

**Assessment of meat production and meat processing in Niamey/Niger:
hygienic quality of fresh meat and the dry meat product “Kilishi”**

Diploma Thesis at the Department of Agricultural Engineering

1. Supervisor: Prof. Dr. Oliver Hensel
2. Supervisor: Prof. Dr. Eva Schlecht

Author: Jörg Schumacher

Witzenhausen, April 2007

Abstract

Meat gains an increasing importance in sub-Saharan Africa due to growing populations and slightly increasing incomes (Delgado et al., 1999). This study assessed the current status of meat production and processing in Niamey, the capital of Niger/West Africa. The aims of the assessment were to provide documentation and to determine critical points of the production and processing chain with regard to hygienic practices. It was evaluated whether solar dryers can be used to improve the traditional dry meat "Kilishi" which is the predominant form of preserved meat in Niger. Further, consumer behaviour and their quality criteria (taste, texture appearance) for Kilishi have been evaluated as they play an important role for the future marketing of improved products on the local market.

During a stay from September to December 2006 in Niger, the following steps were undertaken: 1. literature research in situ, 2. documentation of the meat production and processing chain, 3. interviews and surveys of involved actors and 4. controlled experimentation to determine contamination of fresh and dried meat with lead (Pb) and micro-organisms.

It was found that meat is produced under unhygienic conditions in the out-dated city abattoir and that refrigeration facilities are only used at a marginal extent suggesting the need for promotion of hygienic handling practices for workers and the construction of a more adequately sized and equipped abattoir.

During transport from the abattoir and distribution in butcheries meat is not refrigerated and mostly unprotected. Data from the literature (Souley, 1997) showed increased levels of coliforms and sulphite reducing organisms on fresh

meat from markets in Niamey suggesting poor hygienic conditions. Low lead levels were found in meat after transportation from the abattoir to butcheries except for the sample from Katako market which contained $1.71 \mu\text{g Pb g}^{-1} \text{ DM}$ suggesting that contamination originated from the conditions of Katako market. Kilishi is produced by cutting thin lamellas (0-0.5 mm) of lean beef meat which are sun-dried, coated with a sauce (mixture of groundnut cake, oil, water and spices) and dried again (Kilishi "Ja" and "Fari") or seasoned with salt and spices (Kilishi "Rumuzu"). Finally the product is grilled. One enterprise uses a solar drier to dry meat and markets improved Kilishi in supermarkets. Data from the literature (Souley, 1997; Atio Houdou Maiga, 2006) showed increased concentrations of coliforms and *Staphylococcus aureus* in the traditional final product. Counts were higher during the wet than during the dry season. Results of the lead analysis showed that all traditionally produced samples exceeded the threshold of $0.2 \mu\text{g Pb g}^{-1}$ given by Codex Alimentarius. Pb concentrations in the solar dried sample were below that limit which demonstrates the importance of protecting the meat during drying.

Recommendations for improvements of Kilishi production have been given by Souley (1997). However, interviews with butchers and officials revealed that these were not realized in Niamey because of a lack of official advice, poor hygienic knowledge amongst the producers, lacking public controls despite existing laws on food hygiene and lacking demand for more hygienically produced products.

A consumer survey determined some quality criteria concerning appearance, taste and texture of traditionally and solar dried Kilishi "Rumuzu" and "Ja". Solar dried Kilishi was well appreciated in terms of Kilishi "Rumuzu" but rather disliked in case of Kilishi "Ja" which is thought to result from the missing grilling. The majority of the respondents (70%, $n = 58$) was satisfied with the hygienic conditions on street production sites. Solar dried Kilishi was stated to be too expensive.

Kilishi produced by means of a solar dryer was found to be more hygienic than traditional Kilishi (micro-organisms, lead). A case study of a cooperative in Madaoua showed that the implementation of solar dryers did not succeed because of problems in supervision, transfer of knowledge and lacking marketing structures.

The natural convection dryer used for Kilishi production in Niamey dried meat within one day in the dry season which the indirectly heated dryers did not (Fode et al., 1996; RESEDA, 2006) There is further need for research on the performance of solar dryers in the wet season and or the marketing potential of improved Kilishi in the neighbouring countries.