Agricultural Science Research Journal Vol. 7(7): 247 – 251, July 2017
Available online at http://resjournals.com/journals/agricultural-science-research-journal.html
ISSN: 2026 –6073 ©2017 International Research Journals

Full Length Research Paper

Technical sheet of the influence of grinding technical on some biochemical characteristics of the fermented cassava dough for the production of *Attieke*

***Jean-Paul Koffi Maïzan BOUATENIN[1,2], Alfred Kohi KOUAME[1] , Abel Zamblé Bi Irié BOLI[1], Theodore N'dédé Djeni[1], Hervé Eby MENAN [2], Marcellin Koffi DJE[1]**

[1]Faculty of Food Sciences and Technology, University of Nangui Abrogoua, Abidjan, Côte d'Ivoire
[2]Center for Diagnosis and Research on AIDS and Opportunistic Diseases, BP. V 3 Abidjan, Côte d'Ivoire

*Corresponding Author's Email: bouateninkoffi@gmail.com[1,2]

Abstract

In this study two methods are used to highlight their influence of fermentation cassava dough. The perforated plate is a simple tool, the less expensive, which requires intensive labor and is characterized by low productivity. As to the power-driven machine, it is used to grind larger quantities (10 tonnes per day) of cassava roots. After 20 hours of fermentation, the rate of lactic acid increases is almost the same manner in the dough grinded by perforated plate (70%) and in the dough crushed to the machine (71.42%). The dough grinded to the perforated plate, with a soft texture, contains a sugar rate higher (66.03%) than that of the ground paste to the machine (63.63%). Regarding the hydrocyanic acid, the reduction rate is higher in the dough grated to the perforated plate (51.85%) than that of the dough crushed to the machine (46.29%). The chemical characteristics of the dough grinded to the perforated plate seem to be more improved compared to that of the dough crushed to the electrical machine.

Key words: Perforated plate, Power-driven machine, Fermentation, Grinding, Cassava dough

Introduction

Attiéké is a semolina of cassava roots (Manihot esculenta Crantz) fermented, partially dehydrated, cooked with the vapor of the water and the appearance of agglomerated (Aboua, 1988 ; Djeni et *al*., 2011). It is a food typical of côte d'ivoire, whose local consumption is estimated on a yearly to more than 450 000 tonnes (CNRA, 2003, Djéni et *al*., 2008). Originally, the attieke was produced a long time for the consumption of the family. The Adjoukrou, Alladjan and Ebrié were the three ethnic groups in the south of Côte d'ivoire, considered to be the largest producers and consumers (Djè et *al*., 2008). The transformation was exclusively small-scale and run by womens according to a technology is fully manual involving several operations such as washing, peeling, grating, fermentation, pressing, crumbling, sieving and cooking. The grinding was realized out of a perforated plate with many holes highlights. This grinding consist to reduce the roots in the form of a dough fine (or mash) favourable to the microbial development and to the good functioning of many enzymatic reactions. In addition, the cyanogenic glycosides (linamarin lotaustraline) and specific enzymes (linamarase) were brought into contact, thus favouring the detoxification of the paste of cassava. Thus, The products made from this technique were of good qualities and constant. However, the execution of this operation is very long, tedious, dangerous for the hands and gives a low productivity.

Today, the growing urbanization and the increased demand have boosted the popularity of the attiéké. The attieke is now passed from the family environment to a commercial production and can be found all over the territory and even in the countries of the sub-region of West Africa (Sotomey et *al*., 2001). The attieke is also present in Europe, America and Asia through the black diaspora africaine (Kakou, 2000). The preparation of attiéké has become an income-generating activity for women and because of this, a grinding motor has been developed to cope with the major deficiencies (duration, hardness, and low productivity) of traditional technology.This practice results in a diversity of attieké sold on the ivorian market whose quality uneven, poor sanitation, low nutritional value and short time of conservation.

Thus, to meet the market demand, both qualitatively and quantitatively, it would be necessary to adapt the

mechanical system of the perforated plates to the crusher with the motor for the production of attiéké is constant. Previous studies conducted, have been conducted on the mechanization of the pressing, and the granulation of the paste of cassava, (Akely et *al*., 2008, 2010), the influence of the technique of grinding on the dough of fermented cassava for the production of attiéké is still unknown. Therefore, the objective of this work is to evaluate the impact of the use of the grinding motor on the biochemical characteristics of the dough of cassava.

Materials and methods

Biological materials:

Fig. 1: Cassava roots of the variety IAC

Fig. 2: Traditional cassava inocula.

Grinding materials:

Fig. 3: The power-driven machine

Fig. 4: The perforated plate

Methods

Preparation of cassava doughs

Traditional starter : samples of ready to use traditional were obtained at a small-scale (Women's entreprise) attieke production in Abidjan , Côte d'Ivoire.

Cassava roots: 12 months-old freshly harvested cassava roots of the bitter variety were obtained from a farm of the University of Nangui Abrogoua (Abidjan).

Fermentation of Cassava dough

abouts 4 kg of freshly harvested cassava roots of the bitter variety were peeled , washed. cassava roots peeled and washed were divided into 2 parts. 1.5 kg were grated with a traditional grater and 1.5 kg were grated with the power-driven machine. 500 g of each cassava mash obtained were inoculated singly with

following a traditional starter rate 10% (w/w). The doughs obtained were then incubated at 35°C for fermentation. Fermentation was monitored over time for 20 hours and samples of fermenting dough were aseptically taken for different analyses at the beginning and after 20 h of fermentation. All the preparation operations of the doughs are presented in the preparation process diagram below (fig 5)

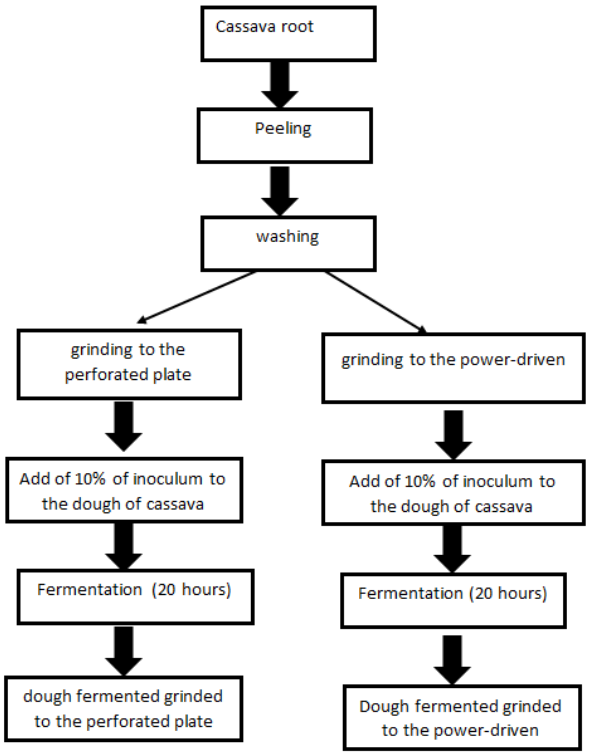

Fig. 5: Process for the preparation of fermented dough from grinders

Biochemical analysis

Determination of pH and total titrable acidity

Thirty (30) g of fermented cassava dough grinded to the perforated plate or grinded to the power-driven machine were blended with 70 mL of sterile distilled water and filtered through a whatman filter paper No. 1. The pH was determined on 30 mL of the filtered solution using a pH meter (P 107, CONSORT, Bioblock Scientitific). Total titratable acidity (TTA) was determined by titrating 30 mL of the filtered solution against 0.1 M NaOH using phenolphthalein as indicator. TTA was calculated as percentage of lactic acid as described by Kimaryo et *al*. (2000).

Determination of hydrocyanic acid content

The hydrocyanic acid content of fermenting dough grinded to the perforated plate or grinded to the power-driven machine was determined using the method of alkalinity titration described by (Holleman et *al*., 1956). Twenty seven (27) g of each sample were soaked in a mixture of water (200 mL) and orthophosphoric acid (10 mL) for 18 h. The mixture was then distilled by internment in water vapor and the distillate was collected in a solution of NaOH (5%). After diluting 100 mL of the distillate to 2/5, the solution was titrated with silver nitrate solution (0.02N) in the presence of 8 ml potassium iodide. Cyanogenic ions in aqueous solution complexed silver ions. AgNO3 molecule reacted with two molecules of HCN, representing 54 g of HCN for an AgNO3 solution of concentration 1N. For a solution of 1 mL of concentration 0.02N AgNO3 will require (54 g × 0.02 / 1) 1.08 g of HCN.

Determination of reducing sugars

Reducing Sugars in the dough grinded to the perforated plate and of the dough grinded to the power-driven machine was determined using DNS (3,5-dinitrosalycilic acid) method described by Bernfeld (1955). Two independent measurements were made on each sample and results were expressed in mg/100g.

Statistical analyses

One way analyses of variance based on DUNCAN multiple tests with significant level α=0.05 were performed in order to compare biochemical characteristics of cassava doughs samples in fermenting and also to determine significant differences between grinding technics.

Results and discussion

In this study, the chemical characteristics of dough obtained by grinding with the perforated plate and by grinding to the electric machine are similar. (Table 1).

Table 1: Chemical parameters crushed doughs

Grinding Technics		Biochemical Parameters			
		pH	AT (%)	RS (mg/100g)	HCN (mg/100g)
Dough grinded to the power-driven machine	before fermentation	6.63±0.2[a]	0.02±0.01[a]	0.20±0.07[a]	7.02±0.6[a]
	after fermentation	4.28±0.03[b]	0.07±0.02[b]	0.55±0.2[b]	3.78±0.4[b]
Dough grinded to the perforated plate	before fermentation	6.8±0.10[a]	0.03±0.01[a]	0.18±0.04[a]	9.18±0.9[a]
	after fermentation	4.28±0.2[b]	0.1±0.01[b]	0.53±0.1[b]	4.42±1.6[b]

In a column for each type of crusher to be considered, the average values followed by an alphabetical letter different are statistically different (P ≤ 0.05) (DUNCAN multiple t-test). pH : potential of hydrogen, AT : acidity titratable, RS : reducing sugars, HCN : hydrocyanic acid

The pH obtained vary according to the mode of grinding. The pH of the crushed dough to the machine is slightly different (6.63±0.2) than pH of the dough grinded to the perforated plate (6.8±0.10).This difference is not significant (P > 0.05). After 20 hours of fermentation, the reduction of pH was more growth in the dough crushed with the perforated plate. This indicates that of two methods of grinding, it's dough obtained by perforated plate is more fermentable. In addition, the crushing allows for the liberation of simple sugars directly fermentable by microorganisms (Asiedu, 1991). These sugars are metabolized by the lactic acid bacteria to form lactic acid. This leads to an acidification of the medium, so a lower pH. Moreover, the rate of lactic acid increases in almost the same manner in the dough grinded by perforated plate (70%) and in the dough crushed to the machine (71.42%). This decline in pH and the increase in lactic acid in fermented doughs were due to a significant production of lactate due to homolactic fermentation of the dough (Toka, 1998). The dough grinded to the perforated plate, with a soft texture, after 20 hours of fermentation contains a sugar rate higher (66.03%) than that of the ground paste to the machine (63.63%). This would be due to a degradation much more pronounced in of complex sugars into simple sugars in the dough grinded to the perforated plate than the dough crushed to the machine. Indeed, the evolution of the rate of reducing sugars is the result of two phenomena : the consumption of sugars by microorganisms and the degradation of complex sugars. Regarding the hydrocyanic acid, the reduction rate is higher in the dough grated to the perforated plate (51.85%) than that of the dough crushed to the machine (46.29%). This assumes that in the course of grinding to the perforated plate, the amount of linamarase endogenous to the cassava released is sufficient to allow a very rapid and complete hydrolysis of the linamarin. Furthermore, the quantity of hydrocyanic acid may also decrease at other stages of the preparation of cassava-based foods especially during the fermentation and the pressing of the pulp of cassava (Okafor and *al.*, 1984).

Conclusion

In the course of this study two methods are used to highlight their influence on the quality of the finished product. The physical and chemical characteristics of the dough grinded by perforated plate seem to be more improved compared to that of the dough crushed by electrical machine.The perforated plate gives low productivity but allows to obtain a soft dough with a uniform texture. As to the power-driven machine, it is used to grind larger quantities (10 tonnes per day) of cassava roots and gives a crumbly texture to the dough. Thus, the crushing system of the electric machine must be improved so that it can give doughs with an improved structure, which is more easily fermentable, as in the case of perforated plates.

References

Aboua F. (1988).Traditional food preparations of cassava in Ivory Coast. Cassava Newletter, 12 ISSN-00259-3688 CIAT.

Akely PMT., Amani NG., Azouma O and Nindjin C (2008). Influence of pressing force on physicochemical and sensory qualities of fermented cassava mash and attiéké semoulina. Food, 2: 48-51.

Akely PMT., Azouma OY and Amani NG (2010). Mechanical pressing and semolina preparation from fermented cassava paste during “attiéké” (yuka flour) processing. Journal of Food Engineering, 101:343-348.

Asiedu JJ (1991). La transformation des produits agricoles en zones tropicales. Approche technologique. Paris Ed, Karthala, Wageningen, Pays-Bas, CTA, 335 p.

Bernfeld D (1955). Amylase β et α, in methods in enzymology 1, S. P. Colowick and N. O. K., Academic press, Inc, New York, 149-154.

CNRA (2003). Manioc et Attiéké : du nouveau. Bulletin d’information et de liaison du CNRA, CNRA Info N° 8, p 8

Dje KM., DJENI NT., TOKA MD. and AKA S (2008). Biochemical and microbiological changes of cassava dough fermenting under different temperature conditions. Journal of Food Technology, 6 (3):114-119.

Djeni NT., N’guessan KF., Dadie AT and Dje KM (2008). Impact of different levels of a traditional starter on the fermentation of cassava dough for attiéké production. Food, 2:155-151.

Djeni NT., N’Guessan KF., Toka DM., Kouame KA and Dje KM (2011). Quality of attieke (a fermented cassava product) from the three main processing zones in Côte d’Ivoire. Food Research International, 44:410-416.

Holleman LWJ and Aten A (1956). Traitement du manioc et produits à base de manioc dans les industries rurales. Collection FAO, cahier n° 54, p 116

Kakou AC (2000). Optimisation des conditions d'application d'une méthode de conservation longue durée de la pâte de manioc (Manihot esculenta,Crantz) en vue d'améliorer la qualité alimentaire de l'Attiéké et du Placali. Thèse de 3ème cycle en Biochimie-Microbiologie, Université de Cocody (Côte d'Ivoire), pp 16-17.

Kimaryo VM., Massawi GA., Olasupo NA., Holzapfel WH (2000). The use of a starter culture in the fermentation of cassava for the production of 'Kivunde', a traditional Tanzanian food product. Int. J. Food Microbiol. , 56:179–190

Okafor N., Ijioma B., Oyolu C., 1984. Studies on the microbiology of Cassava retting for fufu production. J. Appl Bacteria, 56, 1-13.

Sotomey M., Ategbo E., Mitchipkpe E., Gutierrez M and Nago M (2001). Innovation et diffusion des produits alimentaires en Afrique: l'attiéké au Bénin. In : Alimentation, savoir-faire et innovations en agroalimentaire en Afrique de l'Ouest. CIRAD, 1-91.

Toka DM (1998). Conservation longue durée des pâtes de manioc (Manihot esculenta crantz) pour la préparation du placali et de l'attiéké. Etude de leur Composition chimique et Microbiologique. Thèse de Doctorat 3ème Cycle, Fast, Université de Cocody, Côte d'Ivoire, n° 284, p 104