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Production of Millet-Based (*Pennisetum glaucum*) Ablo and Sorghum-Based (*Sorghum bicolor*) Ablo Cultivated in the Republic of Benin

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A B S T R A C T

Ablo is a wet bread, slightly salty and sweet, steamed and sold in the form of pellets. The study is intended to develop the production's technology of two new types of *Ablo.* The methodology adopted consists of carrying out production tests according to the original process described by Aholou-yeyi (2007) modified. The results showed that production of sorghum-based *Ablo* technology and production of millet-based *Ablo* technology followed four main steps, namely: the preparation of flour, the preparation of the dough to ferment, fermentation and cooking. Fermentation lasted 2-3 hours for the millet-based *Ablo* and 3 hours for the *Ablo* made from sorghum. The cooking time of the fermented dough was 15 to 20 minutes. Millet-based *Ablo* and sorghum-based *Ablo* had an alveolar structure and were more consistent than the fermented dough.

Introduction

The major part of the human food supply is provided by cereals such as the millet, sorghum, corn, rice, wheat, and barley. These cereals are subjected to several types of transformations which include fermentation very practiced in Africa. The fermentation is one of the oldest and more economic methods of production and preservation of food (Steinkraus *et al.*, 1983; Cook *et al.*, 1987; Chavan and Kadan, 1989). Sorghum (*Sorghum bicolor*) is a Poacee (ex-graminee) belonging to the sub family of the Panicoidees

and to the tribe of the Andropogonees (Clerget, 2004). The sorghum domestication took place in the southeast of the African deserts margin, in an area now occupied by Sudan and Ethiopia, 5.000 to 8.000 years ago (Wendorf *et al.,* 1992). In Africa, this production reached about 21 million tonnes (Akakpo, 2013). In Benin, the national grain sorghum production was estimated at 107.969 tonnes in 2013 (APRM, 2013). With this production, sorghum is the third largest in cereal production in the country after the maize and rice. It is most widely grown in the North than in other parts of the country. Yields are estimated on average at 1.010 kg/ha with the lowest observed in the regions of South and Central (APRM, 2013).

Millet (*Pennisetum glaucum)* is native to tropical West Africa. There are approximately 2000 years, this culture was introduced in East, Central Africa and India where, due to its excellent tolerance to drought, it established itself in the drier environments (FAO, 1995). The term millet includes a set of annual food grasses that are distinguished by their colors, their forms and their sizes (Tou, 2007). In Benin, the millet has been estimated to 31.023 production about tonnes in 2013 (APRM, 2013). This production is done only in the northern part of the country, in the Alibori, Atacora departments and especially in the Donga.

Fermented foods are an important component in the human diet for thousands of years. But they are often produced in uncontrolled conditions giving rise to a wild fermentation. Several of these fermented products are still badly known and come from cereals, roots and tubers and legumes.

This study focused on *Ablo* which is a moist bread shaped ball, very consumed in Benin, especially in large cities (Abrams *et al.,* 2013; Dan, 2013; Houssou *et al.,* 2014; Aboudou *et al.,* 2014; Houssou *et al.,* 2015). It is intended to develop the technology of production of two types of *Ablo* sorghum and millet based.

Materials and Methods

The productions were made in the Research Unit in Safety Health Food (URSSA) of the Laboratory of Microbiology and Food Technology in the Faculty of Sciences and Techniques (FAST) located at the Applied Biomedical Sciences Institute (ISBA) of the University of Abomey-Calavi (UAC).

Plant material

Sorghum (*Sorghum bicolor*) of red color designated in local language fon by "abokun" and the small millet (*Pennisetum glaucum*) called greenish color "likun" in fon were used. Wheat flour also served as plant material. These cereals were purchased at the Dantokpa Cotonou's international market.

Biological material

The instant yeast (*Saccharomyces cerevisiae*) of trademark PASHA made in Turkey by DOSU MAYA MAYACILIK A.S. Company certified ISO 9001: 2008 has been used. It was purchased at the Dantokpa Cotonou's international market. It is used as a leaven in the manufacturing technology of the *Ablo* (Ahokpe, 2005; Aholou-Yang, 2007; Bokossa *et al.,* 2013).

Other material

The material used for the different manufacturing consisted of ingredients (sugar, salt) and standard production equipment of the *Ablo* such as basins, plastic buckets, pots, a colander or own basket, a spatula, a whip, a mill wheels, a sieve, a tray with perforations, of mussels and a home. The water of the national society of Benin (SONEB) waters was also used.

Method of production

The production tests were conducted according to the original method described by Aholou-yeyi (2007) changed. The difference in this technology was the use of other types of cereals such as millet and sorghum and the reduction of the fermentation time.

Calculation of yield

Production yields were calculated on the basis of the weight according to the following formula:

Yield (%) = [(weight of the final product) x 100] / (weight of the initial product)

Results and Discussion

The production's technologies of *Ablo* using sorghum and millet followed four main steps, namely: the preparation of flour, the preparation of the dough to ferment, fermentation and cooking.

The preparation of flour

The preparation of flour involved several steps such as:

- Cleaning where the grain sorghum and millet were rid of various impurities (rotten grain, foreign grain, plant debris, insects, metal fragments, stones and other waste) by winnowing and sorting by hand.
- Washing and soaking consisted in separating totally the grains of any waste left after sifting. These wastes (rotten grain, plant and insect debris) dated back to the surface of the water and were eliminated with this one.
- Fine grinding to get the flour more or less wet.

The preparation of the dough to ferment

One-third (1/3) of previously obtained flour was used to prepare a mush. This porridge was cooked to a paste. Cooking was stopped immediately after getting the dough to avoid cooking also this last.

The fermentation

After cooling the previously dough, 2/3 of the remaining flour were added. The mixture was undergoing a first kneading. This mixture to which were added the salt and instant yeast wheat flour was undergoing a second kneading. The whole was covered and allowed to rest at room temperature (25 to 30°C) for 2 - 3 hours for the dough of millet and 3 hours to that of sorghum.

Cooking

The previously fermented dough was slightly sweet and distributed in small metal containers lined plastic packaging, all arranged on a van. The van filed inside an aluminum basin in which the steam produced by boiling water, occupying the bottom of the pot, allow to cook paste fermented. The cooking time of the fermented dough was 15 to 20 minutes. The *Ablo* cooked had a honeycomb and was more consistent than the fermented dough. Cooking at the same time played the role of pasteurization.

Figure 1 and 2 present respectively technological diagrams of the *Ablo* production using millet or sorghum. The production output of the paste was 380% (p/p) or 1 kg of grain was on average 3.8 kg of fermented dough.

Figure.1 Technological diagram of millet-based Ablo production

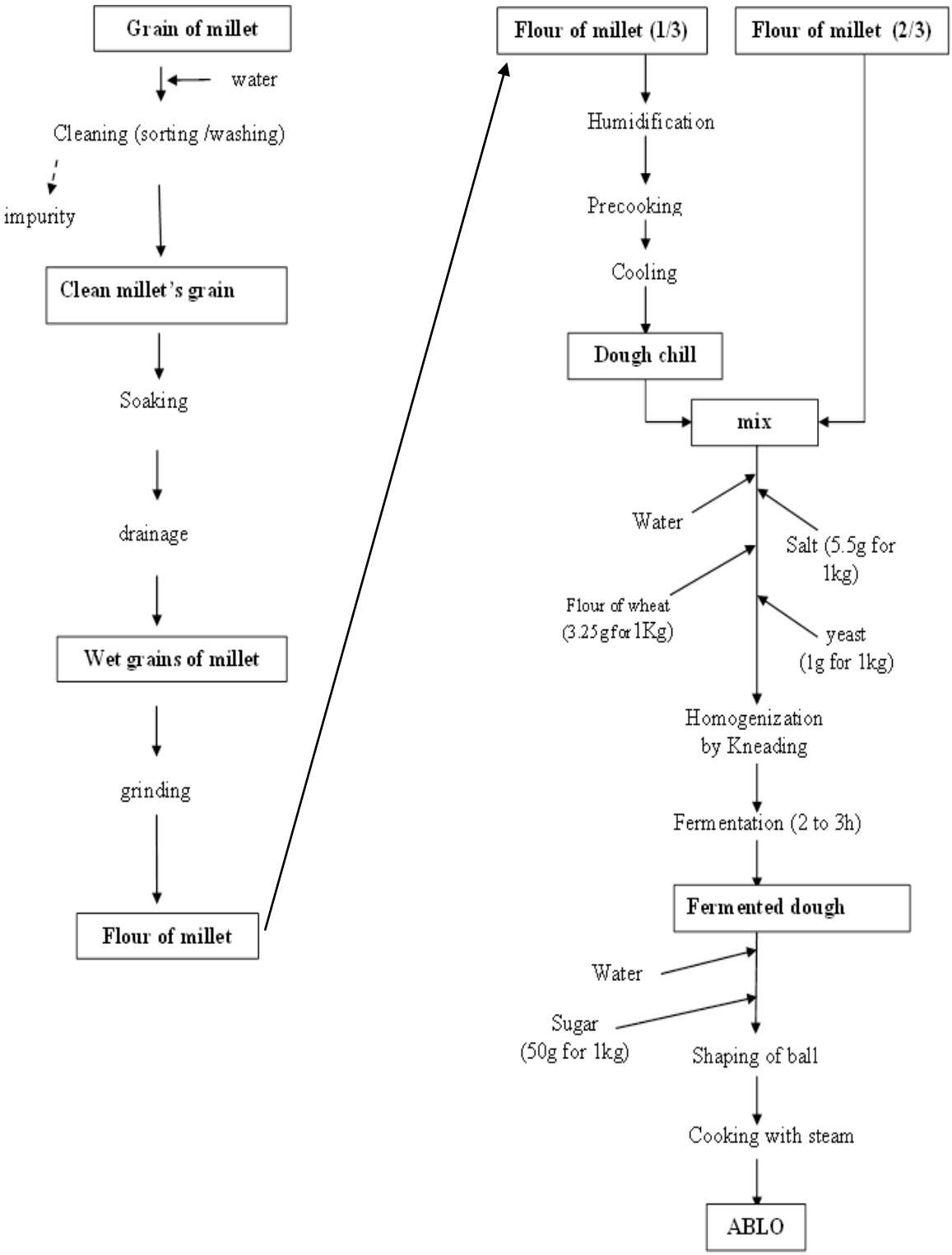
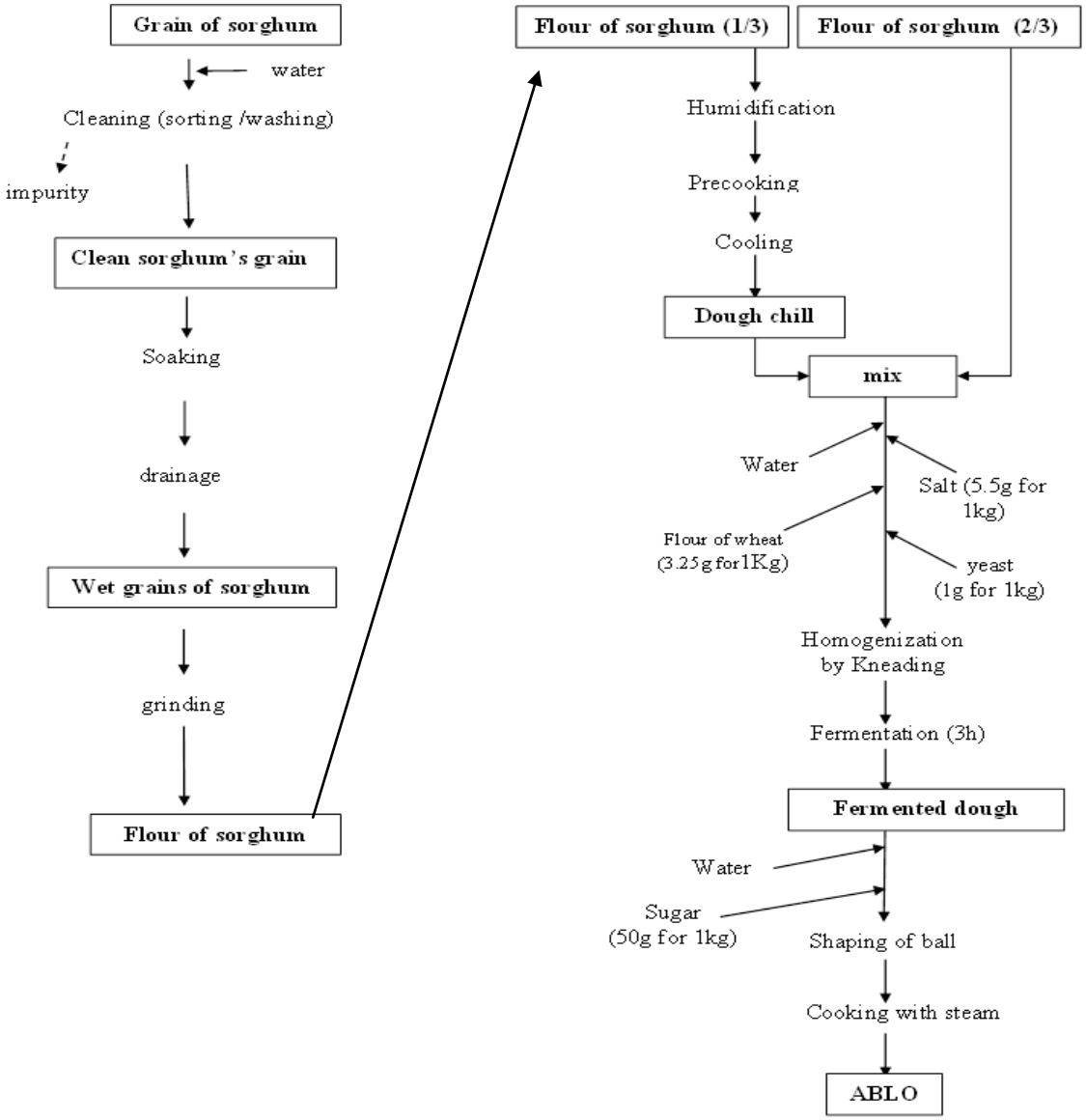


Figure.2 Technological diagram of sorghum-based Ablo production



Works show that *Ablo* production's technologies using sorghum or millet follow four main steps. These results are consistent with those obtained by Ahokpe (2005), Banon (2012) and Bokossa *et al.*, (2013) on the *Ablo* of the rice, who said that the preparation of flour, the dough to ferment preparation, fermentation and cooking are *Ablo* production steps.

The fermentation takes place at room temperature (25 to 30 ° C) for 2 to 3 hours for the dough of millet and 3 hours to that of sorghum. This fermentation being stimulated by yeast is not spontaneous. However the microflora present in the grain, on equipment used or contaminated during grinding would play a role in the fermentation. These results are consistent with those obtained by Ahokpe (2005) and Aholou-Yang (2007) on the *Ablo* corn who pointed out that the microflora present in grain corn, the equipment used and in the mawe or contaminated during grinding play a role in the fermentation.

The two technologies developed have a lower production-term than existing technologies. They exclude long preparation of the mawe and painful step. Thus, these two technologies better meet the aspirations of women producers and *Ablo* vendors who brought them to a substitution or part of corn by rice. The vendors will win so much more time and energy compared to other technologies. Production of the *Ablo* millet-based and sorghum-based contributes to the diversification of the types of *Ablo* produced in Benin but also to the enhancement of our local agricultural products.

The cooking time of the fermented dough is 15 to 20 minutes. The cooked *Ablo* presents a honeycomb and is more consistent than the fermented dough. Cooking at the same time played the role of pasteurization and is responsible for the removal of the vegetative form of microorganisms and eventual flora of contamination. The same comments were made by Leclerc *et al*., (1977), Akapko (2013), Agro (2013) and by Bokossa *et al.*, (2016) who showed that thermal treatment of seconds at 72°C is sufficient to destroy the vegetative forms of microorganisms in food products.

In conclusion, this study allows the technology development of production of two types of *Ablo*. It also contributes to the widening of ranges of grain products eaten in Benin. So, the millet-based Ablo and the sorghum-based Ablo are two kinds of *Ablo* manufactured using two new production technologies.

The vendors will win so much more time and energy compared to other technologies. These two types of *Ablo* are new products developed and deserve to be known to the general public through a good program of promotion of grain foods fermented from Benin.

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