

# The role of the new Food and Nutrition Evaluation Laboratory (FANEL) in developing shelf-storable orange-fleshed sweetpotato purée

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To increase regional capacity to carry out food science and nutrition analysis, we provided technical assistance to establish FANEL as a sustainable regional reference laboratory for assessment of nutritional quality, bioaccessibility of  $\beta$ -carotene, and safety of orange-fleshed sweetpotato (OFSP) roots and products. Progress has been made on our key target—to develop an OFSP purée that can be stored without refrigeration for up to 4-6 months.



OFSP purée processing and packing

EIL purée packaging study

## What is the problem?

Experience across many sub-Saharan countries has shown that using orange-fleshed sweetpotato (OFSP) purée as a substitute for wheat flour is more cost-effective and readily acceptable to consumers than OFSP flour. However, the major bottleneck to expanding the use of OFSP purée has, until now, been the inconvenience related to its preparation and storage. The use of vacuum sealed purée provides processors with the chance to transport and store sacks of OFSP purée without cooling. However, for the product to be widely acceptable, it must have an acceptable shelf-life. Furthermore, products made from the stored OFSP purée should not be markedly different than those from fresh purée.

## What do we want to achieve?

Our goal is to develop OFSP purée that can be stored for four to six months without a cold chain and to ensure that the products made from stored purée are not markedly different than those from fresh purée. This has the potential to be the breakthrough technology for the expanded use of OFSP purée in sub-Saharan Africa.

## How are we going to make it happen?

In collaboration with Euro-Ingredients Limited (EIL), we have embarked on research studies to explore the application of chemical and natural preservatives together with vacuum packaging, and their effect on the shelf storability of OFSP purée without refrigeration (Fig.1). The objectives of the studies are to (1) determine the  $\beta$ -carotene retention in OFSP purée over six months storage in vacuum pack plastic bags with and without preservatives; (2) determine the changes in reducing sugar content in OFSP purée over six months storage in vacuum pack plastics bags with or without preservatives; (3) determine the character and nature of microbial growth in OFSP purée over six months storage in vacuum plastic bags with or without preservatives and (4) determine the varietal effect on the  $\beta$ -carotene retention, reducing sugar content and microbial growth in the OFSP purée over six months of storage in vacuum pack plastic bags with or without preservatives.

The development of OFSP for nutritional improvement in SSA requires high regional capacity in food science and nutritional analysis. In 2014, the Food and Nutritional Evaluation Laboratory (FANEL) was established at the Biosciences for Eastern and Central Africa (BeCA) Hub of the International Livestock Research Institute (ILRI) in Nairobi. Both the SASHA and SUSTAIN projects are providing technical assistance (one food scientist, 2 technicians) and building the capacity of FANEL to function as a sustainable regional reference laboratory for assessment of nutritional quality, bioaccessibility of  $\beta$ -carotene, and safety of OFSP roots and products (Fig. 2).



### ✦ Where are we working and with whom?

Our initial trials were undertaken in collaboration with Euro-Ingredients Limited (EIL) in Nairobi. The second round of trials is taking place in Ringa, Homa Bay County, in Western Kenya in collaboration with a private sector processor, Organi Limited. FANEL is located in Nairobi, Kenya, but is meant to serve as a reference laboratory for national programs in East, Central, West and Southern Africa. The Natural Resources Institute (NRI) is helping to confirm that the lab meets international standards.

### ✦ What have we achieved so far?

On 29 January 2015, FANEL achieved a milestone when the high performance liquid chromatography (HPLC) had appropriate columns installed for beta-carotene analysis and preparation of standard curves began. We registered the lab as a participant in the United States National Institutes of Standards and Technology's Fat-Soluble Vitamins and Carotenoids external validation round robin analysis program. Once our fat soluble vitamins and carotenoids protocols have been externally validated, we will share our research findings publicly.

We did three analyses to determine carotenoid content and retention, food safety, reducing sugar content determination and organoleptic properties. Preliminary findings show that  $\beta$ -carotene content of the OFSP purée does not change significantly during the first 3 months at room conditions (temperature ranges 15-23°C) in Nairobi, Kenya. We also found that using potassium sorbate (1%) and sodium benzoate (1%) in combination with vacuum packing can increase the shelf storability of OFSP by at least two months. Furthermore, Maysa antifungal and antibacterial treatments (at 0.08%) have been found to be highly effective against molds and yeasts in foods and can extend the shelf-storability of OFSP purée by more than four months.



■ Nutrition staff working in the FANEL laboratory (credit S. Quinn)

Based on these findings, we began a second six month trial of the OFSP purée trial storage without refrigeration on 6 June 2015. Our aim is to produce OFSP purée with a pH between 3.8 and 4.6 according to the FDA guidelines for acidified foods. The lower pH will make the OFSP purée safer for human consumption by reducing and limiting the presence and toxicity of spore form bacteria and their toxin producing spores, as well as that of other harmful pathogens.

We have developed a special protocol for analysis of carotenoids in OFSP processed foods (bread, buns, cookies, crisps) as these products are made with oils which tend to interfere with the extraction and analysis of carotenoids. We have also adapted mild saponification methods which are used remove the fatty acids and other impurities in the samples.

### ✦ What's next?

FANEL has secured additional laboratory space at BecA to analyze OFSP roots, purée and food products for analysis of moisture content/dry matter, total fat, protein content, ash, crude fiber, carbohydrate and total calories. The lab, which is expected to be fully functional by October 2015, will undertake nutritional analyses for SUSTAIN Country projects to support OFSP product labeling in those countries.

FANEL is currently working on adapting analytical protocols obtained from the CIP Quality Nutrition Laboratory in Lima such as determination of vitamin C in OFSP fresh roots and processed products; determination of antioxidant activity of OFSP fresh roots and processed products; and determination of phenolic compounds in sweetpotato.

We are continuing work on OFSP purée testing different combinations of preservative under real-life settings on the shelf-storability of OFSP purée. We are also developing molecular techniques of detecting harmful and spoilage micro-organisms in OFSP purée processing and storage. We will conduct studies to show the difference if any of food products made from fresh OFSP purée and OFSP purée stored over time without refrigeration. We will conduct studies to determine the effect of baking temperature on OFSP purée with regards to food safety. We are also planning human studies with partner institutions on determining the health benefits of consuming OFSP-based food products compared to similar conventional products.

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