



REPORT 2017

Nestlé Foundation

for the study of problems of nutrition in the world



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“Live as if you were to die tomorrow. Learn as if you were to live forever.”

Mahatma Gandhi



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52 YEARS OF RESEARCH AND CAPACITY BUILDING

FOCUSED AND GLOBAL

MATCHING POLICIES TO NEEDS

HIGH-IMPACT – RESEARCH PROJECTS TO REDUCE MALNUTRITION

INNOVATIVE – FOR SUCCESS

CAPACITY BUILDING – AS A BASIS FOR IMPROVEMENT

SUSTAINABILITY – A KEY MISSION

ENDURABLE NUTRITION – THE PRESCRIPTION FOR SUCCESS

PUBLIC HEALTH – ORIENTATED

THE FOUNDATION AT A GLANCE

EVIDENCE-BASED – PROACTIVITY

PARTNERSHIP – FOR LONG-TERM SUCCESS

SOLUTION – ORIENTED ACTION RESEARCH

enLINK-ing FOR A BETTER WORLD



CAPACITY BUILDING



enLINK-ing FOR A BETTER WORLD



PUBLIC HEALTH ORIENTATED

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PRESIDENT'S MESSAGE

"Capacity building right now is arguably the most important investment the nonprofit sector can make."

Paul Light

In this 2017 Annual Report, the Vision section articles address questions as important as capacity building, evidence-based nutrition, urbanization and food security, management of food demand, and implementation of nutritional interventions.

Capacity building is a long-standing priority at the Nestlé Foundation for the Study of Problems of Nutrition in the World. There are many definitions that have been proposed for capacity building. At

the Nestlé Foundation, "capacity building" refers to intentional and purpose-driven efforts to strengthen the education and expertise of indigenous researchers in the field of nutrition to improve their performance in solving nutritional problems in Low- and Middle-Income Countries (LMICs). This may also be associated with helping institutions to better understand the problems of nutrition in local populations and to find customized solutions. By strengthening the human and institutional capacities in LMICs, the Foundation promotes the creation of an environment conducive to sustainable development.

The Foundation strives to strengthen the indigenous capacities in a context where the pervasive belief is

often that foreigners are always more knowledgeable and more experienced than local researchers. The issue can be touchy in countries which were colonized by the West or North. Although there is no question that the less-developed countries need help from more-advanced countries in many fields of science, including nutrition, calling on experts from the West or North whenever there is a problem indicates that a colonial mentality still persists in such countries. Time has come to also exchange resources, technologies, and knowledge between developing countries themselves, sometimes regrouped under the term "countries of the Global South".

It is very encouraging to note that there are plenty of research projects conducted in developing countries addressing problems of malnutrition, often targeting, and rightly so, the most vulnerable members of the local populations, namely children and women. These projects increasingly involve indigenous researchers, as experience has shown that development efforts that do not take into account local technologies, local knowledge systems and the local environment do not generally achieve the desired goal of sustainability. When this is done, though, valuable results can be obtained and published in reputed journals. On the contrary, when the role of indigenous researchers in projects with researchers from developed countries is limited to performing the fieldwork to collect data that are analyzed elsewhere, the benefit for the local researchers is marginal. Noticeably, there is still a significant amount of mainstream and "me too" research which does not address the nutritional problems affecting populations with the necessary originality. Therefore, it is legitimate to ask what the impact of this research eventually is. Unfortunately, too often the answer is simply "not much"! One important reason is that implementation of the knowledge newly acquired by these studies remains difficult or, worse, is largely neglected. Encouragingly, this conclusion is not general. In Rwanda, a country I happen to know well, implementation of medical knowledge and technological advances has transformed the health sector under the leadership of Dr. Agnes Binagwaho, a paediatrician and Rwanda's Minister of Health from 2011 to 2016. The implementation strategy applied, in combination with the willingness to reach also the poorest and the geographically isolated, are the keys to this success. In this country, 45,000 community health workers have been trained who regularly reach any home in the country and can contact doctors whenever needed through cell phones. Similar implementation strategies should be applied to the nutritional field, and would enjoy guaranteed success if supported by an organizational structure for the common good, including community leaders, community nutrition workers, women, and a minimum transport capacity.

Not least, implementation has to be evidence-based, a notion still to be promoted in the nutrition field. What is the nutrition problem to be solved? What are its causes? Are the objectives focused on the problem and its causes? Answering these questions will avoid wasting money and time on something that is not sufficiently understood.

More than ever, capacity building remains both a noble challenge and the answer in face of the extraordinary uncertainty affecting the future of many countries.



Walter Wahli



One of the Foundation's main aims is the transfer of scientific and technological knowledge to low-income countries. The Foundation advances nutritional science both by supporting nutrition research projects in established institutes and universities and by giving focused support to existing nutrition schools and educational programs. To further fulfil the mandate of the Council and also encourage sustainable improvement in nutrition, a proactive, strategic area of activities was introduced in 2004: the enLINK Initiative. This encompasses a set of interrelated efforts.

PROJECTS INITIATED BY THE FOUNDATION

THE enLINK INITIATIVE

- Promoting specific research questions
- Promoting access to information
 - The enLink library
- Nestlé Foundation Research for Development program (NF-R4D)



THE enLINK INITIATIVE

Sustainability and public-health relevance have been and will remain key aspects for all activities of the Foundation. Research projects need to result in short- and long-term public-health implementation. Knowledge and know-how have to be sustainable at all levels of the population, meaning that the knowledge has to be implemented and become part of daily life. Knowledge has to trickle down to the population.

The vast experience of the Foundation's Council members as well as the Foundation's past activities led to the creation of the **enLINK Initiative** in 2004, a project which illustrates the proactivity of the Foundation regarding its core issues.

This initiative focuses on information transfer in the area of nutrition and malnutrition as well as on the resolution of specific research questions and their implementation at the public-health level. The core competence and activity of the Foundation is the support of nutrition research in low-income countries. The enLINK initiative is an add-on to our key activities to improve the research capacity.

The name enLINK comes from the old English verb "to enlink", meaning "to chain together" or "to connect, as by links". The analysis of the semantic relations of "enlink" reveals related words which illustrate our central concepts and aims: to connect, to join, to associate, to unite, to tie, to conjoin.

Our mission is to link and join cultures; to associate and conjoin institutions and people locally to study and diminish the problems of malnutrition globally.

Malnutrition can only be solved by "enlinking"—connecting—different strategies and approaches. Malnutrition has to be addressed universally by joint strategies which address many levels, looking at the level of medical issues (such as infection) and hygiene

(such as water quality), proposing changes at the level of agriculture as well as in the society at large, and, last but not least, working to improve the level of education and information.

The enLINK Initiative has five main levels:

1. **exploration in nutrition** – building practical research capacity: This is the main purpose and aim of the Foundation.
2. **education in nutrition**: Also this level of the enLINK initiative implies the creation of research-based evidence and subsequent transfer of the knowledge to the population.
3. **the enLINK library**: At present, after having shipped 217 library trunks to 34 countries, only digital content is provided free of charge in the enLINK digital library.
4. **endurable nutrition**: All activities should be implemented and sustainable.
5. **Nestlé Foundation Research for Development (NF-R4D) initiative**: Sustainable, targeted, concerted support of young researchers and their institutions.

The digital enLINK library is currently offering free full-text access to a few nutrition journals and more than 39 e-books—many of them indispensable classic textbooks. The library is accessible free of charge to registered users who all receive a personal password—registration is also free as long as the applicant comes from a low-income country. The library is continuously updated and adapted to specific needs and in response to user feedback. Evidence and content which make it



“Don’t find fault.
Find a remedy.”
Henry Ford



into textbooks are usually more practice-related than the research knowledge from latest findings which is published in research journals. Therefore the weight of the library lies more in the e-textbook section to assure a good basic knowledge transfer as well as knowledge accessibility. Despite all the advances in information technology, books and printed materials will remain indispensable.

The approach of the Foundation in the enLINK initiative reflects the need for multidimensionality to solve the problems of under- and malnutrition.



THE NEW enLINK INITIATIVE

NF-R4D: RESEARCH FOR DEVELOPMENT

The Nestlé Foundation has been a Research Foundation since its very first days of activity at the “Centre d’Etude d’Adipodoumé” in the Ivory Coast (1). The Foundation Council recognized already at that time that research “holds the same promise for health, a promise that we have seen fulfilled with the development of new tools such as antibiotics for the treatment of disease, vaccines for its prevention, and insecticides for controlling the vectors that transmit it” (2). This quote contains a key concept: the research should be at the public-health level, addressing local health and nutrition problems, and less at the level of purely academic research questions.

The research culture and historic engagement in the South is quite different than in the North. One of the Council’s aims is to develop and maintain a sustainable local research capacity: the research idea has to be generated locally, addressing a local problem, and the research has to be done by local researchers and collaborators. However, there is a research leadership gap in African institutions and the pipeline of young researchers is not well established; indeed it is often non-existent. It is recognized that building local research capacity and closing the leadership gap (3) optimally requires a three-partner commitment between the donor, the recipient and the hosting institution. To meet this challenge the Foundation is establishing a new funding scheme, the **Nestlé Foundation Research for Development grant (NF-R4D)**.

Basically, there are two categories of applicants for a **NF-R4D** grant:

1) Young investigators who have already completed their training at the doctoral level, and who have 3-10 years of post-graduate experience, with publications in peer-reviewed scientific journals.

While stays abroad as part of continuing education during this post-graduate period are acceptable, the individual’s career must clearly demonstrate his/her commitment to the home country as the research location.

2) Pre-doctoral students who require partial support to complete their PhD in a recognized foreign institution (which could be in a developed or developing country).

A first call for the **NF-R4D** grant program was made in Spring 2017 and many letters of intent were received. After an internal and external review process, six applicants have been invited to submit a full **NF-R4D** grant proposal. The council is convinced that the **NF-R4D** grant program will improve the leadership and capacity gap in many institutions and might represent a starting point for sustainable local nutrition research endeavors and promote independent innovative nutrition research communities in low-income countries. This approach is highly relevant since researchers from these regions will ask research questions on issues to be best solved in their home country (4).





THE enLINK DIGITAL LIBRARY

THE DIGITAL enLINK LIBRARY

Also during 2017 the digital enLINK library remained an appreciated source of information for many users in low-income countries. In terms of the number of books offered (at present 38 e-books), the library remained stable. There are only a few journals available and their usage is less important than that of the books. The number of registered users continued to increase (by now over 500 users), and use of the library has remained stable. The latter trend has to be observed closely. It is unclear whether this is only a reflection of the observed levelling off trend in scientific reading habits (1). In the modern world there are many information sources available and a quick check in Wikipedia is obviously faster than searching for an answer in a textbook.

The textbook section in the enLINK library should assist students and young researchers in the specific field of nutrition to acquire basic knowledge, i.e. the established textbook knowledge, to build on in their future work. Only a good basic knowledge will allow successful public-health relevant nutrition research. Much of today's research will never make it into a textbook and thus for students a blended reading approach which combines textbooks and research papers is most likely the best approach. The enLINK library offers this blended approach. Reading habits and skills are developed early in life and then eventually perfected during university studies. The enLINK library is a welcomed tool to cultivate effective reading habits early in one's career.

enLINK user statistics (as of 31 December 2017):

- 510 registered users
- Registrations from over 50 countries
- Regular access from users living in **Nigeria, Ghana, Kenya, Ethiopia, Burkina Faso, Uganda, Indonesia, Sudan, Vietnam**
- Most frequently accessed journals:
Journal of Paediatric Gastroenterology & Nutrition
Nutrition Today
- Most frequently accessed books:
Nutrition in Clinical Practice
Essentials in Human Nutrition
Modern Nutrition in Health and Disease
Oxford Handbook of Nutrition and Dietetics

Anyone from a low-income country can apply to become a registered user. Detailed registration information is available at www.enlink.org
Registration and use of the enLINK library are both free of charge.



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OTHER ACTIVITIES

50TH ANNIVERSARY SYMPOSIUM
OF THE NESTLÉ FOUNDATION

NEW RESEARCH PROJECTS

INSTITUTIONAL SUPPORT

OTHER CAPACITY-BUILDING ACTIVITIES



50TH ANNIVERSARY SYMPOSIUM

50 YEARS OF NUTRITION RESEARCH SUPPORT IN LOW-INCOME COUNTRIES: ACHIEVEMENTS AND NEEDS

The Foundation organized a 50th-anniversary symposium entitled “50 years of Nutrition Research Support in Low-Income Countries: Achievements and Needs” as part of the IUNS 21st ICN International Nutrition Congress in Buenos Aires.

At the symposium, representative research projects from all continents as well as topics around capacity building were presented and discussed in a critical, constructive and proactive manner. Importantly, the symposium was part of the usual main scientific program of the Congress, which reflects the appreciation, as well as the acceptance and key role, of the Foundation in the eyes of the international nutrition community. The Foundation is by any measure an internationally appreciated and valued research Foundation.

This year’s ICN Congress was under the motto From Sciences to Nutrition Security. This motto is in good agreement with the activities of the Foundation during the last 50 years. After the official symposium opening by Prof. Walter Wahli, the President of the Foundation, Prof. Paolo M. Suter set the stage for the subsequent talks and discussion: the history, aims and strategy of the Foundation were recalled in a short “tour d’horizon”. The Foundation’s approach to unconditional awarding of grants is globally rather unique and was well reflected in the talks and lively discussion of the symposium.

Prof. Nelly M. Zavaleta, MD (Peru) presented data from several long-term follow-up studies on the effect

of maternal zinc supplementation during pregnancy on cognition of the offspring. Prof. Zavaleta summarized the effects of zinc supplementation during pregnancy at 4.5- and 14-years follow-up: at both time-points persistent effects on child neurobehavioral development (e.g., lower mean heart rate, greater vagal tone) were observed. It is interesting to note that no differences were detected in child cognitive, social or behavioral development. However, it was shown that zinc supplementation during pregnancy had an effect on autonomic nervous system function in early life, which might lead to health differences in the long term, including modulation of the stress response patterns in later life and maybe even adulthood. It has been suggested that differences in autonomic function might also have implications in the pathogenesis of chronic diseases. To our knowledge these are the longest follow-up studies around zinc supplementation and child health.

Prof. Helen Ndiku from Kenya presented a multistep study for the reintroduction of pearl millet to Africa: this basic study moved more or less from “farm to fork”: Initially the team performed acceptability studies, then agricultural and storage aspects were examined and finally effects on child growth and health were evaluated. In the last phase of the study, the selected populations planted the millet themselves and kept seeds for the next season. In several studies the efficiency and efficacy of pearl millet vs. maize was tested and the results suggest that children supplemented with pearl millet attained better nutritional parameters compared to their maize-supplemented counterparts. Apparently the farmers favored millet over maize—as did the mothers. An interesting aspect was that the elderly in the study region remembered millet very well since

they grew up with a millet-based diet—well before the displacement of millet by maize. Dr. Ndiku raises the provocative—but evidence-based—question, whether it would be time for millet to replace maize. She says that she will fight for that aim. Dr. Ndiku’s study is a convincing example of longer-term, highly sustainable, food-based research with a potential global impact which was supported by the Foundation. In view of the characteristics of millet it is conceivable that pearl millet will “return” to Africa and play a more central role in the food supply.

Prof. Umi Fahmida (Indonesia), also a successful alumna and multiple grant recipient, had to cancel her participation at the Symposium at the last minute. Her research results deal with the role of an ideal food-based approach to improve nutrition. Most of her Foundation-supported studies used the linear programming approach, an underused but very efficient and successful strategy.

Another highlight of the Foundation’s symposium was the talk by Prof. Anna Lartey, the President of IUNS and Director of Nutrition at the FAO in Rome (Italy). Prof. Lartey, also an alumna of the Foundation, stressed the importance that the many commitments

for Africa from all kinds of institutions and individuals must be translated into actions. Based on her own experience she emphasized that any attempts to address malnutrition in Africa would not be effective if efforts are not made to invest more in research. The unique nutritional problems in sub-Saharan Africa call for effective research to identify interventions that fit the local context and situation. Unfortunately, the current research environment is in many places in Africa not conducive to effective research. A recent survey among African researchers identified the lack of recognition by policy makers of the relevance of nutrition research, absence of nutrition research priorities, low local capacity, poor infrastructure and last but not least inadequate funding. As a result, the research agenda is determined by donors and sponsors not too familiar with the real nutrition problems of the Africans. The food systems in most sub-Saharan countries are changing at a very fast pace; traditional diets rich in whole grains, legumes, fruits and vegetables are being replaced by highly processed foods. Until local African researchers and governments take charge of the nutrition research agenda, the significant research funding channeled into Africa will not lead to the expected impact of improving the malnutrition situation on the continent. It is more than timely that African researchers position

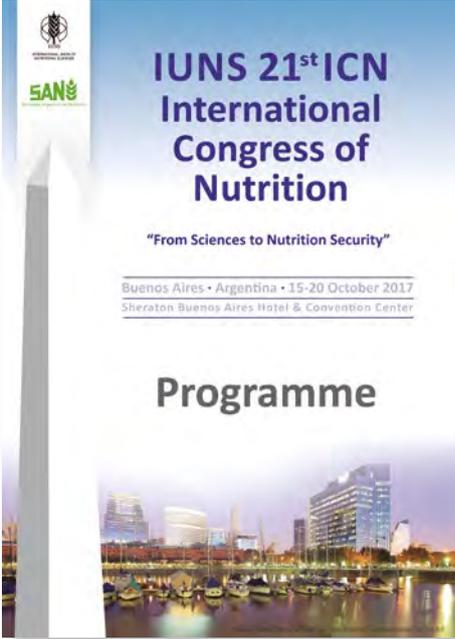
IUNS 21st ICN International Congress of Nutrition

15-20 October 2017
Sheraton Buenos Aires Hotel & Convention Center
Buenos Aires, Argentina

Wednesday, Oct. 18 Scientific Schedule

MORNING	8:00-10:00	10:00-10:30	10:30-11:15	11:30-13:30	13:30-14:30
San Telmo Track 3	144/44 - Physical Activity and Health: new knowledge in research and technologies International Life Sciences Institute (ILSI) (USA)			144/162 - Preventing Childhood Obesity in Latin America: building the evidence base for effective policies and programs National Institutes of Health / Fogarty International Center (USA)	
Libertador C Track 1	144/73 - 50 Years of Nutrition Research Support in Low Income Countries: achievements and needs Nestlé Foundation for the Study of Problems of Nutrition in the World (Switzerland)			144/1017 - Oxygen: a neglected nutrient The Nutrition Society (UK & Ireland)	
Libertador B Track 3	144/103 - Diet, Nutrition, Physical Activity and Cancer: towards new... World Cancer R...				
Libertador A Track 2	144/78 - Ob Feeding Practice International Ato				
La Pampa Track 4	144/133 - Co Obese Patients. Paraguayan Societ				
Catalinas Track 6	144/127 - Funct pounds on the Man Centre for Nutrition and Ciberobn, Carlos				
Retiro C Track 8	144/94 - Food Aid for preventing a Tufts University, Fried Science and Policy (US				
Retiro B Track 7	144/6 - Indigenous biodiversity and food IUNS Task Force - Tradit Cultural Food and Nutri				
Retiro A Track 5	144/147 - The Impc Supporting Health In a Laboratory of Nutrition S Life and Environmental St				
	144/114 - New Topic				

Scientific Symposium: 144/73 - 50 Years of Nutrition Research Support in Low Income Countries: achievements and needs
Room 2 - Libertador C
Track 1: Advances in Nutrition Research
Organized by: Nestlé Foundation for the Study of Problems of Nutrition in the World (Switzerland)
Chairs:
Prof. Walter Wahl
Nestlé Foundation, Lausanne, Switzerland.
Prof. Benjamin Caballero
Bloomberg School of Public Health, Johns Hopkins University, Maryland, USA.
- The Nestlé Foundation 50th Anniversary
Speaker:
Prof. Paolo M. Suter
Nestlé Foundation, Lausanne, Switzerland.
- Zinc and Cognition: The need for long term follow up studies
Speaker:
Prof. Nelly Mercedes Zavaleta-Pimentel
National Center of Food and Nutrition at NIH/MOH, Lima, Peru.
- Re-introduction of Millet in Africa
Speaker:
Prof. Helen Ndiku
University of Eastern Africa, Baraton (UEAB), School of Health Sciences, Eldoret, Kenya.
- Improving nutrition by linear programming
Speaker:
Prof. Umi Fahmida
SEAMED RECFON, University of Indonesia, Jakarta, Indonesia.
- The needs for successful research in Africa
Speaker:
Prof. Anna Lartey
President of the International Union of Nutritional Sciences (IUNS), Director of Nutrition at the Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.
- The future of young African nutrition researchers
Speaker:
Dr. Joseph Ashong
Coordinator AGSNet University Ghana, Ghana.



themselves on center stage to really address the nutritional problems of Africa in a local and sustainable manner.

There is actually already a great deal of nutrition research capacity in Africa available; however, upon closer examination it becomes clear that it is hardly acknowledged and widely underused. Where are the young African researchers? This is the longstanding key question to the more than 300 members of the African Graduate Student Network (AGSNet). The AGSNet was founded in 2002 by a group of motivated and farsighted African nutrition students with the aim to provide a sustainable platform to promote nutrition research and networking on the African continent. Dr. Aaron Christian Kobina (Ghana) presented the AGSNet in his talk. He identified—as Dr. Joseph Ashong (Coordinator AGSNet, Univesity Ghana) wrote in his abstract—forgotten facts which hinder further development: “unfortunately, donors and funding agencies contribute to ‘embolden’ the ‘system’ by funding proposals, travel grants and fellowships of the ‘known’ faces, who are mostly the older generation to the neglect of the young African. Another major obstacle facing the young African is the non-availability of opportunities such as localized funding opportunities. Most funding opportunities are from outside the continent with their attached conditionality, which limits the young African to explore in his quest to find solutions to the malnutrition problem. It is high time African leaders, philanthropists and other stakeholders invest substantially in research funding to encourage the

young African to explore in terms of research to the benefit of the continent.” Maybe it is time to reposition and empower the more than 300 young AGSNet members on the nutrition-research map of Africa; that would not only be timely but much-needed, as several of the conference attendees mentioned.

Overall the event was a well-received, successful, well-attended symposium. It provided an excellent forum for discussion of the Foundation’s achievements and especially also of the needs for better nutrition research in the interest of local populations. It is very encouraging for the Foundation that many of its grant recipients (“alumni of the Foundation”) are engaged either at local Universities, Ministries of Health, Public Health Institutes or in international organizations, such as UNICEF or the International Potato Center (CIP), to mention just two. The many alumni carry our philosophy into these organizations and it can be hoped that the Foundation’s spirit as well as approach and enthusiasm will continue to catch fire in these organizations.







VITAMIN A

COMPLEMENTARY FEEDING

AFLATOXIN

NEW RESEARCH PROJECTS

EDIBLE INSECTS

MALNUTRITION AND BRAIN FUNCTION

NUTRITION & BIRTH OUTCOMES

VITAMIN A

Improving vitamin-A intake in northern Cameroon through nutrition education on food habits

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COLTECH
University of Bamenda
Bambili, NWR Cameroon

USD 18,100

Vitamin-A Deficiency (VAD) is a public-health problem in many developing countries, affecting mostly preschool children. In Cameroon the situation is alarming, affecting over 60% in the extreme north region. A large section of this population depends on staple foods as their primary source of nutrients. Staple foods consumed in this region include the white varieties of maize, sorghum and millet, which are poor in provitamin-A carotenoids, as opposed to the vitamin-A-rich varieties of maize popularly known in the southern regions of Cameroon. In order to add to efforts to use staple foods as the most sustainable means to alleviate VAD, the effect of nutrition education of the population of two villages in this region will be evaluated. A community-based nutrition education intervention with 200 children will be undertaken. Intervention will include training and mobilizing of four village nutrition educators who will give two months of regular nutrition education and counseling on the use of vitamin-A-rich staples (orange flesh maize, yellow sweet potatoes, yellow sorghum etc.) to the households of these children. It is hypothesized that periodic supplementation of their diets with these staples and the provision of planting seeds will boost vitamin-A nutriture. The status of children before and a year later will be determined by a Modified Relative Dose Response test. Clinical tests, anthropometric measurements and questionnaires will be used to determine the effect of changing the food habits, as well as other health and socioeconomic factors, on their vitamin-A status. Results of this study will provide information on the effect on vitamin-A status of nutrition education on changing food habits in favor of vitamin-A-rich staples. Furthermore it will expose other health and socioeconomic factors that affect the intake of provitamin-A carotenoids.

COMPLEMENTARY FEEDING

Designing improved complementary feeding for infant and young children from locally available foods in rural western Ethiopia

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and

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Nekemte, Ethiopia

USD 20,000

In Ethiopia, complementary foods are mainly prepared from plant-based cereal grain, including sorghum, barley, maize, and wheat. However, these are deficient in essential nutrients that are crucial for physical and cognitive development and they are also rich in starch, increasing the viscosity of the complementary foods, which will affect the amount of food uptake. Therefore, it is essential that the potential of other foods which are locally available in the country should be investigated as complements to observed nutritional gaps. Food sources like teff (*Eragrostis Tef*), okra (*Abelmoschus esculentus*), enset (*Ensete ventricosum*), yam (*Dioscorea abyssinica*), anchote (*Coccinia abyssinica*) and other locally available foods like sweet potato, soybean, pea, bean, and chickpea are good examples due to their impact on infants and young children. There are also many potential locally available foodstuffs, which are traditional and native to Ethiopia but not used as complementary foods. The aim of this study is to improve the nutritional status of infants and young children by introducing well-designed nutritious and safe complementary foods from affordable and locally available food items in rural Ethiopia. Initially the study will assess the knowledge, perceptions and practices of mothers/caregivers about complementary foods in the study area. The nutritional status and associated factors of children aged 6-23 months in the study area will be assessed. Further, major food items used in the community, along with the method of preparation, dosing and feeding, will be identified. The compositions, adequacy and safety of existing food items will be determined. Based on this information a safe and nutritious complementary food from locally available food items will be developed. The design of the new complementary foods will be assisted by the linear programming approach to meet the standard.

AFLATOXIN

Development of a bio-control approach for mitigation of aflatoxin in groundnuts using atoxigenic strains of *Aspergillus* spp in Tanzania

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USD 25,470

The multiple uses of the groundnut plant (*Arachis hypogaea* L.) make it an important food and cash crop for domestic consumption and export in many developing and developed countries. Aflatoxin contamination of key staples (maize, sorghum and peanuts) can affect the agricultural sector output generally, and each of the four pillars of food security (availability, access, utilization, and stability) specifically. Aflatoxin disproportionately impacts the poor population groups. The poor may also not be able to adopt costly control strategies. Currently, aflatoxin contamination is prevented with a variety of tools such as pre- and post-harvest technologies. However, even where storage conditions are generally good, aflatoxin frequently form prior to harvest while the crop is maturing and/or awaiting harvest, which can result in significant losses. As concern about aflatoxin toxicity has grown, national, regional and international R&D organizations are taking up the challenge of addressing aflatoxin across the agriculture, trade and public health sectors in a coordinated way. Bio-control of aflatoxin is a control method, which shows promise in tests at the farmer level in West Africa (Nigeria) and is to be tested in Tanzania. Bio-control is based on research that shows that non-toxigenic (non-aflatoxin-producing) strains of *Aspergillus* mould—the 'good moulds' (atoxigenic strains)—exist that can compete with and replace the currently commonly occurring aflatoxin-producing strains of *Aspergillus* mould—the 'bad mould' (toxigenic strains)—when introduced into the soil of fields where susceptible crops such as maize and groundnuts are to be grown. Then, even if 'good mould' does invade the crop plant due to unavoidable crop plant growth stresses, insect damage or contamination at harvest or during shelling, growth by the 'good mould' in the crop plant does not produce harmful aflatoxin.







EDIBLE INSECTS

Formulation and characterization of fortified cereal foods using African palm weevil powder and its effect on the iron status of Ghanaian children

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Graduate School of Nuclear and Allied Sciences
University of Ghana
Legon-Accra, Ghana

USD 19,500

Iron deficiency is the most common and widespread nutritional disorder in the world. As well as affecting a large number of children and women in non-industrialized countries, it is the only nutrient deficiency which is also significantly prevalent in virtually all industrialized nations. In Ghana, four out of five children aged 6–59 months are anemic. Causes include poor bioavailability of non-heme iron from staples like legumes and cereals used as complementary foods, and malaria infection. The Ghana National Nutrition Policy on flour- and vegetable-oil-fortification program launched in 2007 to tackle this micronutrient deficiency menace in Ghanaian children has so far not made any significant impact. There is considerable evidence that many edible insects contain sufficient amounts of protein and micronutrients. Their availability, cultural appropriateness and the minimal ecological impact of their exploitation in a large majority of developing countries makes them good sources of micronutrients to consider. Thus in countries where malnutrition and food insecurity is a primary concern, their use in fortified blended foods ought to be considered. African palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae), locally called akokono, is an edible insect which is currently being produced and consumed in commercial quantities in some parts of Ghana. This insect has been documented to be rich in protein and micronutrients including vitamin A, iron, zinc and calcium. Literature on its usage in formulating and processing in cereal-based foods and postharvest processing is scanty. This pilot study proposes to formulate and characterize a breakfast serving (fortified cereal; rice, maize and millet) using African palm weevil powder, and subsequently investigate the potential of these composite flours to improve the hemoglobin levels of some selected Ghanaian children (6-8 years). The outcome measures would be clinical examinations and hemoglobin concentration at baseline, one-and-a-half and three months

Consumer attitude and perception of the consumption of edible insects in western Kenya

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USD 12,500

The increase in the world population and ever-changing consumer food preferences continue to put pressure on global food security. As a result, there is an urgent need to find alternative and sustainable sources of food. The United Nations (UN) and the Food and Agricultural Organization (FAO) urge the promotion and consideration of edible insects as an alternative food source. Insects are a nutritious and healthy source of food containing high amounts of fat, protein, vitamin, fiber and micronutrient content. However, despite edible insects' having numerous nutritional and environmental benefits, their consumption and uptake still remains low among many local residents in western Kenya. The consumption of edible insects and insect-based products in many communities is always considered to be a primitive behavior. This negative perception has led to consumer reluctance to accept insects as food, thus impeding the realization of their economic, social, nutritional and environmental benefits. Few studies have focused on the consumer perception and attitude towards insects as a novel community source of food. Due to growing interest on this topic, we are proposing a qualitative study to evaluate and determine consumers' attitude, perception and acceptability of edible insects in selected local community markets in Kisumu County, western Kenya. Focus group discussions (FGDs) will be conducted in ten rural markets, including five markets where edible insects are commonly consumed and another five markets where insects are consumed but not popular. Each of the focus groups will comprise both individuals with experience in eating insects and those with little or no experience in consuming insects. The study will provide vital preliminary information on factors and obstacles that impede local community acceptance and consumption of edible insects as food.

MALNUTRITION & BRAIN FUNCTION

Validation of a life-long neural fingerprint of early malnutrition

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and

Joint China-Cuba Lab for Frontiers Research for
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USD 38,600

Early childhood Protein Energy Malnutrition (PEM) is a widespread phenomenon that has lifelong persistent neurodevelopmental effects. Our long-term goal is to integrate nutritional, social, and economic measures of disadvantage with low-cost brain imaging methods to uncover the neural fingerprint of early malnutrition (NFPM). This would allow early stratification of children for cost-effective and neuroscience-based interventions, applicable in lower- and lower-middle-income countries. The objective of this grant is to confirm that the NFPM can be extracted from the electroencephalogram (EEG). The Valdes/Bringas labs have shown that quantitative EEG (qEEG) distinguishes between children with PEM only in the first year of life (PEM cohort) and the control cohort. These preliminary results are described in this application. The EEGs for this analysis were from the Barbados Nutrition Study (BNS) at ages 5 to 11 years. The BNS is a unique collaboration between the Galler and Bryce Labs which for 49 years has guaranteed the regular collection of medical, genetic, neuropsychological, academic, and social measures for the two cohorts. Specifically, we will assess the contribution of qEEG to a cumulative risk model of brain damage four decades after PEM. For this we request funds to: 1) create a qEEG facility in the Bryce Lab as an enhancement of the BNS infrastructure; 2) record, in Barbados, qEEG and behavioral measures from 50 subjects of the PEM cohort and 50 controls; and 3) compare these findings with qEEG measures obtained in the same subjects 49 years earlier at 5-11 years of age.





NUTRITION & BIRTH OUTCOMES

Underlying causes of poor dietary intake, nutritional status and birth outcomes in pregnant adolescents and adults

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USD 73,840

Although the role of proper nutrition prior to, during and after pregnancy in achieving desirable birth outcomes is established, under-nutrition remains a problem in pregnant women in poorer sub-Saharan Africa (SSA). In Ghana, 2,800 maternal deaths were recorded in 2015. Evidence of interventions such as multiple micronutrient and balanced energy-protein supplementation with iron, folic acid and calcium is strong, but these interventions have not yielded the required results. In spite of iron-folate supplementation for pregnant women since 2001, over 40% of these women are anaemic. Neural tube defects are on the rise. Pregnancy during adolescence is globally considered a "high-risk-pregnancy", due to increased risk for maternal and foetal complications owing to anatomical immaturity and competition for nutrients between mother and foetus. However, adolescent pregnancy rates continue to increase. Data on the nutrition of pregnant adolescents in general, and in Ghana in particular, and how it is related to pregnancy/birth outcomes is sparse, but most research has focused on pregnant adults. The nutritional status of this group, factors associated with poor nutrition, and the extent to which poor nutrition affects birth outcomes in Ghana is not documented. Therefore, this project proposes to investigate, using an ethnographic approach and some quantitative methods among pregnant adolescents: 1) dietary habits and nutritional status and associated factors, including knowledge, perceptions, attitudes and practices that affect nutrition decision-making; 2) household economy, income and hunger indicators and their effects on food access, dietary habits and food consumption decision-making; 3) access, compliance and effectiveness of antenatal care nutritional interventions, and 4) how these influence birth outcomes.



One of the major aims of the Nestlé Foundation is the transfer of sustainable capacity-building knowledge to low-income countries. During 2017 several specific capacity-building activities were supported.



INSTITUTIONAL OTHER

DISSEMINATION OF RESEARCH RESULTS

During 2017 the Foundation supported several researchers in presenting results from their research projects which were supported by the Foundation. The presentations included several specific topics besides others at the EB-2017 meeting and the IUNS 2017 meeting. In general the Foundation only supports conference attendance in connection with research projects supported by the Foundation.

CONAPRA

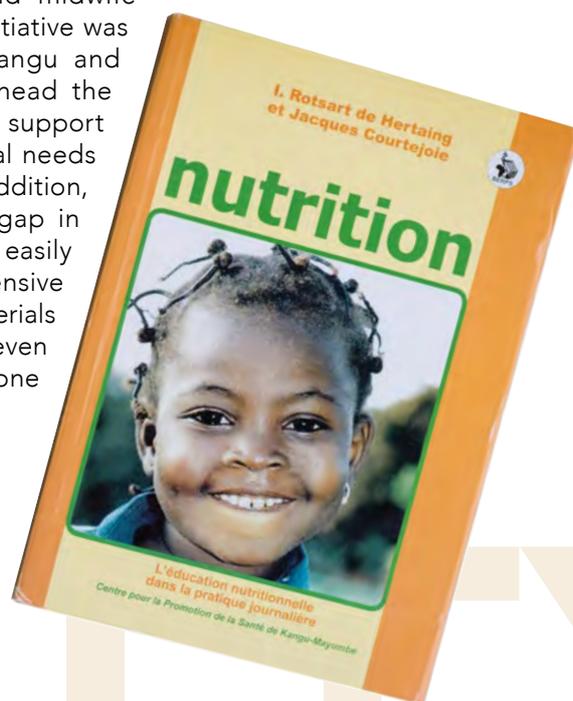
SUPPORT AND CAPACITY-BUILDING ACTIVITIES

NEW EDITION OF "NUTRITION" FROM THE BERPS IN THE CONGO

Without nutrition knowledge, healthy eating is not possible. Accordingly the Foundation supported the printing of a newly reworked edition of the small booklet "Nutrition" by the Bureau d'Etudes et de Recherches pour la Promotion de la Santé (BERPS) in Kangu Muyumbe, the Congo. Four thousand copies of the book "Nutrition" have been printed and will be distributed to health professionals, including students in nursing and midwife schools. This BERPS educational initiative was initiated by Roger Mabilia Zimuangu and by Dr. Jacques Courtejoie, who head the BERPS. The Foundation is proud to support a team which knows about the local needs and the corresponding deeds. In addition, the activities of the BERPS fill a gap in the production and distribution of easily understandable, accessible, inexpensive nutrition and health educational materials in French. Some of the books are even made available in other Francophone countries of Africa.

NESTLÉ FOUNDATION SYMPOSIUM AT THE IUNS CONGRESS

The Foundation organized a 50th anniversary symposium entitled "50 years of Nutrition Research Support in Low-Income Countries: Achievements and Needs" at the IUNS 21st ICN International Nutrition Congress in Buenos Aires (see also page 16).





Many of the studies which have been supported by the Foundation have led to the formulation of evidence-based recommendations and guidelines. As Dennis Bier points out, evidence-based nutrition is not enough on its own; in addition, one needs to know how this evidence is translated into practical recommendations. The latter is in complete agreement with the longstanding aims and endeavours of the Foundation. Pedro Valdes and his colleagues review the Cuban approach of capacity building based on need-oriented, evidence-based action and capacity building. An interesting and successful approach—maybe we could also learn today from their reasoning and approach. It is good to remember that,

as John Ingram points out, malnutrition is related to consumption patterns and often to a lesser degree food production. Nevertheless, the research from Christopher Bren d'Amour and Felix Creutzig shows that we should not forget the effects of urbanization on the availability of fertile crop land. Finally, Halla Ghattas and her colleagues show in a fascinating approach in a very vulnerable population that self-help is once more the best strategy to improve nutrition: in a refugee camp in the Near East a refugee-operated kitchen supplied healthy food for children and simultaneously created an income for women. It is truly an all-around success story worth transferring to other regions of conflict.



VISION

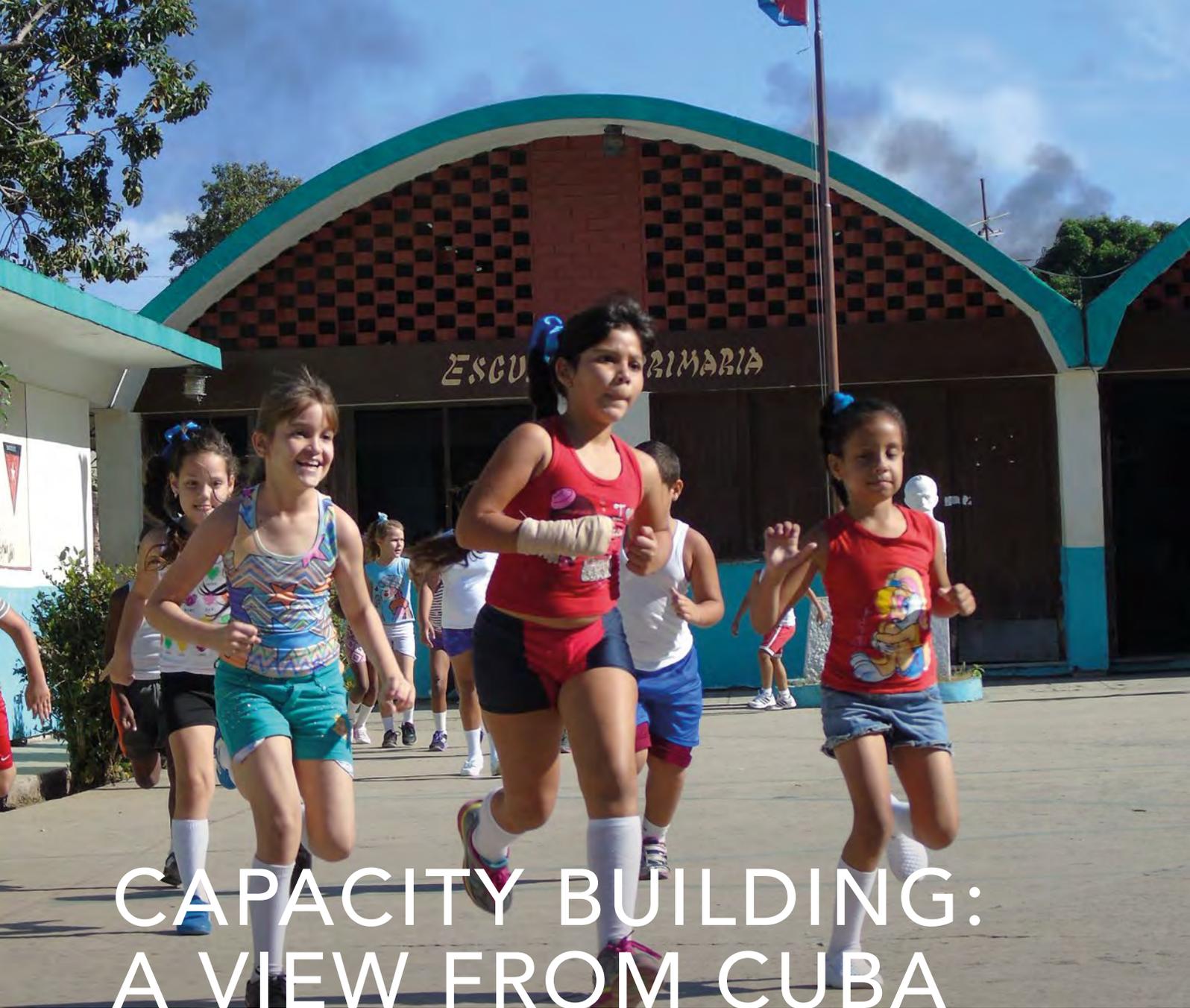
CAPACITY BUILDING: A VIEW FROM CUBA

EVIDENCE-BASED NUTRITION

LAND EXPANSION & FOOD SECURITY

HEALTHY KITCHENS - HEALTHY CHILDREN

THE NEED TO MANAGE FOOD DEMAND



CAPACITY BUILDING: A VIEW FROM CUBA

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Cuba, a small Caribbean country (with a current population of only 11 million), has played a disproportionately large role in international health cooperation. Our history shows continuous engagement with both public health and solidarity.

In 1902, Cuba created the National Health Board, under the leadership of Carlos J. Finlay (1). Population health was part of the national consciousness present in the struggles for independence at the end of the nineteenth century. In 1909, the Board became the Ministry of Health and Welfare. Cuba was thus one of the first countries with a ministry of health (2). Unfortunately, the desire to coordinate public actions for population health was not achieved for decades. It was foiled by the lack of social equity, which blocked access to health services for the impoverished majority of the population.

In 1959, the Revolution transformed this panorama, reaffirming health as a basic human right and setting

universal health coverage (3) as an explicit goal. This required profound structural changes and the foundation of a unified National Health System (NHS) to integrate all actions and services to guarantee free access to all citizens. A vigorous effort in capacity development was required and implemented.

Health cooperation as a national policy dates from 1960. While Cuba was struggling to extend healthcare to all its people, especially in rural areas, a fully equipped medical team went to Chile to help after the earthquake occurred there (4). In 1963, the first Cuban medical brigade arrived in Argelia (5). Since then, 134,849 Cuban health collaborators have served in 104 countries, on almost all continents. Currently there are 38,538 health-care personnel in 74 countries (6).

Cooperation was included as an NHS principle. Its aims include strengthening national capacities according to the country's needs; ensuring sustainability and improvement of the results; adapting tested advances into new scenarios; the systematization of experiences; and technology transfer and the publication of scientific outcomes, which reinforces both bonds between countries and also capacity building (7).

During these years, the collaborators and countries helped increased, as did the experience and quality of care. The cooperation has reached most health fields and, above all, the educational area as it opens new medical schools abroad.

This increase in cooperation is possible due to the development of the NHS. Today, there are more than 72,000 physicians in Cuba, compared to only 3,000 in 1959, and almost half are specialized in Comprehensive General Medicine. From one medical Faculty in 1959 there are now 22.

Health cooperation stages (5)

The 1960s to 1980s were characterized by internationalist missions based on principles of solidarity, boosted by liberation movements in Africa and Central America.

The 1990s were marked by external events that impacted the Cuban economy, most crucially the disappearance of the Soviet Union and socialist countries, which heralded an economic crisis, and the resurgence of the United States' blockade against Cuba. This situation brought another type of cooperation based on an agreement where the professionals were remunerated and part of their incomes went to the NHS to support the cooperation with low-income countries.

The disaster caused by hurricanes Mitch and George in 1998, affecting Central American and Caribbean countries, led to the creation of the Comprehensive

Health Program (CHP), which entailed sending brigades of doctors, nurses and health workers to the most affected and remote places (8, 9). Starting in Central America and the Caribbean, it was later extended to Africa and the Pacific. At present, is the most extended modality.

In 2003, the Bolivarian Revolution in Venezuela, with Cuban cooperation, fostered the creation of new programs such as "Barrio Adentro" (10), a modality integrated with the Bolivarian Alternative for the Americas. Also continuing with programs of stomatology, ophthalmology and "Barrio Adentro II", the latter created 483 Integral Diagnostic Centres, 26 High Technology Centers and 548 Integral Rehabilitation Rooms, developing infrastructure and human resources capacities to contribute to the sustainability of health coverage in Venezuela (5).

In 2005, Cuba institutionalized its global assistance in health emergencies through the Henry Reeve (11) Brigade of physicians, specialized in situations of disasters and serious epidemics. It was organized at the initiative of Fidel Castro to help with the injuries caused by Hurricane Katrina in the United States (8, 9). Since then, 7,254 collaborators have helped in 19 nations on 22 occasions, providing aid to more than 3.5 million people.

In this context, Cuba founded the Latin American School of Medicine to train, free of charge, people from these countries as doctors (12). Most of the students come from low-income families and remote places. Nowadays, 117 countries are part of this project. By 2008, 10,241 students from 108 countries had graduated in medicine, stomatology, nursing or as health technicians. In parallel, a new model for medical careers started, supported by primary healthcare institutions in Cuba that focus on training in services and education at work, using information and communication technologies as teaching aids. This model was adapted to international educational programs.

In 2004, an ophthalmology program was started, "Operacion Milagro". It began with Venezuelan patients and in 2005 was extended to 27 Latin American and Caribbean countries. By 2015, 3,927,406 surgical procedures had been done in 33 countries and 51 ophthalmological centers established in twelve countries (13).

In 2003, Cuba finished a National Disability Study with complete coverage of all affected people; this experience was applied in Venezuela, Ecuador and Nicaragua. The studies allowed for diagnosis and decisions to improve the health and life conditions of people with disabilities (14).

The development of human resources has been a core point within Cuban cooperation programs,

combining healthcare with the growth of medical schools, the training of community leaders, technicians, and consultancies, among others.

Collaboration is extended to technology transference; an example is the joint effort of the Finlay Institute and the Institute of Immuno-biological Technology of the Oswaldo Cruz Foundation (Bio-Manguinhos) in Brazil, which responded to the World Health Organization (WHO) request for meningococcal-AC vaccine production to cover the needs of the massive epidemic in Africa. South-South collaboration is thus helping 21 countries comprising the meningitis belt in Africa (15).

Another example, the Cuban assistance during the Ebola epidemic in Africa, was a milestone of the cooperation with the WHO (16). Its contribution to improve health and social development among the members and regional integration on the continent is based on NHS advances and professional experience and commitment.

Cubans are very proud of this history of solidarity, which the embodiment of what our national prophet, Jose Marti, wrote more than 120 years ago: "Patria es humanidad".



ASC-6100
SHIMADZU



EVIDENCE-BASED NUTRITION

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EVIDENCE-BASED NUTRITION: THE NATURE OF EVIDENCE

All nutrition scientists and policy makers believe that they make decisions based on the evidence available to them. Why, then, is there now so much attention devoted to "evidence-based nutrition"? To a large extent, the current emphasis is focused on the need for the scientific community to understand current, more explicit definitions of what constitutes evidence and to appreciate current, more unbiased approaches to determining evidence quality and its presentation in the scientific literature. Sixty years ago, Werner Heisenberg said "Since the measuring device has been constructed by the observer [...] we have to remember that what we observe is not

nature in itself but nature exposed to our method of questioning" (1). All scientists must appreciate the full impact of this statement on their understanding of the domains of validity underlying the evidence they assess. In human nutrition research, as in many other fields that constitute the biomedical sciences investigating hypotheses in humankind, there are two principal approaches to questioning nature. The first approach is observational only. The observed system is not perturbed in any way. This is the well-established approach used in nutritional epidemiology (2). The second approach requires challenging the system with an intervention in order to determine the response to the intervention (3). Randomized clinical trials (RCTs) are the iconic example. Each approach has its own well-recognized advantages and disadvantages.

Observational studies can assess relationships among variables in large unperturbed populations. This is an immense advantage, but in the field of nutrition these observations are limited by the inaccuracy and imprecision both of food intake methods and of food composition tables. Moreover, the approach is also constrained by the inability to adjust for only a minority of known confounders and, obviously, none of the unknown confounders. Our inability to know with any high degree of accuracy and precision what people eat and the nutrient contents thereof is a serious issue limiting nutritional science as a field. Neil deGrasse Tyson and Donald Goldsmith wrote that "Science is not just about seeing. Science is about measuring—preferably with something that is not your own eyes, which are inextricably conjoined with the baggage of your own brain: preconceived ideas, post-conceived notions, imagination unchecked [...] and bias" (4). Furthermore, environment-wide association studies using current "big data" methodological approaches have demonstrated that the handful of traditional adjustments to nutritional observational data are woefully inadequate to account for the very large number of inter-relationships found among variables in an individual's "exposome" (5,6). Most importantly, however, observational studies cannot prove causality no matter how well they are designed and conducted. Newer approaches such as Mendelian randomization, when possible, can provide evidence that a nutrient is likely on a particular causal pathway or that it is not, but unequivocal establishment of cause and effect remains out of reach.

Randomized interventional trials, done properly, are the only studies that both eliminate experimental biases and prove causality. However, they are limited by the fact that they are generally carried out in small groups of carefully selected individuals who do not often reflect the population as a whole. Furthermore, it is extremely difficult to design interventions with real foods because they are complex substances,

cannot readily be varied individually, and cannot be tested against a "null" control group that does not consume food. Perhaps most importantly, nutrition RCTs are often of short duration, not only due to cost, but also due to the very well-confirmed practical difficulties encountered by subjects attempting to comply with test diets over the long term.

Thus, when each of these different "methods of questioning" has been used to expose Mother Nature's nutritional "rules", the results have generally been contradictory. This is no trivial problem! In essentially every instance where randomized controlled trials have tested causal pathways implied by associations uncovered in nutritional observational studies, causality was not confirmed. The rules of establishing proof via the scientific method are the same for nutritional hypotheses as they are for hypotheses in physics, chemistry, or any scientific field. Human nutrition, however, is clearly limited by the practical nature of designing and conducting the long-term dietary experiments necessary to demonstrate causality unequivocally. But, like the established requirements of the scientific, the hierarchy of evidentiary standards for establishing proof are also well-established in science. Randomized controlled trials are higher in the evidence-based hierarchy than are observational studies. Therefore, we have a distinct problem in the nutritional field. It may be either very difficult, or impossible, to perform the high-evidence-level trials necessary to establish proof of causality. Available data may be limited to mid-evidence-level observational studies. In fact, this situation reflects the current state of the field.

What does one do under these circumstances? One approach is to "promote" the quality of the available observational evidence to a higher level and imply causality. This approach is not defensible on the basis of fundamental scientific principles. It implies that the conditions of proof in nutrition are different than the conditions of proof in other sciences. Moreover, historical practice has not been kind to the scientific hubris of promoting associations to causality, however plausible this assumption may have appeared before causality was tested directly. As scientists, we should readily accept the limitations of the methods available to us, admit to the effects these limitations have on the confidence of our conclusions and report, either in original research articles or in policy positions based on the data, a transparent assessment of the limits of confidence. In other words, we should not claim certainty when we can only rightly claim "maybe".

When policy recommendations are made subsequently from the available evidence, it is important to acknowledge that knowing the evidence itself is distinctly different from knowing what to do with



the evidence now that you have it. Rarely is available nutrition evidence sufficient per se to drive an unequivocal policy decision. Policy decisions almost invariably contain a large, subjective component contributed by the allegiance biases of the expert committee members responsible for the policy recommendations. There appears to be a widespread misunderstanding that an expert imprimatur somehow serves to raise the quality of evidence underlying decisions. In fact, expert opinion occupies the lowest rung on the evidence-based ladder, so it can do nothing to raise the objective quality of the actual evidence. Expert input contributes largely subjectively to opinion-based conclusions about subsequent recommendations based on the evidence. Ultimately, the quality of such recommendations is directly proportional to the underlying quality of the evidence itself (7). Only recently have authoritative bodies taken into account a systematic, unbiased assessment of evidence quality in decision-making processes. Thus, promotion of true evidence-based nutrition recommendation requires that every nutrition policy document (a) make explicitly clear which information contained within it represents original evidence, (b) grade the quality of the evidence by accepted objective scoring methods, (c) provide an overall assessment of the available evidence following established systematic review methodology, and (d) transparently report which recommendations are based on subsequent subjective decisions applied to the policy issue at hand.





LAND EXPANSION & FOOD SECURITY

Christopher Bren d'Amour, PhD
Felix Creutzig, PhD
Mercator Research Institute on Global Commons
and Climate Change and
Technical University, Berlin
Berlin, Germany

FUTURE URBAN LAND EXPANSION AND FOOD SECURITY

As populations grow and more people move into cities, urban areas expand rapidly, especially in developing regions. This has important implications for the surrounding croplands. Historically, many cities have been built near fertile soils, for example along rivers or in river deltas. It is hence not surprising that 60% of the world's irrigated croplands lie in the vicinity of cities.

This begs a fundamental question: what are the implications of the rapid expansion of urban areas for the world's croplands? This question had previously been answered in part, but only at the

local level in a range of case studies. These studies identified urbanization as a main cause of cropland conversion, for example in China, where large swaths of croplands have been converted to urban uses. A global estimate of the magnitude of these cropland losses to urbanization, however, was missing.

This was the starting point for our research in this field, in which we used different spatial datasets on urban area expansion forecasts, croplands, and cropland productivity to tackle this knowledge gap. Our results show that the urbanization of croplands can have substantial implications for food systems, even though the aggregate effects seem marginal at first.

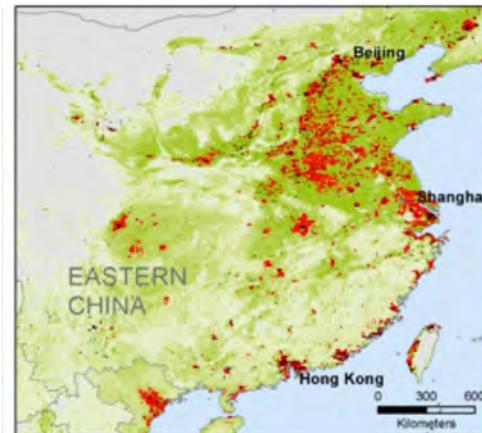
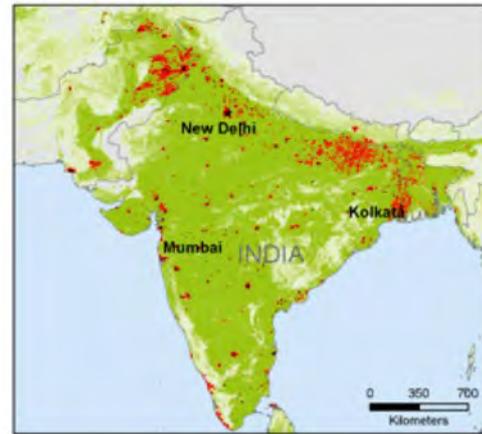
Converted cropland almost twice as productive

300,000 km² are expected to be urbanized by 2030, equaling 2% of total croplands in 2000. While this number seems comparatively low, it still amounts to an area the size of Italy. More importantly, the croplands converted in the process are almost twice as productive as the remaining croplands. The abovementioned losses hence amplify the implications for food production: the 2% cropland loss translates into a 4% loss in production capacity. Overall, however, the global food system will likely be able to compensate for these losses.

80% of the losses will occur in Africa and Asia

A disaggregated look into different world regions shows diverging dynamics. Naturally, the fastest urbanizing regions of Africa and Asia are also the regions where most of the cropland conversion is taking place. Eighty per cent of the losses will occur there. Hotspots of cropland conversion in Africa include Egypt, Nigeria, and the countries that flank Lake Victoria. In Asia, especially China and India lead the way. China alone is responsible for one-fourth of the total global losses. Generally, the majority of the losses will occur in less-developed regions that are more prone to food insecurity. Nigeria, for example, will urbanize cropland where 12% of its crop production took place.

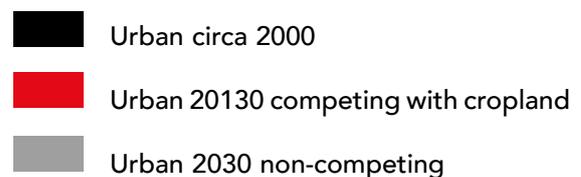
Nevertheless, these losses are not a threat per se to food security. Affected countries could, for example, expand their agricultural production into other areas, or just increase the productivity on the remaining croplands through better management and irrigation. However, the potential of countries to compensate for these losses varies substantially. If the biophysical capacities are limited, as it is the case in countries from more arid regions such as Egypt, countries will experience increasing dependence on imports. That in turn will leave them potentially vulnerable to fluctuations in global food supply and prices. This could undermine food security for the poorest parts of the population.



Cropland Area Fraction



Urban Area Expansion



The bigger question, perhaps, is who is being ousted by the encroachment of urban areas. As cities expand, millions of smallholder farmers will lose their land. In many developing regions, these small-scale producers produce the majority of the food, and are hence instrumental for food security. Displaced smallholders will also lose their livelihoods as they are expelled from their lands. That is particularly true in regions without formal land rights. If these smallholders do not receive adequate compensation, this can lead to social instability, loss of livelihoods, and local food insecurity.

City-level governance as key

Urban area expansion adds to other pressures on the global food system, most notably climate change. While the global effects can be compensated for by global food systems, there are distributional effects that need to be accounted for. Much of the conversion will take place in countries that are already struggling to feed their ever-increasing populations. Egypt, for example, will urbanize about a third of its croplands by 2030, while the population is expected to increase from 66 million in 2000 to 102 million in 2030. The encroachment on croplands will increase Egypt's dependence on imported food and hence increase the exposure of the poorest part of the population to world market volatility.

Regulation of the expansion of urban areas, to keep urbanization as compact as possible, has to be a prerogative of cities. City-level governance and urban planning play a central role. Adequate compensation needs to be provided to those households that are being displaced, and access to urban labor markets facilitated. Spatially efficient urbanization could help to retain the existing agricultural system while continuing to provide small farmers with access to the urban food market.





HEALTHY KITCHENS - HEALTHY CHILDREN

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**THE HEALTHY KITCHENS, HEALTHY
CHILDREN EXPERIENCE: A SUSTAINABLE
SOLUTION TO IMPROVE LIVELIHOODS AND
DIET DIVERSITY IN PALESTINIAN REFUGEE
CAMPS**

Palestinian refugees are a protracted refugee population, having been displaced to Lebanon since 1948. This population continues to face social, political and economic exclusion, which hinders their ability to improve their living conditions and livelihoods. Gender disparities in this community are especially striking when looking at labour market outcomes, with female labor force participation rate of 17% compared to 69% for males (1). High rates of poverty and food insecurity in this marginalized

population threaten diet diversity, physical, mental and social health. There is also evidence of an increasing burden of chronic diseases for Palestinian refugees associated with a shift from traditional diets to processed foods high in fat, sugar, and salt. In fact, among Palestinian adults living in Lebanon, the prevalence of obesity has reached 23.6% in men and 40.6% in women (2).

The UN Relief and Works Agency for Palestine refugees (UNRWA) operates 68 schools in Lebanon with 38,173 students in attendance on a daily basis. Most schools have a small private food seller selling packaged foods inside the school, with products generally high in fat, sugar and salt. Our data indicate that about a third of children come to school without having had breakfast, and purchase these unhealthy foods in schools.

The aim of the Healthy Kitchens, Healthy Children study was to investigate the effect of an intervention that employed women through social enterprises to deliver a subsidized healthy daily school meal to elementary schoolchildren in Palestinian camps.

We established two Healthy Kitchens in existing community-based organizations (CBOs) in Palestinian camps as small business enterprises. Thirty-two Palestinian women living in the camp were employed by the CBOs and received training in the preparation of healthy, nutritious recipes; food safety and hygiene; and entrepreneurship skills. We refurbished one existing kitchen, and built a new one to increase the capacity of the CBOs to meet food safety standards appropriate to delivering healthy meals to schoolchildren. Focus groups were conducted with the women in the kitchens to create a list of potential traditional Palestinian dishes that could be delivered to the children. These recipes were then adapted by our research nutritionists to meet nutritional requirements of school meals according to World Food Program (WFP) guidelines for a midday snack. The meals produced in these kitchens were then used to supply daily subsidized healthy school meals to Palestinian elementary schools for the duration of one school year (approximately eight months), and we assessed the impact of this intervention on both women and schoolchildren and compared the results with control schools that provided nutrition education but no meals.

Participation in the Healthy Kitchens had positive effects on economic outcomes, social support and mental health of women (3). Women generated the equivalent of 110 USD/month working in the kitchens (on average equivalent to 13% of household income) and were thus able to increase their total household, food and entertainment expenditures. They also had reduced experience of food insecurity and resorted less to employing food-related coping strategies at

endline, as compared to baseline. Results also indicate some improvements in the mental health of participating women. The kitchens provided a space for women to form social bonds, discuss personal issues and share experiences. Some women expressed gaining a feeling of self-worth and empowerment from this project: "my personality got really stronger, before I used to say I'm living, and my kids are what are important. Now, I want to live and to prove [show] that I exist [and] I have my personality. Just like a man can work and be productive, a woman as well can work and be productive and the rights should be equal between a man and a woman. Now, thank God, I feel that I am a productive woman."

In parallel, the study provided an opportunity for children participating in this community-based school nutrition intervention to improve their diet diversity and to reduce school absenteeism as compared to schools where the program was not implemented. Over the duration of the school year, about 70% of children chose to participate in the subsidized school meal program (at a cost of 0.25USD/meal). Participating children had lower sweet intake, as well as increased dairy and meat consumption.



The two Healthy Kitchens have now established themselves as catering businesses and are sustaining their operation by selling food to pre-schools, schools, and catering to local events (such as Ramadan dinner or festivals). The collaboration between the Healthy Kitchens and UNRWA schools has increased the recognition of the community-based organizations within their communities. The availability of schools as a constant market for these social enterprises offers an opportunity for sustainable livelihood generation, and economic, food security, social and mental health gains. Further efforts will be needed to scale-up this model and ensure that sound school food policies are put in place to limit the availability of competitively priced processed and packaged foods sold by canteens.

This project was supported by a grant from the Nestlé Foundation.



THE NEED TO MANAGE FOOD DEMAND

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HEALTH, SOCIETAL COSTS AND ENVIRONMENT: THE NEED TO MANAGE FOOD DEMAND

One of the great human achievements over the last half century is that advances in food production have largely kept pace with demand on a global basis. Today, around six billion people are not hungry, up from about two billion 50 years ago. But we should not be complacent. Despite these successes, about one billion people are still hungry, and at least two billion more lack sufficient nutrients. Paradoxically, at least 2.5 billion people consume excess calories for physiological need, many of whom also suffer from

inadequate nutrients. People in all three categories are therefore malnourished, as malnutrition (often taken to mean only under nutrition) really means bad nutrition.

While it remains essential to increase the supply of nutritious food to those who do not have enough, there are growing health consequences of overconsumption, and particularly of “empty calories” from foods including solid fats or added sugars that supply energy but little or no other nutrition. Average diets in richer countries are already around 3400 kCals per person per day, and around 2600 in developing countries. Average needs are around 2500 for men and 2000 for women. As people are becoming wealthier, and if the concomitant changes in diets towards more energy-dense foods continue, the nutritional status of the rapidly increasing proportion of “over-consumers” is sure to diminish.

Nearly every country in the world faces serious health problems linked to the consumption of either too little nutrient-rich food or too much energy-dense food. Adding the numbers in each category of malnutrition indicates that about half the global population is affected; the multiple burdens of malnutrition are the new normal, and poor diets constitute the number-one driver of the global burden of disease (1). Over-consumption—rather than under-consumption—is now a greater global challenge for health. Diet-related raised blood pressure, raised blood sugar and raised cholesterol poses a major risk factor in many non-communicable diseases, especially Type-2 diabetes. Prevalence of diabetes worldwide is estimated at about 8.5%, but in some countries it is much higher. Even more people are “pre-diabetic” (or “border-line diabetes”, i.e. blood glucose levels that are higher than normal but not yet high enough to be classed as diabetes); over 50% of adults in China are now pre-diabetic (2). More worrying still is that, until recently, this type of diabetes was generally only seen in adults, but it is now increasingly occurring in children, leading to life-long health problems.

Closely coupled with the health status concern of over consumption is the financial cost to society. The global cost of diabetes alone for 2015 was US\$ one to 31 trillion, with indirect costs accounting for about 35%. North America was the most affected region relative to GDP and also the largest contributor to global absolute costs. However, on average, the economic burden as percentage of GDP was larger in middle-income countries than in high-income countries (3). Therefore, for poorer nations with rapidly expanding numbers of diet-related diseases, the financial costs will likely be crippling, certainly diverting resources away from other important development needs.

And finally, current methods of producing, processing, packaging, transporting, retailing, and consuming food are significantly degrading the natural resource base upon which our food security depends (4). If an increase in demand for more of the same food (i.e. without dietary change) would impact environmental conditions in an approximately linear manner, an increase in higher energy-dense foods will likely have even greater impact per calorie consumed: a calorie derived from meat or fat has a much higher overall environmental footprint than one from a vegetable source. The environmental cost of satisfying increased demand of more-energy intense food will be enormous, and it is this factor that is most worrisome: the prospect of collapse of the natural resource base upon which food security for us all depends.

The major food-related challenge facing global society is therefore related to the growing over-consumption by many. Population growth, compounded by increasing wealth and a strongly emerging “middle class” in many nations, will likely see this number rise in coming decades.

This situation brings into sharp focus the word “sufficient” in the widely-used definition of food security stemming from the 1996 World Food Summit: “when all people, at all times, have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. As sufficient means not only not too little (as was implied when drafted), but also not too much, the definition is even more pertinent today. Health, societal costs and environment all depend on better managing food demand, not just meeting it.





PROFILE OF A NUTRITION INSTITUTE



THE NATIONAL INSTITUTE OF HYGIENE, EPIDEMIOLOGY AND MICROBIOLOGY INHEM

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THE CUBAN APPROACH TO RESEARCH, TRAINING AND REGULATION IN THE FIELD OF NUTRITION

The interest in nutrition in Cuba has a long history associated with the wide spectrum of hygiene, epidemiology and microbiology specialties. For that reason, the Cuban approach integrated all disciplines in the National Institute of Hygiene, Epidemiology and Microbiology (INHEM) (1, 2). This is a keystone institution for Cuba's public-health system and has played an essential role in improving the population's health since its foundation in 1902. The Institution has lead the formulation and implementation of national policies and programmes, combining scientific research and practice with training programmes in the disciplines of hygiene, epidemiology, microbiology and nutrition. With the triumph of the Revolution in 1959, the Institute was given new, more complex tasks, and since 1969, it has lead a national network of centres established around the country.

In Cuba, the responsibility for food and nutrition security is shouldered first and foremost by the government. This means that the government is obligated to develop and implement policies to ensure that the entire population has consistent access to safe and nutritious foods in sufficient quantities to satisfy daily nutritional requirements and food preferences, thus contributing to an active and healthy life (3).

One of its main areas of research is focussed on the surveillance of chronic, non-communicable diseases and their risk factors, as these are the leading causes of death in the country; another is to find solutions for the principal health issues faced by Cubans. In addition, nutrition and food safety, obesity, and micronutrient deficiency are systematically studied,

CUBA

AREA

Total:	110,860 km ²
Agricultural land:	60.3%
Arable land:	33.8%

POPULATION

Total:	11,239,224
Urban population:	77.3%
Under age 15:	16.6%
Median age:	41.5 years (male 40.1 years / female 42.6 years)
Net migration rate (per 1000):	-4.9 (2016 est.)
Rate of urbanization:	0% annual rate of change (2015-2020 est.)

POPULATION GROWTH RATE

Total:	0.3%
Urban areas:	-0.1%
Total fertility rate:	1.71 children born/ woman (2017 est.)

GDP (per capita, PPP):	\$11,900 (2016 est.)
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LIFE EXPECTANCY AT BIRTH

Total: 78.8 years Male: 76.5 years / Female: 81.3 years

MORTALITY RATES

Births attended by skilled health personnel*:	99%
Neonatal mortality rate:	2/1000
Infant mortality rate (at birth):	4/1000
Infant mortality rate (under 1):	4/1000 (2012)
Under-five mortality rate (2012):	6/1000
Under-five mortality rate, rank:	157
Maternal mortality rate (2012 reported):	33.4/100,000 live births

INFANT AND YOUNG CHILD FEEDING

Six-month exclusive breastfeeding rate (2008-2012):	48.6%
Early initiation of breastfeeding (2007-2011):	76.7%
Timely complementary feeding rate (6-9 months):	77.2%
Children who are still breastfeeding at 12-23 months:	17.1%

KEY NUTRITIONAL ANTHROPOMETRY

Low birth weight (2008-2012):	5.2%
Underweight (moderate and severe, 2008-2012):	-
Stunting (moderate & severe) in children < 5 years:	-
Prevalence of wasting (moderate and severe):	-

MICRONUTRIENT DEFICIENCIES

Percentage of households consuming iodized salt (2008-2012):	88%
Vitamin A supplementation (full coverage, 2012):	-

OTHER PARAMETERS

Median age at first birth among women 25-29:	-
Birth registration (% , urban / rural):	100% / 100%
Total adult literacy rate:	99.8%
% of population using improved sanitation facilities, 2011, total:	92.1%
% of population using improved sanitation facilities, 2011, urban:	93.7%
% of population using improved sanitation facilities, 2011, rural:	87.3%
% of population using improved drinking-water sources, 2011 est., total:	93.8%
Immunization coverage (%) 2012, BCG:	99%
Immunization coverage (%) 2012, DTP1:	96%
Immunization coverage (%) 2012, DTP3:	96%
Antenatal care coverage (%), at least four visits (2008-2012):	100%
Delivery care coverage (%), skilled attendant at birth:	99.9%
Physician density (2011):	7.52/1,000
Adult HIV prevalence (%) 2012:	<0.1%
Overweight or obesity (adult prevalence rate):	43%

from the community level (local, school and housing) to a national scope, with an emphasis on the social determinants as well as the environment and health. Implementation of a maternal-infant program, epidemiological challenges and events and research on social issues are also topics of the INHEM. The latter includes an emphasis on the role of families, which has led to the establishment of a Cuban Network on Health Determinant Factors.

INHEM is a National Reference Center for the study of food safety, nutrition and sanitary regulation of food, cosmetics, toys and other products to be consumed or used by the population. It also engages in environmental safety, with studies to evaluate risks associated with noise pollution, atmospheric contamination and electromagnetic fields. The Institute provides added-value scientific-technical services in the areas of sanitary microbiology and chemistry, as well as biochemistry and physiology.

Its specialists have participated as advisors and field workers in Cuban and international efforts to face the challenges of epidemiological events, such as the epidemics of dengue, contributing to a decision-making process based on scientific results and good practices.

The Institution is working on the application of results from its national surveys on food consumption and health, the elaboration of guides on nutritional best practices and the standardization of protocols and methodologies to face contemporary challenges of health problems and the organization of necessary health services.

The three most pressing issues identified are: unhealthy eating habits, iron-deficiency anaemia in specific population groups, and increasing overweight and obesity in the population at large. In each case, health-sector experts have led multi-sector commissions to develop the national programmes now in place to tackle these problems (4).

There are three documents that guide Cuban efforts in this matter (5,6):

- 1) Food Composition Tables detailing the nutritional content of specific foods, using UN Food and Agriculture Organization (FAO) methodology;
- 2) Dietary Reference Intakes for the Cuban Population, which specify recommended daily amounts of each nutrient by gender, age group and physical activity level, intended for use primarily by health professionals, policymakers and the food industry;
- 3) Healthy Diet Guidelines (HDG), which take technical information from the other two, and were developed taking into account the main illnesses affecting the population, the availability and accessibility of various foods, and socio-cultural aspects that influence eating habits (7).

INHEM supports the aims highlighted by international organizations regarding the importance of national strategies and educational programmes to disseminate information about healthy diets in order to improve the population's eating habits. It works with an emphasis on vulnerable groups such as the elderly and children. The Nutrition and Food Hygiene Institute (INHA, its Spanish acronym), a specialized centre, has returned to INHEM after more than 30 years, as the result of a reorganization in the health sector.

Many national programs and efforts have resulted from the investigations carried out by the centre, including in the following areas:

- The outcomes related to energy expenditure in high-productivity sugar cane workers that enhanced food rations according to their physical performance. This study was extended to builders and forestry workers with a similar implementation (8).
- Nutritional guidelines for children under two years of age, based on the indications proposed by the International Conference on Nutrition, held in 2014.
- Sal iodate (9)
- Iron deficiency is the greatest micronutrient found in deficit at present in Cuba. The population groups most affected are small children and reproductive-age women. A multi-sectorial program is in progress to provide fortified foods and iron supplements, as well as to increase the accessibility of iron-rich foods at the local level. Among them are wheat flour with vitamins and minerals, used in the preparation of bread and biscuit and also compotes for children, and nutritional supplements for pregnant women (10).
- Overweight and obesity constitute growing health problems in Cuba, especially given their association with non-communicable chronic diseases. The national program to reduce them is also a multi-sectorial effort based on education using the HDG and encouraging physical activity and medical orientation. A major challenge is to bring selection of food imports, production and distribution into line with the Guide (11).

There is an almost-finished study to provide guidelines for pregnant women and mothers who stop breastfeeding. The institution also is carrying out microbiological analyses in foods (meats, sausages, vegetables, conserved goods, cereals and dairy products), with a view to ruling out the absence of microorganisms and certifying them as suitable for marketing and human consumption.

Viewing nutrition with a multi-sectorial approach, Cuba has other institutions and industries that look for products to supply the deficits found by researchers in the Cuban diet. Such is the



case of the Institute for Food Research, mainly responsible for developing new food products and new technologies—such as soy yogurt, fortified foods and food supplements. This Institute is part of the multidisciplinary effort mentioned and is coordinated by the health sector to develop nutritional strategies for the country (12).

INHEM's institutional academic program includes one specialty, four post-graduate diploma programs and more than twenty short courses. There is a Master's Degree Program in Environmental Health and another in Nutrition and Public Health.

The staff of around 300 workers counts on more than 100 researchers and around eighty professors. They are the pillars of the human resource program formation conducted by INHEM to provide the National Health System, and also other countries, with well-prepared professionals in the mentioned disciplines. Its graduates contribute to research and scientifically based decision-making in health, grounded in a multidisciplinary and inter-sectorial approach.

The results of the investigations are published in national and international publications. INHEM supports the publication of the magazine *Revista Cubana de Nutrición y Alimentación* (13) jointly with the National Society of Clinical Nutrition and Metabolism. Another serial publication sponsored by the INHEM is the *Cuban Journal of Hygiene and Epidemiology* (14).

National and international collaboration is another pillar of INHEM's work, allowing the influence and participation of the Institution to expand beyond national frontiers. The Center has maintained ties with similar scientific institutions around the world, including the University of Nottingham in Britain and the Belgian Institute of Tropical Medicine. There is also a collaboration agreement with the Osvaldo Cruz Foundation's National Public Health School of Brazil.

The Institute has participated or conducted projects and programmes in collaboration with international organizations such as the Pan-American Health Organization (PAHO); the United Nations Children's Fund (UNICEF); the World Food Programme (WFP); the United Nations Educational, Scientific and Cultural Organization (UNESCO); and the United Nations Development Programme (UNDP).

Founded as the "Laboratory of the Island of Cuba", INHEM has become a national centre of science and technological innovation, attached to the Academy of Sciences of Cuba; it is certified as a post-graduate educational centre by the Ministry of Public Health and as a research institution by the

Ministry of Science, Technology, and Environment. It is also a Center of Excellence of the Latin American and Caribbean Environmental Training Network affiliated with the United Nations Environmental Program (UNEP) and a Collaborating Center of the World Health Organization (WHO) in the area of health in housing.

INHEM makes a great social contribution given the role it plays and the importance of its mission advising decision-makers in the public health system and in other sectors regarding health policies and strategies to guarantee health for all and for the good of all.





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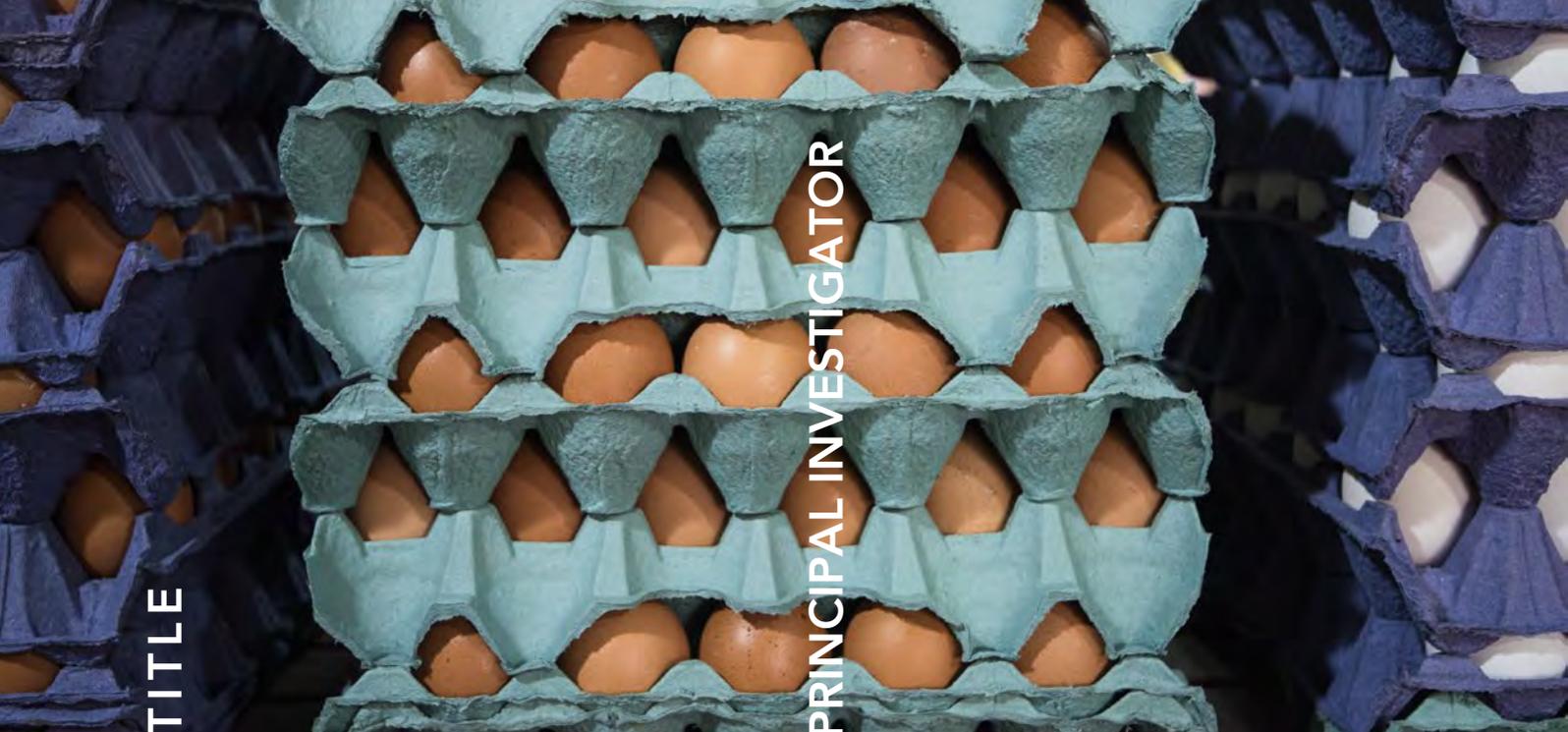
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3



ONGOING PROJECTS





TITLE

PRINCIPAL INVESTIGATOR

MICRONUTRIENTS

- | | | |
|---|--|---|
| 1 | 2011 / Effect of soybean supplementation, parasite control and nutrition education on iron status of adolescent girls in rural China | Lei Li
Medical College of Xiamen University, Siming District, Xiamen, China |
| 2 | 2014 / Minimizing the negative effect of iron supplementation and fortification on gut microbiota using local resources | Siti Helmyati
Gadjah Mada University, School of Health and Nutrition, Faculty of Medicine, Yogyakarta, Indonesia |
| 3 | 2015 / The effect of mixed green leafy vegetables powder on vitamin A and anemia status of Ghanaian schoolchildren | Godfred Egbi
University of Ghana, Noguchi Memorial Institute for Medical Research, Legon, Ghana |
| 4 | 2015 / Nutrition promotion for improving iodine status of children in an iodine-endemic area in West Java, Indonesia | Leily Amalia Furkon
Bogor Agricultural University, Bogor, Indonesia |

INFANT AND CHILD NUTRITION

- | | | |
|---|--|--|
| 5 | 2008 / Nutrition, anaemia, growth and oxygen weaning in low-birth-weight oxygen-dependent infants in a Kangaroo Clinic | Nathalie Charpak
The Kangaroo Foundation, Bogota, Colombia |
| 6 | 2010 / Intensive nutrition and hygiene education for improving nutrient intake of children (6-11 months) | Dwi Nastiti Iswarawanti
SEAMEO Regional Center for Food and Nutrition, Jakarta, Indonesia |
| 7 | 2012 / Food-based approaches to reduce childhood nutrients-energy malnutrition in Bangang community, Cameroon | Marie Modestine Kana Sop
University of Douala, Faculty of Science, Douala, Cameroon |
| 8 | 2012 / Drama for behaviour-change communication on breastfeeding and complementary feeding practices in rural areas of Osun State, Nigeria | Beatrice Olubukola Ogunba
Obafemi Awolowo University, Department of Family, Nutrition and Consumer Sciences, Ile ife, Nigeria |
| 9 | 2013 / Infant and young-child feeding and care practices of caregivers in the Province of Albay, Philippines | Joyce Louise Cruz Ignacio
University of The Philippines Los Banos, College of Economics and Management, Laguna, Philippines |

INFANT AND CHILD NUTRITION

- 10 2013 / Formulation and characterization of infant flours using spirulina powder as a replacement for multivitamin-mineral complex
Evariste Mitchikpe
University of Abomey Calavi, Department of Nutrition and Food Sciences, Cotonou, Benin
- 11 2014 / Effects of feeding style and fiber content of complementary foods on the appetite of Ethiopian infants
Kaleab Baye
Addis Ababa University, Center for Food Science and Nutrition, Addis Ababa, Ethiopia
- 12 2014 / Effect of personalized nutritional counselling on child growth and feeding practices in Burkina Faso
Yassinme Elysee Somasse
Polytechnic University of Bobo-Dioulasso, Department of Public Health, Bobo-Dioulasso, Burkina Faso

MATERNAL NUTRITION

- 13 2010 / Urinary iodine concentration of pregnant women in Zambia as an indicator of their iodine nutrition status
Cyprian Katongo
Copperbelt University, School of Mathematics and Natural Sciences, Kitwe, Zambia
- 14 2010 / Pre-conceptional vs gestational food supplements and pregnancy outcomes in rural Vietnam
Tu Ngu
National Institute of Nutrition, Department of Applied Nutrition and Nutritional Surveillance at the National Institute of Nutrition, Hanoi, Vietnam
- 15 2013 / Impact of pre-pregnancy micronutrient supplementation on infant growth and development
Phuong Hong Nguyen
Thainguyen Medical School, Thainguyen, Vietnam
- 16 2016 / Improving child growth and development through nutrition and psychosocial intervention in early childhood education (PAUD) setting in rural areas
Ali Khomsan
Bogor Agricultural University, Department of Community Nutrition, Bogor, Indonesia
- 17 2017 / Underlying causes of poor dietary intake, nutritional status and birth outcomes in pregnant adolescents and adults
Annan Reginald Adjetey
College of Science KNUST, Department of Biochemistry and Biotechnology, Kumasi, Ghana

TITLE

PRINCIPAL INVESTIGATOR



TITLE

PRINCIPAL INVESTIGATOR

CHILD BEHAVIOURAL DEVELOPMENT

18 2012 / Maternal zinc nutrition: Its influence on human health and development in Peruvian children

Nelly Zavaleta
Instituto de Investigacion Nutricional, Lima, Peru

19 2013 / Food-based intervention and psychosocial stimulation to improve child growth and development: First follow-up study

Umi Fahmida
University of Indonesia, SEAMEO RECFON, Jakarta, Indonesia

EPIDEMIOLOGIC TRANSITION BONE HEALTH

20 2009 / A pilot study of school-based peer education and obesity-related behaviours in adolescents in Beijing, China

Zhaohui Cui
University of Sydney, The George Institute for International Health, Sydney, Australia

21 2016 / Daily consumption of dried bean curd and nutrition education on bone health of postmenopausal women in China

Lei Li
School of Public Health, Xiamen University, Xiamen, Fujian Province, China

FORGOTTEN CROPS / AGRICULTURE

22 2014 / The efficacy of biofortified pearl millet in a randomized controlled trial with children <2y in rural Eastern Kenya

Mueni Hellen Ndiku & Sabaté Joan
University of Eastern Africa, Baraton School of Science and Technology, Eldoret, Kenya
Loma Linda University, School of Public Health, Loma Linda, California, USA

23 2014 / Promoting food sovereignty through a cooperative model for sustainable organic farming in the Mayan region, Mexico

Cristina Osorio-Vazquez ,
Universidad Intercultural Maya de Quintana Roo, Quintana Roo, Mexico

24 2008 / Causes and control of food insecurity: A pilot model in the northwest of Iran

Saeed Dastgiri
Tabriz University of Medical Sciences, Faculty of Medicine, Tabriz, Iran

25 2011 / Effectiveness of nutrition package in improving growth of rural children (6-23 months): A cluster randomised trial

Kissa B.M. Kulwa
Sokoine University of Agriculture, Department of Food Science and Technology, Morogoro, Tanzania

26 2012 / Prenatal and young-child nutritional supplementation and early childhood body composition, growth and development

Momodou K Darboe
MRC International Nutrition Group, Banjul, Gambia

27 2012 / Consumer acceptability of spirulina in Zimbabwe, and the effect of cooking on spirulina provitamin-A carotenoids

Tawanda Muzhingi
Tufts University, Avondale, Harare, Zimbabwe

28 2012/Effect of nutrient-dense complementary food on catch-up growth of Indonesian moderately stunted children

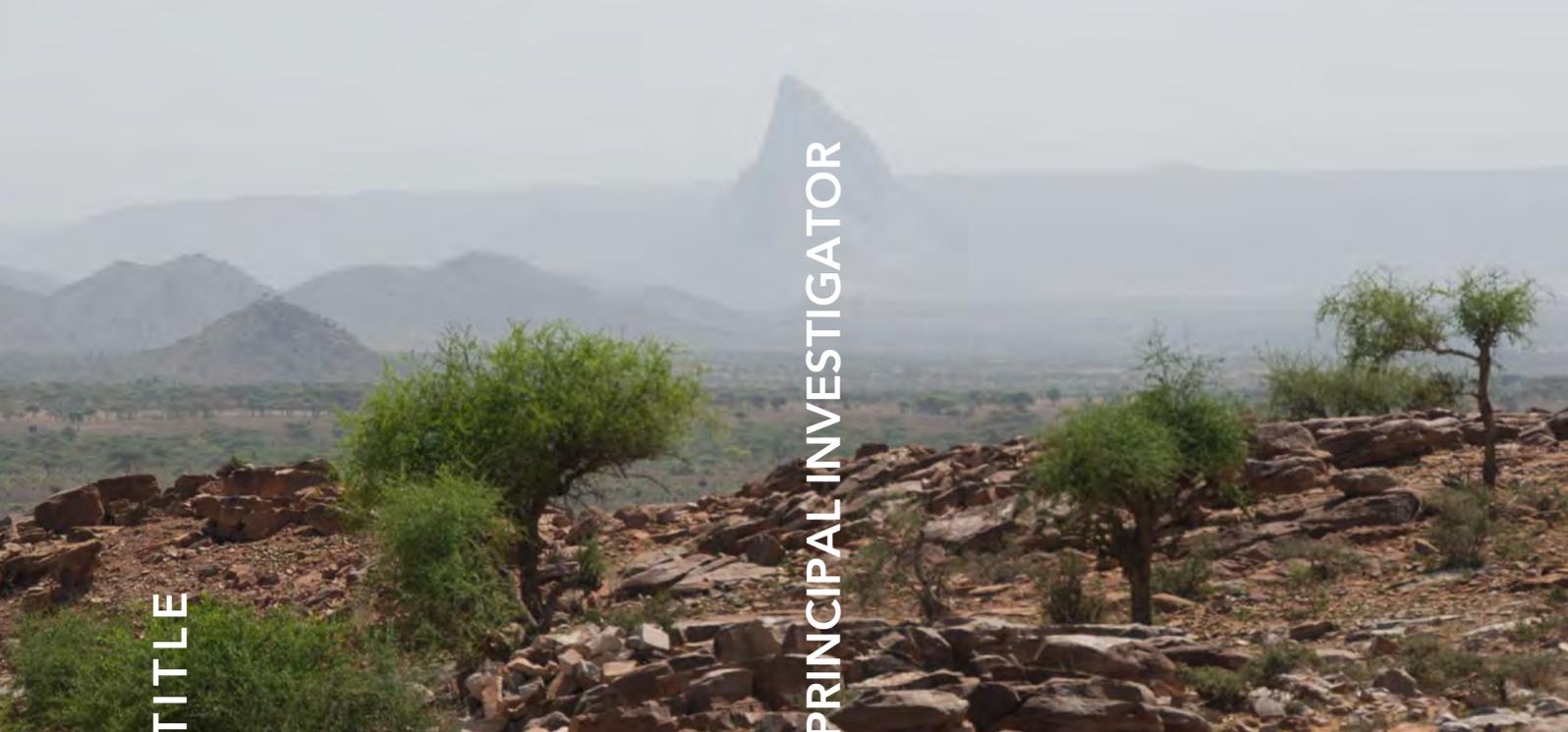
Duma Octavia Fransisca
University of Indonesia, SEAMEO RECFON, Jakarta, Indonesia

29 2013 / Child-centered counseling and home-based food production to improve dietary adequacy and growth of young children in southwestern Ethiopia

Abebe Gebremariam
Jimma University, Department of Population And Family Health, Jimma, Ethiopia

OTHER RESEARCH AREAS





OTHER RESEARCH AREAS

TITLE	PRINCIPAL INVESTIGATOR
30 2013 / Assessing the impact of public health services distribution of vitamin A in the under-five children in remote rural Zambia	Frederick D Kaona University of Zambia, Mwengu Social and Health Research Center, Ndola, Zambia
31 2013 / Behavior change and nutrition associated with integrated maternal/child health, nutrition and agriculture program	Manolo Mazariegos Institute of Nutrition of Central America and Panama (INCAP), Guatemala City, Guatemala
32 2013 / Healthy kitchens, healthy children: A school-based cluster randomized controlled trial	Nadine Sahyoun & Hala Ghattas University of Maryland, Department of Nutrition and Food Science, College Park, Maryland, USA and American University of Beirut, Center for Research on Population and Health, Beirut, Lebanon
33 2013 / Nutrition and food security: Impact of soil fertility and productivity of home gardens on family nutrition (resubmission)	U R Sangakkara †, continued by Janaki Mohotti University of Peradeniya, Faculty of Agriculture, Peradeniya, Sri Lanka
34 2014 / Nutrition gap map: A comprehensive mapping, quality assessment and summary of nutrition-relevant systematic reviews	Zulfiqar Ahmed Bhutta Aga Khan University Hospital, Center of Excellence in Women and Child Health, Karachi, Pakistan
35 2014 / A cohort analysis of the sustainability of food insecurity control programs in the northwest of Iran	Saeed Dastgiri Tabriz University of Medical Sciences, Faculty of Medicine, Tabriz, Iran
36 2015 / Participatory prototyping of complex agro-ecosystem designs to produce diverse food products in East Java, Indonesia	Uma Khumairoh University of Brawijaya, Faculty of Agriculture, Malang, East Java, Indonesia
37 2015 / Removing inorganic arsenic from rice	Andrew A. Meharg & Habibur Rhaman Queens University Belfast, Plant and Soil Science, Belfast, Northern Ireland and Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh
38 2015 / Formative evaluation of an intervention to enhance nutrition and health status of pregnant adolescents in eastern Uganda using education, cell phone communication, and income generation	Josephine Nabugoomu School of Public Health and Health Systems, Waterloo, Canada

OTHER RESEARCH AREAS

- 39 2015 / Maternal folate supplementation and epigenetic changes in the offspring
 Phuong Hong Nguyen
 Thainguyen Medical School, Thainguyen, Vietnam
- 40 2015 / Prevalence of hypoplasia-associated severe early childhood caries and deciduous molar hypomineralization amongst 3-to-6- year-old Anganwadi children
 Bulani Mahima Bharatkumar
 Dr. D.Y. Patil Dental College and Hospital, Pune, Maharashtra, India
- 41 2015 / Effect of vitamin-B12 supplementation during pregnancy and 6-month postpartum to improve B12 status and child development
 Towfida Jahan Siddiqua
 ICDDR, B, Nutritional Biochemistry Lab, Laboratory Sciences Division, Dhaka, Bangladesh
- 42 2016 / Vitamin-A status in pregnant women eating traditionally prepared spirulina (Dihé) in Chad
 Imar Djibrine Souly
 Institut Universitaire des Sciences et Techniques d'Abéché, Laboratoire de Biotechnopôle de IRED (Tchad), N'djamena, Chad
- 43 2016 / Risk factors and the associated cost of preventing childhood stunting: A case study of Buhweju district, Uganda
 John Bukusuba (Mukisa)
 Makerere University, School of Food Technology, Nutrition and Bioengineering, Kampala, Uganda
- 44 2016 / Processing and preservation of Moringa oleifera leaves for combating micronutrient malnutrition in Tanzania
 Oscar Kibazohi
 University of Dar es Salaam, Department of Chemical and Mining Engineering, College of Engineering and Technology, Dar es Salaam, Tanzania
- 45 2016 / Viral contamination of vegetables eaten raw: Sanitary impacts on Usme vulnerable population (Bogota)
 Carlos Arturo Guerrero-Fonseca
 Universidad Nacional de Colombia, Molecular Biology Virus Laboratory, Faculty of Medicine, Bogota, Colombia
- 46 2017 / Improving vitamin-A intake in Northern Cameroon through nutrition education on food habits
 Richard Aba Ejoh
 University of Bamenda, Department of Food and Bioresource Technology, College of Technology, Bamili, Cameroon
- 47 2017 / Designing improved complementary feeding for infant and young children from locally available foods in rural western Ethiopia
 Fekadu Gemedé Habtamu
 Wollega University, Food Science, Nekemte, Ethiopia



TITLE

PRINCIPAL INVESTIGATOR



TITLE

PRINCIPAL INVESTIGATOR

OTHER RESEARCH AREAS

48	2017 / Development of a bio-control approach for mitigation of aflatoxin in groundnuts using atoxigenic strains of <i>Aspergillus</i> spp in Tanzania	Juma Mfaume Naliendele Agricultural Research Institute (NARI), Mtwara, Tanzania
49	2017 / Consumer attitude and perception of the consumption of edible insects in western Kenya	Fanuel Kawaka Technical University of Mombasa, Department of Pure and Applied Science, Mombasa, Kenya
50	2017 / In search of an EEG neural fingerprint of early malnutrition: A 50-year longitudinal study	Pedro Antonio Valdes-Sosa Cuban Neuroscience Center, Havana, Cuba
51	2017 / Formulation and characterization of fortified cereal foods using African palm weevil powder and its effect on the iron status of Ghanaian children	Okyere Abenaa Akyaa Ghana Atomic Energy Commission (GAEC), Biotechnology & Nuclear Agriculture Research Institute (BNARI), Accra, Ghana



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Abizari AR, Azupogo F, Brouwer ID. Subclinical inflammation influences the association between vitamin-A and iron status among schoolchildren in Ghana. *PLoS ONE* 2017;12:1-15.

Baye K, Tariku A, Mouquet-Rivier C. Caregiver-infant's feeding behaviours are associated with energy intake of 9-11 month-old infants in rural Ethiopia. *Matern Child Nutr* 2017;1-8.

Bukusuba J & Kaaya N, Archileo & Atukwase A. Risk factors for stunted growth among children aged 6-59 months in rural Uganda. *Int J Nutr* 2017;2:1-13. 10.14302/issn.2379-7835.ijn-16-1408.

Bukusuba J, Kaaya AN, Atukwase A. Predictors of stunting in children aged 6 to 59 months: A case-control study in southwest Uganda. *Food and Nutrition Bulletin* 2017;38:542-53

Egbi G, Alatah GA, Ayi I, Steiner-Asiedu M. Red palm oil bean-stew improved serum vitamin A and haemoglobin concentrations and anthropometric indicators of school children with low vitamin-A concentrations in a malaria-endemic setting. *AJFAND* 2017;17:12817-36.

Gonzalez-Casanova I, Nguyen PH, Young MF, Harding KB, Reinhart G, Nguyen H, Nechitillo M, Truong TV, Pham H, Nguyen S, Neufeld LM, Martorell R, Ramakrishnan U. Predictors of adherence to micronutrient supplementation before and during pregnancy in Vietnam. *BMC Public Health* 2017;17:1-9.

Katongo C, Brunet D, Kabaghe CG, Mubanga F, Kabwe FK, Bupe B, Siamusantu W. Prevalence of iodine deficiency among school children and access to iodized salt in Zambia. *AJFAND* 2017;17:12628-40.

Mispireta ML, Caulfield LE, Zavaleta N, Merialdi M, Putnick DL, Bornstein MH, DiPietro JA. Effect of maternal zinc supplementation on the cardiometabolic profile of Peruvian children: Results from a randomized clinical trial. *J Dev Orig Health Dis* 2017;8:56-64.

Nguyen PH, DiGirolamo AM, Gonzalez-Casanova I, Young M, Kim N, Nguyen S, Martorell R, Ramakrishnan U. Influences of early child nutritional status and home learning environment on child development in Vietnam. *Matern Child Nutr* 2017;1-11.

Nguyen PH, Gonzalez-Casanova I, Young MF, Truong TV, Hoang H, Nguyen H, Nguyen S, DiGirolamo AM, Martorell R, Ramakrishnan U. Pre-conception micronutrient supplementation with iron and folic acid compared with folic acid alone affects linear growth and fine motor development at 2 years of age: A randomized controlled trial in Vietnam. *J Nutr* 2017;147:1593-1601.

Ogunba BO, Ogunleye FM, Ajayi AO, Alabi S. Drama for behaviour change communication on breastfeeding practices in rural area of Osun State, Nigeria. *Nigerian J Nutr Sciences* 2016;37:46-57.

Osorio Vazquez MC. Enhancing Maya women's development through cooperative associations: What factors support or restrict the contribution of cooperatives? (ISBN 978-90-365-4404-7), University of Twente, Enschede 2017. DOI: 10.3990/1.9789036544047.

Wekumbura WGC, Mohotti AJ, Frossard E, Kudagammana ST, Silva KDRR. Prospects and issues related to tea cultivation in mid-country home-garden-based tea smallholdings in a selected village in Sri Lanka. *Tropical Agricultural Research* 2017; 28:1-12.

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Ghattas H, Jamaluddine Z, Choufani J, Btaiche R, Reese-Masterson A, Sahyoun NR. A community-based intervention improves economic, social and food security outcomes of refugee women: The healthy kitchens experience. *The FASEB J* 2017;31(1 Supp):313-6. Abstract from Experimental Biology, Chicago, April 2017 (oral presentation).

Ghattas H, Jamaluddine Z, Choufani J, Sahyoun NR. The healthy kitchens, healthy children study: A community-based school nutrition intervention improves diet diversity in Palestinian refugee schoolchildren in Lebanon. *IUNS 2017*, Buenos Aires, Argentina.

Jamaluddine Z, Choufani J, Sahyoun NR, Ghattas H. A child-administered food security scale is associated with household socio-economic status, household food security and diet diversity. *The FASEB J* 2017;31(1 Supp):297. Abstract from Experimental Biology, Chicago, April 2017 (oral presentation).

Khumairoh U, Lantinga EA, Groot JCJ, Schulte R, Suprayogo D. Increasing rice productivity and yield stability of organic rice production systems through complex-agroecosystems in East Java, Indonesia. In: Abstract book Wageningen Indonesia Scientific Exposure (WISE) 2017; Wageningen : Wageningen University & Research:56-8

Samarakoon SMDS, Silva KDRR, Thamilini J, Mohotti J, Frossard E. Contribution of home gardening to household food security in a village in Nawalapitiya, Sri Lanka. *Undergraduate Research Symposium* 2015.

Soudy ID, Minet-Quinard R, Mahamat AD, Ngoua HF, Arada A, Tidjani A, Ngo Bum E, Desjeux JF, Sapin V. Vitamin-A status in non-pregnant women eating traditionally prepared spirulina (Dihé) in Chad. 16th Fat Soluble Vitamins Congress 2017, Paris, France (oral presentation).

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Wekumbura WGC, Mohotti AJ, Frossard E, Kudagammana ST, Silva KDRR. Prospects and issues related to tea cultivation in mid-country home-garden-based tea smallholdings in a selected village in Sri Lanka. 28th Annual Congress of the Postgraduate Institute of Agriculture 2016.

Wekumbura WGC, Mohotti AJ, Frossard E, Kudagammana ST, Silva KDRR. Food and cash crop diversity of mid country home-gardens with special reference to Nawalapitiya, Sri Lanka. 6th International Symposium of Sabaragamuwa, University of Sri Lanka (ICSUSL) 2017;45.

Yesmin MDF, Kudagammana ST, Dharmaratne SD, Mohotti AJ, Frossard E, Silva KDRR. Improved home garden and communicable diseases among children in Sri Lanka. 38th Annual Academic Sessions of the Kandy Society of Medicine 2016;116.

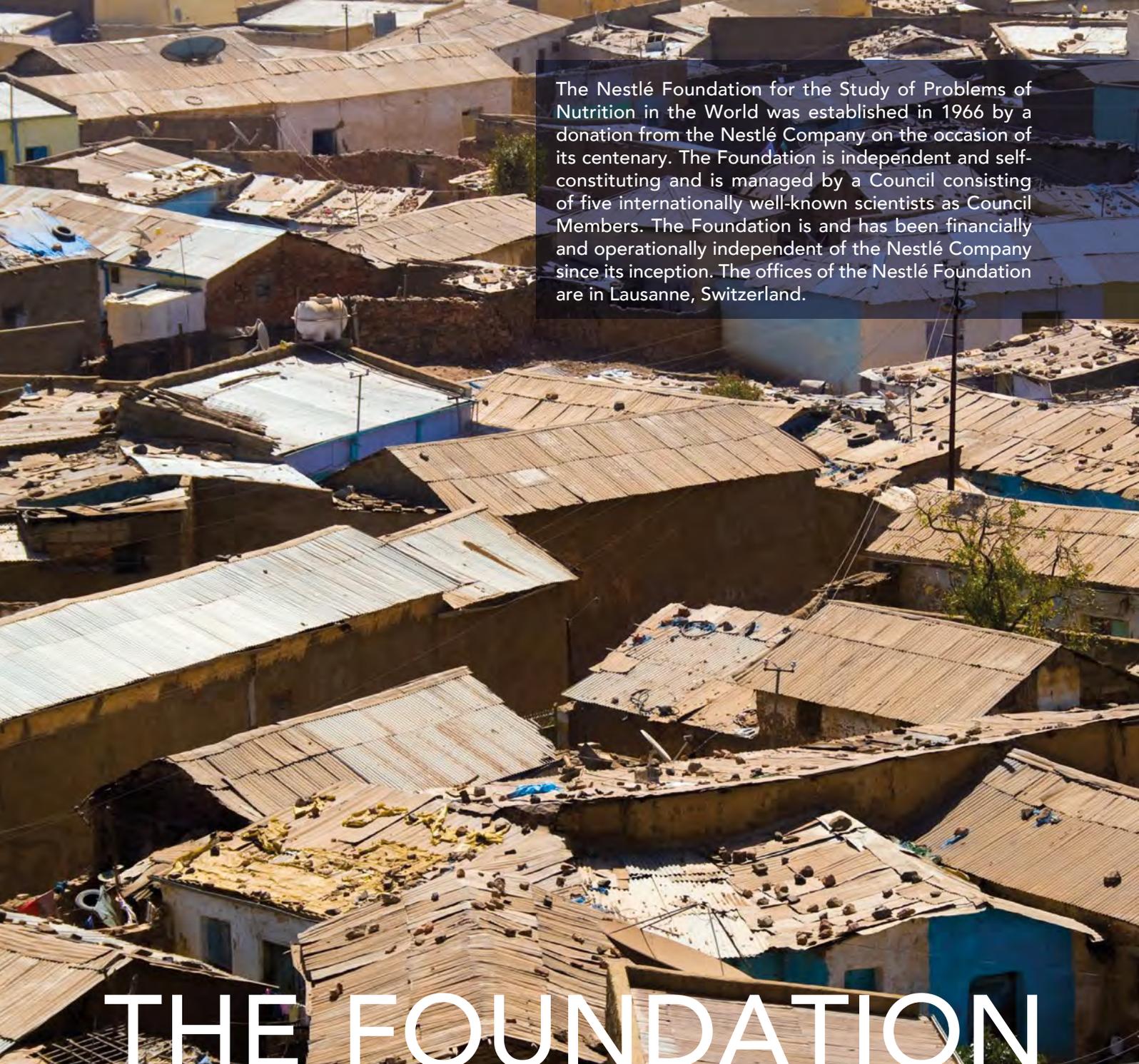
Yesmin MDF, Kudagammana ST, Dharmaratne SD, Mohotti AJ, Frossard E, Silva KDRR. Allergic manifestations in pre-school children in improved vs standard home gardens: Experience from a rural area in Nawalapitiya. 38th Annual Academic Sessions of the Kandy Society of Medicine 2016.

Yesmin MDF, Kudagammana ST, Dharmaratne SD, Mohotti AJ, Frossard E, Silva KDRR. Impact of home garden on the health status of preschool children in Nawalapitiya area. 19th Annual Scientific Congress of Sri Lanka 2016.

The publications are available free of charge upon request.







The Nestlé Foundation for the Study of Problems of Nutrition in the World was established in 1966 by a donation from the Nestlé Company on the occasion of its centenary. The Foundation is independent and self-constituting and is managed by a Council consisting of five internationally well-known scientists as Council Members. The Foundation is and has been financially and operationally independent of the Nestlé Company since its inception. The offices of the Nestlé Foundation are in Lausanne, Switzerland.

THE FOUNDATION

GUIDELINES FOR GRANT APPLICATIONS TO THE NESTLÉ FOUNDATION

PURPOSE

The Nestlé Foundation initiates and supports research in human nutrition with public-health relevance in low-income and lower-middle-income countries according to the World Bank classification (see <http://www.worldbank.org>). The results of the research projects should ideally provide a basis for implementation and action which will lead to sustainable effects in the studied populations as generally applicable to the population at large. They should also enable institution strengthening and

capacity building in a sustainable manner in the host country, and further cooperation and collaboration between institutions in developed and developing countries.

The Foundation expects research proposals to be primarily the initiative of local researchers from the developing countries. However, the Foundation will be inclined to consider favourably those applications made jointly by scientists from developed countries

with those from developing countries provided it is clear that the initiative will result in capacity building and human-resource development in the latter and that the bulk of the budget is spent in the developing country.

CURRENT POLICY

Sustainable improvement in human nutrition is one of the major issues in the portfolio of the Foundation. During more than 50 years, basic and applied research in nutrition has been supported by the Foundation in over 50 developing countries. In view of the past activities of the Foundation as well as the world's situation at the turn of the millennium, it was recognized that the public-health relevance of the supported research as well as aspects of sustainability, capacity building and educational issues should have a higher priority. Thus, priority is given to projects which lead to sustainable developments with strong elements of capacity building, and the implementation of the results of a research project should be immediate and sustainable. Highly sophisticated nutrition research of mainly academic interest without public-health relevance has lower priority for support, as do solely laboratory-based studies or animal experimentation.

RESEARCH TOPICS

At present the Foundation's work is primarily concerned with human nutrition research issues dealing with:

- (1) maternal and child nutrition, including breastfeeding and complementary feeding,
- (2) macro- and micronutrient deficiencies and imbalances,
- (3) interactions between infection and nutrition, and
- (4) nutrition education and health promotion.

The precise priorities and goals of the Foundation are modified from time to time to meet emerging public-health and nutritional needs in the developing world.

Studies in other areas of human nutrition research might also be considered, as long as they are dealing with problems of malnutrition in eligible countries (see above). Other areas of research may possibly be considered for support if the applicant can offer specific and convincing evidence and justification for the choice of the research topic.

Funded projects are usually of one- to three-year duration. Projects with a high potential for effective and sustainable improvement of the nutritional status as well as a high capacity-building component will be funded preferentially. The budget of the projects must be appropriate and reasonable and has to be justified in detail.

One of the Foundation's main aims is the transfer of scientific and technological knowledge to target countries. In cases where Foundation-sponsored research projects are realized in collaboration with scientists at universities and research institutes in high-income countries, at least 75% of the budget has to be earmarked for use within the low-income country.

The Foundation does not normally fund:

- (1) projects with low public-health relevance
- (2) projects with doubtful sustainability
- (3) projects lacking transfer of scientific, technical and educational knowledge, i.e. lacking a capacity-building component
- (4) large-budget projects, meaning projects that exceed USD 100,000 per year or USD 300,000 over the total duration of a 3-year project
- (5) nutrition surveys or surveillance studies
- (6) research on food policy, food production and food technology except when linked to an intervention with high potential for sustainable improvement of the nutritional status
- (7) in vitro and/or animal experiments.

ELIGIBLE INSTITUTIONS

Eligible institutions are departments or institutes from universities, hospitals, and other institutions of higher education in low- or lower-middle-income countries. Joint applications from more than one institution (especially South-South) are welcomed. Joint applications from more than one institution involving a North-South collaboration may also be considered. For project applications demonstrating North-South collaboration, it is important that the following criteria are fulfilled: (i) the Principal Investigator is from the South and the proposal has relevance to nutritional problems of the South; (ii) the majority of the budget is earmarked for the South; and (iii) demonstration upon completion of the project of institution- and capacity building in a sustainable manner in the South.

The capacity-building component represents a core issue for all applications to the Foundation. This means that every application needs to demonstrate a training and human-resource and capacity-building component for the developing world. Ideally graduate students or young investigators should play a key role and, where possible, be designated as the Principal Investigator (PI), i.e. be the primary grant applicant, or Co-PI. Established researchers can nevertheless apply but need to clearly indicate the capacity-building component and the designated beneficiaries. All applications need to clearly state the capacity- and human-resource-building components in the host country as well as the long-term sustainability of research in the host institution. Applications from individuals who are non-affiliated researchers and not attached to research or academic institutions can be considered only in very special cases.

TYPES OF AWARDS

The Nestlé Foundation offers different award and grant categories, some of them using a modular approach; for example, the Pilot Grant Program represents the starting grant module for a later Full Grant Research application. The eligibility criteria as well as the research objectives and topics have to be fulfilled no matter what the award category (for further details see www.nestlefoundation.org):

Institutional Support

Institutional support involves the support of research or educational projects in specific institutions in low- or lower-middle-income countries which contribute to a focused development of capacity and know-how and human-resource development in the corresponding institution.

HOW TO APPLY

Interested scientists should first submit a letter of intent in which they describe very briefly the kind of project they would like to undertake, including an estimated budget. Instructions for the letter of intent are available on the Foundation website at www.nestlefoundation.org. For a submission of a letter of intent only the downloadable form on our website should be used. If the suggested project is compatible with the Foundation's current funding policy, applicants will receive an invitation to submit a full grant proposal. The guidelines for the submission of a full grant proposal are also available on our website. Other formats will not be accepted, neither for the letter of intent nor for the full grant application. In the letter of intent and in the grant application, detailed, evidence-based information about the public-health relevance of the project as well as its immediate impact and sustainability have to be reported. This part of the application is as important as the scientific section of the application.

Research grant applications are evaluated twice a year by the Foundation's Council, a group of independent international scientists. The funding of projects is primarily based on the scientific quality, public-health relevance in the short and long term, sustainability, capacity-building component and, last but not least, budget considerations.

Applications are accepted throughout the year, and the Foundation encourages applicants to submit their proposals early to allow sufficient time for internal as well as external reviews. All submissions should be made electronically by e-mail. Final deadlines for submission are January 10 and May 10 for the Spring and Fall Council Meetings, respectively.

For more information consult
www.nestlefoundation.org



The Council of the Foundation consists of at least five Council Members and Advisors. All Council Members and Advisors are internationally well-known scientists with a specific expertise in different fields of nutrition. The Council is self-constituting and operates independently. The Foundation is directed jointly by the Director and the President of the Foundation.

THE COUNCIL

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From left to right: Ann Prentice, Walter Wahli, Petra S. Hueppi, Benjamin Caballero, Dominique Darmaun, Catherine Lieb, Paolo M. Suter

