UNIVERSITY OF NAIROBI

REMARKS MADE BY PROF. PETER M. F. MBITHI, DEPUTY VICE-CHANCELLOR (A&F) DURING THE INSTAPA PROJECT ANNUAL MEETING HELD ON JUNE 22, 2009

Project Description

AIM: To identify novel staple food-based strategies to improve micronutrient nutrition for better health and development of women and children in sub-Saharan Africa

The project focuses on the improvement of millet-, sorghum-, maize-, and cassava-based foods for young children in sub-Saharan

Africa to safely prevent deficiencies of iron, zinc, and vitamin A and to improve immune function and cognitive development.

Project Concept

Poor nutritional status and limited financial resources often compromise individual welfare in the developing world. In combination with a commonly high concurrent disease load, a self-perpetuating cycle of poverty, malnutrition and mortality arises.

Adequate nutrition is a human right that underpins progress towards most of the Millennium Development Goals (MDG) as formulated under the banner of the United Nations (2000) to be reached in 2015, such as reducing child mortality, improving maternal health and decreasing the burden of malaria, HIV/AIDS and other diseases. The proportion of undernourished people in developing countries fell by only 3% from 1992 to 2003, which still leaves 820 million people undernourished. Undernutrition accounts for half of the 9 million infant deaths each year. According to the

MDG Report 2006, the situation is worst in sub-Saharan Africa, where the absolute number of undernourished people continues to rise. Thus, improving nutritional status in this region is critical to break the cycle of malnutrition, poverty and mortality.

Apart from energy and protein malnutrition, there is rising concern about the nutritional quality of diets in terms of micronutrient adequacy in developing countries. Over 30% of the world's population is anaemic, mainly due to iron deficiency. Iron deficiency may progress to anaemia, which has adverse health effects on pregnancy outcome, infant growth, cognitive performance, psychomotor development, immune status and work capacity, with substantial economic costs related to impaired school performance and decreased productivity. For pregnant women, anaemia contributes to 20% of all maternal deaths. Even mild-to-moderate iron deficiency without anaemia may reduce work capacity and resistance to fatigue and impair cognition. The risk of deficiency is highest when iron needs are proportionately greater than energy

needs, making infants and young children particularly vulnerable. In many developing countries, use of plant-based weaning foods contributes to a high prevalence of anaemia in young children. In sub-Saharan Africa, the prevalence of anaemia in pregnant women was reported to be 68% in Burkina Faso and in the range of 47-63% in Mali. Two surveys in Benin suggested anaemia prevalence rates of 82% among children aged 6-59 months and of 60% in children 36 to 60 months.

Because iron and zinc are found in many of the same foods, high rates of iron deficiency in sub-Saharan Africa suggest widespread occurrence of zinc deficiency in the same populations. Zinc is required by ~50 enzymes in the body, and many metabolic functions are affected by zinc deficiency, including physical growth, immune competence, reproductive function and neural development. Several supplementation trials among high-risk young children have shown that increased zinc intake reduces the burden of diarrhoea and acute lower respiratory infections. Most people in

sub-Saharan Africa have inadequate dietary intake of bioavailable zinc, and surveys indicate that most children are zinc deficient as assessed by plasma or serum zinc concentrations.

Vitamin A deficiency affects an estimated 127 million preschool-age children and 7 million pregnant women. Approximately every third child with vitamin A deficiency lives in sub-Saharan Africa. Health consequences of vitamin A deficiency comprise mild to severe systemic effects on innate and acquired immunity, increased burden of infectious morbidity, xerophthalmia, blindness, and increased mortality. Although clinical signs of vitamin A deficiency show a downward trend, even subclinical vitamin A deficiency is associated with excess maternal and infant mortality. Sub-Saharan African countries are among those with the highest vitamin A deficiency prevalence, often in excess of 50%.

Major causes of micronutrient deficiencies comprise low intake due to food scarcity, unavailability of micronutrient-rich foods, poverty,

or poor dietary habits; high demands that arise from growth spurts during infancy and adolescence, pregnancy, or increased blood loss as occurs with pronounced menstruation or infestation from parasites; and low bioavailability. Africa's traditional weaning foods are watery gruels based on boiled cereals. Such diets are rich in substances that inhibit iron and zinc absorption such as phytic acid and polyphenols, while poor in ascorbic acid and meat that enhance iron bioavailability. The intestinal absorption of provitamin A ingested from plant foods to vitamin A is much less than previously thought. This is particularly the case for darkgreen leafy vegetables, which contain ß-carotene trapped in chloroplast membranes, but bioavailability may be higher for ß-carotene from tubers that do not contain chloroplasts. An expert group recently concluded that it is virtually impossible to correct widespread vitamin A deficiency by conventional plant-based diets alone in developing countries. Foods that are good sources of bioavailable iron, zinc and vitamin A, such as animal products, are generally not

available due to high costs or limited supply, especially to poorer populations in the developing world.

At the World Summit for Children in 1990, elimination of deficiencies of vitamin A, iron, and iodine were placed high on the agenda. Zinc was added to the list in the Third Report on the World Nutrition Situation. In 2001, the UN General Assembly at the Special Session on Children recommended that the prevalence of anaemia be reduced by one third in children by the year 2010. If achieved, this would contribute greatly to the realisation of the Millennium Development Goals.

In a recent series of articles in the Lancet, it was highlighted that at least 200 million children under 5 years of age fail to reach their potential in cognitive and socio-emotional development. Most of these children live in South Asia and sub-Saharan Africa. Malnutrition leading to stunting, iodine and iron deficiency are mentioned as three out of four of the major underlying factors.

Programmes that strive to eliminate iodine and iron deficiency have been shown to be successful and affordable. Since the detrimental effects of deficiencies on development of infants and toddlers might not be readily reversed, preventive approaches are required.

Supplementation strategies have been widely used to provide iron and folic acid to pregnant women, and vitamin A to infants, young children and postpartum to women. However, supplementation usually requires the procurement and purchase of micronutrients in a relatively expensive pre-packaged form, an effective distribution system and a high degree of consumer compliance. Lack of supplies, low coverage and poor compliance are consistently reported as being the main barriers to sustainable success. Safety is also a concern. For example, vitamin A is toxic when ingested in large quantities, this in contrast to dietary provitamin A. Moreover, the recent restrictions on supplementation with iron in malaria-endemic areas by WHO has brought international organizations

that strive to alleviate iron deficiency anaemia in such regions in an impasse. Food-based approaches are the only way to overcome this.

Fortification and biofortification offer the potential of reducing micronutrient malnutrition as part of a food-based approach when existing food supplies or supplementation strategies fail to provide adequate levels of the respective nutrients in the diet. Dietary approaches such as improved processing or food-to-food fortification have the potential to improve micronutrient supply or bioavailability, and could synergistically enhance the efficacy of (bio)fortification. The proposed research not only aims to improve the nutritional quality of the diets especially of children in low-income countries, but also to measure the effect of this improvement on functional outcomes of immunity, infection and cognitive development. Such data is urgently needed in order to help to build a common ground for inclusion of nutrition in the agendas of policy makers.

Strategic Objectives:

- **To evaluate the genetic potential of cassava, maize, millet and sorghum for increased content of provitamin A, iron and zinc and for reduced content of antinutrients**
- **To determine the efficacy of fortified and biofortified cereal-based foods on nutritional status and health**
- **To develop improved (traditional) processing methods of millet, sorghum and maize enhancing iron, zinc and vitamin A bioavailability and/or reducing inhibitory effects of anti-nutrient factors for improvement of micronutrient status of young children and women**
- **To determine the safety and efficacy of iron-fortified maize to alleviate anaemia in malaria-endemic areas in sub-Saharan Africa**
- **To determine the effect of maize-based complementary foods fortified with iron and zinc on cognitive and psychomotor development of young children**

- **To contribute significantly to the improvement of the dietary quality of very young children living in resource poor areas of developing countries resulting in long-term health effects and a major step towards the Millennium Development Goals set for 2015**
- **To establish an international leading role of the consortium in the fields of biofortification, fortification and processing to increase the supply of bioavailable micronutrients from African staple foods by bringing together scientific and technological excellence**
- **Capacity building in knowledge and skills to solve micronutrient deficiencies in sub-Saharan Africa and Europe**
- **Communication within and beyond the consortium regarding the ethical and scientific issues of concern to the agricultural and health sectors as well as consumers,**

enabling African populations to define and choose diets for optimal health for their children.

Thank you.