



## PROCESSING

**Innovative approaches to process local food in Sub-Saharan Africa and Southeast Asia, which contribute to improved nutrition, as well as qualitative and quantitative reduction of losses**

### *Project Acronym: WALF-Pack*

<b>country/countries</b>	Benin, Germany
<b>funding agency</b>	Federal Ministry of Food and Agriculture - BMEL
<b>project management</b>	Federal Office for Agriculture and Food – BLE
<b>project coordinator</b>	Rheinische Friedrich-Wilhelms-Universität Bonn
<b>project partner(s)</b>	University of Abomey-Calavi (Bénin)
<b>project budget</b>	381.026,39 Euro
<b>project duration</b>	01.09.2017-31.07.2021
<b>key words</b>	Improving the processing and packaging of local products, reduction of post-harvest losses, improving food and nutritional security
<b>background</b>	Malnutrition remains highly prevalent in sub-Saharan Africa. Therefore, a great deal of effort has been made to promote the production and consumption of fresh food products such as fruits, vegetables, and protein of plant and animal origin to combat malnutrition. However, in several African countries a major problem is that huge amounts of food products, especially fresh produce are wasted during processing and distribution. One major cause is the lack of appropriate technologies like packaging

	<p>solutions to prevent damage during transportation and storage to prolong shelf life. The implementation of simple packaging solutions can lead to a significant decrease of waste in the chain.</p>
<p><b>objective</b></p>	<p>Aim of the project was to extend the shelf life of perishable local foods widely consumed in West Africa and increasing food security and safety through the implementation of new innovative, sustainable and cost effective packaging solutions.</p> <p>The studies were conducted with the following products: "waragashi", a traditional cheese made from cow's milk, locally produced chicken and the African garden eggplant (<i>Solanum macrocarpon</i>), a leafy vegetable. The following tasks were addressed:</p> <ul style="list-style-type: none"> <li>• Analysis of the complete supply chain of the chosen products with a focus on the identification of hot spots and steps with the highest amount of food waste;</li> <li>• Development of simple and cost effective packaging solutions to reduce food waste along the supply chain</li> <li>• Assessment of the influence of the packaging on the physicochemical, microbial and nutritional properties of the chosen products during storage</li> <li>• Cost-benefit-analysis, resource efficiency analysis and analysis of the consumer acceptance of the different packaging solutions</li> <li>• Implementation of a coordination concept between all actors in the chain on a micro-, meso-, and macro-level for ensuring an appropriate communication and dissemination of the project results</li> </ul>
<p><b>results</b></p>	<p>During the project, the hot spots of food waste were identified in three different supply chains. These are located for Gboman at the retailer, for Waragashi at the transportation, retailer and consumer to the same extend, and for chicken at the processing stage. In the next step, the spoilage characteristic of the food were identified as well as their specific spoilage organism. With these isolated microorganisms, the antimicrobial activity of the plant extracts and essential oils produced during the project was tested. In total, more than 20 pharmaceutical plants and oils from Benin were tested for their antimicrobial activity against more than 30 microorganisms. A high potential for microbial reduction was determined, especially against gram+ but also against gram- bacteria. In addition, a lot of extracts showed an antioxidative effect. The most promising substances were used for the development of active packaging in order to reduce microbial growth on the food products and prolong shelf life. For establishing the concept for the packaging, the development focused on the local availability of the resources, sustainability, price and an easy-to-use implementation of a scale-up. During the project, different packaging solutions were developed: active bioplastic foils, active bio-based wax covers for different applications and paper based on regional resources. For the bio-based wax covers, beeswax, shea butter and coconut oil were combined with ethanolic plant extracts. These active layers were applied to different matrices: cotton sheets, paper or plant leaves, but they can also be used on different surfaces. Pineapple fiber, polylactid and local</p>

oils were used for the bio-based plastic foils and combined with essential oils as bioactive component. In addition, sisal bags were developed for Waragashi in order to replace fossil based plastic bags. On top, bags made of banana leaves (with an optional coating) for chicken and waragashi were produced. The developed paper, produced from regional resources, is an alternative packaging solution for replacing the paper made of cement bags, which is used at the moment. A subset of the developed packaging solutions were tested in laboratory studies, in order to test the effects on product quality and shelf life. During the storage tests, a good antimicrobial effect was determined for some of the packages. For the pilot studies of Gboman, baskets were covered with coated beeswax cloths, filled with Gboman and stored at chain specific environmental conditions. The analysis during this storage trial revealed a doubling of the shelf life using the new packaging in comparison to the reference packaging (basket without beeswax cloth). Further pilot studies and the cost-benefit-analysis could not be completed due to restrictions caused by the Covid-19 pandemic. But, an implementation concept was developed for integrating the Gboman packaging into the supply chain. Selected pictures of the packaging solutions are in the attachment.

### recommendations

It is recommended to implement the developed packaging solutions and pursue a further optimization. This is necessary for prolonging the shelf life of the product as well as reducing health burdens and pollution caused by the packaging used at the moment. A reduction of food waste through the implementation of the packaging is expected and thus a reduction of malnutrition and poverty.


### photos



Paper as packaging solution for grilled chicken (left) (Active) bioplastic as packaging solution for Waragashi (center)  
Coated cotton cloths with antimicrobial components (right)



Packaging solution for Waragashi with closed baskets, covered with biogenic active coatings on the inside (left)  
Sisal bag as packaging solution for Waragashi for the point of sale at the



market (center)

Bag made of banana leaves and a carrying strap made of raffia for grilled chicken (right)