Journal of Global Biosciences
ISSN 2320-1355
Volume 7, Number 9, 2018, pp. 5676-5684
Website: www.mutagens.co.in

Research Paper

TECHNICAL SHEET FOR YAM AND CASSAVA COOKING TEXTURAL QUALITY (MEALINESS AND HARDNESS) ASSESSMENT

Kouadio Kouadio Olivier[1,2], Kouakou Amani Michel[3], Boni N'zué[3], Nindjin Charlemagne[1,2] and Amani N'guessan Georges[1]

[1]Université Nangui Abrogoua,
UFR des Sciences et Technologies des Aliments,
Abidjan Côte d'Ivoire.
[2]Centre Suisse de Recherches Scientifiques en Côte d'Ivoire (CSRS),
Abidjan Côte d'Ivoire.
[3]Centre National de Recherche Agronomique (CNRA),
Abidjan,
Côte d'Ivoire.

Abstract

This study focused on two methods to assess the cooking textural quality (mealiness and hardness) of boiled yam and cassava. The first method delt with a downward pressure exerted on a cooked piece sample on contact with the thumb and the forefinger to be disintegrated. The ease or the dough to disintegrate the piece, determines the mealiness or the hardness of the sample. The second test consisted in evaluating the cooking textural quality parameters of boiled samples. Mealy cooking varieties of yam and cassava are easier to be disintegrated on contact with thumb and forefinger contrary to hard cooking varieties which are tougher to be disintegrated. Soluble dry matter is the main parameter for yam and both water absorbed during cooking and soluble dry matter are main parameters to assess cassava cooking textural quality.

Key words: *yam, cassava, mealiness, hardness, cooking textural quality*.

INTRODUCTION

The annual production of yam (*Dioscorea spp*.) and cassava (*Manihot esculenta*) in Côte d'Ivoire has reached 5.9 and 3.2 million tons, respectively [1]. Thus, breeding programs with the selection of high-yield yam and cassava varieties have been initiated in many agronomic research Centers in West Africa to face the increased food requirements of consumers who prefer mealy boiled varieties adapted to many local deashes. According to [2], mealiness refers to the easiness of disintegration in boiled yam. As reported by [3], the main quality attributes of boiled cassava are whiteness, sweetness and friability. The preferred varieties should have white, sweet and friable cooked tubers. However, few methods to evaluate yam and cassava cooked texture quality have been developed.

This study focused on two methods to assess the mealiness and the hardness which are two important textural quality of boiled yam and cassava. The methods combine sensory approaches dealing with disintegration of cooked samples and the evaluation of cooking parameters related to dry matter, soluble matter and water absorbed during cooking. These two methods will serve as reference to agronomist, consumer and food technologist in yam and cassava quality assessment.

MATERIALS AND METHODS

2.1 Material

Four (04) varieties of cassava (*Manihot esculenta* crantz) composed of two mealy cooking varieties (Bonoua2 and A12F) and two hard cooking (Yacé and KA13) harvested at 12 months after planting and six (06) yam varieties composed of 03 mealy cooking varieties IB88 and 886 (*D. alata*) and Kponan (*D. roundata*) and 03 hard cooking varieties TDa95/00010 and TDa01/00074 (*D. alata*) and TDr95/18894 (*D. roundata*) harvested after 7 months were used.

OnlyKponan was purchased from local market. Varieties have been collected at the Centre National de Recherche Agronomique en Côte d'Ivoire and Centre Suisse de Recherches Scientifiques en Côte d'Ivoire (CSRS) stations.

2. 2. Cooking textural quality assessment by fingers

For sampling, 1/10 cm of both distal and proximal ends were cut off and the middle part is peeled, washed and split into two median slices used (Figure 1). The first median slice was cut with fries-cutter and then into 10 mm^3 pieces (Figures 2A, B). About 10 g of these pieces were cooked in 500 ml of boiling water for 20 minutes and stand for 2 minutes. One of the cooked pieces was then placed on contact with the thumb and the forefinger (Figure 2) on which a downward pressure is exerted. The ease or the dough to disintegrate the piece, determines the mealiness or the hardness of the sample. This method is the first applied on yam and cassava samples.

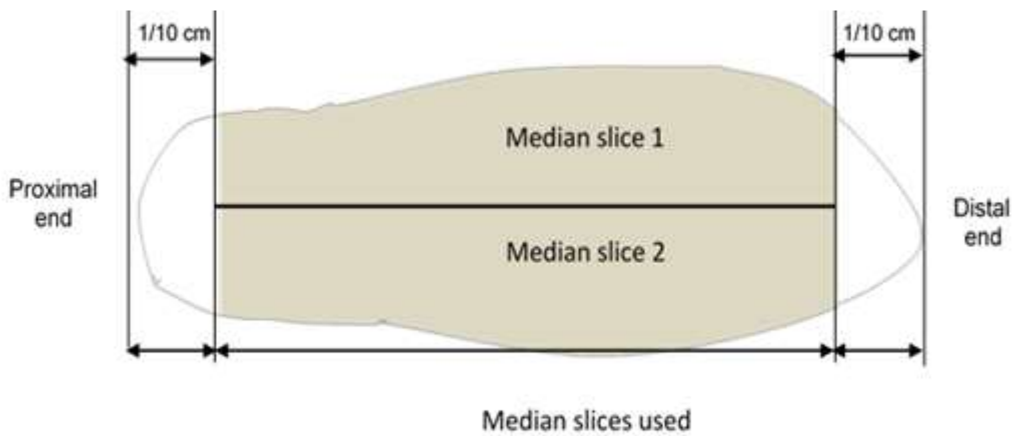

Figure 1: Yam and cassava distribution for tests

2. 3. Cooking quality parameters

The second test consists in evaluating the cooking quality parameters of boiling samples.

The second median slice was cut with fries-cutter and then into 10 mm^3 pieces (Figures 2A, B) and about 30 g were cooked in 500 ml of boiling water for 20 minutes. Cooked pieces were collected in a 1 mm mesh sieve (Figure 2C) which is immersed 10 times in cold water (Figure 2D) and allowed to stand for 2 minutes (Figure 2E). The last drops under the sieve were removed with a blotting paper (Figure 2D). Another 30 g of the second raw median slice was weighted. Both raw and cooked samples were then dried at 70°C for 15 hours and then at 103°C for 3 hours in a vacuum oven (Chopin vacuum dry oven, M. Chopin & Co., F-Boulogne).

The cooking quality parameters (dry matter (1), water absorbed during cooking (2), soluble dry matter during cooking (3) were calculated per 100 g of raw matter according to the relations bellow.

$$\text{Dry Matter (DM)} = \frac{\text{M dried samples}}{\text{M fresh sample}} \text{ X } 100\ (\%) \qquad (1)$$

$$\text{Soluble matter (SM)} = \frac{\text{M cooked and dried} - \text{M dried fresh sample}}{\text{M dried fresh sample}} \text{ X } 100\ (\%) \qquad (2)$$

$$\text{Water absorbed during cooking (WADC)} = \text{SM} + \frac{\text{M boilled samples} - \text{M fresh sample}}{\text{M fresh sample}} \text{ X } 100\ (\%) \qquad (3)$$

Figure 2: Cooked piece on contact with the thumb and the forefinger

Figure 3: Cooked piece on contact with the thumb and the forefinger

RESULTS

3.1. Cooking textural quality assessment by fingers

The result of the first test focus finger disintegration of cooked samples showed that the both mealy cooking varieties of yam and cassava display mealy appearance (MA.). They are easier to be disintegrated on contact with thumb and forefinger (Figures 4 and 6) comparatively to hard cooking varieties which presented translucid appearance (TA) and are tougher to be disintegrated on contact with thumb and forefinger (Figures 5 and 7)

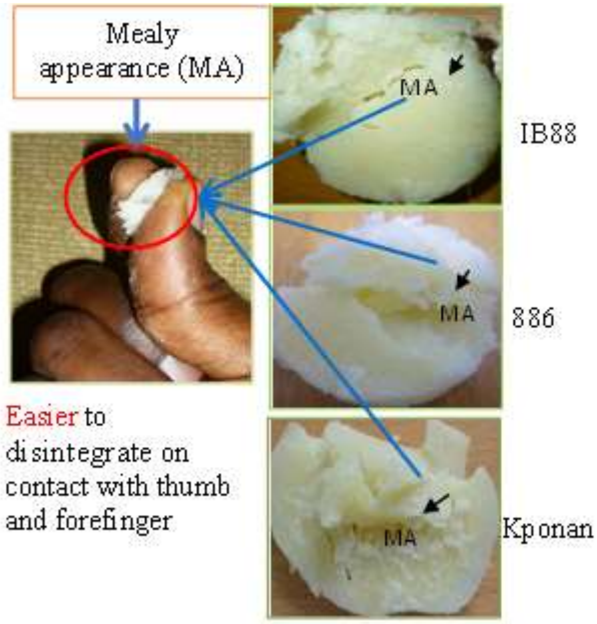

Figure 4: Mealy cooking texture of yam

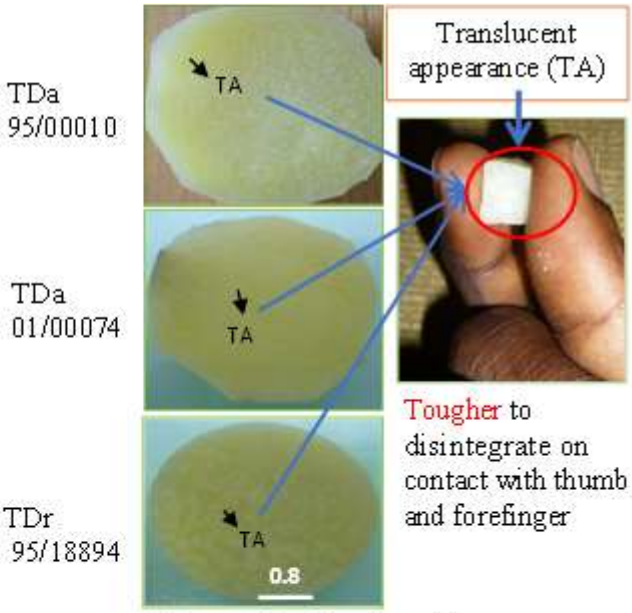

Figure 5: Hard cooking texture of

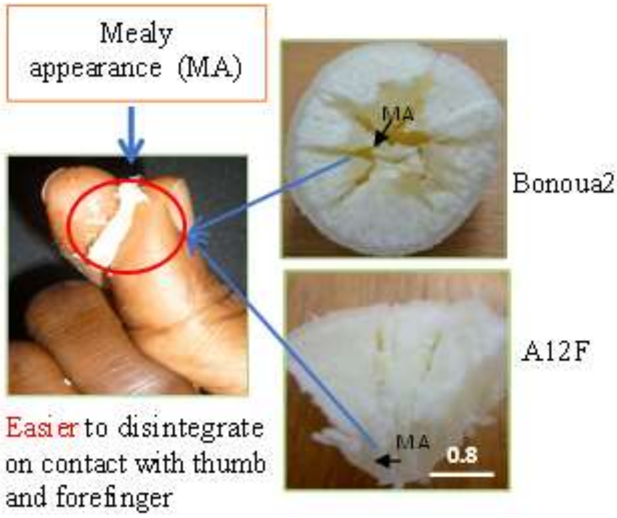

Figure 6: Mealy cooking texture of cassava

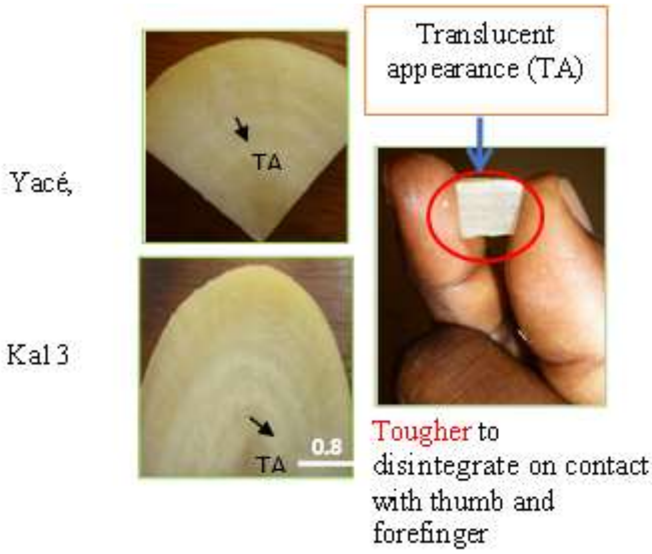

Figure 7: Hard cooking texture of cassava

3.2. Cooking texture quality parameters

The cooking quality parameters of yam and cassava varieties are provided in figure 8.

Dry matter and water absorbed during boiling of yam varieties showed no significant difference ($p \leq 0.05$) even if hard cooking yams absorbed more water during boiling. Mealy cooking yam displayed two times more soluble dry matter (8.3%) compared to hard cooking varieties (3.8%) and led soluble dry matter as the main parameter of yam cooking texture quality assessment (figure 8A). Water absorbed during cooking (35.7%) and soluble dry matter (7.5%) of mealy cooking cassava are two times higher ($p \leq 0.05$) than water absorbed (11.5%) and soluble dry matter (2.95%) of hard cooking varieties and lead the both parameters (water absorbed and soluble dry matter) main parameters of cassava texture cooking quality assessment (figure 8B).

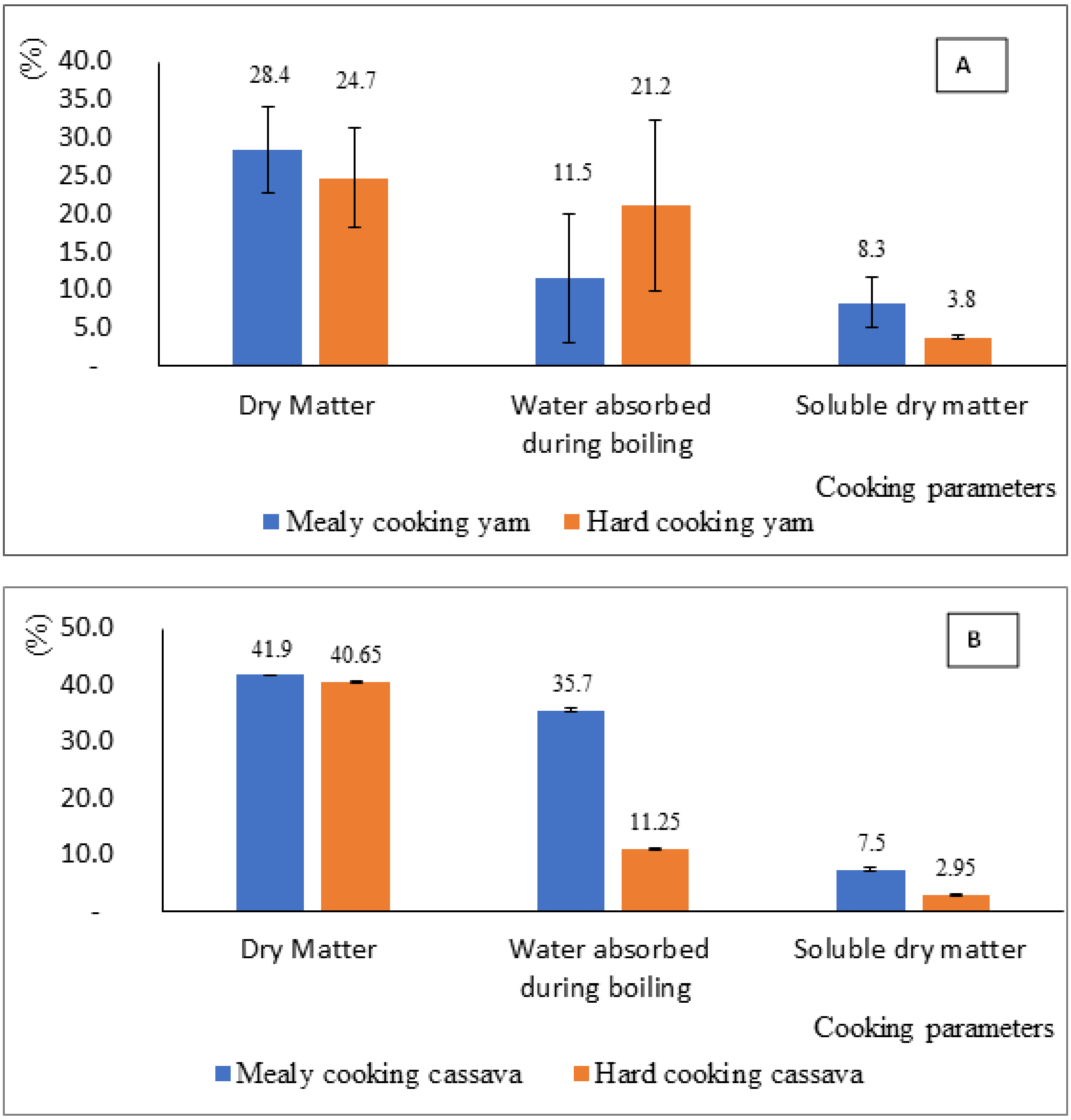

Figure 8 : Yam (A) Cassava (B) cooking parameters

DISCUSSION

Mealy cooking varieties of yam and cassava both displayed easier touch to be disintegrated on contact with thumb and forefinger comparatively to hard cooking varieties which are tougher to be disintegrated. The easier touch to disintegrate mealy cooking varieties of yam and cassava can be explained by a more pronounced detachment of cells [4]. Starch swells during boiling, inducing a distension of the cell wall which facilitates cell separation in mealy varieties as indicated for potatoes [5]. Yam mealy varieties absorb less water due to the facility of cells to be separated and solubilized during boiling contrary to cassava mealy cooking varieties that absorb more water but solubilizes more dry matter. It seems that absorption induce cells separation which explain more soluble dry matter as main parameter of yam and cassava cooking texture quality.

The high-water absorption capacity may be due to amylopectin activity, since amylopectin is primarily responsible for starch granule swelling [6,7]. Hard cooking yam and cassava displayed reverse trends. Hard cooking yam absorb more water contrary to hard cooking cassava which suggests quick saturation of hard coking cassava cells

The lower soluble dry matter of hard cooking varieties could be due to a high structural rigidity of the swollen granules and/or to an increased aggregation rate of amylose [8]

CONCLUSION

The both mealy cooking varieties of yam and cassava display mealy appearance and samples are easier to be disintegrated on contact with thumb and forefinger comparatively to hard cooking varieties which present translucid appearance and are tougher to be disintegrated.

Soluble dry matter is the main parameter of yam cooking texture quality assessment, but water absorbed during cooking and soluble dry matter are both parameters to assess cassava cooking texture quality. These two methods will serve as quick and easy reference to agronomist, consumer and food technologist in yam and cassava quality assessment.

ACKNOWLEDGEMENT
The authors acknowledged the financial contribution and support of the Programme d'Appui Stratégique à la Recherche Scientifique (PASRES), Centre Suisse de Recherche Scientifique en Côte d'Ivoire (CSRS) and Centre National de Recherche Agronomique (CNRA) for providing the varieties of yam and cassava.

REFERENCES

[1] FAO; 2016., FAOSTAT Statistics, Database-Agriculture, Rome, Italy, www.fao.org

[2] Wilkinson, C., Dyksterhus, G.B., and Minekus, M., 2001, From food structure to texture. Trends, Food Science and Technology, vol. 11, pp 442-450

[3] Padonou W., Mestres C., and Nago M. C., 2005, The quality of boiled cassava roots: instrumental characterization and relationship with physicochemical properties and sensorial properties, Food Chemistry, vol 89, pp 261-270.

[4] Nindjin, C., Brunnschweiler, J., Konan, G., GAgbo, N., Otokoré, D.A., and Farah, Z., 2002, Plaisir du consommateur et caractérisation sensorielle et instrumentale de la qualité des ignames (*Dioscorea* spp.). In Bioterre, Revue Internationale des Sciences de la Vie et de la Terre, N°Spécial 2002, Actes du colloque International, Centre Suisse du 27-29 Août 2001, pp 336-343).

[5] McComber, D. R., Osman, E. M., and Lohnes, R. A., 1988, Factors related to potato mealiness. Journal of Food Science, vol 53 (5), pp 1423–1426.

[6] Tester, R.F., and Morrison, W.R., 1990, Swelling and gelatinization of cereal starches. I. Effects of amylopectin, amylose and lipids. Cereal Chemistry, vol 67, pp 551-557.

[7] Singh, J., Kaur, L., and McCarthy, O.J. 2007. Factors influencing the physico-chemical, morphological, thermal and rheological properties of some chemically modified starches for food applications-A review, Food Hydrocolloids, vol 21, pp 1-22.

[8] Brunnschweiler, J., Luethi, D., Handschin, S., Farah, Z., Escher, F., and Conde-Perit, B. 2005., Isolation, physicochemical characterization and application of yam (Dioscorea spp.) starch as thickening and gelling agent, Starch/Stärke, vol 57, pp 107-117.