MICROBIOLOGICAL QUALITY AND ORGANOLEPTIC PROPERTIES OF "CONÔRO", A FOOD SEASONING CONSUMED BY THE POPULATIONS OF NORTHEASTERN CÔTE D'IVOIRE

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Abstract
"Conôro", a fermented condiment made from seeds of baobab (Adansonia digitata), kapok tree (Ceiba pentandra) and/or okra (Abelmoschus esculentus), is consumed in northeastern Côte d'Ivoire. Microbiological and organoleptic characterization study of seven (7) samples of "Conôro" was carried out with a view to their recovery. Indeed, "Conôro" is commonly used by the populations of northeastern Côte d'Ivoire as a flavour enhancer for sauces and also for its therapeutic properties. Results of microbiological analyses did not find any presence of Salmonella, Escherichia coli and thermotolerant coliforms. Preponderance lactic acid bacteria is noted, with loads ranging from 2.89 x 10^6 to 3.71 x 10^7 CFU/g, as well as the presence of Bacillus species (5 x 10^1 – 5 x 10^3 CFU/g). In terms of sensory analysis, "Conôro" samples are characterized by an aroma similar to that of smoked meat, an astringent taste, a slightly sweet aftertaste, a dark brown colour and a granulated appearance with intensities varying according to the type of "Conôro". Hedonic test on sauces seasoned by the "Conôro" samples revealed a pleasant level of acceptability for colour, aroma, taste and texture. In general, no significant differences were noted by panelists between sauces seasoned with industrial broths, "Conôro" made from okra seeds and the one made from a mixture of baobab, kapok tree and okra seeds. In short, various "Conôro" studied could be substituted to industrial seasoning broths with the advantage for "Conôro" that are manufactured from available natural resources.

Keywords: "Conôro", fermented condiment, seeds, flavour enhancer, Côte d'Ivoire

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1. INTRODUCTION

In Africa, there are many traditional food condiments made with local ingredients that have been used for many years to enhance taste of the food but also for its nutritional and therapeutic benefits (Ojewumi, 2016). However, there is a shift from these traditional condiments by population to industrial seasoning broths that are dumped on African markets. In addition, the sanitary quality of these industrial broths sometimes gives rise to concerns. Indeed, ingredients used in the formulation of these broths could contain high levels of sodium and monosodium glutamate, that excessive consumption would be harmful to the body's proper functioning (Ataseven *et al*., 2016; Dossou-Yovo *et al*., 2016; Husarova and Ostatnikova, 2013).
Based on this observation, some researchers have conducted the studies to promote local condiments made in a natural way without chemicals. These condiments include "soumbala", "afitin", "iru", "netetu", condiments derived from the fermentation of nere (*Parkia biglobosa*) seeds, which are known for their role as blood pressure regulators and high protein content (Ojewumi, 2016; Fatoumata *et al*., 2016). In low-income families, they are sometimes used as a substitute for meat or fish (N'dir *et al*., 2000; Fatoumata *et al*., 2016). There is also "dikouanyouri", a fermented condiment produced from baobab (*Adansonia digitata*) seeds, which, a protein concentrate used to season sauces in rural Benin (Chadare *et al*., 2008; Kaboré *et al*., 2012). Similarly, "kantong", a food seasoning obtained by fermenting kapok tree (*Ceiba pentandra*) seeds, is used by people in Ghana in soups as a

thickener, flavouring and flavour enhancer. It is also used in the diet of convalescing people (Kpikpi *et al*., 2014).

Although various scientific studies are being conducted on the some traditional condiments, many of these natural products are still not well known or used. Among these, is "Conôro" which is the subject of this study. Indeed, "Conôro" is a food seasoning consumed in the northeast of Côte d'Ivoire. It results from fermentation of pastes obtained from powders derived from baobab (*Adansonia digitata* L.), kapok tree (*Ceiba pentandra* L.) and/or okra (*Abelmoschus esculentus* L. Moench) seeds which are natural regrowth plants or grown locally. The use of these local plants allows the inhabitants of the region to produce their traditional condiments at a lower cost, allowing them not only to cover their daily nutritional needs but also to treat some diseases. According to the results of the ethno-nutritional survey conducted by Yao *et al*. (2017), "Conôro" could substitute to industrial seasoning broths in culinary preparations. However, until now, no sensory and microbiological characterization studies have been carried out on the "Conôro".

This study aims to promote local food products, particularly "Conôro" samples by the assessing to their microbiological quality and sensory properties.

2. MATERIALS AND METHODS

Study material

Biological material used to make "Conôro" is seeds of three plants species. They include *Abelmoschus esculentus* (L.) Moench (okra), *Adansonia digitata* L (baobab) and *Ceiba pentandra* L (kapok tree). The fruits of these species were harvested dry from fields on the localities of Bondoukou department (north-east of Côte d'Ivoire). The harvests were carried out dry on the plants from December 2016 to March 2017. Systematic identification and authentication of the different species were carried out respectively at the botany laboratory of Nangui Abrogoua University and at the National Floristic Center of Felix Houphouët Boigny University (Abidjan, Côte d'Ivoire).

Powder production

Baobab, kapok tree and okra seeds were sorted to remove all rubbish. They were washed in distilled water and 500 g of each type of seed was weighed and dried in a ventilated oven (Biobase, China, Shandong) at 45°C for 24 hours. The dried seeds were milled with a mixer blender (Binatone BLG-555, China, Hong Kong). The shreds obtained were sieved using a mesh sieve (AFNOR NFX 11504, 500 µm). As a result, three single powders were obtained respectively from baobab, kapok tree and okra seeds. One part of these three single powders was used to formulate four mixed powders. To this end, three mixed powders in a ratio 1/2:1/2 and one mixed powder in ratio 1/3:1/3:1/3:1/3, were obtained. In total, seven types of powders have been obtained that will be used to produce seven samples of "Conôro".

Manufacturing of "Conôro" samples

In 100 g of each type of powder was added a quantity of distilled water proportional to the water absorption capacity. With a stainless steel whisk, the mixture was achieved for each powder in order to obtain homogeneous paste. Containers with the paste were hermetically sealed and put in a dark room at the temperature of 25 to 30 °C during 72 hours for fermentation process. At the end of fermentation, pastes were spread on stainless steel pans and kept in the oven at 45 °C to be dried for 72 hours. Dried fermented pastes commonly called "Conôro" were used for subsequent microbiological and sensory analysis.

Microbiological analysis of "Conôro" samples

Preparation of culture media and decimal dilutions

"Conôro" samples to be analyzed were obtained in the proportions (g/mL), according to the method described by the French Standard (NF) ISO 6887-V08-010-6 (2013). Ten (10) grams of "Conôro" was added to a sterile glass vial containing 90 mL of buffered

peptone water solution (Conda, Spain) previously autoclaved (121°C, 15 min, 1 bar). The mixture obtained after manual homogenization by stirring for 2 min corresponds to the stock solution. Then successive decimal dilutions were prepared from this culture media. For this purpose, 1 mL of the stock suspension was taken and transferred to a test tube containing 9 mL of buffered peptone water. This mixture is homogenized and a suspension at 10^{-1} is obtained. 1 mL of the 10^{-1} suspension was transferred into 9 mL of buffered peptone water to obtain the 10^{-2} dilution. Thus, decimal dilutions ranging from the stock solution to the 10^{-7} dilution were prepared for each of the seven (7) samples.

Aerobic mesophilic bacteria enumeration (AMB)

The medium used for the enumeration of **AMB** was the PCA (Plate Count Agar) (Conda, Pronadisa, Spain) according to French standard ISO 4833 (2003). Seeding was done by incorporating 1 mL of the decimal dilutions into the Petri dishes. Then 15 mL of the previously melted medium and kept under cooled at 45 °C were poured into the dishes containing the inoculum. The mixture was homogenized by stirring and then allowed to cool on the bench at room temperature. After solidification, a second layer of 5 mL of white agar was cast to prevent the invasion of the boxes by some germs. The seeded Petri dishes were then incubated at 30 °C for 72 hours. After this incubation period, all microbial colonies present in dishes containing between 30 to 300 were counted.

Lactic acid bacteria enumeration

Lactic acid bacteria enumeration was performed according to ISO 15214 (1998). Inoculums of 0.1 mL of each decimal dilution was plated on Man Rogosa Sharpe Medium (MRS) agar sterilized and poured into Petri dishes. The inoculums was carefully distributed to the surface of the agar with a spreader and the dishes were incubated in an anaerobic jar at 30° C for 48 hours. Boxes containing a number of characteristic bacteria between 15 to 150 were retained for enumeration. The germs of lactic acid bacteria are circular with regular, milky and shiny outline. They are gram-positive bacilli or shells, anaerobes partially tolerant to oxygen and without catalase. Two Petri dishes were inoculated by dilution.

***Bacillus* enumeration**

Enumeration of *Bacillus* was performed according to ISO 7932 (2004). The samples undergo a heat treatment of 80 °C for 10 minutes in a water bath to eliminate vegetative forms. They are then inoculated by spreading 0.1 mL of the initial suspension and decimal dilutions on the surface of Mossel agar incubated for 18 to 48 hours at 30 °C. The dishes containing a number of characteristic colonies between 15 to 150 colonies were selected for enumeration. Two Petri dishes were inoculated by dilution.

Yeasts and molds Enumeration of

Yeasts and molds enumeration was carried out according to the French standard (NF) ISO 21527-1 (2008) on sterilized Dichloran Rose Bengal Chloramphenicol (DRBC) agar medium and poured into Petri dishes. Seeding was carried out by spreading 0.1 mL of the initial suspension and its successive decimal dilutions on the surface of the agar medium. The Petri dishes were incubated at 30 °C. for 48 hours. Boxes with a colony count between 15 and 150 are used to calculate fungal loads.

Total coliforms, thermotolerant coliforms and *Escherichia coli (E. coli)* enumeration

Total coliforms, thermotolerant coliforms and *E. coli* were counted according to ISO 4832 V08-015 (2006) on RAPID *E. coli* sterile agar medium in Petri dishes by spreading 0.1 mL of the stock solution and decimal dilutions. The plates are incubated at 37° C for enumeration of total coliforms and at 45° C for thermotolerant coliforms and *E. coli* for 24 hours. Coliforms form blue to green colonies and *E. coli* form purple to pink colonies. Two plates per dilution were inoculated for direct enumeration of coliforms and *E. coli*.

Research of *Salmonella*

Research for *Salmonella* sp. was carried out according to ISO 6579 (2002) with the

following steps:

✓ Pre-enrichment

Twenty-five (25) g of each sample of "Conôro" were aseptically collected and placed in a stomacher bag (Gosselin, France). A volume of 225 mL of sterilized buffered peptone water solution has been added. The whole was homogenized for 30 seconds and put in the oven at 37 °C for 24 hours. This step is necessary in order to revitalize stressed strains of *Samonella* sp.

✓ Selective enrichment

Volume of 0.1 mL of each pre-enrichment broth was placed in 10 mL of Rappaport Vassiliadis (RV) medium (Scharlau, Spain). Incubation was performed at 42 °C for 24 hours. This enrichment is selective. It allows *Salmonella* sp., often present in small numbers, to develop and eliminates other microorganisms belonging to the enterobacteriaceae family or other families.

✓ Isolation and identification

From the culture obtained in the RV broth, seeding was done by striations on the Xylose lysine Desoxycholate (XLD) agar (Plasmatec, England) and *Salmonella-Shigella* (SS) (Scharlau, Spain). Incubation was performed at 37 °C for 24 hours. The characteristic colonies appear red. They have been selected and sown on nutrient agar (Biorad, France). Incubation was performed at 37°C for 24 hours.

Expression of results

The number N (bacteria/g of "Conôro") expressed in CFU/g is determined by the following formula:

$$N = \frac{\sum C}{V(n1 + 0{,}1n2) \times d} \times 10$$

- N: Number of bacteria per gram of product;
- ΣC: Sum of the colonies counted on all the boxes selected from successive dilutions;
- V: Volume of inoculums applied to each dish (mL);
- $n1$: Number of boxes retained at the first dilution considered;
- $n2$: Number of boxes retained at the second dilution considered;
- d: Dilution factor corresponding to the first dilution retained.

Sensory analysis

Two sensory analysis studies were conducted, according to the sensory profile and the hedonic test.

Sensory profiles

This method was used for the purpose of giving a sensory identity to the different samples of "conôro". Samples were prepared and tested by a jury of about fifteen people, all students from Nangui Abrogoua University, Abidjan (Côte d'Ivoire). The tasters were trained in the descriptive and quantitative analysis method (Stone and Sidel, 2004). Jury members were recruited on the basis of their availability and expertise. At the end of the training, jury agreed on a common list of 13 descriptors that are: brown for color; aromas of smoked meat, seasoning cube, fermented salted fish, fermented seeds of parkia biglobosa and dried cocoa; tastes sour, salty, sweet aftertaste, astringent and bitter aftertaste ; compact and granul for texture**.** The sensory evaluation of each product was carried out in two steps where the experts evaluated each product according to the 13 organoleptic criteria previously defined on a linear range scale from zero (low intensity) to ten (high intensity).

Acceptability test

Hedonic test was carried out on sauces seasoned by the different formulations of "Conôro", by the "soumara" (traditional condiment based on the fermented seeds of *Parkia biglobosa*) and by the industrial seasoning cube determined the acceptability. In addition, a sauce without seasoning served as a witness to evaluate the impact of these seasonings used. These sauces contained neither fish nor meat, but contained an identical amount of salt. The tests were conducted in two sessions for each of the sauces, with about fifty untrained people and consumers of seasoned sauces. The sauces based on dried okra powder "djoumblé" with different seasonings and that without seasoning (except salt) were presented in identical containers, coded with random numbers of three figures. Acceptability of each sample was tested on a 9-point hedonic scale (Meilgaard *et al.*, 1999).

Numeric values were assigned to the various categories (1-9) of the scale, assigning 1 for extremely unpleasant and 9 for extremely pleasant (Annex 3). Five attributes were evaluated, namely color, aroma, taste, texture and general acceptability.

Statistical analysis

Analyses were performed in triplicate. Statistical analyzes were done using the Statistica software Version 7.1 (Statsoft Inc, Tulsa-USA Headquarters, 2005). Significant differences among samples were determined using analysis of variance (ANOVA one way) and Duncan's test at $P < 0.05$.

3. RESULTS AND DISCUSSION

Microbiological characteristics of "Conôro" samples

The scores of microbiological study of "Conôro" samples at the end of production are shown in Table 1. Results showed a preponderance of lactic acid bacteria, aerobic mesophilic bacterial and the absence of *thermotolerant coliforms*, *Escherichia coli* and *Salmonella*. The high lactic acid bacterial loads ($2.89x10^6$ - 3.71×10^7) in the "Conôro" samples corroborate those obtained by Chadare *et al* (2010) whose work focused on *Mutchayan* (3.98×10^7 CFU/g), *Dikouanyouri* ($7.94x10^8$ CFU/g) and *Tayohounta* (2.51×10^8 CFU/g), all fermented condiments. Lactic acid bacteria play an important role in the fermentation of many foods.

Table 1: Microbiological characteristics of "Conôro" samples

"Conôro"	Microorganisms (CFU/g)							
	T C	TH C	E C	S M	Yeast/Moulds	B	L B	AM B
C.B	Ud	Ud	Ud	Ud	Ud	Ud	$2.89x10^6$ ± $0.15x10^{4a}$	$3.09x10^6$ ± $0.10x10^{4a}$
C.K	$3x10^2$ ± $0.11x10^{1a}$	Ud	Ud	Ud	$4x10^2$ ± $0.58 x10^{1b}$	$6x10^2$ ± $0.54x10^{1c}$	$1.22x10^7$ ± $0.11x10^{5c}$	$1.47x10^7$ ± $0.58x10^{5e}$
C.G	Ud	Ud	Ud	Ud	$2.4 x10^3$ ± $0.12x10^{2e}$	$5.1x10^3$ ± $0.60x10^{2e}$	$1.53x10^7$ ± $0.13x10^{5d}$	$1.31x10^7$ ± $0.51x10^{5c}$
C.BK	$4x10^2$ ± $0.12x10^{1b}$	Ud	Ud	Ud	$1.5x10^2$ ± $0.17x10^{1a}$	Ud	$2.04x10^7$ ± $0.51x10^{5e}$	$1.36x10^7$ ± $0.15x10^{5d}$
C.BG	Ud	Ud	Ud	Ud	$2.1x10^3$ ± $0.56x10^{2d}$	$1x10^2$ ± $0.15x10^{1b}$	$2.61x10^7$ ± $0.09x10^{5f}$	$4.19x10^7$ ± $0.17x10^{5f}$
C.KG	Ud	Ud	Ud	Ud	$2.15x10^3$ ± $0.29x10^{2d}$	$2.1x10^3$ ± $0.17x10^{2d}$	$7.85x10^6$ ± $0.23x10^{4b}$	$5.20x10^6$ ± $0.11x10^{4b}$
C.BKG	$6x10^2$ ± $0.14x10^{1c}$	Ud	Ud	Ud	$4.5x10^2$ ± $0.16x10^{1c}$	$5x10^1$ ± $0.23x10^{a}$	$3.71x10^7$ ± $0.54x10^{5g}$	$1.30x10^7$ ± $0.23x10^{5c}$

The values are mean ± SD. $^{a-g}$ Mean values in the column with different superscript lowercase letters are significantly different ($p<0.05$), as analyzed by the Duncan's post hoc test. **C.B:** "Conôro" based on baobab seeds; **C.K:** "Conôro" based on kapok tree seeds; **C.G:** "Conôro" based on okra seeds; **C.BK:** "Conôro" based on combined baobab and kapok tree seeds (1/2 :1/2); **C.BG:** "Conôro" based on combined baobab and okra seeds (1/2 : 1/2); **C.KG:** "Conôro" based on combined kapok and okra seeds (1/2 : 1/2); **C.BKG:** "Conôro" based on combined baobab, kapok and okra seeds (1/3 : 1/3 : 1/3). **TC:** Total coliforms; **TH C:** Thermotolerant coliforms; **EC:** *Escherichia coli*; **SM:** *Salmonella*; **Yeast/Moulds:** Yeast and moulds; **B:** *Bacillus*; **LB:** Lactic bacteria; **AMB:** Aerobic mesophilic bacteria; **Ud:** Unidentified bacteria.

They are involved in the development of flavour, aroma and taste as well as the preservation of food safety through the production of bacteriocins and lactic acid (Messens and De Vuyst, 2002), they improve the nutritional value of fermented products (Kayodé et al., 2007). Indeed, the high load of lactic acid bacteria in the "Conôro" would not only improve their organoleptic quality but also preserve their safety.

Aerobic mesophilic bacteria perform all bacteria, yeasts and moulds able of multiplying at a temperature between 20 °C and 45 °C in the presence of air. Their high load in the "Conôro" samples (3.09×10^6 – 4.19×10^7 CFU/g) is due to the high load of lactic acid bacteria. These results are similar to those obtained by Lo (1993) who worked on *guédj* (9.72×10^7 CFU/g) and *tambadiang* (1.84×10^7 CFU/g), all fermented fish-based condiments. Yabaya (2006) reported an increase in the microbial count from 2.8×10^7 at 24h to 1.8×10^{10} at 72 h of fermentation and attributed it to the breakdown of protein, lipid, starch and other nutrients to their simpler forms which the organisms use as their source of carbon and nitrogen.

Yeasts and moulds are present in the "Conôro" samples at loads between 1.5×10^2 and 2.4×10^3 CFU/g. These loads are low than that recommended threshold of 10^4. So, various "Conôro" studied can be consumed without risk of food poisoning, most of which are caused by these fungi.

Bacillus were counted in all "Conôro" samples, except samples "Conôro" based on baobab seeds (C.B) and "Conôro based on combined baobab and kapok tree seeds (C.BK), with loads between 5.10^1 and 5.1×10^3 CFU/g. These loads corroborated with findings in the various samples of soumbara based on fermented néré (1.1×10^3 - 2.5×10^3 CFU/g) and soybean (6.2×10^3 CFU/g) seeds (Fatoumata *et al*., 2016). According to Yao et al (2009), *Bacillus* are strains of technological interest that are responsible for the excretion of metabolites (enzymes, exopolysaccharides, lipopeptides, etc.) and the genesis of aromatic compounds during fermentation. It is these compounds that would give fermented products the characteristic taste, odour and aroma. These compounds would also be responsible for the antibiosis phenomenon (Chadare *et al*., 2008; Savadogo *et al*., 2011) which would contribute to eliminate pathogenic flora on the fermentation medium. Thus, presence of *Bacillus* as well as lactic acid bacteria in "Conôro" samples would contribute to extending their shelf life and also to improving their organoleptic and sanitary quality.

Total coliforms were counted in three "Conôro" samples (C.K, C.BK and C.BKG) at loads below the recommended limit of 10^3 CFU/g (Fatoumata *et al*., 2016). In addition, since "Conôro" is consumed cooked in a meal, this total coliform load in the "Conôro" samples would be reduced or even eliminated after cooking

The absence of thermotolerant coliforms, *Escherichia coli* and *Salmonella* in the "Conôro" samples could be explained by fermentation, which would make the environment hostile to their development (Yao *et al*., 2009). However, this absence of pathogenic microorganisms would indicate the acceptable microbiological quality of the "Conôro" samples studied that could be consumed without risk to health.

Sensory analysis of "Conôro" samples

Sensory profile of "Conôro" samples

In order to give a sensory identity to the different samples of "Conôro", their profile is made with 13 descriptors, including "brown" for colour; "smoked meat", "maggi cube", "adjouévan", "soumbala", "dried cocoa" for flavor; "sour", "salty", "sweet aftertaste", "astringent", "bitter aftertaste" for taste; "compact", "granulated" for texture. A profile in radar representation was created based on the averages of the scores (0 to 10) assigned by all panelists (Fig 1). Analysis of variance carried out on all the descriptors indicated a significant difference between the different samples of "Conôro" ($p < 0.05$).

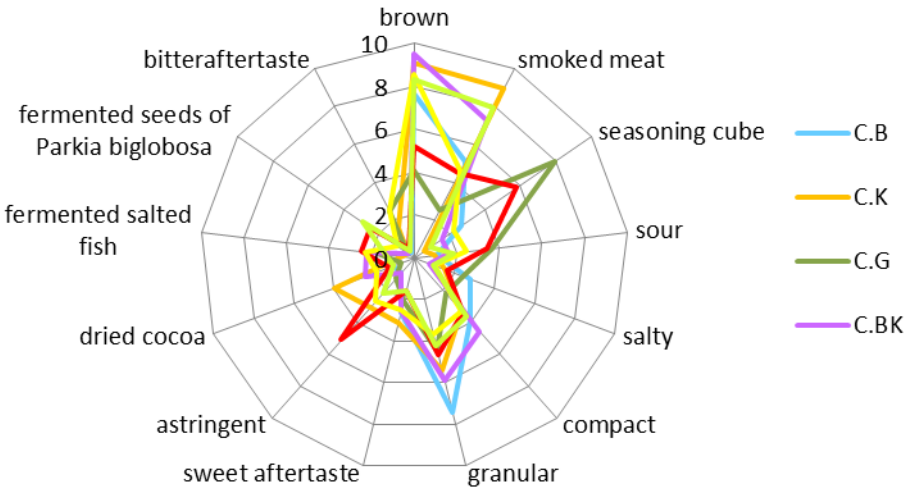

Figure 1: Sensory profile of "Conôro" samples

C.B: "Conôro" based on baobab seeds**; C.K**: "Conôro" based on kapok tree seeds; **C.G**: "Conôro" based on okra seeds; **C.BK**: "Conôro" based on combined baobab and kapok tree seeds (1/2 :1/2); **C.BG**: "Conôro" based on combined baobab and okra seeds (1/2 :1/2); **C.KG**: "Conôro" based on combined kapok and okra seeds (1/2 :1/2); **C.BKG**: "Conôro" based on combined baobab, kapok and okra seeds (1/3 :1/3 : 1/3)

From a flavour point of view, "smoked meat" and "Maggi seasoning cube" are the most popular in the "Conôro" C.K (8.91) and C.G (7.97) respectively. These flavours are believed to be due to the metabolic activity of the lactic and *Bacillus* bacteria already counted in the "Conôro" samples. Indeed, the proteolytic activity of lactic acid bacteria leads to the formation of some peptides and amino acids that are precursors of aromatic substances such as diacids (aspartic, glutamic) that have a broth flavour (Singh *et al*., 2003). Bacteria of the genus *Bacillus* carry out an alkaline fermentation responsible for the development of flavours. More than 116 aromatic compounds have been identified in samples of *soumbala*, a condiment similar to "Conôro", obtained from fermented seeds of *Parkia biglobosa* (Ouoba *et al*., 2005).

Concerning the colour, brown was chosen for all samples with the highest intensity attributed to the "Conôro" C.BK (9.51). This brown coloring would probably come from the enzymatic browning that occurred during fermentation. Indeed, some authors have reported the presence of *Bacillus* species and enzyme activities (amylase, protease and lipase) during the production of "Kantong", a fermented condiment made from kapok tree seeds (Kpikpi *et al*., 2014)

Hedonic test

The results of hedonic test of sauces seasoned by the different samples of "Conôro", "Soumbala", "maggi cube Tablet" and unseasoned sauce are presented in Table 2. Significant differences between the different sauces were noted ($P<0.05$).

Hedonic test is a sensory analysis method that focuses on consumer preferences. It aims to compare the appreciation of different products by focusing on individual feelings related to the pleasure or displeasure caused by the food (Stone and Sidel, 2004). Indeed, the sensory test carried out on sauces made from dry okra powder and seasoned with the various samples of "Conôro", the "soumbala" or the industrial seasoning cube showed that these sauces obtained general acceptability scores (6.98 - 7.91) corresponding to the "pleasant" level. On the other hand, the sauce did not receive any seasoning obtained the lowest rating (4.91) corresponding to the "unpleasant" level. This difference between seasoned and unseasoned sauces, taken as a control, shows the impact of these different seasonings on the organoleptic properties of the sauces studied.

Table 2: Acceptability of sauces seasoned with different samples of "Conôro", "soumbala" and "Tablette maggi cube".

Samples	Parameters				
	Color	Aroma	Taste	Texture	General acceptability
S.CB	6.49±0.32 [b]	7.21±0.10 [b]	6.67±0.71 [b]	6.51±0.14 [c]	7.16±0.17 [b]
S.CK	6.51±0.52 [b]	6.93±0.24 [b]	6.55±0.70 [b]	6.44±0.05 [c]	6.98±0.30 [b]
S.CG	7.00±0.07 [c]	7.81±0.14 [c]	6.63±0.24 [b]	6.94±0.22 [d]	7.82±0.11 [c]
S.CBK	6.88±0.03 [c]	6.86±0.39 [b]	6.67±0.57 [b]	6.19±0.12 [b]	6.98±0.44 [b]
S.CBG	6.33±0.38 [b]	7.02±0.34 [b]	6.93±0.76 [b]	6.30±0.44 [c]	7.16±0.38 [b]
S.CKG	6.56±0.18 [b]	7.28±0.12 [b]	7.83±0.36 [c]	6.33±0.21 [c]	7.28±0.37 [b]
S.CBKG	6.63±0.40 [b]	7.02±0.37 [b]	7.05±0.40 [b]	6.81±0.47 [d]	7.81±0.39 [c]
S.SM	6.16±0.79 [a]	7.07±0.55 [b]	6.88±0.75 [b]	6.09±0.74 [b]	6.98±0.33 [b]
S.Cube	6.70±0.73 [b]	7.93±0.21 [c]	7.86±0.42 [c]	6.91±0.63 [d]	7.91±0.26 [c]
S.T	6.40±0.68 [b]	4.98±0.70 [a]	4.40±0.89 [a]	5.58±0.58 [a]	4.91±0.28 [a]

The values in table are mean of panelists of two tasting sessions, affected by standard deviations. Mean values in the column with different superscript lowercase letters are significantly different ($p<0.05$), as analyzed by the Duncan's post hoc test. **S.CB**: Seasoned sauce of "Conôro" made from baobab seeds, **S.CK**: Seasoned sauce of "Conôro" made from kapok tree seeds, **S.CG**: Seasoned sauce of "Conôro" made from okra seeds; **S.CBK**: Seasoned sauce of "Conôro" made from combined baobab and kapok seeds (1/2 : 1/2); **S.CBG**: Seasoned sauce of "Conôro" made from combined baobab and okra seeds (1/2 : 1/2), **S.CKG**: Seasoned sauce of "Conôro" based on combined kapok and okra seeds (1/2 : 1/2), **S.CBKG**: Seasoned sauce of "Conôro" based on combined baobab, kapok and okra seeds ((1/3 : 1/3 : 1/3 :1/3 : 1/3); **S.SM:** Soumara seasoned sauce; **S. Cube**: Maggi tablette cube seasoned sauce; S. T: Sauce without seasoning.

Highest rating obtained for the "tablet maggi cube" seasoned sauce (7.91) could be explained by the habit that consumers have with this cooking aid (Dossou-Yovo *et al*., 2016). However, no significant difference was noted between the sauce seasoned by the "maggi tablet cube" (S. Cube) and those seasoned by the "Conôro" C.G and C.BKG. Consequently, "Conôro" C.G and C.BKG could replace industrial seasonings with the advantage of the absence of chemical ingredients such as glutamate and sodium, which are present in industrial broths in high proportions (Dossou-Yovo *et al*., 2016). Indeed, excessive sodium consumption is a contributing factor to high blood pressure and is associated with cardiovascular disease and stroke (Dossou-Yovo *et al*., 2016). Concerning glutamate, its toxicity to organs such as nerves, liver and genes has been demonstrated by some authors (Husarova and Ostatnikova, 2013; Ataseven *et al*., 2016).

4. CONCLUSION

It results from analyses that "Conôro" samples have a satisfactory microbiological quality with the absence of pathogenic flora. The main microflora consisting of lactic acid bacteria and *Bacillus sp* in the different "Conôro" plays an important role in the preservation and development of flavors and aromas in foods. The "Conôro" samples presented overall interesting organoleptic properties and were considered acceptable by the panelists. Moreover, no significant difference was noted between the sauce seasoned with industrial cube maggi tablet broths (S. Cube) and those seasoned with "Conôro" made from okra seeds (S. CG) and the mixture of baobab, kapok tree and okra seeds (S. CBKG), with an advantage for the latter which are natural products. All samples of "Conôro" are characterized by the color brown. The predominant aromas are those of "maggi cube" and "smoked meat" with the strong intensities attributed respectively to "Conôro" C.G and C.K.

To summarize, the various "Conôro" studied have acceptable hygienic qualities and contain strains of technological interest. In culinary preparations, the "Conôro", particularly those made from okra seeds (C.B) and the mixture of baobab, kapok tree and okra seeds (C.BKG), could be a substitute for industrial seasonings, since their organoleptic properties are equally appreciated.

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Conflicts of interest

Authors declare that there is no conflict of interest regarding the writing and publication of this work.

5. REFERENCES

[1]. Ataseven N., Yüzbas D., Keskin A.Ç., & Ünal F. (2016). Genotoxicity of monosodium glutamate. Food and Chemical Toxicology, 91, 8-18.

[2]. Chadare F., Hounhouigan J., Linnemann A., Nout M., & Boekel S. (2008). Indigenious Knowledge and Processing of Adansonia Digitata L. . Food Products in Benin, Ecology of Food and Nutrition, 47, 1-25.

[3]. Chadare, F., Gayet, D., Azokpota, P., Nout, M., Linnemann, A., Hounhouigan, J., & van Boekel, M. (2010). Three traditional fermented baobab foods from Benin, Mutchayan, Dikouanyouri and Tayohounta: Preparation, properties and consumption. Ecology of Food and Nutrition, 49, 1-19.

[4]. Dossou-Yovo, P., Tossou, L.T.C., Sezan, A., & Yelouassi, R.A.C. (2016). Evaluation of the nutritional quality of the most consumed "cube" broths in South Benin. International Journal of Innovation and Applied Studies, 17(1), 94-99.

[5]. Fatoumata, C., Soronikpoho, S., Souleyman, T., Kouakou, B., & Marcellin, D. K. (2016). Caractéristiques biochimiques et microbiologiques de moutardes africaines produites à base de graines fermentées de Parkia biglobosa et de Glycine max, vendues en Côte d'Ivoire. International Journal of Biological and Chemical Science, 10(2), 506-518.

[6]. Husarova V., & Ostatnikova D. (2013). Monosodium Glutamate Toxic Effects and Their Implications for Human Intake: A Review. Journal of Medical (JMED) Research. Article ID 608765, DOI: 10.5171/2013.608765, 12 p.

[7]. ISO (International Organisation for Standardization). (1998). Microbiologie des aliments - Méthode horizontale pour le dénombrement des bactéries lactiques mésophiles - Technique par comptage des colonies à 30°c sur la gélose PRS, ISO 15214 V 08-030.

[8]. ISO (International Organisation for Standardization). (2002). Microbiology of food and animal feeding stuffs, Horizontal method for the detection of Salmonella spp, Fourth edition. ISO 6579, 34p.

[9]. ISO (International Standardization Organization). (2003). Microbiologie des aliments. Méthode horizontale pour le dénombrement des micro-organismes; technique de comptage des colonies à 30°C, ISO 4833.

[10]. ISO (International Organisation for Standardization). (2004). Microbiology - General Guidance for the Enumeration of Bacillus cereus Colony-count Technique at 30°C., Geneva, Switzerland, ISO 7932.

[11]. ISO (International Organisation for Standardization). (2008). Microbiologie des aliments-Méthode horizontale pour le dénombrement des levures et moisissures – Partie 1: technique par comptage des colonies dans les produits à activité d'eau supérieure à 0,95. Edition la plaine saint-denis, Villeurbanne, France. ISO 21527-1, 9 p.

[12]. ISO (International Organisation for Standardization). (2013). Microbiologie des aliments-Préparation des échantillons, de la suspension mère et des dilutions décimales en vue de l'examen microbiologique-Partie 6: règle spécifiques pour la préparation des échantillons prélevés au stade de production primaire. ISO 6887-V08-010-6, 5 p.

[13]. Kaboré, D., Sawadogo-Lingani, H., Dicko, M. H., Diawara, B., & Jakobsen, M. (2012). Acid resistance, bile tolerance and antimicrobial properties of dominant lactic acid bacteria isolated from traditional "maari" baobab seeds fermented condiment. African Journal of Biotechnology, 11(5), 1197-1206.

[14]. Kayodé, A., Hounhouigan, J., & Nout, M. (2007). Impact of brewing process operations on phytates, phenolic compounds and in vitro of iron and zinc in opaque sorghum beer. Lebensm.-Wiss. Technology, 40, 834-841.

[15]. Kpikpi, E.N., Thorsen, L., Glover, R., Dzogbefia, V.P., Jespersen, L. (2014). Identification of Bacillus species occurring in Kantong, an acid fermented seed condiment produced in Ghana. International Journal of Food Microbiology. 180, 1–6.

[16]. Lo M. (1993). Contribution à l'étude de la qualité microbiologique et chimique des poissons fermentés-séchés artisanaux sénégalais: le «guedj»

et le «tambadiang». Thèse, Université Cheick Anta Diop du Sénégal, EISMV, 86 p.
[17]. Meilgaard, M.C., Civille, G.V., & Carr, B.T. (1999). Sensory Evaluation Techniques. 3rd edition CRC Press LLC, Boca Raton, Florida, New York, USA, 387 p.
[18]. Messens, W., & DE Vuyst, L. (2002). Inhibitory substances produced by Lactobacilli isolated from sourdoughs-a review. International Journal of Food Microbiology, 72, 31-43.
[19]. N'dir, B., Lognay, G., Wathelet, B., Cornelius, C., Marlier, M., & Thonart, P. (2000). Composition chimique du nététu, condiment alimentaire produit par fermentation des graines du caroubier africain Parkia biglobosa (Jacq.) Benth. Biotechnologie Agronomie Société et Environnement, 4 (2), 101-105.
[20]. Ojewumi, M.E. (2016). Optimizing the conditions and processes for the production of protein nutrient from Parkia biglobosa seeds. A Thesis Submitted in the Department of Chemical Engineering to the School of Covenant University, Ota, 201 p.
[21]. Ouoba, L., Diawara, B., Annan, N., Poll, L., & Jakobsen, M. (2005). Volatile compounds of Soumbala, a fermented African locust bean (Parkia biglobosa) food condiment. Journal of Applied Microbiology, 99, 1413-1421.
[22]. Savadogo, A., & Traoré, A.S. (2011). La flore microbienne et les propriétés fonctionnelles des yaourts et laits fermentés. International Journal of Biological and Chemical Sciences, 5(5), 2057-2075.
[23]. Singh, T., Drake, M., & Cadwallader, K. (2003). Flavor of Cheddar cheese: a chemical and sensory perspective. Comprehensive Reviews in Food Science and Food Safety, 2, 166-189.
[24]. Stone, H., & Sidel, J.L. (2004). in Sensory evaluation practices. 3rd ed. Academic Press, San Diego, 377 p.
[25]. Yabaya, A. (2006). Production of local dadawa seasoning and condiment from Acacia nilotica (linn) seeds. Science world journal, 1(1), 27-31.
[26]. Yao KA, Faulet MB, Dan CG, Fagbohoun JB, Yao K, Kouame LP. (2017). Endogenous knowledge and importance of "Conôro", fermented condiment from seeds of Baobab (Adansonia digitata), Kapok (Ceiba pentandra) and Okra (Abelmoschus sp) by Bondoukou department populations (North-Eastern Côte d'Ivoire). Asian Journal of Agrculture and Rural Development; 7(12):244 261.
[27]. Yao, A.A., Egounlety, M., Kouame, L.P., & Thonar, T.P. (2009). Les bactéries lactiques dans les aliments ou boissons amylacés et fermentés de l'Afrique de l'Ouest: leur utilisation actuelle. Annales de Médecine Vétérinaire., 153, 54-65.