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Traditional production system of Ablo, West Africa steamed cooked moist bread

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Abstract

Ablo is a slightly salted and sweet steamed-cooked bread based cereal grains, sold in the form of pellets as street food in Benin. A survey was carried out in Parakou municipality in the North of Benin to collect information on the production and commercialization of Ablo, through a questionnaire. The questionnaire focused on the socio-cultural profile of actors, the raw materials used for the processing, the technologies used and the quality attributes of Ablo. Then, it was followed by physicochemical analysis of different types of Ablo. The results showed that the production and commercialization of Ablo were a significant activity mainly done by women. Three types of Ablo were distinguished, varying in their raw materials and processing technologies. The appreciation of the quality of Ablo by processor-vendors was mostly based on sensory attributes such as the colour, texture, odour, consistency, and the presence of honeycomb. Also, Ablo is an acidic product (pH =3.91-4.52) with a titratable acidity of 0.51-1.14 % lactic acid, dry matter (35.6-37.4 g/100g), protein content (7.5-8.4 g/100 DM) and lipid content (0.3-0.4 g/100g DM). The quality sensory attributes and the optimization of Ablo production should be useful for future standardization of its processing technology.

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Introduction

Cereal grains (maize, wheat, barley, millet, sorghum and rice) are worldwide crop production (Amoa-Awua and Oduro-Yeboah 2010; Soro-Yao *et al.,* 2014). According to FAO (2015), the three major cereal species (wheat, maize and rice) represented nearly 90% of cereal grain production and the production of each was over 900 million tons in 2013. They are a major food source for human consumption and also used for animal feeding and industrial processing (Ezeokeke and Onuoha 2016; Nuss and Tanumihardjo 2010). They are used alone or in combination sometimes as substitution in several indigenous foods (Ezeokeke and Onuoha 2016; Osungbaro 2009; Sacchetti *et al.,* 2003). The most of indigenous cereal based food consumed in Africa countries especially in Benin are processed by spontaneous fermentation (Adinsi *et al.,* 2017; Akissoe *et al.,* 2014 ; Kalui *et al.,* 2010; Sacca *et al.,* 2012). The indigenous cereal based foods are processed using easy technologies which have been offered from ancestral generations and from a significant part of the cultural heritage of Benin (Adinsi *et al.,* 2014b; Sacca *et al.,* 2012). Despite the rudimentary nature of the technologies used to process a large diversity of indigenous cereal based foods to meet the demands of consumers of various socio-economic groups. The indigenous cereal based foods are appreciated for the taste, aroma, bioactive components and texture. In terms of texture, the indigenous fermented cereal based foods are either liquid (porridge) or stiff gels (dough) (Osungbaro 2009). The fermented cereal porridges prepared from maize or sorghum include Ogi (Omemu 2011), Akpan (Akissoe *et al.,* 2014 ; Sacca *et al.,* 2012), Gowé (Adinsi *et al.,* 2014a; Adinsi *et al.,* 2014b), Amahewu (Chelule *et al.*, 2010). The fermented cereal gels take account of Kenkey (Amoa-Awua and Oduro-Yeboah 2010), Akassa (Sacca *et al.*, 2012), Banku (Osungbaro 2009), Ablo (Agro *et al.,* 2014; Dossou *et al.,* 2011), etc. Ablo is traditional steamed cooked fermented moist bread commonly produced in Benin, Togo and Ghana especially in the coastal areas. Originally it has been produced by Mina socio cultural group (Agro *et al.,* 2014; Dossou *et al.,* 2011).

Ablo is produced all year round and although it is considered as street food ready-to-eat, it enjoys extensive consumption, popularity and high demand (Dossou *et al.*, 2011). So there is slight information on processing techniques or sensory quality attributes in southern Benin (Agro *et al.,* 2014; Dossou *et al.,* 2011). However, no information is known on the processing technique and quality profile of Ablo in the northern region of the country. So, this study aims to gather useful information on the indigenous processing techniques, quality attributes and evaluate physicochemical characteristic of Ablo.

Materials and methods

Sampling of stakeholders and data collection

The survey was conducted in the North Benin, especially Parakou municipality (latitude 9°21'N and longitude 2°36'E) due to its cosmopolitan aspect for ablo identification and its production characteristic. Using snowball techniques (Hongbété and Kindossi, 2017), a total of 21 Ablo processors and vendors were interviewed using structured questionnaires.

Survey tool design

A questionnaire was designed to collect data on ablo production. Demographic data related to gender, age, academic qualifications and experience acquired in ablo production of processors and vendors were collected. Then, technical data on the process were gathered, including raw materials and ingredients used, type of ablo and constraints related to processing. Other information collected included sensory quality attributes of ablo.

Physico-chemical analysis

The dry matter of Ablo was determined as described in AACC method 44-15 (AACC 2000). The pH was determined using a digital pH meter (Inolab pH 730 WTW 82362 Wellhein Germany) calibrated with buffers at pH 4.0 and 7.0 (WTW, Wellhein Germany). The titratable acidity, expressed as lactic acid equivalent, was performed by titrating 10 g of Ablo using 0.1 N NaOH (Merck, Darmstadt, Germany) as described by AACC method 02-31.01 (AACC 2000). Protein (N x 6.25) contents were determined using kjeldahl's method 955.04 (AOAC 1995) and lipid contents according to Soxhlet method 960.39 (AOAC 1995).

Data analysis

Data were entered on Microsoft excel 2007, organized, analysed using descriptive statistics (frequencies, percentages, means, etc.). The mean and standard error of means of the triplicate analyses related to proximate composition were calculated and the analysis of variance (ANOVA) was performed with Statistica (version 7.1, Stat Soft France, 2006) to determine significant differences between the species ($p < 0.05$).

Results and discussion

Socio-cultural characteristic of Ablo production Table 1 shows the distribution of the socio-demographic characteristics of stakeholders. The processor-vendors of Ablo in the study area were female activities (100%). These processor-vendors were aged between 25 and 45 years; 52.4% of them were between 25 and 35 years, while 47.6% were between 36 and 45 years.

Table 1. Socio-demographic characteristics of study subjects.

Variables	Frequency (n= 21)	Percentage
Gender		
Females	21	100
Ages (years)		
25-35	11	52.4
36-45	10	47.6
Educational status		
Primary	3	14.3
Secondary	10	47.6
University	8	38.1
Know-how acquisition		
Mother	15	71.4
Mother-in-law	4	19.0
Against money	2	9.5
Socio-cultural group		
Adja	4	19.0
Xwla	6	28.6
Mina	7	33.3
Fon	4	19.0

The distribution of ages obtained in this study corroborates that of study on Toubani production which allude to massive involvement of young people in food production in West Africa countries (Hongbété *et al.,* 2017). The survey showed that all processor-vendors surveyed were well-read women; 14.3% of them did not finish primary school, 47.6% had attended secondary school and 38.1% had gone to university. The women surveyed were well-read, this observation is in utter contrast with those studies reported by Kindossi *et al.* (2012) on Lanhouin production; Ayegnon *et al.* (2015) on *Pentadesma butyracea* butter production; Hongbété *et al.* (2017) on Toubani production; in which processors were found to be rather dominated by illiterate women.

Also, from the survey the transmission of Ablo production is matrilineal; 71.4% and 19.0% of processors inherited the process techniques, the know-how from their mothers and mother-in-law respectively and the rest (9.5%) received the knowledge from others against money. The pattern of transmission of the production technology recorded is in line with that of Akinnifesi *et al* (2008), Kindossi *et al* (2012) and Hongbété *et al* (2017), which found a predominant proportion of processors with matrilineal transmission of the production technology. From the survey, the processors' socio-cultural origin was diverse. The main socio-cultural groups were Mina (33.3%) followed by Xwla (28.6%), Adja (19.0%) and Fon (19.0%).

These socio-cultural groups recorded are mainly found in the southern of Benin where Ablo is traditional consumed by Mina, Xwla and Pedah (Dossou *et al.*, 2011) but are in contrast with findings of Hongbété *et al* (2017) on Toubani which is a typical product of north people. Their presence is due to the migratory movements of the population and trade which led Ablo production and sale to take place in this cosmopolite area. In this area, Ablo is sold in the evening not far from known hotels and public places.

Table 2. Chemical characteristics of Ablo.

Type of Ablo	Dry matter (g/100g)	pH	Titratable acidity (%as lactic acid)	Protein (g/100g DM)	Lipid (g/100g DM)
Rice (n=3)	36.3±2.5[a]	4.13±0.21[a]	1.13 ±0.10[a]	8.4±1.5[a]	0.4±0.0[a]
Maize (n=3)	37.4 ±1.2[a]	3.91 ±0.50[a]	1.41 ±0.50[a]	7.5±0.5[a]	0.3±0.1[a]
Rice/maize (n=3)	35.6 ± 0.5[a]	4.52 ±0.31[a]	0.51 ±0.20[b]	8.1 ±1.1[a]	0.4±0.1[a]

[a,b]: Means with different letters in a column are significantly different ($p<0.05$); n: number of samples analysed DM: dry matter.

Processing technique for Ablo

Raw material used

Ablo production technologies used maize (*Zea mays*) and rice (*Oryza sativa* L.) main cereal grains. These cereal grains were used singly or in combination.

The majority of processor-vendors used preferentially a mixture of maize and rice (100%).

This was followed by maize (25.6%) and rice (65.4%). Similar report was recorded on Akpan, a Benin fermented cereal consumed as a thirst-quenching beverage, for which maize (*Zea mays*) and sorghum (*Sorghum vulgare*), were used singly or combined (Sacca *et al.,* 2012) also on Kunu, a Nigerian non-alcoholic cereal beverage, using maize/millet, sorghum/millet and maize/sorghum (Gaffa *et al.,* 2002).

The colour of the raw material for Ablo production was the most important quality criterion. From the survey, Processor-vendors used white cereals (rice or maize) varieties for Ablo production. According to them, this choice has been supported by consumers who preferred light white Ablo with honeycombed. The ingredients added to produce Ablo are wheat flour, sugar, salt and yeast (Saccharomyces cerevisiae).

The addition of wheat flour for Ablo production was due to the presence of gluten is composed of gliadin and glutenin that confers to wheat its baking properties (Baba *et al.,* 2015).

During the kneading and fermentation, these two components will form a strong protein network allowing good gas retention and resistance of the dough to collapse (Ali and Halim 2013).

The yeasts for Ablo production were *Saccharomyces cerevisiae* used to convert carbohydrates of cereal grains. Yeasts contribute to upgrade the organoleptic characteristics, the nutritional values of the end fermented product and can also contribute to the improvement of human health (Greppi *et al.,* 2013; N'Guessan *et al.*, 2016; Vieira-Dalodé *et al.*, 2008).

According to processors surveyed others parameters, as the quantity of wheat, sugar and salt used could influence the development and the taken up of mixed dough during fermentation and the quality of end product. Analogous information was obtained by Baba *et al.* (2015) who conducted a research on influence of partial substitution of wheat flour with banana flour on sensory evaluation of toasted bread and observed that toasted bread with 30% banana flour was found to be the most acceptable.

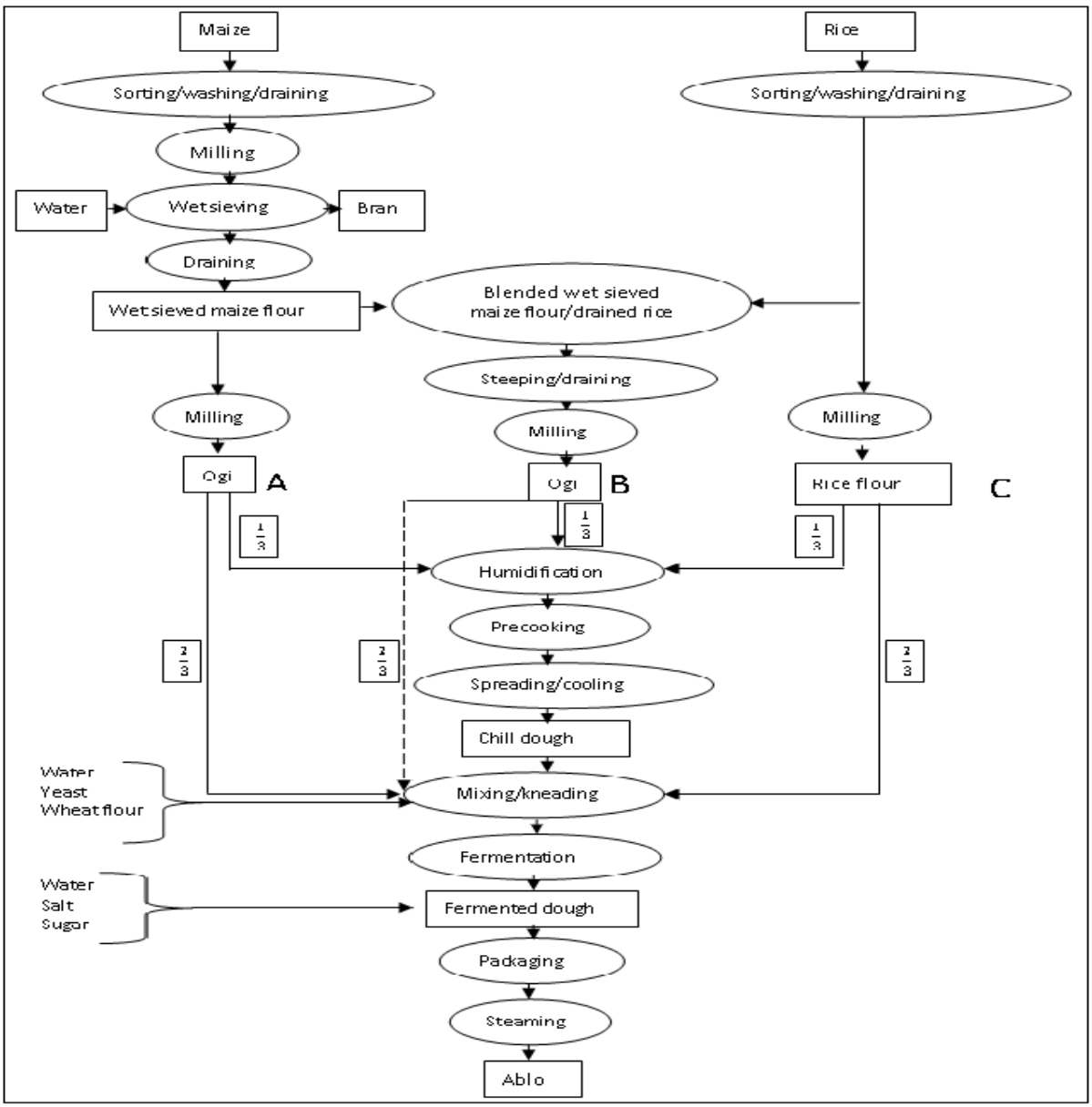

Fig. 1. Flow diagram of Ablo production.

Technology of Ablo production

From the survey, three processing techniques were identified according to the raw material used: Ablo based from maize, Ablo based from rice and Ablo from mixture of maize/rice in the ratio 2:1 (w/w). The maize and rice is processed into Ablo using the diagram shown in Fig. 1.

The cereal grains are sorted, washed of various impurities such as rotten grains, foreign grain, plant debris, metal fragments and stones. They were drained before milling. The milled maize flour was wet sieved and drained followed by milling to produce Ogi (Fig. 1.A).

The blended wet sieved maize flour and rice were steeped and milled (Fig. 1B).

The rice was milled to produce rice flour (Fig. 1C). One-third (1/3) of each product obtained was made into slurry and it was then slightly cooked, with low intensities of gelatinized starch. The precooked dough was then spread and chilled in large flat at room temperature (28 ± 2°C). After cooling the precooked dough was mixed with the remaining uncooked two-third (2/3) products, wheat flour and yeast. The mixture was undergone a kneading before covering and allowing to fermentation at room temperature (28 ± 2°C) for 2-3 hours.

After fermentation, sugar and salt were added and homogenized. The salted and slightly sweet dough was then poured into different labeled packaging material (milk tin, tomato tin, plastic) and steam-cooked for 15-25 minutes.

Quality attributes of Ablo

The quality appreciation of Ablo was largely based on observations of sensory attributes as the colour, texture, odour, consistency and presence of honeycomb, etc. (
Fig. .). According to the processor-vendors (> 50% of informants), Ablo from white cereal grains should have whitish colour, smooth texture, fermented odour, consistent, soft to the feel and honeycombed. It should be slightly sweet, salty and acidic (< 50% of informants).

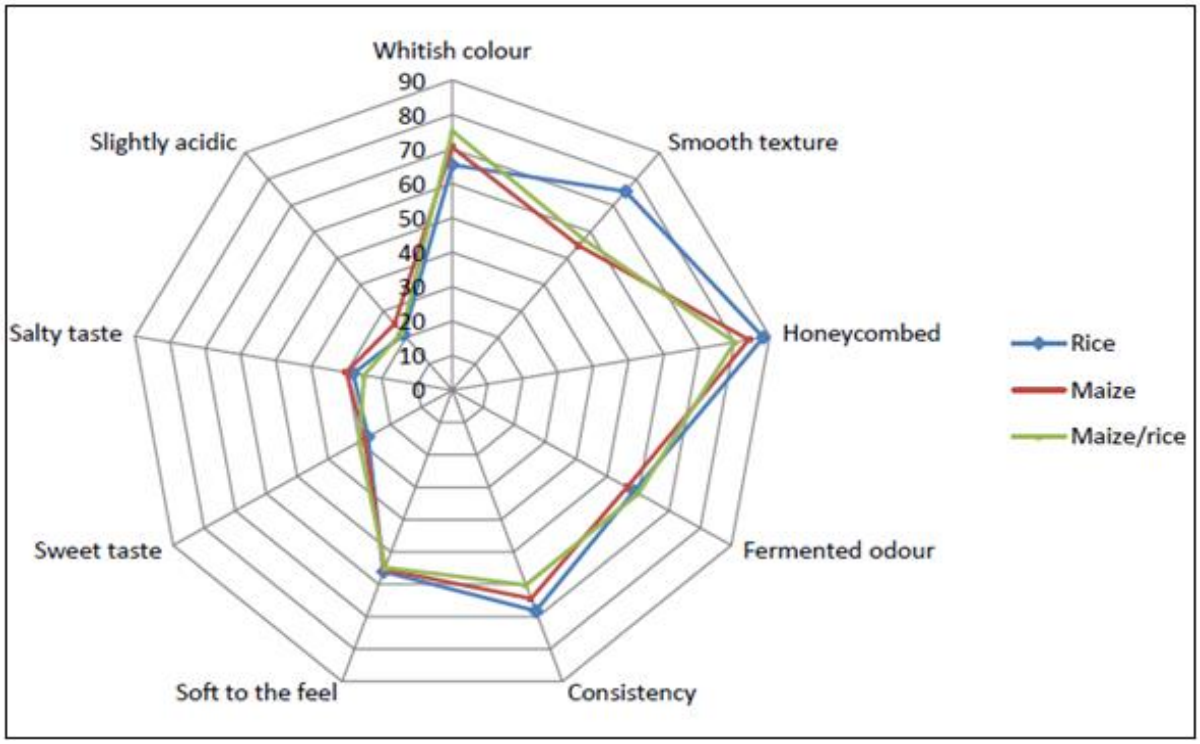

Fig. 2. Quality attributes of Ablo from different cereal grains according to processor-vendors.

Physico-chemical properties of Ablo

Table 2 shows the results of physico-chemical analyses of Ablo samples. The dry matter content of Ablo samples varied from 35.6 to 37.43 g/100g. No significant different ($p>0.05$) was recorded in the dry matter content of Ablo samples. These dry matter contents were similar to those of cooked kenkey, a fermented dough based maize.(Amoa-Awua and Oduro-Yeboah 2010). The pH values of three types of Ablo samples ranged from 3.91 to 4.52. There was no significant difference ($p> 0.05$) in the pH values of Ablo samples. Titratable acidity values of Ablo samples varied from 0.51 to 1.41 % as lactic acid. The titratable acidity value of Ablo from the mixture rice/maize was significant lower ($p<0.05$) than those Ablo from single cereal. But no significant different ($p>0.05$) was recorded in the titratable acidity value for Ablo from maize and that from rice. The pH and titratable acidity values of Ablo samples were similar to those of fermented cereal products (Mugocha *et al.,* 2000; Wedad *et al.,* 2008).

Protein contents of Ablo samples varied from 7.5 to 8.4 g/100g DM. Lipid contents of Ablo samples ranged from 0.3 to 0.4 g/100g DM. Proteins are growth and repair of tissues. Maize and rice as cereals are low in protein and lipid. The nutritional value of maize and rice product Ablo is mainly dependent on the variety of cereal and the processing technique applied. Processing methods such as milling, sieving, fermentation, packaging material and steam-cooking might either reduce or increase one nutrient depending on the susceptibility of the nutrient pointed out.

Conclusion

From this study, the production and commercialization of Ablo were exclusively female activities. Ablo as street food based maize and rice is convenient cheap and affordable for general public. Ablo is mainly processed by following steps: milling, sieving, fermentation, packaging and steam cooking. Due to its socio-economic importance and its place as food in Benin, the industrialization of Ablo production with modern techniques must be profitable.

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