

Technical variation in the processing of dockounou, a traditional plantain derivate dish of Côte d'Ivoire

Akoa Essoma E. Flore¹, Mégnanou Rose-Monde^{1*}, Kra Kouassi Aboutou Séverin¹
and Niamké Lamine Sébastien¹

¹Laboratoire de Biotechnologies, UFR Biosciences, Université de Cocody, Abidjan, 22
BP 582 Abidjan 22, Côte d'Ivoire.

* Corresponding author

Name: Kra Kouassi Aboutou Séverin

Email : kra_severin@yahoo.fr

GSM : 00225 08 39 33 31

ABSTRACT

Dockounou, a plantain senescent derivate dish, constitute an original solution to post-harvest losses. Nevertheless it presents wide sensorial quality on towns markets which often limits its consumption. Hence, this study aimed to determine the processing factors which influence the dish quality, through a survey performed on producers of Abidjan. Descriptive analyses performed on data revealed a same processing scheme with six points of divergence about ingredients (plantain variety, flour and wrapper) and three steps (fermentation, cooking and saving modes) of the processing chain. The most common options were mixture of plantain varieties (40%), maize flour (48%), *Thaumatococcus daniellii* leaf (60%), exclusion of fermentation (86%), boiling (68%) and ambient conservation (64%), respectively. Resulting dockounou sensorial characteristics also varied, but the most dominant were brown color (68%), hard texture (60%), smooth structure (86%), spicy taste (80%) and plantain/leaf flavor (48%). Moreover, its most frequent selling-price was 50 fcfa (72%), followed by 100 fcfa (24%) and 125 fca (4%).

Key words: Plantain, dockounou, producer, processing, variability, sensorial characteristics

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INTRODUCTION

Musa (Plantain and banana), the first fruit crop is produced throughout the world and constitutes an important staple food in many developing countries, especially in Africa (IITA, 2012). Indeed, of the numerous edible varieties, plantain account for 19% and in 2010, its production was estimated at 8.462.530 tons in West Africa with Ghana (3.537.730 tons), Nigeria (2.733.300 tons) and Côte d'Ivoire, the regional greatest producers (FAOSTAT, 2012). In the same time, world production achieved 36.561.851 tons. Nevertheless, plantain accounts 35 to 100% of post-harvest losses (Fellows, 2011), generally resulting from diseases (crown rot, anthracnose, cigar-end rot, finger rot etc.), predator attacks (insects, birds, etc), physiological disorders (finger drop, peel splitting and chilling injury), mechanical damages induced by handling and transportation (impact, pressure, vibration, etc) and the natural maturation process (Dadzier and Orchard, 1997; Tchango-Tchango *et al.*, 1999; Emaga *et al.*, 2008).

Several solutions were found to reduce these post-harvest losses but fruit transformation into less perishable products (flours, ships, etc) is at far the most concrete of all, mainly as far as trading is concerned (Dadzier and Orchard, 1997; Emaga *et al.*, 2008; Fellows, 2011). Indeed, plantain fruit has a short storage life; moreover, it is important to carry out harvesting at the right maturity stage so that fruit would develop its full characteristic (flavor, taste and color) during storage. Above all, people have not only developed methods to increase plantain storage life, but they have also invented several dishes (fried, boiled and roasted plantain, porridge, pounded plantain) using unripe and ripe plantain fruits (Camara, 1984; Dzomeku *et al.*, 2005;

Koffi, 2007; Dzomeku *et al.*, 2011; Honfo *et al.*, 2011). One of these dishes involves senescent plantain pulp and can be considered as an interesting solution in reducing post-harvest losses (Akoa *et al.*, 2013). Nevertheless, urban producers/sellers offer dockounou with various sensorial characteristic about which consumers often complain. Hence, the present study aimed not only to determine the process but also to identify factors inducing sensorial variation. Therefore a survey was performed on greatest markets of Abidjan, where producers/sellers were interviewed.

MATERIEL AND METHODS

The survey was conducted in 2011, on greatest markets of the different communes of Abidjan (Côte d'Ivoire). All the dockounou producers/sellers (men and women) in transit and those selling at permanent locations of the main markets of Abobo, Adjamé, Anyama, Attécoubé, Cocody, Koumassi, Marcory, Port-Bouët, treichville and Yopoungon, were interviewed. Prepared questionnaire were administered to each of them. These questionnaires, established following a survey method on *Sphinx Software Version 5*, took into account their socio-demographic status namely the genre, age category, education level, function, ethnic group, commune where they reside and the market where they sell dockounou. The questionnaire also asked general information about dockounou; more precisely, dockounou local vernacular calling, the period and how it is consumed, its processing frequency and its selling-price. Producers also had to provide details about dockounou processing and its sensorial characteristics. About characteristics, producers had to precise the color, the texture, the structure, the flavor and the taste of their resulting preparation. Finally, the different data were analyzed using descriptive statistics of SPSS Software Version 17.0.

RESULTS

Respondent socio-demographic characteristics and generality about dockounou

The respondents were mostly constituted by women (92%) and just 8% for men. They belonged to several ethnic groups namely Akan (68%), Krou (12%), Northern (4%) and Southern Mandé (12%). The ethnic group Akan constituted the most important part of the producers and consisted in Abouré (4%), Agnis (20%), Alladjan (12%), Appollo (8%), Baoulé (16%) and Ebrié (8%). The Krou group included Guéré (12%) and Wobê (4%) when Southern and Northern Mandé was essentially constituted by Gouro (16%) and Koyaka (4%), respectively. About ethnic group, eight vernacular-calling were attributed to dockounou and varied from a group to another (Table 1). In fact, dockounou is known as *apity*, *lokounou* or *banadockron* by Abouré, Agnis, Appollo and Baoulé, while Guéré, Koyaka and Wobê recognize it as *kpapa* or *kpa*. As for Gouro, Ebrié and Alladjan, they knew it as *gogloui*, *koukou* and *innèvri winsin djui*, respectively. Concerning age categories, there were 48% of majors (25-40 years) and 52% of seniors (more than 40 years) with different education level, both of them. In fact a greater percentage (56%) of respondent had no formal education while about 28% and 16% of them had respectively, secondary and primary school level. All of the respondents resided in Abidjan where their main activity was to produce and sell dockounou on markets. They used to produce dockounou during plantain high production periods, except for four respondents of Anyama, Koumassi and Port-Bouët, who produce unconditional.

About dockounou consumption, it would be eaten as break-fast, lunch and/or as snack; but the most usual were break-fast and lunch (72%). It might be consumed without accompaniment, according to most of respondents (68%), nevertheless, for Gouro,

Wobê and Koyaka, it would be served with vegetable oil, while Appollo and Ebrié would suggested roasted or boiled groundnut as accompaniment.

Table 1: Dockounou vernacular callings

Group	Ethnic	Vernacular calling
Akan	Abouré	<i>Apity</i>
	Agni	<i>Apity, banadokron</i>
	Alladjan	<i>Innèvri winsin djui</i>
	Appollo	<i>Apity</i>
	Baoulé	<i>Lokloun</i>
	Ebrié	<i>Koukou</i>
Krou	Guéré	<i>Kpapa, kpa</i>
	Wobê	<i>Kpa</i>
Southern Mandé	Gouro	<i>Gogloui</i>
Northern Mandé	Koyaka	<i>Kpa</i>

Variability in dockounou processing

Survey data revealed a similarity in the process of dockounou despite of some variability in ingredients and several steps of the process. Indeed for the whole producers, senescent plantain finger might be peeled; its mushy pulp might be blended and mixed with a few quantity of flour. The mixture would then, be parted in plant leaves and cooked (Figure 1). Six points of variability were identified and concerned

successively the variety of plantain, the type of flour, fermentation, wrapping or packaging, cooking and conservation modes.

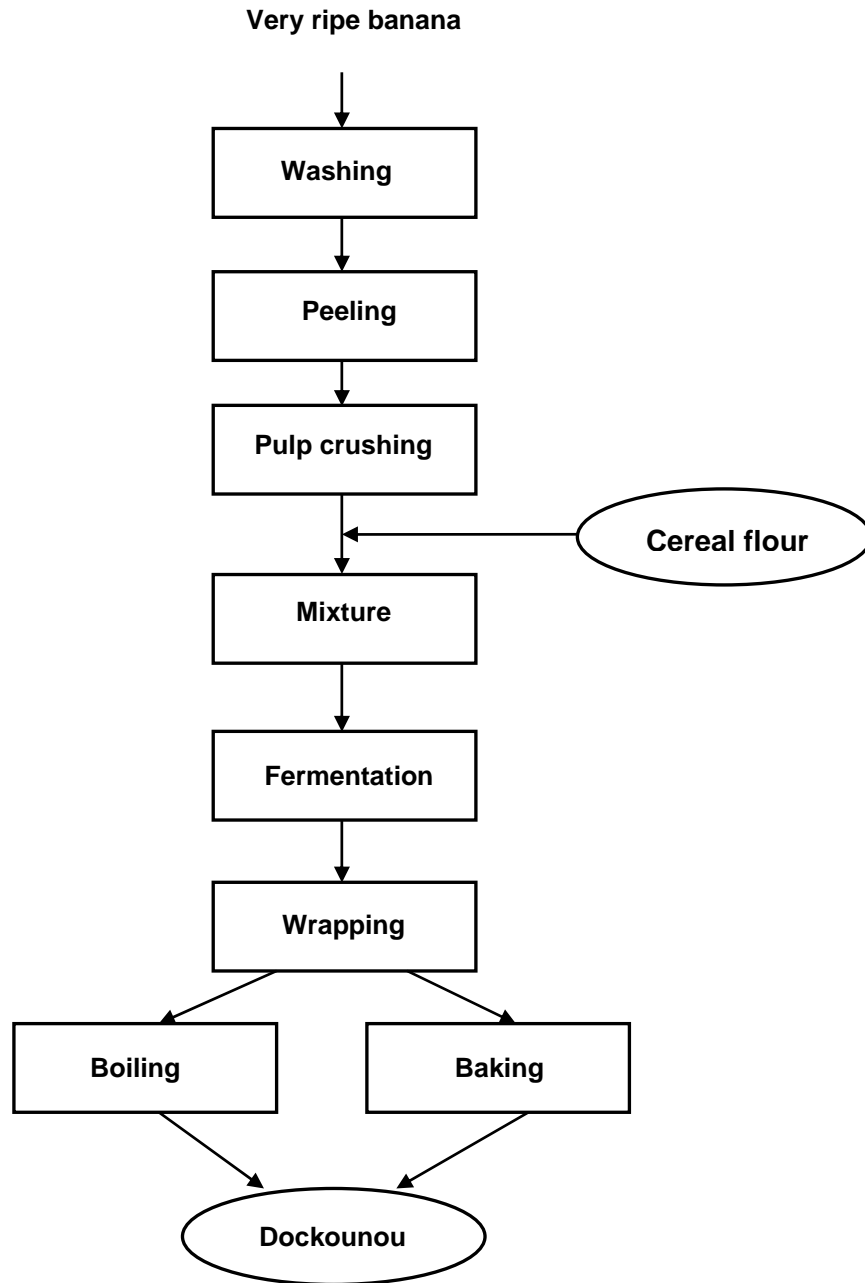


Figure 1: Dockounou empiric (traditional) processing

Variety of plantain (Figure 2-A)

The choice of the plantain constituted the first variant of dockounou manufacturing, the survey identified. In fact, respondents told about three varieties of plantain on markets, namely *afoto*, *agninin* and *amlétia*. These varieties might be utilized separately (28% of respondents), but for 40% respondent, they would be mixed (*Afoto + agninin*, *agninin + amlétia* or *afoto + agninin + amlétia*) together. The other respondent (32%), as for them, didn't care about that ingredient (Figure 2-A). Above all, plantain fruit might be bought at its senescent step, on local markets.

Nature of flour (Figure 2-B)

The second variability concerned the type of flour, since three type of flour were reported, namely maize, rice and wheat; they interested respectively 48%, 44% and 8% of respondents (Figure 2-B). The different choices were influenced by age category since maize flour (36%) was mostly selected by seniors and rice (32% of majors) flour by majors.

Fermentation

The step of fermentation constituted the third variant, because it was not involved in the process by all the producers; only four of them (Two Agnis, one Abouré and one Appollo) considered fermentation as essential. Moreover, the fermentation duration also varied from a producer to another (10 minutes to 10 hours). In fact, Abouré ferment for ten minutes, Appollo, for four (4) hours when Agnis achieve ten (10) hours.

Wrapping or packaging and dockounou prices (Figure 3)

The wrapping constituted the fourth variable since the choice existed between *Thaumatococcus daniellii* (60%) and *Musa spp.* (40%) leaves. Moreover, the price of wrapped dockounou varied from a market to another and in the same market, from a

seller to another; it was evaluated at 50, 100 or 125 FCFA, but the most common was 50 FCFA and concerned 72% of respondents.

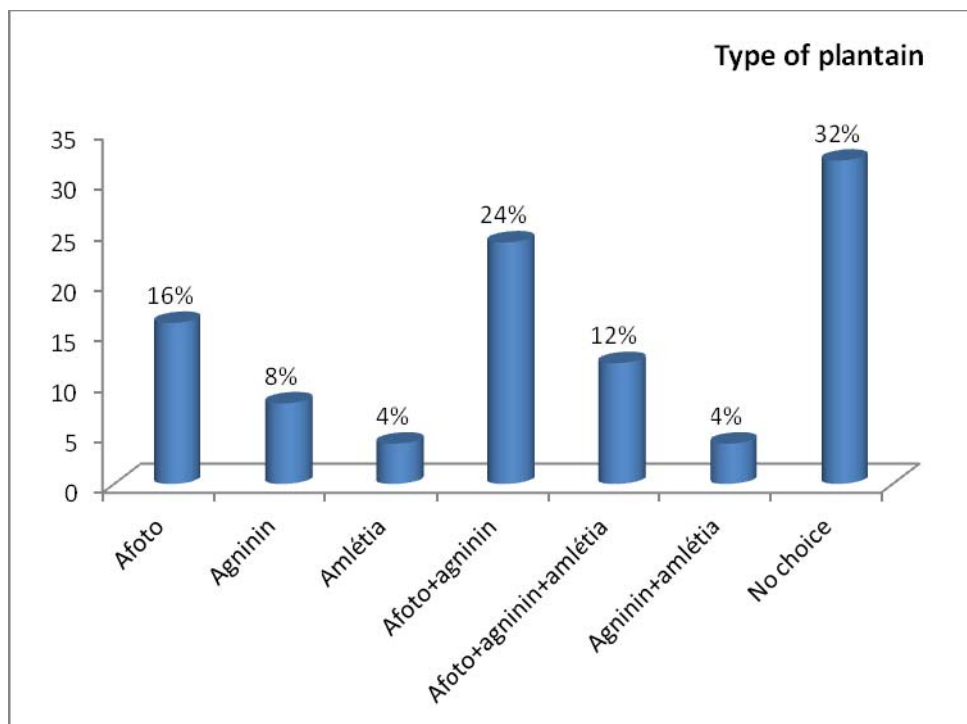
About the possibility of adoption of another wrapper, six of the producers were up to; most of them refused and eight did not care about it.

Cooking mode and duration

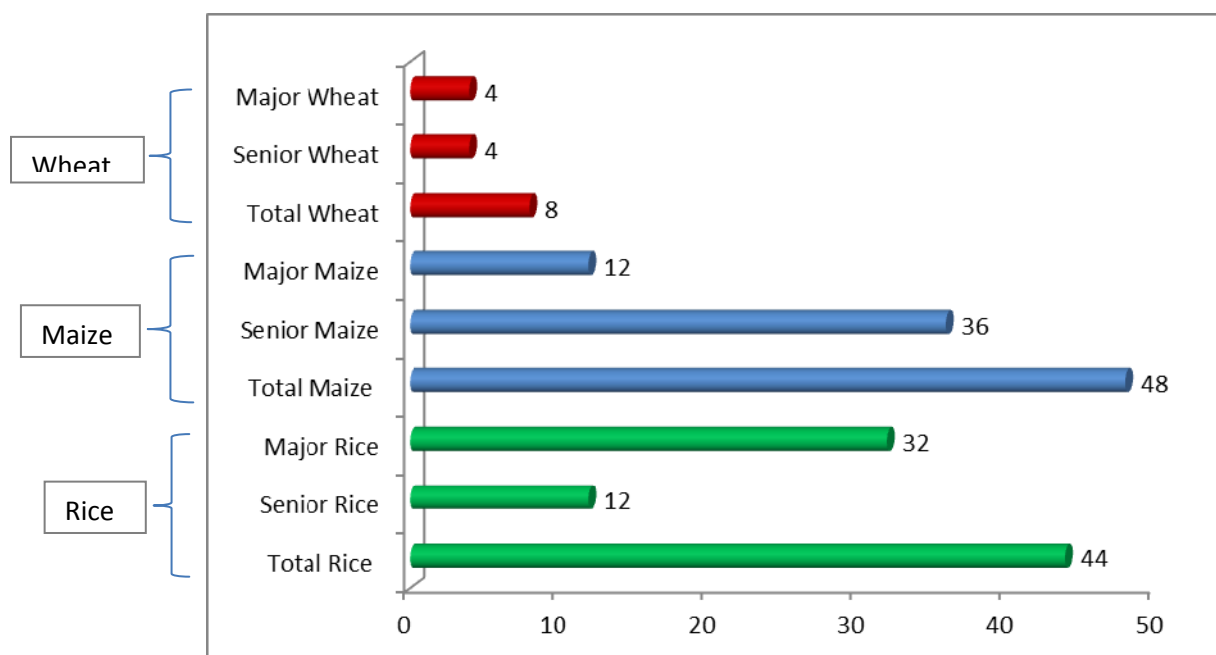
The cooking mode constituted the fifth variable in dockounou process because three different methods were concerned namely boiling (68%), baking (16%) and braising (16%), with boiling as the most utilized (Figure 3). Concerning the cooking duration, no time was precised; producers used sensorial proceedings which change from an ethnic group to another. In fact, results revealed that to appreciate the cooked statute, most of the producers press the dockounou with their fingers to evaluate its firmness. Nevertheless, Alladjan taste the dockounou, when Ebrié and Appollo smell its odor. As for Gouro and Guéré, they appreciate the wrapping leaf, the boiling water and the dockounou colors.

Post-cooking storage (Table 2)

Respondent ranged their dockounou self-time from three to twenty one days. The majority (80%) kept it for less than eight days; more precisely for three (24%), four (24%), five (4%) and seven (28%) days. The other indicated fourteen (12%) and twenty one days (4%). Various storage mode such as refrigerator (4%), braise (28%), sun-dry (28%) and ambient air (32%) were also reported. The more usual modes were ambient air, mainly for short self times (3 to 7 days). Whatever, dockounou with twenty-one self-days were daily kept on grill over small braises when those of fourteen self-days were conserved either at ambient air or braise or sun-dried.



A- Variety of plantains



B- Type of flours

Figure 2: Variety of plantain and type of flours involved in dockounou preparation. The first figure (A) represents the different variety of plantain, and the second. (B) indicates the type of flours.

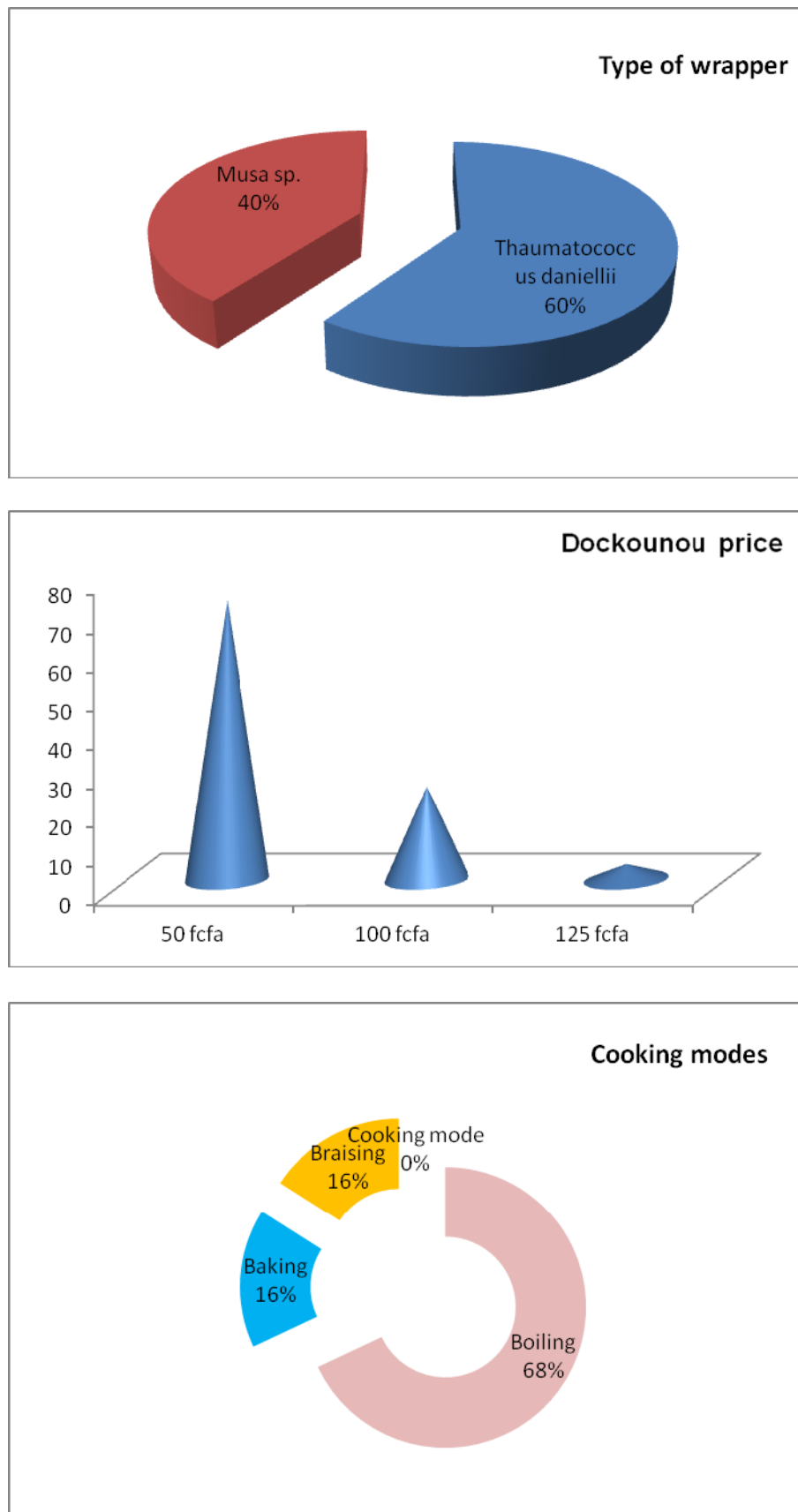


Figure 3: Dockounou different plant-wrapper, unity-costs and cooking modes

Table 2: Dockounou self-times and common saving mode

Self-time (Day)	Storage mode
3-7	Ambient air, sun drying, braise and refrigerator
14	Ambient air, sun drying and braise
21	Braise

Dockounou sensorial characteristics (Table 3)

Results showed that dockounou sensorial characteristics varied from a producer to another. In fact, concerning the color, it could be orange (8%), red (24%) or brown (64%), with prevalence of the brownish. Reported structures were smooth or granulous, while textures were hard (60%), soft (36%) and doughy (4%), independently to the nature of the flour. Concerning the taste, producers cited sweet (20%) and spicy (80%) dockounou, with the latest representing the most common. As for flavor, producers indicated three types such as plantain (40%), leaf (12%) and a mixture (48%) of the previous flavors; the latest flavor (plantain + leaf) was the most dominant.

Table 3: Characteristics of original dockounou

Color	Flavor	Texture	Structure	Taste
Brown (84%)	Plantain/leaf (48%)	Hard (60%)	Smooth (84%)	Spicy (80%)
Orange (8%)	Plantain (40%)	Soften (36%)	Granulous (16%)	Sweet (20%)
Red (24%)	Leaf (12%)	Doughy (4%)		

Most common (dominant) characteristics are in red

DISCUSSION

Dockounou, as many other plantain derivate dishes, is a traditional meal involved in the feeding (break-fast, lunch and snack) habits of several plantain producing areas (Camara, 1984; Dzemeku *et al.*, 2005; Koffi, 2007; Dzemeku *et al.*, 2011; Honfo *et al.*, 2011). That habit might also induce the way of consuming (with accompaniment or not) as the culture and/or individual choice, do (Shenoy, 2005; Daniel and Roudot, 2007). Nevertheless, it would be rather either adopting accompaniments or adding other nutrient (fat, protein) in dockounou, as reported by Dzemeku *et al.*, (2005), Honfo *et al.*, (2011) and Akoa *et al.*, (2013) for plantain derivate dishes, since it is mostly eaten at break-fast and lunch. Indeed, for this purpose, dockounou might be nutritionally enriched, while plantain pulp by itself would be poor in fat, protein and vitamins (Sharrock and Lusty, 2000; Dzemeku *et al.*, 2007; Baiyeri *et al.*, 2011). Hence, since consumers (rural consumers, mainly) independently to their origin, might be taught on the necessity of proposing accompaniment such as meat, fish and/or adding oil and fish powder during dockounou processing.

It would be important noting that respondents/producers' origins, namely Western (Guéré, Wobê), Central (Baoulé, Gouro), Southern (Abouré, Alladjan, Appollo and Ebrié) and Eastern (Agnis) Côte d'Ivoire, would be justified by the natural localization of plantain producing sites in Côte d'Ivoire (Camara, 1984; Koffi, 2007) which might coincide with coffee and cocoa plantations. This diversity of origin could also explain the various vernacular-calling of dockounou reported by respondents. However, plantain producing sites would be generally enclave and might constitute, with the perishable nature of plantain fruits, the main cause of plantain post-harvest losses and its irregular availability on towns markets (Dadzie and Orchard, 1997; Tchango-Tchango *et al.*, 1999; Emaga *et al.*, 2008). Hence, variation noticed about dockounou prices, from a

period/market to another, could be linked to that irregularity. Above all, dockounou could be considered as a traditional (original) solution for reducing plantain post-harvest losses; since its processing mainly involves senescent plantain (Dzomeku *et al.*, 2005; Akoa *et al.*, 2013) which might constitute for most of plantain consumers, an undesirable raw material. The traditional character of that dish could explain the use of plant leaf as wrapping despite of its production in a town such as Abidjan. Hence option for a leaf or another might be linked to producer habit and/or its availability and lowest cost on markets (Nout *et al.*, 2003; Ojekale *et al.*, 2007). Anyway according to producers/respondents, dockounou authentic consumers would be intransigent not only about leaf wrapping and consequently to the specific flavor (plantain/leaf) induced, but also about its spicy taste (Akoa *et al.*, 2013). Consumers' intransigence would be in conformity with the greater implication of seniors in dockounou producing and might suggest a necessary aptitude in reproducing original characteristics of this empiric dish. Hence, producers' different options might not be induced by scientific knowledge, but by habit and/or suggestive ideas. However, ingredients choice might constitute an important step in dockounou preparation; that could be the reason why the producers of the present survey made various choices of plantain and flour. Indeed, the main option for variety *afoto* (*false Hornes*) would be linked to both its availability on markets and its bigger and longer fingers in contrary to *agninin* and *amlétia* (*French varieties*) which fingers are smaller (Koffi, 2007). So, the mixture of *afoto* with *amlétia* and/or *agninin* would lead not only to higher amount of pulp, but also to sweeter dockounou. In fact, some respondents reported that *amlétia* and *agninin* might be sweeter than *afoto* is. It is worth précising that, whatever producer think, senescent plantain pulp are naturally very sweet because of the increasing of reducing sugar (Dadzie et Orchard, 1997; Emaga *et al.*, 2008). In reality, their starch stock they got, unripe might be totally converted into

simple sugars. Concerning flour, it would be added to senescent plantain pulp to consolidate its mushy texture (Slembrouck *et al.*, 1991; Emaga *et al.*, 2008); moreover, according to respondents, flour would not only consolidate the pulp texture (maize flour), but would also provide softness (wheat flour) to the dockounou and enhance its taste (rice flour). Hence, most of time, producers might utilize the different flour more by habit/heritage (Daniel and Roudot, 2007) than by personal choice.

Concerning fermentation of plantain pulp before cooking, according to the producer of the present survey, it might constitute an essential step in dockounou original processing. Nevertheless, in Abidjan, producer avoid this step either by ignorance or to win time. Whatever, it is worth underlining here, the importance of fermentation which would not only contribute to soften the plantain dough but also and mainly, to provide sourness to the dish (Toka and Dago, 2003). Moreover, the presence of resulting organic acids in fermented dockounou might prevent consumers from stomach aches (Lorri and Svanberg, 1994). These organic acids would also inhibit microorganisms' development (Caplice and Fitzgerald, 1999; Cabo *et al.*, 2002), so, dockounou self-time might also rise up. Hence, fermentation might be recommended to producer though most of them just conserve their dockounou at ambient air for several days, probably by lack of knowledge about health problem they would expose consumers. Indeed, let's recall here, that most of the respondent/producers had no formal education. However, the most prudent saving mode might be in refrigerator instead of ambient, oven and braise. Really food over-heating (daily braising) would degrade some nutritional compounds such as vitamins, reducing sugar and amino acids (Dieffenbacher *et al.*, 2000; Machiels and Istass, 2002) and ambient air would induce microorganism or/and dust contamination (Cruz *et al.*, 1988; Adegunloyé *et al.*, 2006; Ojekale *et al.*, 2007). At this level, it is important précising that the use of plant leaf would systematically

suppose prudence in dockounou handling because of its fragility; hence, it would be better using other and more resistant wrappers and shortening most as possible, dockounou self-time.

Conclusion

Diversities in dockounou-producers choices of plantain variety, type of wrapping and flour would be mainly linked to their habit and/or the availability and the cost of these different ingredients. As for variability in process steps such as fermentation, the mode of cooking and storing, it could be essentially explained by the empiric knowledge of each producer. Hence, dockounou various sensorial characteristic might result from producers' different option. It would then, be rather proposing an improved process which could constitute a standard and lead to specific sensorial characteristics.

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