Background
The nutritional quality of complementary foods ('babyfoods') in developing countries is often insufficient to sustain optimal growth in infants and young children. During the complementary feeding period from 6 to 24 months of age is where the infant gradually change from breast-milk to solid food. It is well documented that retarded growth and micronutrient deficiencies are rapidly emerging in this period. It therefore also considered as a 'window-of opportunities' for interventions to prevent undernutrition.

Local alternatives
There is a growing recognition of the needs for locally available nutritious complementary foods in order to efficiently prevent undernutrition, especially chronic undernutrition manifested as retarded linear growth ('stunting'). Decades of optimistic expectations that micronutrient supplementation could compensate for poor dietary quality has not been transferred into strategies that efficiently reduced stunting.

International stakeholders such as World Food Programme (WFP), UNICEF and FAO; international NGOs such as World Vision, PATH, Alive & Thrive, Care etc., increasingly points to improving diets as the long-term but also the short-term solution to prevent and treat undernutrition.

Interventions aiming at improving diets through nutrition education about better use of available foods have proved to be efficient in some settings, but also shown that access to a stable and sufficient intake of nutritious complementary foods is necessary for successful improvement in child nutrition. Access to processed foods during the critical complementary feeding period may be needed to achieve substantial improvement of the dietary intake.

The WINFOOD project investigated how local ingredients can be used in locally produced processed foods. In close interaction with WFP and national stakeholders it was prioritized that evidence based knowledge about how much processed products could improve nutritional status during complementary feeding was highly valuable for policy formulation and development of national nutrition interventions.

WINFOOD in Cambodia and Kenya
The project focused on a stepwise procedure for development of processed complementary food products based on local ingredients in Cambodia and Kenya. Through collaboration with WFP the WINFOOD products at both project sites were developed to be a potential alternative to standard food aid products currently widely distributed in food insecure populations.

In Cambodia the optimized WINFOOD products were based on rice and small indigenous fish. One product included an edible spider to add zinc, and a parallel product was fortified with micronutrients matching WFP products (Table 1). In Kenya, a WINFOOD product consisted of maize, germinated amaranth grains, small fish and termites. A parallel product without ter-
mites was fortified with micronutrients (Table 2).

The model foods were called ‘WINFOODS’ and batches were produced in collaborations with local food manufacturers. The WINFOODS were tested in randomized intervention trials in infants enrolled at age 6 months and provided a daily portion for 9 months, to age 15 months. The WINFOODS were tested against WFP standard products called ‘Corn-Soya-Blends’. In Cambodia we tested against two CSB products, one with milk and one without. In Kenya we tested against the standard product without milk.

Key findings

**Food development**

The project findings in both Cambodia and Kenya demonstrated that local processed complementary foods can be developed and produced with simple and available technologies, achieving nutritious and acceptable products. The identification of local animal-source foods in both project sites (fish and insects) which could successfully be incorporated into processed foods demonstrate that there is a promising potential to significantly improve nutritional quality of processed foods by using local alternative to milk used in standard food aid products.

**Nutritional impact in children**

Interventions in Cambodia and Kenya showed that the children in all food groups were deteriorating in growth compared to WHO growth standards, despite provision of a food supplement. A true control group not receiving food was not included for ethical reasons. However, parallel assessment of similar population groups indicated that the provision of food left the children less undernourished than the background population.

In Cambodia, the fortified WINFOOD product with fish and no spider tended to support length growth in the children similar to the WFP product with milk, and slightly less that the WINFOOD product with spider and no micronutrients. The unfortified spider-WINFOOD product was not different from the WFP product without milk. In Kenya, the fortified WINFOOD product tended to support better nutritional status than the unfortified product with termites manifested as better iron status.

At both sites major scientific understanding of children’s growth patterns was achieved through application of advanced novel methods for assessing body composition (deuterium dilution
method). The pioneering results are not applicable for providing direct policy recommendations

Modelling optimal diets
In Cambodia, the diets of the child groups receiving the food supplements was modelled by the mathematical tool linear programming available in the software OptiFood. The modelling provides information about best scenarios for how the whole diet can be optimized and be impacted by provision of a daily portion of different food supplements. The modelling showed that even with the fortified foods (WINFOOD as well as WFP products) in realistic portion sizes certain micronutrients would remain under threshold for required intake.

The WINFOOD project confirmed:

- There is a great interest among national and international stakeholder for identifying local nutritious complementary food alternatives as a long-term sustainable approach to prevent undernutrition, especially stunting.

- In Cambodia and Kenya a broad range of local and traditional food items with advantageous nutritional qualities are available with a potential to improve the complementary diets if made available for stable and sufficient intake.

Policy recommendations

- In nutrition strategies and programmes it should be recognized that a major constraint for achieving better nutritional quality of complementary foods is accessibility to a stable and sufficient intake of quality diets with a component of especially animal-source food (fish, meat, milk).

- In agriculture as well as in nutrition programmes a systematic approach to identify nutrient dense local foods can contribute to reveal local resources for improving diets.

- The use of Linear Programming should be extended to improve predictions on how nutrition interventions such as providing a food supplement can impact the dietary quality and guide if parallel and complementary interventions e.g. fortification are needed.

- Processed complementary foods (‘babyfood’) produced locally and with local ingredients holds a promising potential for being scaled up as a substantial contribution to improving nutrition in children. Value-chain analysis and development of business models are needed for efficient implementation.

The WinFood project was funded by FFU (57-08-LIFE), 2008-2013. Coordinator: Kim Fleischer Michaelssen, Department of Nutrition, Exercise and Sports (NEXS). University of Copenhagen. Partners: Fisheries Administration, Cambodia and University of Nairobi, Kenya.

1. Mother feeding child WinFood, Cambodia. The pre-cooked powder was boiled in water to porridge.
2. WinFood daily ration packaging. Cambodia
3. Kenyan child eating termites, a WinFood component.