramatically different and can result in different impacts on metabolism and functions in the body. High-risk subjects may not respond the same way as the general population.

β-carotene supplementation increased risk of lung cancer in ATBC and CARET trials

The first large intervention trial to investigate the use of β-carotene supplementation for reduction of lung cancer risk was the Alpha-Tocopherol Beta-Carotene Cancer Prevention Trial (ATBC). Over
29,000 Finnish male long-term smokers received daily supplements of placebo, 50 mg α-tocopherol, 20 mg of β-carotene, or both α-tocopherol and β-carotene. At 18 months, an increase in lung cancer incidence by β-carotene supplementation was evident, and at the end of the average six year long trial, β-carotene supplementation resulted in a 17% increase in lung cancer and an 8% increase in overall mortality. The negative findings raised serious concern for the safety of β-carotene supplementation and resulted in early termination of the β-carotene arm of the Women’s Health Study.

Negative findings of ATBC and CARET trials have had a long-lasting impact on carotenoid and nutrition research

Unfortunately, similar negative results were seen in the Beta-Carotene and Retinol Efficacy Trial (CARET). Over 18,000 US male and female smokers, former smokers, and asbestos workers received a daily supplement of 30 mg β-carotene and 25,000 IU (7,500 RAE) of retinyl palmitate or placebo for an average of four years. The active treatment group had a 28% increased risk of lung cancer and a 17% increased risk of death by all causes, leading the investigators to end the study 21 months early.

In contrast, the Physicians’ Health Study did not observe a relationship between β-carotene and cancer risk. The study employed a 2x2 factorial design to examine the potential use of aspirin and β-carotene for prevention of cancer and cardiovascular disease. The aspirin arm was terminated early, but over 22,000 US male physicians continued on β-carotene (50 mg) or placebo supplementation every other day for over 12 years. β-carotene supplementation had no significant effect on risk of total cancer, lung cancer, or cardiovascular disease. It is important to note that this study population had considerably fewer current smokers (11%) and former smokers (39%) than the ATBC or CARET trials.

A recent meta-analysis of nine randomized clinical trials with β-carotene supplements found no effect of supplementation on combined cancer incidence. However, supplementation in smokers and asbestos workers in the ATBC and CARET trials significantly increased total cancer risk (RR 1.08; 95% CI 1.01–1.15). Although there was no effect of β-carotene supplementation on incidence for many individual cancers, risk of lung and stomach cancer was higher in smokers and asbestos workers supplemented with 20–30 mg a day compared to the placebo group.

Potential reasons for the outcomes of the trials

Proposed explanations for the adverse outcomes after β-carotene supplementation in high-risk patients include: dose level was too high; supplementation was too late in the process after considerable lung damage from smoking and/or asbestos had occurred; smoking creates too much oxidative stress for dietary components to overcome; the intervention was too short; high dose β-carotene adversely impacted the absorption of other carotenoids or other nutrients; and β-carotene has the potential to be a pro-oxidant when consumed at high dose levels. Clearly, β-carotene doses provided in the supplementation trials were substantially higher than what is achieved by typical dietary intakes.

In the mid 1990s, NHANES III estimated the median daily intake of β-carotene in the US population was less than 3 mg. The Food and Nutrition report on DRIs (Daily Recommended Intakes) of antioxidants suggested that a daily intake of 3–6 mg of β-carotene would be achieved when consuming five or more serv-
ings of fruits and vegetables.\textsuperscript{11} Consumption of food sources of β-carotene results in blood concentrations far less than what is achieved through daily intake of 20 or 30 mg of highly bioavailable supplements of β-carotene.\textsuperscript{12}

Susan Mayne first compared the blood levels of β-carotene achieved at the completion of each of four intervention trials to those reported from NHANES III for men primarily obtaining β-carotene from food sources.\textsuperscript{12} We have re-expressed this same data along the X axis of Figures 1 and 2, while showing the relative risk of lung cancer (Figure 1) and stomach cancer (Figure 2) reported for the four trials (Y axis). It is remarkable that the two curves almost fall on top of each other. The relative risk of both lung and stomach cancer from the CARET trial was quite high, potentially because in addition to β-carotene, 25,000 IU of vitamin A was also provided daily.

**Nutrition research was given a “black eye”**

As a comparison to the blood levels achieved in the four trials, the fifth and 95th percentile plasma β-carotene levels for adult males in NHANES III were 5 and 49 µg/dL. Mayne estimated that 20 µg/dL plasma β-carotene was an approximate threshold associated with reduced risk of cancer and all-cause mortality based on a review of epidemiology studies.\textsuperscript{12} β-carotene levels achieved in the CARET and ATBC trials were approximately 10–15-fold higher than the “threshold”. This strongly suggests a “U” shaped curve where low blood levels (below 20 µg/dL) or high levels (above ~200 µg/dL), are related to an increased risk of cancer, at least in high risk smoking individuals.

Following the reports of the adverse lung cancer incidence from the CARET and ATBC trials, a number of animal trials were undertaken to evaluate the potential mechanism(s). Of note is the work of Xiang-Dong Wang and colleagues at Tufts University, which utilized a “smoking” ferret model. Ferrets were exposed to a controlled amount of cigarette smoke over time while consuming β-carotene at levels that mimicked normal consumption or the higher supplement doses provided in the human intervention trials. Pre-cancerous lesions in the lung were found in animals taking high dose β-carotene supplements, while no adverse histology or metabolism was seen with low dose supplementation.\textsuperscript{13} These carefully-designed trials demonstrated that the dose of β-carotene determines its effects in the body. At high dose levels, β-carotene behaves as a pro-oxidant; oxidative metabolites can enhance carcinogen binding to DNA, increase oxidative stress, and alter retinoid metabolism and signaling by inducing CYP450 enzymes.\textsuperscript{14}

**Damage done**

The results from the animal studies were critical in the understanding of the molecular mechanisms behind the β-carotene chemoprevention trials gone awry. The negative findings in the ATBC and CARET trials were not taken lightly, and funding for research in the carotenoid field fell for the next decade. Nutrition research was given a “black eye” and the ATBC trial is often still pointed to as a failure of a nutrition intervention.

Despite worldwide vitamin A deficiency, some policy makers appear to prefer avoidance or a ban on addition of β-carotene to foods or supplements. For example, the UK’s Expert Group on Vitamins and Minerals took into considera-
tion the results from ATBC and CARET to set a safe upper limit of 7 mg of β-carotene from supplements.\textsuperscript{15,16} A concern is that overreaction to the outcome of these trials might create a “substantial barrier” to supplementation or fortification in developing countries or for other populations in need of enhanced vitamin A status.\textsuperscript{17}

**Lessons learned**

In the fallout of the β-carotene supplement trials, there are three important lessons to be learned. The first is that animal trials to determine safety and an appropriate dose level are critical. The relationship between the dose of a compound and its toxicity is key. As Paracelsus noted: “All substances are poison; there is none that is not poison. The right dose differentiates a poison and a remedy.” Indeed, this lesson is apparent in the ATBC and CARET trials where supra-physiological levels of β-carotene resulted in an increased risk of lung and stomach cancer in high-risk individuals. In contrast, lower, physiologically relevant levels may confer a protective effect in healthy individuals.

**High-dose β-carotene supplements may have a pro-oxidant effect in high-risk subjects**

The second lesson to be learned is that special populations may have unique sensitivity or toxicity issues that must be considered. Smoking has profound health effects and greatly alters the cellular environment within tissues. As demonstrated by the work of Wang et al, the free-radical-rich environment of the smoke-exposed lungs may actually contribute to the instability of the β-carotene molecule, creating a pro-oxidant effect.\textsuperscript{13,14} In essence, β-carotene may have produced a negative outcome because of the pre-existing cellular environment in the tissues of smokers and asbestos workers. Special populations may have unique metabolic characteristics that alter how they respond to specific dietary compounds.

Thirdly, we all should have learned at this point that single nutrient supplements, while appropriate to overcome frank deficiency of that nutrient, will be unlikely to reduce the risk of a complex chronic disease condition. There are many examples of intervention trials with single antioxidant nutrients that have failed. However, the β-carotene trials stand out due to the unintended adverse outcomes.

**Key messages**

- Epidemiological evidence suggests a decreased risk of lung cancer with high consumption of β-carotene rich fruits and vegetables
- Clinical intervention trials with β-carotene began without pre-clinical work to establish efficacy or safety
- β-carotene supplementation increased risk of lung cancer in the ATBC and CARET trials
- High-dose β-carotene supplements may have a pro-oxidant effect in high-risk subjects
- The negative findings of the ATBC and CARET trials have had a long-lasting impact on carotenoid and nutrition research
- Pre-clinical safety and dose-response studies are key before moving into human clinical trials.

**Conclusions**

Pre-clinical safety and dose-response studies are key before moving into human clinical trials.

Have we learned any lessons regarding the enthusiastic jump into β-carotene intervention trials prior to having completed the foundation of safety and dose-setting studies? One guiding principle that characterized James Olson's pioneering work was to always move forward based on careful experimentation and substantiation with data. At a minimum, the ATBC and CARET trials failed to consider appropriate dose and safety of the dose chosen, given the high risk nature of those populations. Thus, those trials appear to have violated the principles of dose setting and safety considerations that should be hallmarks of human clinical trials. Let us all be mindful of the adverse outcomes of these trials and have the foundational studies completed prior to launching new trials.

**References**

4. Blot WJ, Li JY, Taylor PR et al. Nutrition intervention trials in Linxian, China: Supplementation with specific vitamin/mineral combinations, cancer incidence, and dis-

Carotenoid-rich mixed diet.
The True Story of Zinc Nutrition and Homeostasis

Donald Oberleas, Barbara F Harland
Texas Tech University, Lubbock, Texas, USA
Department of Nutrition, Howard University, Washington, DC, USA

Correspondence: Donald Oberleas, 3404 88th Street, Lubbock, TX 79423, USA
Email: doberleas@clear.net

Introduction

The essentiality of zinc was first demonstrated in rats by feeding a diet that was chemically deficient in zinc. The zinc required to meet the needs of these rats was so little that for many years it was assumed that a deficiency of zinc was unlikely to occur. Therefore, the practical aspects and prevalence of zinc deficiency worldwide was not appreciated until 1960 when it was determined that phytate, inositol hexaphosphate (Figure 1), a natural constituent of all plant seeds, was an important aspect in the production of zinc deficiency. This was first demonstrated using baby chicks as the experimental animal model (Table 1), it was later demonstrated in pigs (Table 2) and rats (Figure 2). This evidence included not only growth retardation but also parakeratosis, a severe symptom of zinc deficiency seldom seen in human subjects. Thus, studying the effects of zinc deficiency with chemically deficient diets becomes an academic curiosity, but to study zinc deficiency utilizing phytate-containing diets becomes a serious practical problem.

Table 1: Phytate effect on zinc homeostasis with chicks (weight at four weeks (g)).

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<th>Diet Type</th>
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<td>Cassein-Gelatin</td>
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<td>Protein Diet</td>
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<tr>
<td>Basal diet</td>
<td>469</td>
<td>447</td>
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<tr>
<td>Basal + phytate</td>
<td>206</td>
<td>153</td>
<td></td>
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<tr>
<td>Basal + phytate + Zn</td>
<td>473</td>
<td>395</td>
<td></td>
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<tr>
<td>Soybean Protein</td>
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<tr>
<td>Diet</td>
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<tr>
<td>Basal</td>
<td>162</td>
<td>122</td>
<td></td>
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<tr>
<td>Basal + 15 ppm Zn</td>
<td>382</td>
<td>391</td>
<td></td>
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<tr>
<td>Basal + 55 ppm Zn</td>
<td>473</td>
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Initial “n” = 10 chicks
Data from O’Dell and Savage

Figure 1: Undissociated phytic acid molecule, myo-inositol 1, 2, 3, 4, 6, 5-hexakis (dihydrogen phosphate). The hydrogens associated with the oxygen atoms dissociate to provide the phytate anion and provide an anionic character for complexation with cations. From Oberleas.

Table 2: Phytate effect on zinc homeostasis with pigs (weight at four weeks (g)).

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<td>Dietary Protein</td>
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<tr>
<td>Diet</td>
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<td>Basal</td>
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<tr>
<td>Basal + phytate</td>
<td>206</td>
<td>153</td>
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<tr>
<td>Basal + phytate + Zn</td>
<td>473</td>
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Other aspects of zinc nutrition and physiology

The best evidence for the metabolic effects of zinc rests with the activity of zinc dependent enzymes. There are at least 50 different enzymes that have been shown to be zinc dependent in several species. Two of the most sensitive enzymes associated with zinc metabolism are thymidine kinase and lactic dehydrogenase, neither of which contains zinc as a cofactor.

In 1983 the presence of zinc-finger proteins was demonstrated (Figure 3). Since this initial demonstration, more than 1,000 different zinc-finger proteins have been identified. Zinc-finger proteins attach to DNA at critical points and alter the expression of specific enzymes, hormones or other metabolic entities. Under these conditions, the synthesis of these zinc-finger proteins become the most sensitive processes affected by zinc because the regulation, in these cases, is to control the synthesis of the respective enzyme proteins. The effect on the expression of enzyme activity is reflected in this manner. The effect on thymidine kinase activity was demonstrated (Figure 4) using young rats as the experimental model. Since thymidine triphosphate is an essential component of DNA replication, the lack of thymidine kinase slows DNA replication and thus explains the depression of growth rate (cell division) in zinc-deficient subjects. The several enzymatic activities that have been demonstrated to be zinc related in the nucleus of each cell division are illustrated in Figure 5. This clearly illustrates the importance of the involvement of zinc in cell division.

The physiology of zinc is unique in many ways

A second sensitive enzyme regulated by a zinc-finger protein is lactic dehydrogenase. The activity of this enzyme hydrolyzes the lactic acid that accumulates in muscles and causes fatigue and pain following extensive exercise. Many people have experienced these symptoms and spent several days recovering for lack of adequate lactic dehydrogenase activity as a consequence of zinc deficiency. This symptomatology is frequently experienced as one of the earliest and thus
Table 2: Effect of phytate and zinc on the growth of swine.

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<th>Diet</th>
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<tbody>
<tr>
<td>Casein basal (diet 1)</td>
<td>1.21</td>
</tr>
<tr>
<td>Soybean basal (diet 2)</td>
<td>0.31 §</td>
</tr>
<tr>
<td>Casein + (0.7% phytic acid)</td>
<td>0.64</td>
</tr>
<tr>
<td>Casein + (0.7% phytic acid) + Zn</td>
<td>1.09</td>
</tr>
<tr>
<td>Soybean protein +(1.4% phytic acid)</td>
<td>0.18 #</td>
</tr>
</tbody>
</table>

Students t test
§Significantly lower than diet 1, p<0.001
#Significantly lower than diet 1, p<0.001 and diet 2, p<0.05

most sensitive symptoms and is seldom associated with zinc deficiency. It is a useful tool for diagnosis of early stages of zinc deficiency because with adequate zinc homeostasis the pain and distress, devoid of bruises, should disappear overnight.

The physiology of zinc is unique in many ways, in addition to the regulation of different enzymes. Most other enzymes are less sensitive to zinc depletion and some may have increased activity as deficiency advances. A very unique physiology occurs in the pancreas, an organ that is normally rich in zinc. The pancreas secretes zinc as a zinc-metallothionein I (protein) complex back into the duodenum of the gastrointestinal (GI) tract along with several protein digestive enzymes. Each metallothionein I protein molecule complexes with seven atoms of zinc. This fragile metallothionein protein is quickly digested and the zinc becomes ionic zinc. The amount of zinc secreted endogenously is two to four times that consumed each day. Thus the terms absorption or bioavailability become misnomers in the understanding of zinc homeostasis. This secretion was first described using dogs as the experimental animal and has been repeated in seven species including man and most recently the rat. Little importance was attributed to this secreted zinc until recently when its importance was demonstrated as shown in Figure 6. The evidence indicates that the secreted zinc may be zinc consumed two or more weeks prior to its time of secretion. Thus the greater consideration should be reabsorption, and therefore homeostasis.

The effect of zinc deficiency on the development of various organs is illustrated in Figure 7 that was studied using young pigs as the experimental animal. This illustrates that zinc deficiency atrophies the thymus gland more than any other organ in the body. The thymus gland is important in converting bone-derived white blood cells (B lymphocyte cells) to T lymphocyte cells and it is the T lymphocyte that seeks invasive viruses and bacteria and initiates the synthesis of antibodies to these invasive organisms. A thymus gland does not function adequately when atrophied and thus the individual child or adult becomes more...
susceptible to various infectious diseases, including but not limited to, colds, influenza and pneumonia. Truly, a healthy thymus gland is the body’s best defense against invasion of infectious disease organisms.

It has recently been shown that a limited amount of dietary phytate is absorbed and has some physiological function associated with the inhibition of crystallization of calcium phosphate and calcium oxalate into kidney stones where it is ultimately excreted into the urine. This amount is well within the molar ratio of 10 and though it may have some importance physiologically, the impact of phytate nutritionally is of greater importance.

A healthy thymus gland is the body’s best defense against infectious disease

Diagnosing zinc deficiency

The early symptoms of zinc deficiency are subtle and considered a part of normal physiology. The above example of the thymidine kinase affecting the rate of growth is always considered the leading symptom in young animals and children. First, there must be some standard for comparison. Frequently, experimental animals and livestock are selected for uniformity of growth. To follow the growth rate is adequate to study growth performance. With children throughout the world, both genetics and diet affect the relative growth rate. For adults growth is no longer a factor in zinc deficiency and is not a useful parameter. In most populations, studying the diets of the children reflects the diets of the family as a whole. Thus if the children are consuming a zinc-deficient diet, the parents are likewise.

Figure 8 shows results from the study of children from the Maya population living in the mountains of Western Guatemala. For lack of a better standard, the 50th percentile established by the National Center for Health Statistics was utilized as the standard. With this conservative standard, 99% of the children of this population were declared zinc-deficient. Considering that this is a population living largely on a survival diet, that proportion of the total population was declared zinc deficient. The paired “t” statistical analysis had a probability of $p<0.0001$. The major dietary ingredients are shown in Table 3. The major dietary constituents were maize (corn) tortillas and refried black beans. All of the other dietary ingredients combined contained insufficient zinc to negate the phytate content of the intake of these two food components.

The most precise method to determine zinc deficiency is to utilize the formula derived that utilizes the phytate and zinc content of the diet, converts these to moles (phytate content in grams per kilogram divided by 660, the molecular weight provides gram molecular...
weights or moles of undissociated phytic acid) and the (zinc content in grams per kg divided by the atomic weight of zinc (65.4) gives gram atomic weight an equivalent to moles on an atomic basis). The moles of phytate divided by the moles of zinc produces the molar ratio as shown in Figure 9.10 The critical molar ratio has been established at 10. Molr ratios less than 10 provide adequate zinc homeostasis, but as the dietary molar ratios become larger than 10, zinc deficiency is established (by definition) whether any identifiable deficiency symptoms exist.11 This is more precise than any basis for the diagnosis of any other nutritional deficiency. The data available at the time this formula was derived are shown in Table 4 and do not define absorption or bioavailability that is about 30% of the total process.12 Reabsorption is about 70% of homeostasis. This formula has also been used to determine the amount of zinc required to fortify infant cereals in the United States and Canada to give infants a better start in life, with less risk of secondary infections. The major drawback of this methodology is the lack of sufficient analytical phytate data at the present time. At sometime in the future, with sufficient phytate analyses of many foodstuffs added to nutrient databases, it will be possible to calculate this information at the same time other nutrients are being analyzed. This can occur if there is adequate interest and coordination of this analytical activity. This technology is the same for all monogastric species and is far more precise and reliable that plasma analysis. There are also no invasive techniques involved.

### Some chemical aspects of phytate

Zinc complexes with phytate with greater stability than any other essential cation. On passage through the GI tract it may also complex with some ferric iron (Fe$^{3+}$) though the maximum complexation of ferric phytate is at pH 1 and 2, it dissociates as pH increases. Thus, the complexation with iron would occur primarily in the stomach and have a lesser effect on iron absorption; it is probably much less a factor than on zinc homeostasis where there are two chances for complexation at the more desirable pH of the small intestine. It may also have some effect on the absorption of copper.

---

### Table 3: Phytate and zinc analyses for major foodstuffs in the Maya diet.

<table>
<thead>
<tr>
<th>Foodstuff</th>
<th>Phytate g/kg</th>
<th>Zinc g/kg</th>
<th>Phytate:zinc molar ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refried black beans (canned)</td>
<td>5.56</td>
<td>0.025</td>
<td>22.0</td>
</tr>
<tr>
<td>Maize tortilla</td>
<td>10.48</td>
<td>0.027</td>
<td>38.5</td>
</tr>
<tr>
<td>Black beans (air-dried)</td>
<td>30.40</td>
<td>0.031</td>
<td>97.2</td>
</tr>
<tr>
<td>Hybrid corn1</td>
<td>10.58</td>
<td>0.022</td>
<td>47.65</td>
</tr>
</tbody>
</table>

### Table 4: Data used to derive phytate:zinc molar ratio. From Oberleas.12

<table>
<thead>
<tr>
<th>Dietary variant</th>
<th>Phytate %</th>
<th>Zinc mg/kg</th>
<th>Gain g/wk ± SD</th>
<th>Phytate:zinc molar ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0</td>
<td>2</td>
<td>8.8±3.0 (24)</td>
<td>495.5$^3$</td>
</tr>
<tr>
<td>2</td>
<td>1.0</td>
<td>15</td>
<td>12.5±4.1 (27)</td>
<td>66.1</td>
</tr>
<tr>
<td>3</td>
<td>0.4</td>
<td>15</td>
<td>15.3 ± 4.6 (18)</td>
<td>26.1</td>
</tr>
<tr>
<td>4</td>
<td>0.4</td>
<td>70</td>
<td>37.5 ± 7.0 (47)</td>
<td>5.7</td>
</tr>
<tr>
<td>5</td>
<td>0.4</td>
<td>125</td>
<td>48.5 ± 42 (30)</td>
<td>3.2</td>
</tr>
</tbody>
</table>

$^3$Protein EDTA (ethylenediaminetetraacetic acid) washed
Correlation of molar ratio/weight gain = 0.97
From Oberleas$^12$
There is an interesting synergy among secondary cations of magnesium, calcium, and copper in the presence of zinc that must be considered in order for them to be affected. Most assuredly zinc deficiency that does not exhibit as many overt symptoms, is probably more prevalent worldwide than is iron deficiency.

The relative solubility of various cations at a molar ratio of 2 cations: 1 phytate molecule in vitro adjusted to pH 6, the approximate pH of the duodenum and upper jejunum, is shown in Figure 10. This clearly shows that zinc is the least soluble under these circumstances. Also the fact that zinc is also resecreted via the pancreas gives the dietary phytate two opportunities to complex the zinc cation.

Psychobiological aspects of zinc deficiency

By observing various groups of rats multi-housed in cages large enough to provide freedom of movement, it was observed that rats fed a zinc-deficient diet were less active and lethargic. From these subjective observations, a study was designed to observe the effects of zinc on the behavior and learning effects of these animals. One test was of voluntary activity that was inversely related to emotionality. Two learning tests were then conducted. Zinc supplemented rats were clearly more stable. The zinc-deficient animals performed significantly more poorly than the zinc adequate rats.

Zinc supplemented rats were clearly more stable in learning

In a second study, prenatal female rats were fed similar diets as above. The offspring from the above litters, though fed the zinc adequate diet from weaning until tested at 45 days of age, produced a sizeable prepartum and post-partum mortality of both the dams and offspring. The rat pups from zinc-deficient dams performed more poorly on voluntary activity and on one of the two learning tests.

In a similar study with iron deficiency, voluntary activity was reduced by iron deficiency but no deficits were observed on the learning tasks.

Looking at the future

It should be clear from the above discussion that phytate is necessary for the production of zinc deficiency. It should also be clear that zinc deficiency could then be treated by supplementation with zinc salts to a level such that the final phytate:zinc molar ratios were less than 10. It should also be feasible to treat zinc deficiency with phytase. Grain and legume phytases have a very narrow pH range of activity. This is fine for germinating seeds in which the soil pH is fairly constant. However, these phytases are fairly ineffective in the GI tract where the stomach is acid and small intestine becomes less acid where most digestion and absorption occurs. This would indicate that such digestion would necessarily have to occur very quickly to be effective. A genetically modified fungus, Aspergillus niger, produces a phytase that is active in a range of pH from two to six (Figure 11). This provides a more suitable range of activity to be effective in the tract.

Zinc supplemented rats were clearly more stable in learning
Conclusion

The problem associated with zinc deficiency has been well recognized. It should be obvious that phytate, a natural constituent of all plant seeds, is an important causative factor. Since most of the foodstuffs available to the populations of the developing countries are of plant seed origin, it should be easy to discern that the greatest threat to the world’s malnutrition problem is zinc deficiency. It should also be recognized that if the phytate content of the diet were reduced enzymatically during food preparation or during passage through the GI tract, that the zinc content of these seed grain products would provide sufficient zinc to fulfill the nutritional needs of these populations. The latter should become more economically feasible. The end result would improve growth rates in children and reduce the susceptibility to a wide variety of infectious diseases in both children and adults thus reducing the morbidity and mortality throughout the world.

References

Iron: Nutrition’s Two-Edged Sword

Noel W Solomons, Monica N Orozco, Caitlin Crowley, Maria Eugenia Romero-Abal, Klaus Schümann
Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM), Guatemala City, Guatemala and Technische Universität Munich, Freising, Germany

Correspondence: Noel W Solomons, CeSSIAM, 17 a Avenida 16–80, Zona 11, Guatemala City, Guatemala
Email: cessiam@guate.net.gt

The paradoxes of iron

Iron is the third most abundant of the elements of the earth’s surface after silicium and oxygen. It has an atomic weight of 55.845, and with an atomic number of 26, is found among the transition metals in the Periodic Table of Elements.

Virtually no multi-cellular organism can survive and grow without iron

As expressed in the title, iron is a two-edged sword. On the one hand, it is an essential nutrient. Virtually no multi-cellular organism can survive and grow without iron. In humans, it is important in oxygen transport, oxidation-reduction reactions and host defense. It is indispensable to have enough iron. On the other hand, it is a highly reactive element and the basis of all oxidation processes within living organisms. If iron is not confined, or if its oxidation reactions spiral out of control, it can produce severe damage to the organization. One should not have too much iron.

Iron deficiency – failure to consume or absorb sufficient iron from the diet, or losing it through bleeding – are the routes to its nutritional deficiency. A consequence of iron deficiency is insufficient iron for the production of a normal volume of red blood cells. This results in iron deficiency anemia. Anemia prevalence in the world is estimated to be 1.32 billion people or about 25% of the world’s population. Not all of the anemia, however, is due to iron deficiency. International norms have been established for public health response to endemic anemia. These call for targeted population-wide interventions with iron and folic acid if 40% or more of the population segment is anemic.

Iron excess – a genetic disease, hemochromatosis – results from a failure of the intestine to control iron absorption. Hemochromatosis produces tissue destruction and death if not detected and treated. Other iron-overload conditions, such as nutritional hemosiderosis, related in part to diet and in part to genetic predisposition, are known. Negative aspects of excess accumulation of iron in the body, only slightly above the normative range, have only recently been recognized, but have been enumerated by Schümann and co-workers.

“Did the ‘Iron Age’ end in Pemba?”

Then the aforementioned public health norm was applied to children aged six to 36 months on the Zanzibari island of Pemba off the coast of mainland Tanzania, an area of intensive transmission of Falciparum malaria, in a field trial of efficacy and safety. The iron components of the trial were halted early, stopping randomized assignment to the recommended dose of 12 mg of iron and 50 µg of folic acid daily, when monitoring of the data showed excess mortality and hospitalization in the children receiving iron, especially among those who were not anemic. In response to these findings, and the consternation in the international public health community, Schümann and Christ commented on the current status of policies for iron intervention in an essay entitled: “Did the ‘Iron Age’ end in Pemba?”.

Recent iron research at CeSSIAM

One wing of the recent research at the Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM) addresses the issues raised around the dark side and the bright side of the nutrient iron. This narrative will use three examples from our ongoing work, some of it yet to be published, to
demonstrate how elements of basic and applied science blend to address a relevant problem in human health and nutrition.

**Demonstrating Iron-Induced Loss of Fecal Free-Radical Suppression and a Manner to Restore:** This has been the work of Monica Orozco of our group in collaboration with the Technische Universität Munich (Klaus Schümann) and the University of Manitoba (James Friel). The central question relates to the provocation of free-radical formation within the fecal stream by oral iron supplements; 120 mg of iron as ferrous sulfate is a commonly used dose given to pregnant women daily. Monica Orozco first perfected a method to determine the amount of anti-oxidant capacity in stool to buffer the generation of reactive oxygen species (ROS), which measures free-radical adducts from salicylic acid (Figure 1).8,9

In initial metabolic studies in healthy male volunteers, six consecutive days of oral dosing with 120 mg of iron as ferrous sulfate were shown to produce a significant increase in the ROS formed *in vivo* in iron-laden stools (Table 1). Our first attempt to mitigate the loss of fecal buffering capacity was to administer natural antioxidants along with the 120 mg of iron. The supplement preparation chosen was an extract of the oil palm plant (*Elaeis*) with high concentrations of *α*- and *β*-carotenes and a modest amount of tocotrienols. At both doses administered (Table 1), there was a significant reduction in ROS production compared to the iron treatment alone. This has been interpreted as a restoration of the iron-induced loss of fecal buffering capacity by the exogenous antioxidant compounds in the supplement.

**Quantifying Post-Oral-Iron Rise of Non-Transferrin-Bound-Iron (NTBI) and Iron Compounds that Mitigate:** The mechanism by which the adverse effects of iron treatment on non-anemic children is mediated is not known. Among the speculations, however, is that a form of “free” (unbound) circulating iron, so-called “non-transferrin-bound iron” (NTBI) is involved.10

The World Health Organization (WHO) Lyon Consultancy warned against oral supplements or home-fortificant powders in the amount of 12.5 mg of iron, but approved the consumption of iron-fortified foods.11 German graduate student Sylvia Kroll12 from the Technische Universität Munich assisted Maria Eugenia Romero-Abal and they showed that the ingestion of a bolus dose of iron as ferrous sulfate at 0, 15, 30, 60, 120 and 240 mg led to an increase in circulating NTBI proportional to the increase in plasma iron in iron-replete male volunteers. Led by Maria Eugenia Romero-Abal in the metabolic study collections and Monica Orozco in the analytical laboratory, a comparison of the circulating iron and NTBI responses with ferrous sulfate, sodium ferric ethylene diamine tetra-acetate (NaFeEDTA) and iron polymaltose showed that the latter was absorbed more slowly and had reduced uptake of its iron component into the blood.

---

**Table 1:** The concentration of total hydroxylated products in fecal samples of experimental subjects according to metabolic treatment phase.

<table>
<thead>
<tr>
<th>Treatment Phase</th>
<th>Baseline</th>
<th>Fe in oil</th>
<th>Low-dose mixed antioxidants</th>
<th>High-dose mixed antioxidants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hydroxylated</td>
<td>0.27 ± 0.02</td>
<td>0.31 ± 0.02</td>
<td>0.27 ± 0.03</td>
<td>0.27 ± 0.04</td>
</tr>
<tr>
<td>products (mg/mL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Achieving a Non-Invasive Method for Screening for Anemia in Populations of the Highlands: The current recommendations of WHO for public health iron intervention in areas of intense malarial transmission were elaborated at a consultancy in Lyon, France. A specific recommendation emerged: “Universal iron supplementation for children under the age of two years is not recommended in malaria endemic areas … Prior screening to identify iron-deficient children should be a necessary component of any such intervention.” The problem in implementing the screening component of this guideline is that the standard approaches for detecting iron deficiency or anemia under field conditions – fluorescent spectrometry on a drop of capillary blood and cuvette-based photometry on capillary blood – involve cost, culture, safety and validity. Both techniques require investment in a portable device and have reagents and disposable items with a finite and renewable operating cost. They require the obtaining of capillary blood samples, often drops of blood from a finger tip. Blood sampling is problematic in rural settings because it is painful, certain cultures have resistance to blood taking, and in the era of HIV and other blood-borne viruses, a finite risk for transmission to handlers is present. At least for the HemoCue capillary-blood hemoglobin meter, it has been established that sensitivity is limited.

Sensitivity and specificity of the Rad-87 was poor at all four of the cut-off levels.

It would obviously be ideal if an accurate method requiring no blood extraction could be mobilized to address the screening mandate of the Lyon Consultancy. Rainer Gross and a team of investigators in Indonesia, with the backing of General Electric in Germany, were the first to design, explore and publish on the Erlanger Photometer (EMPHO). The Microvision Co used the visualization of the microcirculation of the sublingual vasculature in the mouth to devise an algorithm for non-invasive screening. An instrument designed for use in operating rooms for interoperative monitoring of systemic oxygenation and blood loss, the Rad-87TM with Rainbow Set technology (Masimo, Irvine, CA, USA), was shown to have high diagnostic reliability in studies in hospitalized children in Southamp- ton, UK. A prototype of a similar apparatus, called Haemospect® (MBR Optical Systems, Wuppertal, Germany), has been tested, along with the Rad-87, in field settings in the highlands (men) and lowlands (pregnant women) in Guatemala, in order to get the widest possible spectrum of Hb concentrations. The WHO defines the cut-off criterion for the diagnosis of anemia at a sea level altitude differently, depending on the population of interest:

- <11.0 g/dL for children 0 to 5 years and pregnant women;
- <11.5 g/dL for children aged 5 to 12 years;
- <12.0 g/dL for children aged 12 to 15 years and non-pregnant adult women;
- <13.0 g/dL for adult men.

Sensitivity and specificity of the Rad-87, which measures over the nail bed of the finger, was poor at all four of the cut-off levels. The measurement on the forearm with the Haemospect® was poor at <11.0 g/dL (sensitivity = 58%; specificity = 96%). However, at the next three relevant cut-off points, the diagnostic improvement was remarkable: <11.5 g/dL (sensitivity = 93%; specificity = 93%); <12.0% (sensitivity = 100%; specificity = 92%); and <13.0% (sensitivity = 97%; specificity = 97%). The application of the Haemospect® sensor to the skin on the palm of the hand had almost the same pattern. The Altman-Bland regression for forearm and hand are shown in Figure 2. For all zones above the lowest cut-off criterion, these values compare favorably to the best sensitivity – specificity pairing for whole blood versus capillary blood in studies by Morris et al19 of 80% and 95% and by Neufeld et al20 of 84% and 93%.

The residual problem of the non-invasive measurement would be that of cost, as no blood would be involved and engineering would be expected to resolve a sensitivity and specificity at least as good as the blood-based techniques.

The way forward

In each of the areas of observation there are obvious next steps to pursue. In the case of the quest for the...
mitigation of the oxidation and free-radical formation in the digestive tract associated with ingestion of therapeutic or prophylactic doses of oral iron, we need to separate whether carotene or tocotrienols are the more potent antioxidant. We need to encounter a practical dosage of antioxidants – alone or in combination – suitable for routine companionship of oral iron doses. With respect to the mitigation of free iron rises in the blood following ingestion of therapeutic or prophylactic doses of oral iron, we have proof of principle for "slow acting" iron compounds producing a lower NTBI response, we must therefore find the locations and opportunities to treat iron deficient individuals in malarial zones with the alternative formulations of oral iron. Finally, until a safe and effective iron dosing regime suitable for indiscriminant universal mass fortification becomes available, the mandate of the WHO for screening the population of malarial areas remains the most prudent course for protecting the iron-sufficient segment of the population and to eliminate exposure to individuals with normal hematological status.

The current devices need improved engineering and software to be accurate into the range for anemia in pregnant women and young children living in lowland areas. This is important because malaria is primarily a low altitude disease. However, in highland populations such as those in Guatemala, throughout the Andean region, in central South Africa, and in the Himalayan foothills, where anemia occurs at higher Hb concentrations, the investigative application of this apparatus seems to be an immediate opportunity.

The original version in Spanish of this article is going to be published in Anales de Nutrición, the official journal of the Spanish Academy of Nutrition and Food Sciences.

References

What is Qualitative Research and how does it differ from Quantitative Research?

Qualitative research can help project teams understand the cultural environment that they are working in, deliver insights into people’s attitudes to health, medicine and food, increase uptake within programs and educate people into healthier behaviors, ultimately improving people’s levels of nutrition and lives. Qualitative research is a formalized way of listening that enables objectivity; it reduces bias and exposes incorrect assumptions carried in cultural differences. This is important for international programs, as many involve staff from a scientific and foreign cultural background.

Qualitative research is like using a fishing net to catch all the fish: it captures all the thoughts and ideas put forward. Quantitative research, by contrast, is like using a fishing line and bait to catch one type of fish, one at a time. Qualitative research leads to rich insights into people’s beliefs, experiences, attitudes, behaviors and interactions. It does not produce statistics; it produces themes and non-quantifiable snapshots of people’s lives. Research findings create the context and reasons behind people’s actions. Qualitative research uncovers the reasons behind statistics. Quantitative research, by contrast, will be able to tell you which flavor from the options x, y, and z people like most, but it will not be able to tell you that flavor b is actually what people would really like. Moreover, it will not reveal that they don’t understand the instructions in the first place so have been mixing it incorrectly, with the result that all the flavors taste horrid!

When do we use Qualitative Research?

Qualitative research delivers insights into the culture and environment in which interventions occur, so one crucial phase with which it can help is the inception of any program. On-going research can then support the implementation of interventions by understanding why roadblocks to program success have occurred and what action is required to remove them. It can also help sustain change by following up after programs have finished to see how effective they have been in changing people’s behaviors.

When we talk about qualitative research programs it is important to remember that they can be scaled to fit any project, large or small. The tools and processes below are equally effective on a grand scale or simply applied correctly to a small village.

How can we apply Qualitative Research?

Qualitative research is used in many fields in many ways, in both the for-profit and not-for-profit sectors. To make this article as relevant as possible, we have based our discussion on the example of micronutrient interventions. Using this scenario, we can see how qualitative research can be applied to help us understand, for example:

• Are the instructions understood?
• Does the logo convey a positive and accurate meaning to users?
• Are the health benefits understood and valued?
• What are the social/cultural reasons why micronutrient supplementation is not valued?
• Are there practical reasons why home use is not a viable option?
• Who is trusted by the people to administer the supplementation: nurses, doctors, food distributors?
• What possible flavors are acceptable?

Building a research program

The skill to building a useful qualitative research program is to start with the right set of questions. These are not the questions you will ask in the study, but the overall research findings you need, for example:

• How can we best communicate the health benefits to the population?
• How can we best design and deliver the supplementation program to maximize take-up?
• Why are people not taking up the supplements provided?

Once we have defined the primary reason for the research, we then have to think about setting the context for the answers. Using the first bullet point above as an example, we would then think about what we needed to know about the people’s beliefs, attitudes and situation to understand their answers. For example we would have to know:

• What do they understand about the link between health and food?
• How do people manage their own and their children’s health?
• Where would they go and who would they listen to find out more about the health benefits?

Then we take these questions and craft the specific research questions and exercises that will enable us to answer them. If we take the first of the above bullet points, we would perhaps ask the following:

• How do the food you eat affect your health?
• If yes, how?
• If no, why not?
• If no, what does affect your health?
• What else affects your health?
• What makes you strong?

You can see in the above list that every question needs to be open-ended. While delivering certain information to us, ‘Yes’ / ‘No’ answers are still very limiting. We need to discover the ‘why’ wherever possible.

This three-tier process to question identification helps you to structure your discussion guide into a clear flow. It means that you have thought through why each question is on the discussion guide and have planned what the question is going to give you and how you are going to use that information. Remember, if the questions are too broad or too narrow in focus, you won’t find out anything useful.

<table>
<thead>
<tr>
<th>Stage One</th>
<th>Stage Two</th>
<th>Stage Three</th>
<th>Stage Four</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Conduct expert interviews</td>
<td>• Choose research environment and tools</td>
<td>• Conduct research</td>
<td>• Digest findings</td>
</tr>
<tr>
<td>• Collate background information</td>
<td>• Recruit respondents</td>
<td>• Record findings</td>
<td>• Report results</td>
</tr>
<tr>
<td>• Define research objectives</td>
<td>• Write discussion guide and stimulus</td>
<td></td>
<td>• Implement recommendations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Observations</td>
<td>Focus Groups</td>
</tr>
<tr>
<td>Follow-me’s</td>
<td>One to One</td>
</tr>
</tbody>
</table>

**Respondent’s Environment**

- Expert Interviews
- Home Visits

**Researcher’s Environment**

- One to One
Three things to remember about formulating questions

The questions to which you need answers are not necessarily the questions that you will ask respondents directly. Ask open-ended questions, i.e. questions that elicit more than a ‘yes/no’ answer, so people can tell you exactly what’s going on. Think about how you are going to use the information people give.

The above matrix sets out the research tools most used in qualitative research. The first choice to make is whether the topic and population are best researched in public or private, i.e. as a group or as individuals. Is this a topic people will honestly discuss in front of others in the community? If so, a group discussion is most effective as it means you get more discussion flowing and cover more respondents in the given time. If not, one-on-one interviews are best. It is important that each group is of a similar age, same gender and / or ethnic group, so people feel safe to express their true opinions. For example, wives may not express their true opinions in front of husbands.

So how many people do we talk to and how do we group them?

Because we have no statistical basis, it is not necessary to have a set amount of people for the results.

### Table 1: Advantages and disadvantages of research tools.

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Description</th>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert Interviews</td>
<td>One-to-one interviews with key stakeholders and experts in the area you want to understand.</td>
<td>Quick and effective way to understand the environment and best practice.</td>
<td>Can be hard to identify the experts and their bias.</td>
</tr>
<tr>
<td>Focus Groups</td>
<td>A discussion within a homogeneous group of 6–8 people. The session is facilitated by a trained moderator using a discussion guide. Several are undertaken to make sure that they are representative of a larger population.</td>
<td>Group discussions are the most effective at creating insightful dialogue, ideas and insights; time efficient.</td>
<td>People need to be selected carefully to avoid dominant minority that influence/inhibit the group.</td>
</tr>
<tr>
<td>Home Visits</td>
<td>Researcher will arrange to visit a respondent’s home to observe their domestic environment.</td>
<td>Gives an honest, not recounted, version of home life. Offers insights to researchers not screened by respondents.</td>
<td>Time-intensive.</td>
</tr>
<tr>
<td>Follow Me’s</td>
<td>Researcher will shadow a person to observe their daily routine and talk with them and the people they interact with.</td>
<td>Quickly establishes cultural environment.</td>
<td>Care has to be taken to recruit people who are outgoing.</td>
</tr>
<tr>
<td>Community Observations</td>
<td>Researcher will visit relevant public spaces and observe behaviors and interactions.</td>
<td>Easy to conduct and report on.</td>
<td>Observations can be misinterpreted.</td>
</tr>
</tbody>
</table>
to be valid. However, as a general rule it is important to cover at least two or three groups of six to eight people of the main audience. And one to two groups of four to six of the secondary audiences. As in any research, the more sub-divided the research base, the more groups you need to make sure you have a big enough base in order to avoid skewed results. Using the example of researching micronutrient supplementation take-up in under two year-olds in a refugee camp, we could break it down as follows:

The key is to group the mothers into similar, heterogeneous groups e.g.: by age, ethnic group, and/or age children, and then by life situation that might elicit different responses, e.g. length of stay in the camp. The more established group will already have their feeding routines, education links, and medical systems in place whereas the new families will be in the process of establishing these and will have different needs and opinions.

**How to recruit people**

In the case of micronutrient supplementation it is obvious that mothers are the key people to talk to, but it is also important to talk to the people who influence the mothers’ decisions. While the bulk of research will be with mothers, it might also be useful to talk to opinion-formers such as community matriarchs, nursing staff, husbands, or teachers.

Once the number and structure of groups has been decided, you then have to find the people to attend the research. Create a check list of characteristics that the respondents must have for each group, then simply take the list to a busy place where you think the type of person you need will be and start asking people to join. If they meet the criteria, you invite them to the groups. Research companies in the corporate sector have large databases of possible candidates, but most projects do not. So it may well be a case of stopping people in the market, introducing yourself and what you are doing, and asking them the criteria questions. Be careful to avoid friends being recruited into the same group, as this can lead to a dominant minority with an established spokesperson in the group which will inhibit responses.

Keep a record of which respondents are attending which group so you can follow up the initial invitation to ensure attendance. Whilst the groups are anonymous and quoted never attributed to specific people it is important to keep contact information for future research and sharing research results if appropriate.

**Incentives**

In the developed world, respondents are paid to attend groups as a thank-you for their time. This however may not be appropriate in some projects, as it could be misinterpreted and result in people thinking they have to agree with researchers in order to be paid. Project leaders will have to make an individual assessment of this, and possibly consider not offering an incentive or offering an alternative to money. Incentives should not be linked to the project, as this could bias selection of the respondents – for example, if the incentive involved a month’s supply of the micronutrient supplementation, then only people who understood and valued the supplementation would be interested in attending. The research results would thus reflect their positive attitudes to the intervention and not that of the wider population. The incentive’s

---

**Table 2: Advantages and disadvantages of research tools.**

<table>
<thead>
<tr>
<th>Mothers of under two year-olds</th>
<th>Ethnic group 1</th>
<th>Ethnic group 2</th>
<th>Ethnic group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established in the camp (i.e. living in camp for over 6 months)</td>
<td>2 groups</td>
<td>2 groups</td>
<td>2 groups</td>
</tr>
<tr>
<td>New to camp (i.e. living in camp for under 6 months)</td>
<td>2 groups</td>
<td>2 groups</td>
<td>2 groups</td>
</tr>
</tbody>
</table>
value should be perceived as a thank-you and not the primary reason for attending the research.

**Where to conduct the interviews**

The next consideration is which research environment to choose. The respondents need to feel safe, secure, and in control, they need a non-threatening environment and moderator, the person who conducts the research. This is crucial, as the environment has been shown to alter people’s responses unconsciously. People will agree more with the moderator if they are in the moderator’s environment, and this does not give accurate research findings. Applying this to a program is easy. Choose a location that is neutral, communal and informal, maybe a school or someone’s home. Avoid using the program offices or areas associated with authority, like a village hall, or nursing station. If you need to understand how people cook / care for their families, arranging home visits is also important.

An associated point to this is that wherever possible, researchers should avoid uniforms and clipboards, and other obvious signs of authority and reporting. These inhibit responses, as people feel judged and will give the answers they think you want rather than the truth.

**In summary**

In this brief overview of qualitative research, we have covered the main steps in creating a research program. So far we have concentrated on the planning and design of the research. In the next article, we shall continue with how to conduct the focus groups, write the discussion guide, record what is said, and report your findings. We will also discuss the role of the researcher.
Introduction

A recent systematic review sponsored by the UK Food Standards Agency to compare the nutrient quality of organic with conventionally produced foodstuffs found no evidence of any difference that might have an impact on health.\(^1\) This review looks at some of the issues surrounding the intake of fruits and vegetables and its effect on health.

Some reasons for the growing popularity of organic food

An ever increasing pre-occupation with “health” is one of the prime motivators for the growing popularity of organic food – i.e. food produced without the use of fertilizers, pesticides and intensive agricultural methods – in modern Western societies. Organic food is conceived as being more natural. Fruit and vegetable consumption has also been promoted for more than 20 years as beneficial for health.\(^2\) The World Health Organization (WHO) recommended people to eat at least five portions of fruit and vegetables a day to prevent cancer and other chronic diseases and aim for an intake of at least 400 g/d.\(^3\) Can organically grown fruit and vegetables provide any more benefits for health than come from the conventionally grown fruit and vegetables prescribed by WHO?

The one issue that is raised whenever studies are conducted to determine the motivation for purchasing organic food is the use of chemicals in conventional food production and how much is present in foodstuffs at market.\(^3\) The fact that our bodies have the metabolic machinery to deal with chemical residues in our foods in the same way that we handle the many thousands of other chemicals in our other foods every day is never considered. Fertilizer and pesticide residues are regarded as “foreign” and suspicious and the public is all too ready to accept stories in the media of the harm that can result. For example, Alar was a chemical, first marketed in 1968, that apple growers sprayed on trees to make their apples ripen longer before falling off and was found in samples of apple sauce and apple juice, including formulations for infants. In use, Alar breaks down to a by-product called unsymmetrical dimethyl hydrazine or UDMH. The first study showing that UDMH can cause cancer was published in 1973. It was followed by others, and the USA Environmental Protection Agency confirmed in 1985 that both Alar and UDMH were “probable” human carcinogens.

The statement does not mean that everybody eating an apple is at risk of cancer, but the knowledge of the carcinogen’s presence in foods caused an enormous public furor and caused enormous harm to apple
growers in the USA. It is now widely believed that the risks to human health from Alar were exaggerated; nevertheless the media attention to such issues increased public awareness of potential dangers from food contaminants and made the public ever more concerned over possible dangers from the use of pesticides, growth hormones and chemicals in the growing or processing of their foods. Hence there is an increasing interest from the consumer in organic food.

**What is organic food?**

The term “organically grown food” denotes products that have been produced in accordance with the principles and practices of organic agriculture. There are hundreds of organic certifying agencies around the world that have established their own production and certification processes. These agencies can gain accreditation from the International Federation of Organic Agriculture Movements (IFOAM), and others have gained ISO (International Organization for Standardization) accreditation and/or been audited by government agencies to provide a verification of their standards and operating systems. At the time of writing, IFOAM currently unites 750 member organizations in 116 countries. The organic trade is a rapidly growing reality all over the world. The growth rates of the organic sector demonstrate that organic products are moving from the niche into the mainstream markets. The total land under certified organic production worldwide has reached over 26 million hectares.

**Table 1: Reasons for buying food labelled organic**

<table>
<thead>
<tr>
<th>Concerns for the environment</th>
<th>Concerns regarding chemical residues in food</th>
<th>Dislike of factory farming methods</th>
<th>Belief that the more expensive the product the better it must be</th>
</tr>
</thead>
</table>

Modified from Davies et al.5

A profile of the Irish purchasers of organic produce showed them to be female, aged 30–45, with children and having a higher level of disposable income. The researchers classified them into four groups: (1) those who were concerned with the environment; (2) food phobics who were concerned with chemical residues in food; (3) humanists who disliked factory farming; and (4) hedonists who believed that a premium product must be better, and more importantly, taste better (Table 1). Most studies appear to describe a mixture of these characteristics in describing the organic consumer; e.g. older Californians in white-collar occupations or higher income earners, while younger Norwegians based their buying behavior on the considerations for the environment and animal welfare but health considerations were the most prominent reason in the oldest age group. Researchers found that although there was a strong environmental lobby in Norway, consumers were not willing to pay the present high prices for these products.
Organic food has no additional health benefits

In the course of the systematic review of organic foods and health issues, the authors tried to be as inclusive as possible and extracted a total of 52,471 articles published between 1958 and 2008 using PubMed databases and a wide variety of search terms. From the titles of the articles, the reviewers identified 292 potentially suitable papers that examined nutritional quality in organically grown foodstuffs. They narrowed their selection to include only (1) comparison studies of “organic” and conventional foods, (2) comparisons of nutritional composition, and (3) peer-reviewed papers. The resulting 162 studies in the review included 137 on crops and 25 on livestock products and comprised 60 field trials, 76 farm surveys, 23 basket surveys and three combined studies.

From their analyses, the authors suggested that organically and conventionally produced foods were comparable in their nutrient content.\(^1\) From a pragmatic point of view, this is the result you would expect. The plant’s composition is designed for the benefit of the plant and not for the human being that eats it! Over the generations man may have changed plant composition by selection and specific breeding for taste, appearance, storage and cooking properties, drought resistance etc, and this gives us the many varieties of different food plants that we have today. But any one variety grown under different conditions will tend to grow and mature to achieve its genetic potential. Thus if organic or conventional conditions provide optimal nutrition for a plant, we should not expect any difference in the final results.

Organically and conventionally produced foods were comparable in nutrient content

The authors of the review found that for 10 of 13 nutrient categories analyzed, there were no significant differences between production methods. Eleven of these nutrient categories are shown in Table 2 where there were ≥10 studies. Differences that were detected in crops were biologically plausible and were most likely to be due to differences in fertilizer use; nitrogen from inorganic fertilizers and phosphorus from animal and plant manures, or ripeness at harvest (titratable acidity). In organic foods, nitrogen was significantly lower while phosphorus and titratable acidity were higher. The authors concluded that it was unlikely that the consumption of these nutrients at the concentrations reported in organic foods in their study provided any additional health benefit and, of equal importance, they were not inferior to conventionally produced foods.

The review highlighted the heterogeneity and generally poor quality of the research reported in the literature. More than half the studies identified failed to specify the organic certifying body, 20% of studies failed to state the plant cultivar and 14% failed to state the statistical methods used. Only one third of the com-

### Table 2: Comparison of content of nutrients and other nutritionally relevant substances in organically and conventionally grown crops as reported in satisfactory quality studies.

<table>
<thead>
<tr>
<th>Nutrient category</th>
<th>Number of studies</th>
<th>Number of comparisons</th>
<th>Standardized difference (%)</th>
<th>Higher concentration in organic or conventional crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td>12</td>
<td>35</td>
<td>8.1 (2.6)</td>
<td>Organic</td>
</tr>
<tr>
<td>Titratable acidity</td>
<td>10</td>
<td>29</td>
<td>6.8 (2.1)</td>
<td>Conventional</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>17</td>
<td>64</td>
<td>6.7 (1.9)</td>
<td>No difference</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>14</td>
<td>65</td>
<td>2.7 (5.9)</td>
<td></td>
</tr>
<tr>
<td>Phenolic compounds</td>
<td>13</td>
<td>80</td>
<td>3.4 (6.1)</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>13</td>
<td>35</td>
<td>4.2 (2.3)</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>13</td>
<td>37</td>
<td>3.7 (4.8)</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>12</td>
<td>34</td>
<td>2.7 (2.4)</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>11</td>
<td>30</td>
<td>10.1 (5.6)</td>
<td></td>
</tr>
<tr>
<td>Total solids</td>
<td>11</td>
<td>29</td>
<td>0.4 (4.0)</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>11</td>
<td>30</td>
<td>8.6 (11.5)</td>
<td></td>
</tr>
</tbody>
</table>

Table modified from Dangour et al\(^1\)
Comparative studies identified (n=162) were of satisfactory quality and comprised 46 reports on plant products (20 field trials, 22 farm surveys and four basket surveys) and nine reports on the composition of livestock products (four field trials, five farm surveys). The authors extracted 1,149 nutrient content comparisons from the 46 “satisfactory quality crop studies” and data on 11 nutrient categories were reported in 10 or more studies. There was no evidence of a difference in eight of these 11 nutrient categories (vitamin C, phenolic compounds, magnesium, potassium, calcium, zinc, copper and total soluble solids) but there were significant differences in nitrogen, phosphorus and titratable acidity as described above (Table 2).

**Table 3:** Comparison of nutrients and other substances in organically and conventionally produced livestock products.1

<table>
<thead>
<tr>
<th>Nutrient category</th>
<th>All studies</th>
<th>Satisfactory quality studies only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Studies 'n'</td>
<td>Comparisons 'n'</td>
</tr>
<tr>
<td>PUFA (unspecified)</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Trans-fatty acids</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>Fatty acids (unspecified)</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Saturated fatty acids</td>
<td>13</td>
<td>61</td>
</tr>
<tr>
<td>MonoUFA (cis)</td>
<td>13</td>
<td>42</td>
</tr>
<tr>
<td>n-6 PUFA</td>
<td>12</td>
<td>42</td>
</tr>
<tr>
<td>Fats unspecified</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>n-3 PUFA</td>
<td>9</td>
<td>34</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Ash</td>
<td>5</td>
<td>9</td>
</tr>
</tbody>
</table>

1 Modified from Dangour et al8
2 No available data from satisfactory studies
3 Statistical analysis not possible as all data from one study

The observation that trans-fatty acid concentrations may be higher in organic food products needs further comment in view of public health concerns that these fats increase the risk of cardiovascular disease. None of the studies in which the observation was made met the satisfactory criteria of the authors. However, a paper on milk published since the review was conducted, which did meet the criteria of the authors, also found trans-fatty acids were higher in the organic product (Table 4).7 The authors suggested that the higher percentages of vaccenic acid and conjugated linoleic acid (CLA) were due to the feeding of higher levels of fresh forage (>80% dry matter intakes) compared with those received by conventionally fed herds (<40%). However, two points are worth mentioning regarding trans-fatty acids in natural products: (1) the...
amounts are much less than in commercially hydrogenated fats, and (2) the trans-fatty acid “vaccenic acid” in milk is a source of CLA, which is believed to lower risks for some cancers, type-2 diabetes and cardiovascular disease as well as enhancing immune function. Therefore the higher amount of the specific trans-fatty acids in organic milk than in conventionally produced milk may be a health advantage.

Reasons for poor quality of comparative studies

The authors of the review proposed that any comparative study of organic and conventional foodstuffs should require at least five criteria to be of acceptable quality; indicate the organic certification body by which the food is assessed, specify the cultivar of crop or breed of livestock and give details of the nutrients analyzed, the methods used for analysis and details of the statistical analyses. These criteria were a bare minimum and there were many other factors that needed to be taken into account in controlling the growing of the crops, husbandry of animals, handling foodstuffs from retailer to consumer and in the preparation of the food for eating. In fact the authors listed so many variables potentially affecting growth and maturation that it was surprising that differences did not exist. Of course differences have been reported but as the authors of the review point out, when only those reports of satisfactory quality were examined, the differences tended to disappear. That is, when the studies included in any comparisons were carefully selected, genetic characteristics determined the composition of nutrients in the foodstuff, and the end product by either production method would be same.

The minimum requirement for comparative studies would seem obvious and it is hard to understand why studies comparing organic with conventionally grown foodstuffs should be of such poor quality. It is not as if the issue of poor quality has only recently been revealed. The extensive review prepared by Bourn and Prescott highlighted studies that made no effort to verify organically labeled products, and mentioned with respect to another study that it was “one of the few to have used appropriate statistical techniques.”

Studies on crop growth in fields, greenhouses etc. are well known to present variability problems that require special statistical approaches to prevent the influence of environmental factors exceeding that of the factor under study. Latin square, randomized block designs etc. are essential tools of the experimental biologist to enable him or

### Table 4: Trans-fatty acids in milk from conventional high input and low input organic and non-organic dairy production systems during the outdoor, fresh forage based feeding period.

<table>
<thead>
<tr>
<th>Vaccenic acid and conjugated linoleic acid (CLA) isomers g/kg milk fat</th>
<th>Production system</th>
<th>Low input conventional production</th>
<th>Organic</th>
<th>Non-organic</th>
<th>ANOVA P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High input, conventional production</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccenic C18:1 t11*</td>
<td>22.5</td>
<td>35.5</td>
<td>41.9</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>CLA C18:2 c9,t11*</td>
<td>8.8</td>
<td>14.1</td>
<td>17.5</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>CLA C18:2 t10,c12*</td>
<td>0.31</td>
<td>0.33</td>
<td>0.38</td>
<td>0.59</td>
<td></td>
</tr>
</tbody>
</table>

*Indicates the trans double bond on carbon atom 11 in the fatty acid chain

Table modified from Butler et al.7

### Table 5: Serum salicylic acid concentrations in non-vegetarians, vegetarians and diabetics taking low dose aspirin (75 mg/d).1,2

<table>
<thead>
<tr>
<th>Serum salicylic acid (µmol/L)</th>
<th>Number</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-vegetarians</td>
<td>37</td>
<td>0.07</td>
<td>0.02–0.20</td>
</tr>
<tr>
<td>Vegetarians</td>
<td>39</td>
<td>0.11</td>
<td>0.04–2.47</td>
</tr>
<tr>
<td>Diabetic patients</td>
<td>14</td>
<td>10.03</td>
<td>0.23–25.4</td>
</tr>
</tbody>
</table>

Non-vegetarians were all men recruited in Dumfries, Scotland. Vegetarians were all men recruited from a group of European Buddhist monks living in a retreat in Yorkshire, UK, and fed from a communal kitchen. The diabetic patients were seven men and seven women recruited at the Dumfries diabetic clinic.

Modified from Blacklock et al17
Comparisons of organic and conventionally grown plant foodstuffs require another level of complexity in the experimental approach, since by definition the two systems cannot be grown together because of the potential interference in “organic” certification that conventionally grown food might have. Thus good comparison studies of organic and conventionally grown foodstuffs will require large numbers of studies not only to minimize the influence of type of soil, fertility and similar environmental variations but also to ensure, for example, that variations in the origin of seeds, time of planting, age at picking, crop handling etc. are controlled as far as possible to increase confidence that any differences found are real.

### Potential health-related properties of vegetables and fruits

When Dangour and colleagues restricted their comparisons of nutrient composition in organic and conventionally grown foodstuffs to the “satisfactory quality” studies, they found no differences in many nutrients and other dietary ingredients such as flavonoids and other phenolics, and concluded that there were no health benefits to be gained from organic food. However, when all studies were included in the comparisons (i.e. independent of quality), phenolic compounds and flavonoids were higher in organic plant foods. This is interesting, as many phenolic compounds are produced by plants as stress responses or protective mechanisms against harmful pests or adverse growing conditions. Furthermore there is evidence to suggest that these components have a role in protecting man against cardiovascular disease, cancer and other chronic diseases. If there are higher amounts of phenolics in organic foods, they might provide additional health benefits over conventionally produced fruit and vegetables.

### Phenolic compounds and flavonoids were higher in organic plant foods

Interest in fruit and vegetable intake as a determinant of health arose in the early 1980s. Peto and colleagues pointed out that human cancer risks were inversely correlated with blood retinol and β-carotene concentrations. Plasma retinol is metabolically controlled in the blood, but the authors reasoned that if dietary
β-carotene could be increased this might reduce the risk of cancer, particularly lung cancer. The hypothesis did not prove correct\textsuperscript{13} but interest in fruit and vegetables as a source of other cancer- and cardiovascular-protective factors did not diminish. Hertog and colleagues showed that flavonoid intake mainly from tea, onions and apples was inversely associated with coronary heart disease in the Zutphen Elderly Study\textsuperscript{11}, and American studies showed that cancer mortality in persons over 60 in Massachusetts was inversely associated with their intake of carotene-containing vegetables.\textsuperscript{14} No differences were found in β-carotene concentrations of vegetable foods in the Dangour review.\textsuperscript{8}

A review by Duthie and colleagues on the importance of polyphenols to prevent cancer and heart disease pointed out that measuring intakes of potentially protective factors in fruit and vegetables presented a number of problems.\textsuperscript{10} Not only may absolute quantities be difficult to measure, but concentrations of plant nutrients and other dietary ingredients can be affected by species, light, degree of ripeness, processing and storage. This variability confounds the formulation of databases for the estimation of dietary intakes used widely in epidemiological studies as well as comparisons of organic and conventionally grown foodstuffs. Most attention in that paper was focused on the flavonoids and other polyphenols and suggested that high intakes of flavonoids may be protective against heart disease (CHD) while polyphenols may be active against cancer through a range of mechanisms including antioxidant activity, enzyme modulation, gene expression, apoptosis, up-regulation of gap junction communication and P-glycoprotein activation.

**Aspirin and plants**

A stress factor of known importance to man is salicylic acid or aspirin (acetylsalicylic acid). Centuries ago, the American Indians and ancient Greeks independently discovered that the leaves and bark of the willow tree cured aches and fevers. Subsequently the active component was identified as salicin, the glucoside of salicyl alcohol, which was the major salicylate in willow bark.\textsuperscript{15} It was subsequently found that some disease-resistant plants restrict the spread of fungal, bacterial or viral pathogens to a small area around the point of initial penetration. Resistance developing around the wound was shown to be due to the carriage of an endogenous messenger, salicylic acid, in the plant phloem.

Aspirin spontaneously breaks down to salicylate on ingestion and has powerful properties in protecting against cardiovascular disease.\textsuperscript{16} In the Physicians’ Health Study, the use of aspirin over a period of eight years was associated with significant reductions in the risk of myocardial infarction. Aspirin was of particular benefit in those in the highest quartile of C-reactive protein (CRP) concentrations at the outset, where the reduction was 55.7% (P=0.02). The authors concluded that their findings may explain, in part, the health-promoting effects of dietary fruits and vegetables. However, although many fruits and vegetables contain salicylates, and in particular herbs and spices, a wider examination of salicylates in food led others to suggest a normal mixed diet provided far too few salicylates to have an effect on disease risk.\textsuperscript{18}

**Fruit and vegetable intake and overall cardiovascular and cancer risk**

No studies have yet reported on the influence of organic foods on cardiovascular and cancer risks. It is interesting to note however that women, who are the main consumers of organic foods, tend to be the group with the higher fruit and vegetable intakes and who fare best in epidemiological studies to assess the protective benefits of fruit and vegetable against cardiovascular disease and cancers.\textsuperscript{19,20}
In 2002, Bazzano and colleagues described follow-up studies on 9,680 adults of 25–74 years who participated in the first National Health and Nutritional Examination Survey (NHANES) which occurred between 1971 and 1975. Fruit and vegetable intake was measured at baseline using a food frequency questionnaire. Incidence and mortality from cardiovascular disease were obtained from medical records and death certificates. Over the 19 years’ follow-up the dietary data suggested that consuming fruit and vegetable ≥3 times/d compared with <1 time/d was associated with a 27% lower stroke incidence, 42% lower stroke mortality, 24% lower ischemic heart disease mortality, 27% lower cardiovascular mortality and a 15% lower all-cause mortality after adjustment for established cardiovascular disease risk factors. Participants who consumed higher fruit and vegetable intakes tended to be white and female. The mean daily intake of fruit and vegetable corresponding to <1 and > 3 times/day were calculated to be 242 g and 520 g respectively. The authors pointed out broadly similar findings by others who reported on smaller studies and maintained that their own work was particularly important as it was conducted on a representative sample of the US population.

The lower “all-cause” mortality after adjustment for cardiovascular risk factors would suggest that fruit and vegetable intake was inversely associated with cancer mortality in the NHANES cohort although this was not actually discussed by Bazzano and colleagues. However the recent report from the European Prospective Investigations in Cancer (EPIC) did not find strong evidence to support this in the European database. Of the initial 142,605 men and 335,873 women included in the study, the crude cancer incidence rates were 7.9 and 7.1/1000 person-years for men and women respectively. A reduced risk of cancer associated with high vegetable intake was restricted to women where the hazard ratio was 0.98 (95% CI 0.97–0.99). That is, women in the highest quintile with a vegetable and fruit consumption had a 2% lower risk of cancer mortality than those in the bottom quintile. In this study, fruit and vegetable intake data were collected from a self-administered, country-specific, food frequency questionnaire administered between 1992 and 2000 and cancer incidence was obtained from active follow-up of study participants and mortality from next of kin or mortality registries. The median follow-up was 8.7 years and ended between 2002 and 2005 in different countries.

The authors concluded the results support a modest cancer-preventative effect

A standardized, baseline dietary questionnaire was administered to 8% of the population to calibrate measurements of fruit and vegetable intakes across countries. Median intake of fruit and vegetables in the entire cohort was 335 g/d ranging from country-specific medians of 231 g/d in Sweden and 511 g/d in Spain. High intakes of fruit and vegetables were associated with the female sex, higher education, physical activity, low alcohol intake and never smoking status. In categorical analysis of total fruit and vegetable intake, there was decreased overall risk from the second to fifth quintile compared with the first quintile. For example, for fruit and vegetable intakes of men and women combined, the hazard ratios were 0.95, 0.91, 0.93 and 0.89 for quintiles 2–5 compared with the lowest quintile set at 1.0. The authors concluded the results support a modest cancer-preventative effect of high intake of vegetables with little confounding by body weight, physical activity and smoking. However, the observed association between cancer risk and fruit and vegetables was very weak and the authors could not entirely rule out the possibility of residual confounding by these or other factors.

Conclusions

The popularity of organically grown food continues to rise mainly because consumers are increasingly aware of environmental issues and believe that organic production methods are less damaging to the environment than conventional techniques. Consumers are also concerned that chemical residues in conventionally produced foodstuffs may be harmful to themselves and feel that organic food will be healthier. The review by Dangour and colleagues examined studies that compared the two production methods and reported on nutrient composition. Many nutrients could not be compared, as there were insufficient studies of satisfactory quality. Where there were ≥10 studies that enabled mean differences in composition to be calculated with confidence, most nutrients were not different. Phosphorus and titratable acidity were higher in organic plant foods and nitrogen in conventional foods. Far fewer studies on livestock products could be compared, but some evidence emerged that the natural non-harmful, trans-fatty acid conjugated linoleic acid was higher in organic food. Studies continue to show that the intake of fruit and vegetables is beneficial against cardiovascular disease, but the most recent epidemiological
study on cancer mortality suggests that fruit and vegetable intake offers no practical benefit against cancer. However no nutrient or nutrients have yet emerged that might be responsible for any benefits and as all epidemiological studies are subject to difficulties in quantifying intakes and uncertainties regarding composition of foods, it may be a long time before any epidemiology on the benefits of organic and non-organic foods is attempted.

References
Opinion 1: Using Systematic Reviews to Evaluate Contradictory Evidence

Alan D Dangour
Department of Nutrition and Public Health Intervention Research, London School of Hygiene & Tropical Medicine, London, UK

In his thoughtful review, David Thurnham identifies the increasing interest from consumers and the media in the quality and health benefits of food. Many of us, although sadly not all of us, are now able to make informed decisions about the foods we choose to eat, and an increasing number of us are able to make more healthy dietary choices. However, despite growing knowledge and better availability of healthy food choices, the global burden of nutrition-related chronic diseases marches upwards in almost all parts of the world.

In the context of this enormous current global public health concern, the ongoing debate over whether foods produced under one agricultural regimen or another contain slightly more or less of any particular nutrient seems of significantly lesser importance. There is however, especially in high income countries, an often cited view that organic foods are more nutritious and healthier than conventionally produced foods. As we discovered in our two systematic reviews on nutritional composition¹ and nutrition-related health benefits² of organic foods, close examination of the evidence on which this view is based provides some troubling insights.

The data suggest that there is no evidence of important differences in nutritional composition between organically and conventionally produced foods

First, while there have been a large number of studies on the nutritional composition of organic foods, many of the studies are of poor quality, and our meta-analysis of the available data suggests that there is no evidence of important differences in nutritional composition between organically and conventionally produced foods. Second, the evidence base on nutrition-related health benefits of organic foods is extremely limited (we were only able to identify 12 relevant studies published in the past 50+ years), and from an epidemiological perspective some of the existing work is of lamenable quality. And third, all previous attempts to review the available evidence have been non-systematic and are thus likely to be partial and incomplete. Systematic reviews bring together and critically evaluate the totality of the available evidence and provide comprehensive displays of the evidence in a common format. Systematic reviews are used internationally to define public health policy,³ and are enormously powerful tools with which scientists can evaluate the strength of the available evidence relating to specific questions.

There are many factors which determine consumer dietary choices, and it is clear that some consumers prefer to choose organic foods. Our systematic reviews provide for the first time comprehensive and impartial evaluations of the strength of existing evidence relating to nutrient content and nutrition-related health benefits which can help to inform these choices. What our reviews specifically do not address are the other important questions such as the effects on the environment or biodiversity of different farming regimens, and the differences in chemical residue content of organic and conventionally produced foods. These remain important questions for which there is currently limited and often conflicting evidence. Questions which would best be answered by impartial and comprehensive systematic reviews.

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Opinion 2: Is Buying Organic Food Just a Matter of Health?

Bernhard Watzl
Department of Physiology and Biochemistry of Nutrition, Max Rubner Institute, Karlsruhe, Germany

Correspondence: Bernhard Watzl, Department of Physiology and Biochemistry of Nutrition, Max Rubner Institute, Federal Research Institute for Nutrition and Food, Haid-und-Neu-Str. 9, 76131 Karlsruhe, Germany
Email: bernhard.watzl@mri.bund.de

Consumers are increasingly buying organic foods, and they expect from these superior food quality and taste compared to conventional products. Avoidance of pesticide residues in food has been, and still is, a major reason for buying organic food. In addition, consumers perceive organic foods as providing more health benefits than conventional foods.

Within the past ten years, studies into the nutritional quality of organic foods have increased in numbers and improved significantly in quality. We are now in a much better position to judge the impact of different farming systems on the nutritional quality of foods. The outcomes of recent review articles and systematic reviews clearly indicate that compared to conventional foods, organic foods do not differ significantly in nutrient contents with a few exceptions (dry matter, nitrogen compounds, potassium). Variety and environment are clearly the dominating factors for any type of farming system and determine the nutrient content. A well investigated example is the polyphenol content in different varieties of apple.

Another question relates to the issue of defining organic and conventional foods. In reality, the opposed categories “organic food” and “conventional food” do not exist. Within different farming systems, the quality and price of foods can vary extremely, ranging from premium products to cheap mass-produced products. As a consequence, process quality within one farming system can differ significantly, which does not permit the drawing of generalized conclusions about organic versus conventional products. In addition, while the European Commission has regulated the production of organic food (EC No. 834/2007), there is no comparable regulation for the production of conventional foods.

How relevant are these minor differences in nutrient contents for overall health status and for the risk of developing heart disease or cancer? Today we have a robust understanding of the key factors that contribute to a healthy lifestyle, including diet. For example, with a healthy lifestyle and diet, the risk of getting type 2 diabetes, myocardial infarction and stroke can be reduced by 93%, 81%, and 50% respectively compared to an unhealthy lifestyle. Such healthy diets are known to be high in moderately processed plant foods, with a smaller than currently consumed percentage of animal products. It is currently unrealistic to think that farming system-specific food qualities might induce measurable beneficial health effects beyond those that can be achieved by means of healthy diets and a healthy lifestyle.

For many consumers today, the motivation for buying organic food goes beyond direct personal health benefits. Issues such as animal welfare, soil fertility, biodiversity, sustainability, and the CO2 footprint of food production systems are further reasons for buying organic foods. A recent article in Nature reported that organic agriculture promotes evenness of species within an ecosystem and supports natural pest control.

In conclusion, the current motivation for buying organic foods is still driven by considerations of health. But with more knowledge of the minor differences in the nutrient contents, and a better understanding of, and interest in, the systemic effects of the two different farming systems, health issues will no longer be the consumer’s primary reason for buying organic foods.

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Infant Vitamin A Supplementation: From Research to Policy

Vitamin A is probably the best known vitamin and plays an essential physiological role in the body, affecting vision, growth and immunity. It influences cell differentiation in the epithelial lining of the eye and the respiratory tract, and the expression of over 300 genes. Vitamin A deficiency is a major public health problem, accounting for approximately 1.3–2.5 million infant and preschool child deaths worldwide. It is estimated that about 250,000–500,000 malnourished children in developing countries become blind each year due to vitamin A deficiency. Vitamin A deficiency also leads to a diminished ability to fight infections and may result in childhood deaths from complications of measles in places where vitamin A supplementation programs have not been implemented.

At birth, the infant’s total liver stores of vitamin A in relation to its post-natal requirements are very small and just sufficient to meet the World Health Organization (WHO) estimate of the basal requirement of infants for about 10 days of life or 33 days in the best of circumstances. The situation of infants in developing countries is further compounded by the fact that the vitamin A concentration of their mother’s breast milk is about half that of well-nourished mothers and these...
deprived infants use nearly all of this for daily needs. There is therefore a need to consider replenishing the vitamin A reserves of deficient infants with an exogenous source of vitamin A to meet their requirements and to build liver reserves.

Random studies bring clarity

In 1989, two random controlled trials, the “Survival Study” and the “VAST Health Study”, were carried out by the Ghana VAST Study Team in the Kassena-Nankana district of northern Ghana. The effects of four monthly large doses of vitamin A (100,000 IU) on childhood mortality and morbidity were assessed. It demonstrated a 19% reduction in all-cause mortality and a substantial reduction in clinic attendances and hospital admissions. These findings were important because although earlier studies had demonstrated that vitamin A supplementation in infants reduced mortality, the effect on morbidity was not clear.

The main staple foods in the northern parts of Ghana are millet, sorghum and groundnuts, which are deficient in carotenoids and vitamin A. In a household baseline survey carried out as part of the Ghana VAST Study, red palm oil, a major source of carotenoids in coastal West Africa, was found in only 2% of households surveyed. The problem of vitamin A deficiency and xerophthalmia were recognized locally and there were words in the local languages for night blindness, suggesting that perhaps vitamin A deficiency was endemic.

In developing countries, 70–90% of vitamin A is obtained from pro-vitamin A carotenoids in plant foods and these are absorbed much less efficiently depending on vitamin A status and other non-dietary factors. However, in Europe and in industrialized countries such as the United States, 75% of dietary vitamin A is from pre-formed vitamin A, largely from multivitamins and the fortification of foods such as milk, butter, margarine, breakfast cereals and some snack foods.10 The results of the two Ghana VAST studies have subsequently been translated into policy and children 6–59 months of age are currently given 100,000 IU vitamin A during six-monthly vitamin A supplementation campaigns organized by the Ghana Health Service.

Vitamin A supplementation reduces mortality and severe morbidity in children of 6–59 months in less developed countries.11,12 Suggestions have been made for vitamin A to be administered as early as six weeks in the child’s life alongside childhood immunizations. It is expected that this would ensure the child’s vitamin A liver stores are replenished early enough to avert a number of early childhood illnesses and deaths and ensure that the child enters the second six months of life with an improved vitamin A status.13,14 A suggestion has been made that the well-developed infrastructure for child and infant immunization programs, which makes an estimated 500 million child contacts per year, could be an ideal opportunity for vitamin A to be administered to infants alongside routine immunizations.15,16 The concern, though, was the safety of administering high-dose vitamin A supplements to young infants. The possibility of acute toxicity has to be considered, factoring in the combination of vitamin A’s rapid absorption and its slow clearance from the body.17

A cautionary note

A note of caution had been expressed that vitamin A doses greater than 50,000 IU may be harmful, especially for infants less than four months of age. One of the potentially adverse effects of young infant vitamin A supplementation is bulging of the anterior fontanelle, even though reported cases are few and transient.

In 1994, WHO co-ordinated three trials in Ghana, India and Peru to examine the safety and benefits of linking vitamin A supplementation to infant immunization. The Kintampo Health Research Centre participated in this trial. The study showed that administration of 200,000 IU vitamin A to mothers of newborns and an additional 25,000 IU vitamin A given to infants with each dose of diphtheria, pertussis and tetanus (DPT) vaccine at six, 10 and 14 weeks was safe, but the effect on vitamin A status at six months of age was marginal and was not sustained to nine months of age. The results of this study ensured that young infant vitamin A supplementation linked to immunization was not adopted as policy as part of the Expanded Program on Immunization (EPI).

In 2001, based on results from modeling and the failure of the WHO multi-center trial in Ghana, India and Peru to demon-
strate a benefit beyond the first six months of life, the International Vitamin A Consultative Group (IVACG) in the Annecy Accords recommended a doubling of the vitamin A dose given to young infants to 50,000 IU alongside routine immunizations.\textsuperscript{20} IVACG also recommended increasing the post-partum dose of vitamin A given to mothers from 200,000 IU to 400,000 IU vitamin A and these recommendations were endorsed by WHO.\textsuperscript{21}

The Ministry of Health in Ghana subsequently adopted the policy of the increased post-partum dose of 400,000 IU vitamin A to mothers, expecting their infants to benefit through breastfeeding, but failed to adopt the second recommendation for the administration of 50,000 IU vitamin A to young infants alongside immunization.

**Calls for new trials**

These new IVACG recommendations prompted calls for new trials to be conducted to investigate whether the new regime would result in increased vitamin A status beyond the first six months of life. The trials did not demonstrate an improved vitamin A status beyond six months of life, irrespective of whether 25,000 IU or 50,000 IU vitamin A was administered\textsuperscript{22,23} and led to the rejection of the Annecy Accords for doubling of the dose of vitamin A given to post-partum women and their infants.

Vitamin A administration alongside EPI vaccines raises an additional issue of the possible interaction with the immunogenicity of administered vaccines. In spite of the anticipated advantages of this linkage, it was important to confirm that vitamin A administration during the early months of life did not affect the infant’s immune responses to EPI vaccines. Studies have subsequently confirmed that vitamin A administration at the time of vaccination has no negative effect on seroconversion to DPT vaccines\textsuperscript{24–28} but reduces the antibody responses to the measles vaccine when it is given at six months of age, when maternal antibodies tend to be high.\textsuperscript{29} This finding has influenced policy and it is now preferred to give the measles vaccine at nine months of age.\textsuperscript{29}

Several random controlled trials have also been conducted to assess the effects of vitamin A supplementation on the oral polio vaccine and have demonstrated that vitamin A has no negative effect – an important finding, because the polio vaccine (type 1, 2 and 3), like measles, is a live attenuated vaccine.\textsuperscript{30,31}

**Trials have demonstrated that vitamin A has no negative effect on oral polio vaccine**

In 2002, the Ministry of Health in Ghana introduced the pentavalent (DPT-HepB +Hib) vaccine into Ghana’s immunization program in place of the conventional DPT while still maintaining the immunization schedule at 6, 10 and 14 weeks. This new vaccine was expected to protect all children against diphtheria, pertussis, tetanus, hepatitis B and *Haemophilus Influenzae* type b. The safety of this vaccine was assessed in clinical trials to ensure its implementation would not adversely affect the immunogenicity of the newly added hepatitis B and *Haemophilus influenzae* type b components which had not been assessed in random controlled trials.\textsuperscript{32}

**WHO and UNICEF reassured**

A further study showed that vitamin A supplementation had no effect on *Haemophilus Influenzae* type b but enhanced immune response to the hepatitis B component of the pentavalent vaccine.\textsuperscript{33} This result has reassured agencies such as WHO and the United Nations Children’s Fund (UNICEF).

The Annecy recommendations\textsuperscript{20} for a doubling of the dose of vitamin A given to young infants have now been abandoned by WHO. Scarce resources which would have been used to implement the double dose regime can now be better used to support other proven interventions which improve the survival of children in developing countries.

Communicated by:
Samuel Newton, Kintampo Health Research Centre, PO Box 200, Kintampo, Ghana
Email: samkofinewton@yahoo.com

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Introducing Sprinkles™ in Kyrgyzstan: from People's Mandate to National Policy

Background

Starting in 2001, participatory assessments of people's health priorities, within the context of a community capacity building program, revealed anemia as one of the top health concerns. This coincided with epidemiological data that showed a prevalence of anemia of 50% in children 6–36 months of age. Dietary iron deficiency was the likely cause as other possible causes were ruled out. However, a previous

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program that had provided iron supplementation with tablets and syrup in one region had shown no effect. In this context, in 2003, we came to know about Sprinkles as an alternative form of iron supplementation. We initiated an efficiency study, in 2005, that failed to show sufficient effect of a weekly dose of Sprinkles over six months in pregnant women (60 mg iron) and children 6–36 months of age (30 mg of iron). We followed this, in 2007, with an efficacy study to see whether Sprinkles could be effective in Kyrgyzstan where consumption of black tea is ubiquitous even among small children. In a cluster-randomized trial we gave Sprinkles daily for two months to the intervention group (pregnant women 60 mg of iron, children 6–36 months of age 12.5 mg). Anemia prevalence among children dropped by 28% in this group, while increasing in the control group (p=0.000). Differences in hemoglobin and cure rates were also highly significant. These results provided the basis to choose Sprinkles in several strategic documents as the preferred intervention for the control of anemia in children. A pilot intervention in one region is under way and we are looking for funding to extend the program throughout the country. In pregnant women the impact was much smaller and we recommended that the government wait for more evidence before deciding on a strategy.

In 2001, we started a program for community capacity building around health issues in one rayon (district) of Kyrgyzstan. It was called Community Action for Health and would evolve over the years to become a countrywide partnership between Village Health Committees and the governmental health system. In each region to which the program was extended, an extensive, qualitative, participatory assessment of people’s health priorities was conducted in order to develop interventions for health issues identified as priorities by the people. While extending the program throughout the country, we found that people identified anemia everywhere as one of their most important health issues. This led us down the path of searching for an intervention to fight anemia. This essay describes the evolution from this mandate by the people to find a strategy against anemia to choosing micronutrient home fortification as a key strategy for the prevention and control of anemia in Kyrgyz children.

Anemia in Kyrgyzstan

Studying the available epidemiological data confirmed that anemia and other micronutrient deficiencies are highly prevalent among young children in Kyrgyzstan. In the 1997 Demographic and Health Survey, the prevalence of anemia was 50% in children 6–36 months of age. Non-nationally representative surveys undertaken since 1997 suggest that the prevalence of anemia has not declined. Studies measuring ferritin had not yet been conducted, but it was assumed that dietary iron deficiency was the cause of the high prevalence of anemia among young children. As the prevalence of anemia among children under three years of age was higher than 40%, it could be inferred that all children in that age group have some degree of iron deficiency.

There was evidence of other micronutrient deficiencies as well. In 2003, a serological study of 504 children <5 years of age detected vitamin A deficiency (< 20 µg/dL or 0.7 µmol/L) in 33% of children. Growth stunting in children under five years is also a serious public health problem in Kyrgyzstan, with a national prevalence of 13.7%, while wasting, on the other hand, is almost at normal levels at 3.5%. High levels of stunting, in the absence of wasting, was also suggestive of micronutrient deficiencies.

Previous experience and preliminary investigations

The World Health Organization (WHO) recommends universal iron supplementation for children 6–36 months of age when the prevalence of anemia is greater than 40%. The Ministry of Health (MoH), with support from UNICEF, therefore, implemented an iron supplementation program from 1998 to 2000, in one region of the country. They distributed iron tablets for pregnant women and iron syrup for children. Unfortunately, instead of showing a reduction in anemia, the prevalence of anemia actually worsened over the course of the program period of two years. Reasons for the disappointing outcome were thought to be poor distribution, communication and training, and to a lesser extent, side effects of tablets, which resulted in low compliance.

Anemia is highly prevalent among young children in Kyrgyzstan

But this failure led some in the health system to suspect that iron deficiency was not the chief cause of the high prevalence of anemia. As mentioned, no studies had been conducted measuring ferritin, and at the time, ferritin measurement was not possible in Kyrgyzstan. Years later studies including fer-
ritin measurements did confirm iron deficiency, but at the time, we could only indirectly establish dietary iron deficiency as the cause of the anemia. Malaria could be excluded as a cause because it exists only in defined pockets of the country and the incidence is very low. Existing studies on intestinal parasites, as well as a study we initiated, did not find any existence of hookworm infection. We also investigated a small number of women and men in the same communities and found that while women had a high level (44–62% prevalence) of anemia, 90% of the men were not anemic, which made causes other than iron deficiency very unlikely. Lastly, several investigations of nutrition patterns had shown that a large part of the population consumes food low in micronutrients and especially iron. Furthermore, tea, which is high in tannin content (a known inhibitor of dietary iron), is widely consumed in large quantities especially at meals. Mothers start to give their babies tea at a very early age, and by the age of one year virtually all children drink tea.

Iron supplementation with Sprinkles has been developed by the Sprinkles Global Health Initiative at the Hospital for Sick Children in Toronto, Canada. Sprinkles are a mixture of iron and various other micronutrients in powder form. The micronutrients are packaged in single dose sachets and contain microencapsulated iron, zinc, vitamins A and C, and folic acid. This powder is sprinkled over semi-solid food just before it is consumed. Sprinkles have considerable advantages over traditional iron-containing drops and tablets in terms of compliance, convenience, acceptability, cost, incorporation of other micronutrients, and reduced side effects. Lipid encapsulation of the iron prevents it from interacting with food, and thus there are minimal changes to the color, taste, and texture of the food to which Sprinkles are added. The use of Sprinkles does not require mothers to alter their feeding practices, as they can easily be mixed with any home-made food.

The efficacy, safety, and acceptability of Sprinkles for infants and young children has been tested through several community-based studies in development, and began to explore this option. Meanwhile, we also initiated other interventions that aimed at improving nutrition. Village Health Committees were trained to help people grow vegetables and to promote a balanced diet, exclusive breastfeeding in the first six months, and proper complementary feeding.

Women had a high level (44–62%) of anemia, while 90% of the men were not anemic.

Iron supplementation with Sprinkles began in 2001, UNICEF and the Asian Development Bank began to promote flour fortification with iron in Kyrgyzstan. We therefore investigated the consumption of flour by people in villages (where roughly two-thirds of the population live) and found that the majority grow their own wheat and have it milled in small local mills. A study by UNICEF found an average of 1.5 flour mills per village and a low consumption of fortified flour. As fortification in small mills is not feasible and convincing people to buy fortified flour would involve major changes in food consumption patterns for a majority of households, we concluded that for the short- and medium-term, supplementation was the only feasible strategy to provide children and pregnant women with the necessary iron.
ing countries in Asia, Africa, and Latin America. Sprinkles have proven to be as effective as the standard iron drops in treating and preventing anemia in young children, with cure rates ranging from 55–90%.

We initiated a partnership with the Sprinkles Global Health Initiative, and in 2005, we conducted a study on the effectiveness of Sprinkles given to children 6–36 months of age and pregnant women in one region of the country. As the efficacy of Sprinkles had been proven through studies in several other countries, we opted for an effectiveness study with cross-sectional samples taken pre- and post-intervention. A recent efficacy study in Bangladesh had shown that two months of weekly administration of Sprinkles in children was almost as effective as daily administration for two months. These results encouraged us to try a weekly regimen in the hope that, if proven effective, it would lower the costs of a national program and therefore increase the likelihood that Kyrgyzstan would adopt this strategy. To compensate for the lower compliance that could be expected in an intervention study, as compared to the efficacy study in Bangladesh, we prolonged the duration of the intervention to six months. The Sprinkles sachets for children contained 30 mg of iron as ferrous fumarate, and for women they contained 60 mg.

Effective in the fight against anemia in Kyrgyz children

Unfortunately, the results of this study were disappointing for both children and pregnant women. There were differences in the results between intervention and control groups, but the effect was by far not sufficient to justify a strategy based on this dosing regimen. There was a dose-response effect among the children, based on compliance, but even in the highest compliance group, the effect was markedly lower than what had been reported in Bangladesh among the weekly administration group. This was true despite the fact that the high compliance group in Kyrgyzstan received a cumulative dose of iron almost four times higher than the weekly group in the Bangladesh study. On the positive side, we learned that Sprinkles were accepted by mothers, compliance was generally good, and there were few side effects.

In reviewing these results, we noted that Sprinkles had never before been tested in a context where black tea consumption was ubiquitous in small children and suspected that this may explain our results. We therefore decided to conduct an efficacy study that would answer the question of whether Sprinkles could in principle be effective under the prevailing nutritional patterns in Kyrgyzstan. This second Sprinkles study was conducted in 2007, among children 6–36 months of age and pregnant women. It was a cluster-randomized trial among 2,193 children and 228 pregnant women. The intervention consisted of two months of daily Sprinkles administration (12.5 mg iron as ferrous fumarate for children, 60 mg iron as ferrous fumarate for pregnant women). In this study, Sprinkles were found to be effective in preventing and treating anemia in children, with a 28% relative reduction in the prevalence of anemia among children in the intervention group (from 71.9% to 52.0%) versus an increase in anemia among children in the control group. Among pregnant women the Sprinkles intervention did not reduce the prevalence of anemia, nor increase the mean hemoglobin. However, when we compared the pre- and post-intervention results between the intervention and control groups, it was clear that Sprinkles did have some impact on hemoglobin, anemia prevalence, and iron stores. This effect, however, was not large not enough to counter the physiological effects of pregnancy that lead to anemia.

Advocacy

We concluded that, despite tea consumption, daily administration of Sprinkles could be an effective tool in the fight against anemia in Kyrgyz children. A number of influential people in the health system had been involved in planning the study and became advocates of Sprinkles when the second study showed their effectiveness. Together with them we began to lobby for the inclusion of the Sprinkles intervention becoming a part of the strategy to prevent and control anemia in Kyrgyzstan. For pregnant women, we recommended that the government wait for additional evidence on Sprinkles and multiple micronutrient tablets before determining which one to choose for supplementation. The skeptics that remained, despite our positive study results among children, were gradually convinced using lobbying measures that included a trip to a successful Sprinkles program in Mongolia, a national conference on international evidence for Sprinkles with experts from CDC Atlanta, their inclusion in the working group on development of an anemia prevention and control strategy, and countless individual talks.

By 2009, these efforts over time led to the MoH itself becoming the main driving force behind Sprinkles becoming a key intervention against ane-
emia in Kyrgyzstan. Meanwhile, a coalition of partners (MoH, UNICEF, Swiss Red Cross, Centers for Disease Control and Prevention) initiated in mid-2009 a pilot Sprinkles program for children 6–24 months in one region, while an extension to another region is in preparation for 2010. Sprinkles were locally branded for Kyrgyzstan as “Gulazyk” (a Kyrgyz word referring to an old tradition of drying meat for long journeys). Village Health Committees are involved in education efforts for Sprinkles and in promoting compliance. Thus, the initial prioritization of anemia by communities has come full circle, as Village Health Committees are now participating in promoting an effective intervention against it. Proposals to a variety of donors are in preparation for financing the nationwide extension.

Communicated by:
Tobias Schueth, Swiss Red Cross, Sydykova 187/1, Bishkek 720001, Kyrgyzstan
Elizabeth Lundeen
Kyrgyz-Swedish Health Project
Cholpon Imankulieva, UNICEF, Kyrgyzstan office
Email: tobias@elcat.kg

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Positioning Nutrition at the Center of the Development Agenda: The Malawi Experience

The Vice President of Malawi, The Right Honorable Joyce Banda, recently gave the keynote address at a roundtable meeting on ‘Hidden Hunger – the missing link between health and food’, jointly host- ed by the Commonwealth Secretariat and SIGHT AND LIFE, ahead of the 2010 Commonwealth Health Ministers’ Meeting in Geneva in May. Other speakers who made up the panel were Dr Klaus Kraemer of SIGHT AND LIFE, Dr Martin Bloem of the WFP, and Dr Werner Schultink of UNICEF. All expressed the urgent need for governments to incorporate policies that include nutrition and the provision of micronutrients, especially for the most vulnerable, in order to avoid a social and economic disaster and to achieve the Millennium Development Goals (MDGs). In her speech, which follows below, the Malawian Vice President shared how the Malawian government has made tackling nutrition security and hidden hunger a key economic and social priority and how this policy is making a tangible difference in Malawi.

Vice President Banda started by stating how Malawi has earned recognition as a country that has a successful model for placing nutrition at the center of the development agenda. “As overseer of the Department of Nutrition, HIV and AIDS in the Office of the President and Cabinet, I am delighted to present Malawi’s model as an example of best practices that could be replicated in other countries and could accelerate the attainment of the nutrition-related Millennium Development Goals (MDGs).”

The 2004 Malawi Demographic and Health Survey showed that malnutrition was widespread and endemic, with 48% of children under five being stunted, 25% underweight and 5% wasted.

In addition, some 20% of the babies were born with a birth weight of less than 2.5 kg. Overall, malnutrition (directly or indirectly) accounted for 52% of child mortality. Malnutrition was also prevalent among the adult population at 25%, with 75% of the malnourished adults being HIV positive.

Micronutrient deficiencies were also common:

• Vitamin A Deficiency was 60% among under-five children, 38% among school-aged children, 57% in women of child-bearing age and 38% in men.
• Iron deficiency was equally common, with statistics showing that 80% of preschool children, 54% of children aged 5–10 years, 44% women of child-bearing age and
17% men were iron deficient. Anemia contributed to 57% of maternal mortality (1,200 per 100,000 live births).

- Iodine deficiency, based on the 2001 national micronutrient survey, was set at 50% amongst children aged 5–10 years and goiter was estimated at 3% in endemic districts.

It was therefore clear that in 2004, malnutrition was a universal problem in Malawi. The causes included:

- Low dietary intake;
- High disease burden, including an HIV prevalence of 14.4%;
- Persistent food insecurity from 1992 to 2004, which rendered 4.3 million Malawians food insecure;
- Poor child care practices – exclusive breastfeeding being as low as 53% – and suboptimal complementary feeding practices;
- Low coverage of vitamin A supplementation, at less than 60% for children and 46% in postnatal mothers;
- Poor health-care seeking behaviors and limited access to quality health care and sanitary facilities.

In addition, in the early 2000s there was also slow economic growth, at an average of 2% below the minimum 6% required to reduce poverty. The development policies at the time also did not prioritize nutrition and so there was no budget for nutrition activities and programs. As a result, some 65% of the population lived below the poverty line; child mortality and malnutrition-related deaths amongst children under five was as high as 52%, and the mortality rate amongst children admitted to Nutrition Rehabilitation Units with severe malnutrition was 20%. Sadly at this time there was also the withdrawal of home craft workers and nutrition education programs on national radio, both of which played a critical role in community-level

**Malawi: The Facts**

The Republic of Malawi is a landlocked country in southeast Africa that is often called the warm heart of Africa. It has borders with Tanzania, Zambia and Mozambique, and Lake Nyasa (some 580 km long) is the country’s main geographical feature. It has a total population of 15 million, most of whom live in rural areas and 45% of whom are children under 14 years of age.

Malawi is one of the world’s least developed but most densely populated countries and the economy is predominantly based in agriculture, with tobacco being the lead export. It is ranked as having the 12th highest infant mortality rate in the world – 83.5 deaths/1,000 live births – and the life expectancy is 50.92 years. The Malawian economy depends on substantial inflows of economic assistance from the IMF, the World Bank, and individual donor nations and agencies.

The capital of Malawi is Lilongwi, but the largest city is Blantyre and the official language is Chichewa. The literacy rate (those of 15 years and older who can read and write) is 62.7%. The country held multiparty elections in 2004 and the current President is Bingu wa Mutharika, of the Democratic Progressive Party, who was re-elected for a second term of office in 2009. Some of the key challenges that the government faces include developing a market economy, improving educational facilities, addressing environmental problems and dealing with the large problem of HIV/AIDS.

- 17% of the population are children under the age of five and 51% are women.
- 40% of the population lives below the poverty line, and the core poor account for 15%.
- More than 85% of rural households derive their livelihoods from agriculture, mainly as smallholder farmers.

Ref: The CIA Factbook and Speech of the Vice President of Malawi.
nutrition education. Further negative outcomes were delayed school enrollment as (underweight and stunted) children looked too young to be school-aged and high-school dropout rates increased, compromising the country’s expected gains from the provision of free primary education.

Adding to this, in 2005 Malawi conducted a nutrition profiling, which revealed that Malawi would lose US$ 446 million between 2006 and 2015 if stunting, nutritional anemia and iodine deficiency were not addressed, and yet that the country could gain US$ 83 million in productivity in a single year if stunting, nutritional anemia and iodine deficiencies were reduced by 30% each. This equated to a productivity cost-benefit ratio of US$1.0 : US$ 5.3.

In the light of this evidence, the current Malawian government declared malnutrition a silent crisis with significant negative economic, health, social-cultural and political consequences. In his 2004 inaugural speech the President of Malawi, Ngwazi Dr Bingu wa Mutharika, highlighted the government’s commitment to fighting malnutrition, HIV and AIDS and to ensuring that the country attained food security.

There are six pillars that have led to the success of Malawi’s nutrition model:

1. Political Will: The highest political will has placed nutrition directly under the Presidency, making the State President the Minister responsible for Nutrition, HIV and AIDS. The President and his Vice President, who is the overseer of the Department, are the lead champions of nutrition, HIV and AIDS.

2. Coordination: In order to enhance effective coordination and mainstreaming of nutrition in all implementing sectors, a fully fledged Nutrition Department in the Office of The President and Cabinet was established in November 2004. The Department is the secretariat and its mandate is to play a central role in the interpretation of Government’s vision of an adequately nourished and HIV-free nation. The Department provides visionary guidance and strategic direction on Nutrition, HIV and AIDS programming, and develops mechanisms that enhance the effective planning, implementation, monitoring and evaluation of the Nutrition, HIV and AIDS issues.

The Department facilitates research and dissemination of best practices and information on nutrition; facilitates the institutional and human capacity development to design, implement and manage nutrition programs; facilitates the enactment and enforcement of relevant nutrition legislation; and ensures the maintenance of standards in the delivery of nutrition services and mobilizes resources for implementation of nutrition programs by various sectors.

To strengthen coordination, the Government adopted a multi-sectoral approach to Nutrition based on what is known as the 3 ones principle – implementing one policy and strategic plan; one business plan which was developed with clearly defined roles and responsibilities for each stakeholder; and one joint action plan with annual work plans.

At the national level, there are nutrition coordination and implementation committees, namely; Cabinet Committees on Nutrition; Parliamentary Committee on Nutrition; Principal Secretaries’ Steering Committee; Government and Development Partners’ Committee on Nutrition; National Nutrition committees with membership from various nutrition constituencies, for instance, public and private sector, development partners, NGOs, academic and research institutions.
3. **Policy Framework:** A conducive policy environment was created and nutrition was included in the Malawi Growth and Development Strategy (MGDS), which is the blueprint for Malawi’s development agenda. Nutrition is under Priority Six, the ‘Prevention and Management of Nutrition Disorders, HIV and AIDS’. In addition, the country developed and launched the first ever comprehensive National Nutrition Policy and Strategic Plan (NNPSP) for the nutrition sector for the period 2007–2012 in order to operationalize the nutrition component of the MGDS. The policy has three priority areas, which are:

- Prevention and control of various forms of nutrition disorders;
- Promoting access to, and the quality of, nutrition and related services for effective management of nutrition disorders;
- Creation of an enabling environment that adequately provides for delivery of nutrition services and implementation of nutrition programs, projects and interventions.

The policy has defined the cost of the National Nutrition Policy and Strategic Policy as an investment basic.

4. **Resources:** Knowing the importance of having resources in order to turn policy into action, the government of Malawi has a special vote for nutrition within the Government Other Recurrent Transaction (ORT) and Development budget.

5. **Mainstreaming:** In order to incorporate and strengthen nutrition’s positioning, nutrition is also programmed in other sectors, including Health, Agriculture, Education and Gender and Child Development Policy. The process is ongoing, and it will cover all the Ministries.

6. **Capacity Development:** To ensure that the policy is implemented, Nutrition, HIV and AIDS has been made into a common service, and nutrition specialists at decision-making levels have initially been posted in 10 Ministries. By early next year, all the Ministries will be covered. Their role is to facilitate and coordinate the integration and implementation of nutrition interventions at the sectoral level in the outreach programs, policies, functions and activities within the sector; to ensure that there are vibrant nutrition workplace programs; to rationalize resources for sectoral nutrition work; and to ensure that the utilization of nutrition resources in the sector is tracked. At the community level, the home craft workers’ program has been reintroduced and will start training 2,000 community workers.

These pillars have supported the implementation of innovative interventions in nutrition that include:

- Promotion of optimal feeding of infants, children, pregnant and lactating women through various public and targeted nutrition education activities;
- Promotion of micronutrients and disease prevention campaigns covering vitamin A supplementation, use of iodized salt, deworming, insecticide-treated bed nets and public nutrition education;
- Promotion of dietary diversity and modification;
- Food fortification;
- Social support to vulnerable groups; targeted nutritional support to vulnerable groups, such as school feeding; nutrition support to people living with HIV (PL HIV); cash transfer; and targeted agriculture input subsidy;
- Promotion of access to nutrition and related services such as scaling-up of community therapeutic care for malnourished children and scaling-up of nutrition, treatment, care and support for PLHIV;
- Strong emphasis of nutrition in our national HIV and AIDS response; and
- Nutrition education campaigns, which even include radio programs done by the University of Malawi, through the Bunda College of Agriculture.

To date, Malawi has registered many achievements in the nutrition sector. For the past three years, Malawi has attained national level food surplus, and the kilocalories energy intake has increased from 680 in 2004 to 1,500 in 2008 and 2,000 in 2009.

Through collaboration with partners such as the World Food Programme (WFP), the majority of children access one nutritious meal a day via the school feeding program, and this has improved retention rates in primary schools, especially amongst orphaned and vulnerable children.

Exclusive breastfeeding rates have increased from 53% to 57% in 2004, and since the introduction of Community Based Therapeutic Centers, malnutrition mortality rates in Nutrition Rehabilitation Units have declined from 20% in 2004 to 2% for the first time in 15 years.

Nutritional status has also generally improved from 2004. Stunting, which was 48% in 2004, declined to 46% in the 2006 Multiple Indicator Cluster Survey and
The three other speakers at the Commonwealth Secretariat and SIGHT AND LIFE Geneva Commonwealth Health Ministers’ round table meeting also shared wise words on the way forward for nutrition in addressing the MDGs.

Dr Martin Bloem, Chief of Nutrition and HIV/AIDS Policy of the World Food Programme (WFP), supported the need for an integrated and multi-disciplinary approach and stressed that we need to break down the silos within which we have traditionally functioned (health, nutrition, agriculture, social services) in order to ensure effective and efficient nutrition policy and programming. “The reality is that the world has not been very successful in dealing with poverty during the first phase of the MDG targets. But there is optimism. We can make good strides in the next 5 years – provided that we make linkages and break down silos.”

Dr Werner Schultink, Associate Director of Nutrition at UNICEF, talked about the need to ‘scale up’ nutrition and the recently launched framework for action to meet the Millennium Development Goals. “Countries have to seize the initiative now and not wait until hidden hunger has a visible and measurable impact on economic figures. Only by tackling the problem now can we hope to meet the MDGs. This is a social and economic imperative. It is well documented that those children who are nutrition secure (quantity and quality) in their early years, with the window of opportunity being from 6 months to 2 years, are likely to be more economically productive as adults.”

Dr Klaus Kraemer, Director of SIGHT AND LIFE, argued that developing nations must take decisive action now in order to address the issue and to fulfill the Millennium Development Goals by the target date of 2015. “Micronutrient malnutrition is often a hidden problem, where people may have an adequate supply of energy from the food that they eat, but the nutritional value is insufficient to meet their needs for optimal growth and development. Hidden hunger is under-recognized, and not enough is done to combat this problem, which not only results in long-term health problems for individuals, but also impacts on the health of communities and eventually has huge negative economic consequences, especially for developing countries. We need to highlight the problem and encourage all nations, especially developing countries, to address the missing link between health and food.”

is currently being projected at 42%. Indications are that wasting has reduced from 5% to 2.5% and underweight from 25% to 15%.

Malawi’s economic growth, which has averaged 7% in the past three years, has also been a strong enabler for these nutrition gains. The 2009 Millennium Development Goals Assessment revealed that Malawi is likely to meet most indicators under Goal One related to the reduction of extreme poverty and hunger.

In conclusion, the Malawian Government has demonstrated that nutrition is a priority in economic development. Key success criteria are to ensure that there is the highest political will, with clear champions; that there are conducive policy environments with clear strategies, actions and resources for implementation; the harnessing of institutional and human capital development; well defined coordination and implementation mechanisms based on clearly stated roles and responsibilities and reporting mechanisms; and the development and maintenance of strong partnerships within a well defined action framework championed by government, which forms the core for resource mobilization.

Vice President Banda concluded by saying, “At the global level, there is need to have high level structures supporting the advancement of nutrition. If nutrition is to get back on the agenda, we need to ensure that global and regional bodies have the right architecture for nutrition. Unless nutrition is at the center of the development agenda and there is highest political will at all levels, poverty will never end in the world, nor will MDG 1 be met by 2015. In addition, improvements in nutrition will have spin-offs not only for MDG 1 but also for other related MDGs in health and education. We all have to recommit ourselves to placing nutrition high on the agenda.”
A Day in the Life of Mary Shawa

“Never try to be an island”

Dr Mary Shawa is the Permanent Secretary for Nutrition, HIV and AIDS in the offices of Ngwazi Professor Bingu wa Mutharika, President of the Republic of Malawi. She discusses the concerted efforts made by the Government of Malawi in recent years to address the problem of malnutrition in that country.

SIGHT AND LIFE (SAL): Mary, what is the key focus of your work?

Mary Shawa (MS): My office is mandated to provide visionary policy direction, guidance and oversight in the areas of Nutrition, HIV and AIDS. It is also responsible for day-to-day coordination of the activities in the country in addition to facilitating the creation of implementation structures and high-level advocacy and lobbying. My office is located within the office of the President and the Cabinet. The Minister responsible for Nutrition, HIV and AIDS is the President himself. I’ve been in this position since November 2004.

SAL: What is your professional and educational background?

MS: I have a diploma in Agriculture from Bunda College of Agriculture, University of Malawi, which I followed with a post-graduate diploma in Food Resource Related to Community Development from King’s College, University of London. I then moved on to do a Master’s degree in Clinical Nutrition and Dietetics from King’s, London. Finally I did a PhD in Nutrition at King’s, London, and my thesis was on The Impact of Economic Empowerment Programs for Women in Malawi on the Nutritional, Economic and Social Status of Household Members.

SAL: Could you tell our readers something about the nutritional status of Malawians and the relationship between nutrition and HIV as it expresses itself in Malawi?

MS: When this office was set up, malnutrition was a universal problem in Malawi. The 2004 Malawi Demographic and Health Survey and the 2005 Nutrition Survey revealed that 48% of children and 53% of under-fives were stunted, 21% and 33.1% respectively were under weight, 4.9% and 5.7% were wasted, and 60% had vitamin A deficiency. Malnutrition accounted for 52% of child mortality. Added to this, 25% of adults had malnutrition, with 75% of the malnourished adults also being HIV positive. TB cases, meanwhile, were estimated at 30,000, of whom 77% were HIV positive and 75% were malnourished. So the link between nutrition and HIV was a very clear one.

SAL: Why did malnutrition exist on such a large scale in Malawi?

MS: Principally because Malawi suffered from food insecurity from 1992 through to 2004 due to the removal of agriculture subsidies, community workers and AMARC, the country’s sole food distributor, as part of structural adjustment policies. This meant that three quarters of the population were unable to obtain their necessary daily calorie and micronutrient intake. The government policy of subsidizing agriculture was abandoned during that period, with disastrous effects. Poor child care practices, inadequate access to sanitary facilities and quality healthcare, and reluctance to seek healthcare compounded the problem, leaving Malawi as a nation with many significant challenges.

SAL: You describe a grave situation with many ramifications. What has the Government of Malawi done to tackle it since Dr Bingu wa Mutharika became President in 2004?

MS: Malawi recognized the importance of nutrition and put in place a
consumption – are not consumed by many people, since Malawians process their own flour at home. At the moment, plans are at an advanced stage to fortify sugar with vitamin A. Vitamin A supplementation is also given to lactating women for 6 months after delivery and to children under five. Salt is iodized because Malawi has a Salt Iodination Bill, and iron is given as a supplement to pregnant women and school-age children. There is also promotion of bio-fortification in sweet potatoes and consumption of the six food groups with emphasis on brightly colored foods and use of oil-based foods to promote vitamin A intake.

SAL: What personally motivates you in this very important role, Mary?

MS: The powerful political commitment of His Excellency Ngwazi Professor Bingu wa Mutharika makes my work very easy. This is crucial, because I have to deliver. There is a multi-sectoral approach with very good collaboration between sectors and there is the National Principal Secretaries’ Steering Committee on Nutrition, HIV and AIDS, Government – Development Partners’ Committees on Nutrition and Malawi Global Fund Coordinating Committee, among others. The support of my family is critical, too. It’s also important for me to read widely and to listen carefully to everyone with whom I speak. I try to extract the best ideas I can from all my reading and conversations and to create practical solutions that will work on the ground.

When I started in this role, a Malawian died every four seconds due to malnutrition. The cure rate is currently 86%. When you look at these statistics, you realize how vital my work is. What my office does directly affects the lives of people who might otherwise die within the next two weeks, or even the next two days, unless we reach out to support them.

I said that the President is the champion and lead person in the national Nutrition, HIV and AIDS responses and is extremely supportive; this applies to the entire Cabinet and all of my colleagues. We are all dedicated to doing everything we can, and we work together in a highly collaborative manner.

SAL: It’s wonderful that you work in such a mutually supportive context given the huge problems that still confront the population of Malawi. If you could change one thing about your current situation, what would that be?

MS: If I had a single wish, it would be to have adequate resources to do our work properly. We need well trained human resources, we need adequate funding, and we need appropriate materials. Malawi would be a very different place to live in if we could prevent the spread of HIV and eradicate the scourge of malnutrition. Poverty levels in this country would be reduced tremendously.

SAL: What does SIGHT AND LIFE mean to you in the context of the fight against micronutrient deficiency?

MS: I’ve been familiar with SIGHT AND LIFE since 1990, and we have been receiving SIGHT AND LIFE magazine ever since that date. The articles published in SIGHT AND LIFE provide a great deal of useful information on pro-
grams that are of relevance to us here in Malawi: this information would not be available to me by any other means. It keeps me in touch with what is happening all around the world.

**SAL:** How about your life outside work, Mary?

**MS:** I’m a strongly religious person. The Holy Trinity of God the Father, God the Son and God the Holy Spirit guides my life. When I am not busy with my job, I’m involved with the work of the Church.

**SAL:** Does your job give you the opportunity to travel outside Malawi and swap notes with other people?

**MS:** Yes, I travel a great deal in connection with my work. We share the Malawi model of nutrition management with others around the world because in Malawi the management of nutrition, HIV and AIDS is at the heart of our political agenda. You need political commitment in the first place, and then you need allocation of budgets. You also need clear allocation of responsibilities and lines of reporting. Integration has made all the difference for us.

**SAL:** Do you have a final message for our readers, Mary?

**MS:** I’d like to say one thing. If somebody has given you work, do it to the best of your ability. Always be prepared to work, and always be prepared to learn, and never try to be an island. Involve everybody around you in the work you do. This will make your work much easier for you yourself, and also make it much more helpful to other people. This means that when you succeed, it’s not just your success: it is everyone’s success.
CARIG Conference 2010: Carotenoids and Cancer

Noel W Solomons
Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM), Guatemala City, Guatemala

Correspondence: Noel W Solomons, CeSSIAM, 17a Avenida 16–80, Zona 11, Guatemala City, Guatemala
Email: cessiam@guate.net.gt

As part of the week of activities related to Experimental Biology 2010 and the annual meeting of the American Society for Nutrition, the Carotene Research Interaction Group (CARIG) held its annual conference in Anaheim, California. The topic was carotenoids and cancer. The conference was chaired by Dr Elizabeth Johnson of the Tufts University/Human Nutrition Research Center on Aging and featured five invited presentations closely related to epidemiology, dietary behavior and mechanistic considerations that relate exposure to the full range of carotenoids (carotenes and xanthophylls) to cancer prevention.

Following the death of James Allen Olson, a charter member of CARIG and the founder of the CARIG/VARIG social, the group established an annual award and lecture. The honor of presenting this, the eighth James Allen Olson Perspectives on Carotenoids Memorial Lecture, fell to John Erdman of the University of Illinois at Urbana-Champaign.

Earl Harrison, of Ohio State University, followed with a lecture entitled: “Excentric cleavage products of dietary carotenoids: occurrence and possible biological functions”. β-carotene can be cleaved centrally and excentrically by the enzyme carotene monoxygenase 2 (CMO2), which oxidizes the chain at a site removed from the 15–15’ central double bond. Action of CMO2 produces a family aldehyde species know as apo-carotenals along with a residual (β-ionone) ketone.

Jonathan Mein, recent doctoral graduate of Tufts, gave the next presentation with the title “Excentric cleavage of carotenoids into metabolites other than vitamin A”. His focus was also on the enzyme carotene monoxygenase 2 (CMO2), but in the context of other substrates, namely: lutein, zeaxanthin and β-cryptoxanthin. Until recently, it was felt that CMO2 had a substrate specificity for the cleavage of β-carotene and lycopene.

The intestinal handling of dietary carotenoids

Mario Ferruzzi, of Purdue University, followed with an exploration of the factors related to the intestinal handling of dietary carotenoids, with a presentation entitled “The influence of co-consumed lipid on carotenoid absorption”. He framed his talk around the observation that the quantity and pattern of carotenoids in diets are rarely reflected in serum and tissue concentrations in the consumer.

Enhancing carrot colors for the prevention of diseases

Sherry A Tanumihardjo, University of Wisconsin, gave the final presentation of the Conference on the topic of “Enhancing carrot colors for the prevention of diseases”. This was the product of an extensive collaboration between the biological investigators around Sherry and plant geneticists working with Philip Simon.

Student poster competition

The student poster competition attracted 12 entries, and three equivalent first prize awards of $500 were given to Nancy Engelmann, Nikki Ford and Julie Evans.

Lewis P Rubin, University of South Florida; Elizabeth J Johnson, Tufts University; Neal E Craft, Crafts Technologies, Inc.; María José Soto-Méndez, CeSSIAM; Mario G Ferruzzi, Purdue University.
The good news headline appeared in The New York Times earlier in the year when reporting on the findings published in The Lancet that described a significant drop worldwide in the number of women dying annually from pregnancy and childbirth from 526,300 in 1980 to 342,900 in 2008. This is especially positive in view of the fact that many have considered maternal mortality to be an intractable problem. The study cites the reasons for the improvement as being: lower pregnancy rates in some countries; higher income that has a positive effect on nutritional status and access to healthcare; improved education for women; and the increasing availability of ‘skilled attendants’ to help women give birth.

Improvements in large countries such as India and China significantly impact on bringing the global death rates down. This report, however, does not mean that we can now be complacent. Addressing maternal mortality must remain high on the agenda – especially considering that the 2009 MDG Goal Report still states that 536,000 women and girls die as a result of complications during pregnancy, childbirth and the six weeks following delivery.

The Lancet report shows that, as with all the MDGs, among poor countries with longstanding death rates, progress varies considerably. For example, from 1990 to 2008, the maternal mortality rate dropped by 8.8% in the Maldives but rose by 5.5% in Zimbabwe. Six countries accounted for more than half of all maternal mortality – India, Nigeria, Pakistan, Afghanistan, Ethiopia and the Democratic Republic of the Congo – and as a region, Sub-Saharan Africa has the highest maternal death rate, followed by South East Asia. The two countries with notable improvements were India, down from 408–1080 deaths per 100,000 live births in 1980 to 154–395 in 2008 and China, where the 2008 figures are down from 144–187 per 100,000 live births in 1980 to 35–46 in 2008. Despite this good news, developing countries still account for 99% of maternal deaths, and maternal mortality is among the health indicators that show the greatest gap between the rich and the poor – both between countries and within them.

The findings should add to the body of evidence that needs to be used to force governments to spend more on pregnancy-related healthcare and that also illustrates to them that money allocated to women’s health actually accomplishes positive results.

NOTE: The June 5th 2010 edition of The Lancet includes a number of articles on the topic of maternal and child health that make excellent reading.
G8 Meeting and Muskoka Declaration Puts Maternal and Infant Health High on the Agenda

Each year the leaders of France, Germany, Italy, Japan, the United Kingdom, the United States, Russia and Canada, that make up the G8, meet to discuss issues of mutual and joint importance based on an agenda set by the host country. The European Union is also represented but cannot host or chair the meeting, and throughout the year there are also various Ministerial meetings.

The G20 – made up officially of Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, United Kingdom and the United States of America – has also been around for just over a decade, but with the onset of the financial crisis in 2008, the loose affiliation of major economies took on new importance. Since then, four G20 summits have taken place. Each of both the G8 and G20 summits usually results in the issuing of a statement or declaration, but many question if these have any real impact as the record of promised action being followed through is not good!

The 2010 G8 and G20 meetings took place in Muskoka and Toronto in Canada in June, and ahead of the meetings the Canadian Prime Minister announced that improving maternal health and reducing child mortality (MDG 4 & 5) would be included on the agenda. The statement issued by the G8 leaders has been called the ‘G8 Muskoka Declaration – Recovery and New Beginnings’ and acknowledges that despite the meeting taking place ‘as the world begins a fragile recovery from the greatest economic crisis in generations’, support for development and a strong partnership with developing countries – particularly Africa – that aims at sustainable outcomes remains a cornerstone of their approach.

A call to all to ‘Keep the promise’ and reach the MDGs

The G8 stressed that governments of developing countries must be urged to meet their primary responsibilities for social and economic development and good governance, in the interests of their citizens. They recognized that it is the most vulnerable states that have made the least progress towards achieving the MDGs at the two-thirds point towards the target 2015. The leaders made it clear that to achieve the MDGs ‘the effort needs to be truly global, encompassing a comprehensive, whole-of-country approach, including actions not only from all governments, but also the private sector, foundations, non-governmental organizations and civil society, as well as international organizations, focusing more on the protection and empowerment of individuals and communities to improve human security.’

Highlighting and committing to MDG 4 and 5 – the Muskoka Initiative

It was acknowledged that progress towards improving maternal health (MDG 5) has been unacceptably slow and that the high maternal mortality rate could be prevented with better access to strengthened health systems, and sexual and reproductive health care and services. Progress on MDG 4, reducing child mortality, is also accepted as being too slow and it is acknowledged that the annual 9 million under-five child deaths are profoundly concerning and underscore the need for urgent collective action. The group thus ‘reaffirm our strong support to significantly reduce the number of maternal, newborn and under-five child deaths as a matter of immediate humanitarian and development concern.’ This led to the announcement of the Muskoka Initiative, which is described as a comprehensive and integrated approach to accelerate progress towards MDGs 4 & 5. The pledge is to mobilize an additional US$5.0 billion over the next five years from governments and foundations. That is over and above the US$4.1 billion annually that is already contributed to international development assistance for maternal, newborn and under-five child health. Canada itself committed $2.85 billion over the five years, and a number of governments together with the Bill and Melinda Gates and UN Foundations committed an additional $2.5 billion.

US$5 billion for maternal, infant and child health

The big question, apart from if the money will actually materialize, is where it will be spent. The Muskoka Initiative highlights key areas of focus:

- Training of medical personnel and establishing stronger health innovation networks.
- Prevention, treatment, care and support with respect to HIV/ AIDS.
• Continued support for polio eradication and the control or elimination of high burden Neglected Tropical Diseases.
• Food security with an emphasis on sustainable agricultural development over three years while remaining committed to ensure emergency food aid.

What about nutrition?

Within its commitment to food security predominantly through agricultural investments, we read that ‘reduced malnutrition is a primary outcome of the Food Security initiative and will contribute to improved maternal and child health.’ Nutrition is also mentioned in the Scope of the Initiative, where it is said that ‘basic nutrition and relevant actions in the field of safe drinking water and sanitation’ are included in the Initiative. So it is clear that although nutrition is mentioned, it is going to require a concerted effort of the global nutrition community to ensure that some of the pledged financial resources come our way!

An Africa footnote

The G8 leaders also met with the Heads of State or Government of Algeria, Egypt, Ethiopia, Malawi, Nigeria, Senegal and South Africa and together reaffirmed their shared commitment to continued collaboration. It was agreed that the attainment of the MDGs is a shared responsibility, that strategies based on mutual accountability are essential going forward, and that greater effort is required by all in order to achieve the MDGs in Africa. The African leaders expressed support for the Maternal, Newborn and Child Health Muskoka Initiative and – mindful of its central importance in development – undertook to explore how to accelerate progress in the implementation of their commitments.

The full G8 Muskoka Declaration can be downloaded from http://g8.gc.ca/g8-summit/summit-documents/g8-muskoka-declaration-recovery-and-new-beginnings/

The Sun is Shining on Nutrition

There is currently a flurry of global activity around ensuring that the nutrition message and the critical role of nutrition in development and achieving the MDGs is heard by global leaders at all levels so as to ensure that nutrition is placed high on the global development agenda and is allocated funds for the scaling up of effective nutrition interventions. The launch of the ‘Scaling up Nutrition: A Framework for Action’ (SUN) document (available on the SIGHT AND LIFE website www.sightandlife.org) has been timely. The fact that is carries the endorsement of more than 100 multilateral, bilateral, academic, and civil society agencies and institutions makes it an exceptionally important advocacy tool. The SUN Framework has been described by many as ‘historic’, as the global nutrition community has for the first time rallied around a common agenda and solutions to the problems of malnutrition. It is designed to be used by a broad range of stakeholders at local, national and regional levels, and spells out what needs to be done to improve nutrition outcomes; what is the level of investment required to scale up effective nutrition actions in priority countries, and what are the key working principles to move this agenda forward.

World Bank-IMF Meeting: A ray of light

The Governments of Canada and Japan, the United States Agency for International Development (USAID), and the World Bank co-hosted a high-level meeting on ‘Scaling-up Nutrition’ during the World Bank-IMF Spring Meetings. Senior members of delegations (including ministers of finance) from countries with the highest malnutrition burden, high-level representatives from civil society organizations, development partners, bilateral donor governments (including G8 members), and the media participated in the meeting which appealed to governments worldwide to invest more in halving the rate of malnutrition (MDG 1c). The primary objective of the meeting was to mobilize buy-in from countries and global development partners on an inclusive approach to country ownership and action for scaling up nutrition investments for sustainable development.
Opening the meeting, Robert B. Zoellick, President of the World Bank, said: “Malnourishment not only means children have to suffer, but it also makes them less productive adults. We need to break the vicious cycle of poverty and malnutrition to give people opportunity and to achieve sustained economic growth. The new multi-partner Framework for Action represents a united call to action for this ‘forgotten MDG.’” The USAID Administrator, Dr. Rajiv Shah, called on the development community to use nutrition outcomes and indicators such as stunting for measuring progress in related sectors such as water and sanitation and agriculture. In a press release, Dr. Shah said: “For too long, nutrition has been separated from agricultural practices and food policy. We must strive to make fortified foods more available and step up proven ways to change women’s young infants’ feeding and caring behavior, where needed, through community-based programs. The approach that we’re working out today marks a turning point in the way we see how agriculture and nutrition policy interact.” Dr. Shah discussed USAID’s Feed the Future strategy, describing it as a comprehensive initiative that targets the causes of hunger and aims to reduce poverty, hunger, and undernutrition at national scale.

With 2010 marking the five-year countdown to achieving the 2015 MDGs and signs that food prices are rising again in developing countries, Dr. David Nabarro, Special Representative of UN Secretary General Ban Ki-moon for Food Security and Nutrition, said: “Food and nutrition security is the prerequisite for a decent and productive life and the achievement of all Millennium Development Goals. It is our collective responsibility to ensure food and nutrition security for all through synergy across the full range of sectors. The SUN Framework has the potential to mobilize all of us behind a smart new approach for vastly better development outcomes.”

A new thought pattern is emerging with a focus on the wider agenda through “nutrition-sensitive investments” in agriculture, social protection, water and sanitation and other sectors that will further help to maximize and sustain the impact of the “nutrition-specific investments”.

Graeme Wheeler, Managing Director at the World Bank, closed the meeting with the comment that “this meeting could not have happened three years ago.” He talked about the huge progress that has been made over the last few years in terms of defining the scale of the problem, building the consensus, and the linkages with other development issues. He ended with the note that “we have the solutions in our hands”, and that there is now “tremendous opportunity” in front of the development community to act at scale to address malnutrition.

Ensuring the SUN continues to shine
Following on from the Washington meeting, an action planning meeting of key nutrition stakeholders was held in Rome, hosted by the WFP. The focus of the discussion was the challenge of moving the SUN framework into action so as not to miss the window of opportunity that exists but might soon be gone. The meeting acknowledged that it is a matter of urgency to develop concrete recommendations for the wider group of SUN stakeholders on how to scale up nutritional outcomes relevant to the realization of the MDGs.

A Task Team was agreed on to develop the necessary recommendations in the form of a SUN Road Map that would be completed by the September 2010 Summit on the Millennium Development Goals. The Road Map will answer the question “how to bring the SUN Framework to life and ensure that it leads to real – and sustained – improvements in Nutrition in the highest burden countries?” It will indicate ways in which developing countries, development partners, businesses and civil society can become more deeply involved in making the SUN Framework operational. It will indicate the political, technical and financial means through which development agencies can support the development and implementation of action plans for scaling up nutrition. It will set out pathways, processes and milestones for this collective work.

In order to ensure that the expertise of as many groupings as possible was harnessed and to speed up the process, it was also agreed that the Task Team would have five working groups that would focus on:

1. Stronger national (country-level) capacities and systems for scaling up nutrition actions;
2. Effective campaigning and advocacy for the nutrition scale-up;
3. Social movements necessary for scaling up nutrition;
4. The sustained engagement of development agencies in support for scaled-up nutritional outcomes, and;
5. The successful and appropriate involvement of commercial enterprises in nutrition-sensitive sustainable development.
The SUN Task Team will be made up of a maximum of four developing country and middle income country governments, up to three civil society organizations, of which one would come from the Southern hemisphere, at least two donor development partners, the World Bank, and one multilateral development bank, the Gates Foundation, and a representative of the business community. David Nabarro, the Special Representative of the UN Secretary-General for Food Security and Nutrition, will chair the Task Team and the Executive-Secretary of the United Nations Standing Committee on Nutrition will serve as resource person.

The Working Groups would be open to any SUN stakeholders who wish to participate, and will most likely be representatives of governments, civil society, the private sector, donor agencies, foundations and the research community. SIGHT AND LIFE will participate in the effective campaigning and advocacy working group.

Speaking on the final day of the meeting, Ms Josette Sheeran, Executive Director of the WFP, said: “Today all nutrition roads lead to Rome. Today is a tipping point. This specialty cause of nutrition is becoming a cause for the world. Food security needs to be turned into food and nutrition security. We can make malnutrition history. Globally we have to create a nutrition movement or a nutrition revolution. We have the possibility to do it – it is within our grasp to give the world’s children a better future. We know what to do and now we need to do it. We have to put aside our differences and have the ‘tribes’ come together. We no longer need a scientific breakthrough, we just need to do it – it is a moral imperative!”

The months leading to the September MDG Summit will be busy as the SUN teams put together the next and most critical road map document. But they are critical for nutrition, as it either claims its vitally important place under the sun or else the sun will set and it will be a long time before we get another chance to show that with the right resources and commitment, nutrition can make a difference.

Feed the Future – The United States’ new focus on agriculture and women, infants and children

“...the United States is leading an effort to reach out to people around the world who are suffering, to provide them immediate assistance and to extend support for food security that will help them lift themselves out of poverty. All of us must join together in this effort, not just because it is right, but because by providing assistance to those countries most in need, we will provide new markets, we will drive the growth of the future that lifts all of us up.” President Barack Obama

The Unites States has launched an initiative known as ‘Feed the Future’ that will see it deliver on its pledged US$3.5 billion over three years. This pledge was made at the 2009 G8 Summit in L’Aquila, Italy, where global leaders responded to the combined effect of underinvestment in agriculture and food security, the steep rise in global food prices, and the economic crisis by committing to “act with the scale and urgency needed to achieve sustainable global food security.” They established a framework for coordinated and comprehensive action among host governments, donors, civil society, the private sector and other stakeholders that centers around country-owned processes and plans to improve food security.

Feed the Future pursues two paths: firstly addressing the root causes of hunger that limit the potential of millions of people; and secondly establishing a lasting foundation for change by aligning US resources with country-owned processes and sustained, multi-stakeholder partnerships. Through their leadership in this initiative, the US hopes to advance global stability and prosperity by improving the most basic of human conditions – the need that families and individuals have for a reliable source of quality food and sufficient resources to access and purchase it.

Focus on agriculture

The Feed the Future initiative will see the US government working with other governments, multilateral institutions, NGOs and private companies to sustainably reduce global hunger and poverty by tackling their root causes and employing proven strategies for achieving large scale and lasting impact. The aim is to accelerate progress toward the poverty and hunger Millennium Development Goal, as measured by:
• Reducing the prevalence of poverty
• Reducing the prevalence of underweight children
To achieve these goals it will:
• Accelerate inclusive agriculture sector growth through improved agricultural productivity, expanded markets and trade and increased economic resilience in vulnerable rural communities;
• Improve nutritional status by increasing access to diverse and quality foods and by strengthening the prevention, identification and treatment of undernutrition.

Focus on women, newborns and children

In addition through the Global Health Initiative the United States will invest $63 billion over six years to help partner countries improve health outcomes through strengthened health systems – with a particular focus on improving the health of women, newborns and children through programs including infectious disease, nutrition, maternal and child health, and safe water. The nutrition goal involves the reduction of child undernutrition by 30 percent across assisted food-insecure countries and will work in conjunction with the Feed the Future Initiative.
Micronutrient Forum 2011 Postponed

Recent communications from the United States Agency for International Development (USAID) have expressed the Agency’s intent to broaden the scope of the Micronutrient Forum in order to more fully represent the comprehensive approach to nutrition promoted under two new US Government initiatives: the Global Health Initiative and the Feed the Future Initiative. This broadened Forum will target content to support implementation of these initiatives and involve a broad set of stakeholders. To adequately prepare for this, USAID has decided to postpone the Senegal meeting originally planned for May 2011 to a date later in 2011 or early 2012.

Since 2005, A2Z, the USAID Micronutrient and Child Blindness Project, has served as the Secretariat for the Micronutrient Forum, which consolidated and expanded upon more than thirty years of successful leadership by the International Vitamin A Consultative Group (IVACG) and the International Nutritional Anemia Consultative Group (INACG). The next proposed Forum meeting will fall beyond the A2Z Project end date. Therefore, the A2Z Project will not be coordinating this next meeting.

The A2Z Project wants to take this opportunity to thank all the organizations, companies, and individuals that contributed to the technical quality of the Micronutrient Forum’s international meetings and technical consultations. Without their commitment, the Micronutrient Forum meetings, as well as previous IVACG and INACG meetings, would not have been as successful as they were.

SIGHT AND LIFE Magazine will keep our readers informed about developments regarding the Micronutrient Forum.

One Person Can Make a Difference

SIGHT AND LIFE is proud to announce that a very special person whom we support on a project in South Africa, Trees Stege, recently received the highest recognition that can be given by the Dutch Queen: she was made a Knight of the Order of Oranje Nassau.

It is an inspiring story... In 1996 Trees and her husband Hennie went to South Africa on holiday. They decided that they did not only want to see the tourist hotspots and as a result spent a few days in a local township where they visited hospitals and children’s homes and looked poverty and the ravages of HIV/AIDS in the face. Little did they know how those few days would change their lives forever! On returning to the Netherlands, they talked about their experience and shared their pictures and started fund raising for some of the projects they had seen. When they were asked to assist with a project to develop a care center hospice for street children with AIDS in Johannesburg, so that the children could die with dignity, they decided they needed to actually be there. They sold up everything and moved to South Africa, where they have been for nine years, doing wonderful work creating and implementing sustainable social entrepreneurial projects designed to improve the quality of life in one of the poorest townships in South Africa – Ivory Park.

Not only did the Steges get the original care center hospice, which accommodates 80 people, up and running in bustling Hillbrow, they then moved to establish a hospice in the Ivory Park Township. This then led to the creation of a daily child care center where hundreds of children, many of them AIDS orphans, are being provided with top-quality day care, a vegetable garden, and a soccer team to engage the youngsters.

Hennie, Trees and their two daughters and grandson.
and keep them off the streets. There is also a soup kitchen for the elderly. In addition, thousands of school children are also now having their vision tested and are receiving affordable glasses at a newly established eye clinic. And there is now a community center to house the eye care clinic, the day care center, the soup kitchen, the library and the after-school study/tutoring center. Of course, this amazing couple have more plans and dreams, and we know that with Trees and Hennie at the helm these will become reality sooner rather than later.

One drop in a pond makes a very big ring

SIGHT AND LIFE Magazine got to ask Trees a few questions to give us some insight into the person behind the award.

Q: Trees, how do you decide where to spend your energy?

A: I believe it’s better to do small things in a big way, and so remain very focused. We also never stay involved with a project for longer than three years and then the community must take the project over and it must be self-sustaining.

Q: What book has been your favorite read?

A: There are many, but they are always about amazing and warm-hearted people – Barack Obama, Nelson Mandela and Desmond Tutu, for example.

Q: What inspires you, and do you have a specific role model or mentor?

A: I find getting away into the South Africa bush is inspiring – just to be still with nature. My greatest role models were my grandparents who, despite being poor, were always there for me and always encouraged me. My husband is also a very special person – he gave me the inspiration and encouragement to study (initially social work, and then I got involved in supervision and counseling) and in order to enable me to do it got involved with the housework and the family.

Q: Tell me a little about your family, Trees.

A: My husband and I have two daughters and three grandchildren in the Netherlands. Recently our eldest grandson finished school and came to South Africa with two friends to work in the community. They are all very involved in and supportive of our work.

SIGHT AND LIFE is proud that we can in our small way assist Trees and Hennie in their work by supplying the multiple micronutrient powder MixMe™, which is used in the meals provided to the children. We wish them continued success in their work at providing so many with the opportunity for a better life.
Spanish Academy for Nutrition and Food Sciences Recognizes Outstanding Achievements

On June 8, 2010, the annual assembly of the Spanish Academy for Nutrition and Food Sciences was held in Madrid, Spain. Noel W Solomons was inducted as a corresponding academic member of the Academy. His formal discourse was entitled Iron: A nutritional two-edged sword: Towards its safe use in all aspects. He received the medallion of membership.

Simultaneously, Dr José Ordovas was also awarded the medallion and named as a corresponding academic member. His speech addressed the possibilities of nutrigenomics, providing an eloquent discourse on the evolution of nutrition. During the ceremony, the following individuals were named honorary academic members: Dr Olga Moreiras, Dr Abel Marín, and Dr José Mataix. Dr Mataix, who passed away in 2008, was designated Honorary President.

Mataix and Varela Awards

In the second part of the ceremony, the Academy presented their Mataix Awards, which take the form of a Diploma plus a bronze sculpture of this Spanish researcher who conducted pioneering studies on olive oil. The recipients were Dr José María Bengoa (Outstanding Research Career), Dr Lluís Serramatjén (Best Nutrition Researcher), the Bilbao City Hall (Best Intervention in the Public Sector), and Alimentaria-Fira de Barcelona (Best Initiative in the Business Sector).

The ceremony closed with the presentation of the second Gregorio Varela Award, which was given by the Spanish Nutrition Foundation, Alimentaria, and the Mediterranean Diet Foundation to Dr José Ordovas.

Independent forum of excellence

In addition, the AEN (Academia Española de Nutrición) awarded prizes of merit for outstanding contributions in Spain during 2009 in distinct areas of nutrition and food technology.

The Spanish Academy of Nutrition and Food Sciences was constituted to serve as an independent forum of excellence within the field of Nutrition in Spain, as well as having a solid commitment to Latin America.

Nutrition – the Forgotten Priority in Development Agenda

A roundtable meeting was held on May 23, 2010, as the pre-conference event at the 10th South East Asia (SEA) Regional Meeting on Epidemiology in Colombo, Sri Lanka. Over 50 scientists and decision-makers from across the region attended the meeting.

The direction of the discussion was as follows:

Although the high rate of malnutrition in the South Asian region has
been brought up and discussed at various forums from time to time, no concrete steps have been taken to recognize the importance of proper nutrition as a prerequisite for economic development.

The burden due to malnutrition in Asia is more than double that of Africa. The Millennium Development Goals (MDGs) to which most South Asian countries are a signatory have set the eradication of poverty and hunger by 2015 as their first priority. However, with just five years to go to the target date for their achievement, and going by the level of achievement so far, it is unlikely that nutrition-related MDGs can be achieved by 2015.

Improving nutrition is central to a country’s development. Understanding that determinants of good nutrition are multifaceted and have variable influences at different stages of the lifecycle is important in order to have appropriate interventions in place.

However, in the development agendas of most South Asian countries little or no emphasis has been given to improving the quality of nutrition as a priority.

In the effort to achieve the MDGs, it is pertinent to ask whether merely improving incomes and providing food security would help effectively to achieve a country’s economic development goals. It is clear that the malnourished would be ill-equipped to contribute effectively towards the development effort and a healthy nation is a vital prerequisite for any country’s development.

At the roundtable, attention was drawn to the need for governments to focus on fulfilling nutritional requirements as a basic human right and improving people’s quality of life, rather than merely striving to achieve the MDGs.

The roundtable discussion was entitled “Reversing Negative Trends in Malnutrition in Asia” and doctors, scientists and members of civil society from five South Asian countries participated in it. The objective of the discussion was to identify 10 priorities common to all South Asian countries, which needed to be addressed speedily via their respective governments. Priority areas included:

• Addressing disparities in income, education, and access to knowledge, with substantial investment in these sectors;

• Accurately targeting evidence-based interventions tailored to meet individual country/regional needs, with effective safety nets in place for the nutritionally vulnerable such as those communities that are displaced and below the poverty line;

• Investment in sustainable and culturally appropriate behavior change communication in health and nutrition and food consumption at a household/community level, based on a healthy lifestyle, in addition to feeding and caring practices for children;

• Extending regional co-operation in exchange for ideas and experience for creative and cost-effective solutions;

• Identifying effective mechanisms to promote a multi-sectoral response, within countries and across the region;

• Promoting constructive public, private, and civil society partnerships for concerted action for maximizing social and cost benefit;

• Strengthening the quality and coverage of healthcare systems overall, taking cognizance of international collaborative research, comprehensive public health programs, and competent human resource for nutrition improvement;

• Focusing on sustainable and evidence-based solutions to combat and control micronutrient malnutrition;

• Given that South Asia is a region prone to emergencies, drawing up regional and national level nutrition contingency plans and mechanisms for inter-country co-operation; and

• Managing nutrition transition effectively as South Asian countries suffer from the double burden of over- and under-nutrition.

According to a statement issued after the roundtable discussion, “Malnutrition and poverty are interrelated through a vicious cycle and countries should not wait for eradication of poverty to address malnutrition. Governments should consider improving nutrition on top of the development agenda.” It is time to cut out the rhetoric and act now.

This statement was sent to the international press via Easypr web. It was also lobbied through the Federation of Asian Nutrition Societies with their respective governments. The meeting was sponsored by DSM Nutritional Products and organized by the Nutrition Society of Sri Lanka and the National Nutrition Alliance Sri Lanka.

Communicated by:
Visakha Tillekeratne
Email: sakhatillekeratne@yahoo.com
Healthy Eyes Activity Book Enlightens Children of Aurangabad, India

Eyes are not only the window of soul but also the doorway of knowledge. They help us understand the wonderful diversified world so we can gain a variety of knowledge and information. Usually, we take our senses for granted until we are forced to negotiate the world without them.

In February 2009, SIGHT AND LIFE and its partners in India launched the Marathi language version of The Healthy Eyes Activity Book to raise awareness of avoidable blindness through eye health promotion in schools. Commonly referred to by its acronym, HEAB, the book was introduced by volunteers committed to educating children in the state of Maharashtra, India, about eye care in their local language.

The Nutrition Improvement Program of India also provided financial support to print 5,000 copies of the Marathi HEAB for distribution to schools in Maharashtra. The HEAB, which was first developed by the International Centre for Eye Health (ICEH) and Sight Savers International, was subsequently adopted and supported by SIGHT AND LIFE for wide distribution. Published in more than 10 languages, with the addition of Marathi, it was created to meet the need for eye health communication specifically targeted at, and accessible to, children.

In 2007, SIGHT AND LIFE and ICEH produced the second edition of the HEAB. The HEAB has proven to be a unique and effective tool for educating children in eye health. SIGHT AND LIFE has supported many educational projects around the world using this book, providing grants for its translation and printing in local languages.

Children are our most precious resource. They are the future and hope of any nation. Vision is a vital sense by which children, or adults, learn about the world around them. Eye disease and nutritional deficiencies compromise an individual’s social development, hampering their ability to process the world around them.

Communicated by:
Kailash Baviskar, Academy of Eye Care Education, Aurangabad, Maharashtra, India
Email: Kailashbaviskar@yahoo.co.in

Bangalore Boston Nutrition Collaborative

Emerging demographic, economic and dietary factors suggest that a large burden of preventable illness is poised to develop in India. In order to design feasible and valid public health interventions to reduce these outcomes, a new generation of Indian nutrition scientists needs to be trained. To address this, the Bangalore Boston Nutrition Collaborative (BBNC) has been established between scientists at St John’s Research Institute in Bangalore and colleagues at Harvard School of Public Health and Tufts University in Boston.

The BBNC aims to build educational infrastructure through mentorship and training of nutrition students at research institutions in Bangalore and Boston. A short course has been established to introduce students to public health research topics through critical evaluation of the scientific literature and exploration of a variety of...
factors that affect nutritional status. The course focuses on training the students in planning research studies from “cell to society”, with its main objectives being:

- Gain substantive knowledge in topics related to public health nutrition research including: clinical nutrition, physiology, biochemistry, molecular nutrition, epidemiology and biostatistics;
- Enhance methodological skills in nutritional, infectious disease, and chronic disease epidemiology, with emphasis on clinical, research and laboratory areas;
- Explore the role of nutritional factors and health outcomes through critical evaluation of the scientific literature and exploration of demographic, epidemiological, biological, social, political and economic determinants;
- Understand evidence available on the Internet, identify the various reliable resources and conduct structured literature searches;
- Gain knowledge in critically evaluating scientific literature and findings from epidemiologic studies on the role of nutrition in the prevention, care and treatment related to key infectious, perinatal and chronic disease outcomes.

The first course ran in January 2010 in Bangalore and of the 150 applicants, 27 were selected. The students were post-graduates from academic institutions, government agencies and non-government organizations. The course was free and a SIGHT AND LIFE donation was used for student accommodation and travel. Feedback was excellent, with 76% of students saying they would “very strongly” recommend the course to others.

A second course is planned for January 2011. For further information, please visit http://www.sjri.res.in.

Communicated by:
Anura Kurpad, St John’s Research Institute, Bangalore, India
Email: akurpad@sjti.res.in

Berlin Policies Against Hunger
VIII Conference Addresses Hunger as a Structural Problem

“The FAO puts the number of hungry people worldwide at 1 billion, yet what is often forgotten is that behind these numbers are real humans and their suffering, making the right to food one of the most frequently violated human rights. This makes the battle against hunger and malnutrition one of the most important challenges of the international community.”

These were the words of Ilse Aigner, the German Federal Minister of Food, Agriculture and Consumer Protection, in her opening address to delegates attending the Berlin Policies Against Hunger VIII Conference, hosted by the German government. The meeting focussed on the need to address global governance around food and nutrition security in order to adequately address the problem of global hunger. Its overall aim was to support the realization of the human right to food by ensuring intense dialogue and exchange among international policy makers, experts, and civil society groups and, consequently, to develop concrete policy recommendations.
The indivisibility of human rights

Keynote speaker Prof. Asbjørn Eide, from the Norwegian Centre for Human Rights, highlighted the indivisibility of human rights: both civil and political rights as well as economic, social, and cultural rights. He made it clear that states need first to respect the individual’s right to food by respecting their own solutions to their livelihood, such as respecting smallholders’ and indigenous peoples’ agricultural lands. Secondly, states must protect individuals or communities from discrimination and harmful interference by others. And thirdly, states must fulfil the right to food by actively providing assistance to people. He also stressed that the special attention that must be given to the most vulnerable is inherent to human rights. Prof Eide was of the opinion that the problem of hunger is a structural one and thus that addressing hunger is a much wider issue than simply producing enough food for all. It requires ensuring that adequate food is physically and economically accessible to all.

"Thus, critical issues and measures with regard to all aspects of the food system, including the production, processing, distribution, marketing, and consumption of safe food, as well as parallel measures in the fields of health, education, employment, and social security must be addressed. This can only be done through a human rights-based approach," Prof Eide said.

The delegates divided into five groups, each of which discussed a specific topic and then presented recommendations to the meeting. The five topics addressed access to natural resources as a condition of the right to food; experiences with the national implementation of the right to food guidelines; the right to food as a criteria for coherent international policies; consideration of the right to food in strategies for solving the food crisis; and the strengthening of the enforceability of the right to food.

The conference also addressed the urgent need for governance of food and nutrition security. It was felt that the Committee on Food Security (CFS) could serve as the global authority. The good news is that the CFS will have a meeting in October to release and discuss its new strategy. Ms Aigner stressed that "improved cooperation between stakeholders’ institutions is also urgently required. And there is one thing we must remember: we need a strong UN Committee on Nutrition. This has my full support. And we need close coordination with the reformed Committee on World Food Security. The reforms to the CFS have opened the doors for this.”

Food security is a public good

In his closing address, UN Special Rapporteur Olivier De Schutter re-emphasised that hunger is a structural problem and therefore demands structural changes, with corresponding consequences for institutional development and food system governance. Food security for all must be considered as a global public good. It must also be made a central focus of global governance, as well as of national development, taking into account the fact that the main problem is often not insufficient food production but rather a lack of access to this food. Thus states should, as a matter of priority, revise policies and practices to guarantee that the food-insecure and vulnerable groups in their society can feed themselves. For this to become a reality, all national and international policies should be guided by a human rights-based approach, to guarantee that they respect, protect, and fulfil the progressive realization of the right to adequate food.

The conference clearly showed that, in order to ensure the full realization of this right for all, the commitment and cooperation of an enormous number of people, states, international institutions, civil society, media, academia, and all other interested stakeholders is necessary.

A comprehensive report from the conference which includes a summary of each group’s discussions, as well as their recommendations, comments from key delegates, and a comprehensive and valuable list of resources and links, is available from http://www.policies-against-hunger.de/fileadmin/redaktion/dokumente/DokumentationPaH-VII.pdf
Throughout time, food has been used in healing. In recent decades, food and medicine have taken divergent paths. Consequently, the healing potential of food is underutilized in modern medicine. After decades of journeying on different paths, food and medicine are now located far from each other in the health care system. The current gap between food and medicine is illustrated in our terminology, which considers food and nutrients to be alternative and complementary to modern medicine.

Food and nutrients are in fact the original medicine. They are the molecules of biochemistry, physiology, and immunology, and the shoulders on which modern medicine stands. This textbook was developed to help physicians reunite food and medicine in clinical practice. With food deviating from what the human body was designed to eat, with the population’s health challenged, and with emerging technologies creating new clinical tools, this is a time like no other to restore food and nutrients to their vital clinical roles.

Optimal nutrition as understood by recent advances in molecular science has the potential to unfetter patients bound by chronic disease. Once disease is present, dietary counseling may be insufficient. Treatment may require diagnosing associated medical conditions, screening genetic factors, minimizing nutrient-drug interactions, ordering blood tests, referring patients to appropriate specialists, and modifying prescriptions.

In other words, this book is not intended to add another responsibility to ever-shrinking office visits. It is about the practice of medicine. Each chapter was written by medical doctors for medical doctors who are on the front line of disease management. It is written for doctors who want the latest treatment approaches that benefit today’s patients.

For more information, please visit www.crcpress.com

Global Crises, Global Solutions

This book addresses the rational rather than the fashionable. It is fashionable to declare that we want to tackle every major world problem. It is also a great thing to say. Unfortunately, it is not rational. We have limited resources. A dollar spent in one place cannot be spent elsewhere. A few big issues get the most airtime, attention and money.

The vogue issues of this decade are terrorism and global warming. They dominate some sections of the media, but also...
attract billions of dollars and use vast amounts of political capital.

Terrorism and climate change are both serious problems that deserve attention. However, this book focuses on other threats that we hear less about but also deserve attention. It considers the Copenhagen Consensus exercise, which started as a simple, but untested, idea of applying economic principles to prioritize global opportunities. In 2004, the process was carried out for the very first time. The result was a prioritized list of opportunities to solve, or ameliorate, some of the world’s greatest problems, compiled by some of the world’s top economists. It attracted attention from all over the world.

Since 2004, of course, knowledge about the world’s many problems has increased. New and smarter solutions have been proposed. That is why the Copenhagen Consensus was always designed as a global project that would be updated every four years. Time and again, the new research presented in this book shows we have the knowledge to do tremendous amounts of good in each of the biggest world challenges. The hurdle is often getting the right resources to the right place.

Copenhagen Consensus 2008 started with one big question: If we had an extra $75 billion to put to good use, which problems would we solve first? This book presents some of the solutions recommended by specialist experts in each field. It offers a range of fresh thinking and new approaches and helps to undermine one of the many excuses that policy makers have used for not investing more in global aid and development projects. It provides sorely needed information about where money can achieve the most good.

For the readers of SIGHT AND LIFE Magazine it is worth mentioning that the Copenhagen Consensus concluded that out of 30 specific solutions to combat some of the world’s most pressing problems, addressing micronutrient deficiency – otherwise known as hidden hunger – among children would be the single best investment. The return on investment for such programs is estimated at US$ 17 for every US$ 1.

For more information, please visit www.cambridge.org

Scaling Up Nutrition: What Will It Cost?
The World Bank 2009

This report is a plea for help from The World Bank calling for action against the malnutrition that affects 360 million children in 36 countries.

“They stand as a silent rebuke to us: millions of young children around the world who are sick, dying, wasted, or stunted by inadequate nutrition. Even in times of abundance, they wait at the end of the line for their share. Now, as food, fuel, and financial crises continue to spread hardship across rich and poor nations alike, they are the most vulnerable.”

Graeme Wheeler, Managing Director, World Bank

Undernutrition imposes a staggering cost worldwide, both in human and economic terms. It is responsible for the deaths of more than 3.5 million children each year (more than one-third of all deaths among children under five) and the loss of billions of dollars in forgone productivity and avoidable health care spending. Individuals lose more than 10 percent of lifetime earnings, and many countries lose at least 2–3 percent of their gross domestic product to undernutrition. The current economic crisis and its potential impact on the poor make investing in child nutrition more urgently necessary than ever to protect and strengthen human capital in the most vulnerable developing countries.

What resources are needed to fight undernutrition? This report offers a preliminary answer by estimating the cost of scaling up a minimal package of 13 proven nutrition interventions from current coverage levels to full coverage of the target populations in the 36 countries with the highest burden of undernutrition.

For more information, please visit www.worldbank.org
Research from the Institute of Nutrition of Central America and Panama (INCAP) 1949–1999

The project, which summarizes the early research on many different aspects of health and society by the Institute of Nutrition of Central America and Panama (INCAP) starting in the early 1950s, was begun ten years ago. The research described has made significant contributions to the modern recognition of the role of nutrition in both infectious and chronic disease.

The special issue was developed because INCAP was pioneering work in many different fields of nutrition at a time when there was very little nutrition research in developing countries. Much of its early research on kwashiorkor and marasmus, nutrition and infection, energy, protein, and amino acid requirements, low cost protein rich foods, diet and atherosclerosis, endemic goiter, growth and development, malnutrition and cognitive behavior and social anthropology cannot be duplicated because conditions have changed. But the INCAP research findings are still relevant to many developing countries that do not have the facilities or resources to find solutions to their nutrition and health problems.

The purpose of the special issue is to make conveniently available to nutrition and health workers worldwide the most important published research findings of INCAP from its founding in 1949 to, in some cases, the end of the 20th century.

In the early years, we never imagined how much INCAP’s research findings and advanced training capacity would contribute to Latin America and the developing world. The contributions of professional services from INCAP staff members, through positions in Latin America, the United States, and Europe and in international organizations dealing with regional and worldwide nutritional problems, are extensive.

Each of the chapters summarizes the research in a different area, with some unavoidable overlap, and is written by the leaders of the respective research divisions or projects.

For further information email the editor nscrimshaw@inffoundation.org.
Colophon

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Editorial team: Jee Rah,
Anne-Catherine Frey,
Svenia Sayer-Ruehmann,
Jane Badham

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SIGHT AND LIFE
Dr Klaus Kraemer
PO Box 2116
4002 Basel, Switzerland
Phone: +41 61 815 8756
Fax: +41 61 815 8190
Email: info@sightandlife.org
www.sightandlife.org

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