Laboratory Standard Operating Procedure

Sensory Characterization of Fufu

Biophysical Characterization of Quality Traits, WP2

Umudike, Nigeria, December 2020

Ugo CHIJIOKE, National Root Crops Research Institute (NRCRI), Umudike, Nigeria
Nwamaka OGUNKA, NRCRI, Umudike, Nigeria
Oluchi ACHOMWA, NRCRI, Umudike, Nigeria
Justice OKORONKWO, NRCRI, Umudike, Nigeria

This report has been written in the framework of RTBfoods project.

To be cited as:

Ugo CHIJIOKE, Nwamaka OGUNKA, Oluchi ACHOMWA, Justice OKORONKWO, (2021). *Sensory Characterization of Fufu. Biophysical Characterization of Quality Traits, WP2.* Umudike, Nigeria: RTBfoods Laboratory Standard Operating Procedure, 18 p.

Ethics: The activities, which led to the production of this document, were assessed and approved by the CIRAD Ethics Committee (H2020 ethics self-assessment procedure). When relevant, samples were prepared according to good hygiene and manufacturing practices. When external participants were involved in an activity, they were priorly informed about the objective of the activity and explained that their participation was entirely voluntary, that they could stop the interview at any point and that their responses would be anonymous and securely stored by the research team for research purposes. Written consent (signature) was systematically sought from sensory panelists and from consumers participating in activities.

Acknowledgments: This work was supported by the RTBfoods project https://rtbfoods.cirad.fr, through a grant OPP1178942: Breeding RTB products for end user preferences (RTBfoods), to the French Agricultural Research Centre for International Development (CIRAD), Montpellier, France, by the Bill & Melinda Gates Foundation (BMGF).

RTBfoods

WP2: Biophysical Characterization of Quality Traits

SOP: Sensory Characterization of Fufu

Date: 02/12/2020	**Release: 1**

Written by: Ugo CHIJIOKE, Nwamaka OGUNKA, Oluchi ACHOMWA and Justice OKORONKWO

For information on this SOP please contact:

- Ugo CHIJIOKE, ugochijioke4@gmail.com
- Nwamaka OGUNKA, Amakaogunka268@gmail.com
- Christophe BUGAUD (RTBfoods Focal Point for Sensory Analysis) Christophe.bugaud@cirad.fr

This document has been reviewed by:

Christophe BUGAUD (CIRAD)	02/12/2020
Nelly FORESTIER-CHIRON (CIRAD)	02/12/2020
Isabelle MARAVAL (CIRAD)	02/12/2020

Final validation by:

Christophe BUGAUD (CIRAD)	02/12/2020

CONTENTS

Table of Contents

ABSTRACT

Fufu is one of the popular fermented products processed from cassava roots and it is widely consumed in Nigeria and other West African countries. This study was carried out to establish the sensory profile of fufu processed from different cultivars of cassava. This standard operating procedure (SOP) describes systematically the procedures involved in preparation of *fufu*, cutting acrosss selection of fresh cassava roots suitable for preparation of fufu, extraction of the intermediate fufu mash as well as cooking the intermediate mash to a final dough-like product called fufu. Five (5) different cassava clones were processed into fufu during the development of this SOP. Roots from each cassava clone were classified into heavy roots (weight greater than 260g) and light-weight roots (weight less than 250g) and were soaked in separate fermenting vessels. However, a uniform root length of 18cm was maintained across all root weights. This was to determine the effect of root weight on fufu processing, synchronize fermentation time and identify range of root weight that is most suitable for fufu processing. The experiment revealed that heavy roots yield more fufu mash when compared to the light-weight roots. On the other hand fermentation was faster with the light-weight roots. Sensory attributes of the cooked fufu such as colour, smoothness, mouldability, stickiness, hardness, stretchability and fufu odour were evaluated by trained panelists using a harmonized scale rating of 0-10, revealing the intensity of each attribute.

Keywords: Fufu, SOP, Cassava, Sensory attributes, Fermentation.

1 SCOPE AND APPLICATION

The study aims to establish the sensory profile of fufu processed from different cassava varieties using Qualitative descriptive analysis.

2 PRINCIPLES AND DEFINITIONS

The principle of fufu preparation involves fermentation of the fresh cassava roots for a period of 72 hours to obtain an intermediate fermented product, cooking of the intermediate wet fufu into a final dough-like product called fufu. Fermentation as a major unit operation in fufu preparation was employed under controlled conditions to soften the cassava roots, reduce pH and the potentially toxic cyanogenic compound and also to enhance textural attributes and flavor of the final product. The traditional method of cooking fufu in Abia state which involves constant stirring of the fufu paste with continuous supply of heat for about 5 minutes was adopted and standardized under laboratory conditions.

3 APPARATUS

- Fermenting vessels (24 diameter plastic buckets with cover)
- Weighing balance
- Stainless steel kitchen knives
- 0.3cm pore size plastic or metal sieve
- Gas cooker as a source of heat
- Cooking pots
- Plastic or stainless bowl
- Measuring cylinder
- Wooden stirrer
- Muslin cloth for sieving
- Infrared thermometer to check the initial gelatinization and final cooking temperature
- Stop watch to record gelatinization, stirring and cooking time

4 PRODUCT PREPARATION

4.1 Sampling and intermediate product preparation in laboratory conditions

Step 1. Documentation

- Checks the nature of the samples received and documents the details in a sample logbook. These should include the sample name, date received, nature or type of packaging and condition of roots.

Step 2. Sample pre-selection:

- Select mature roots of the highest integrity. They should be fresh roots that have not softened and are free of any visible damage incurred during harvesting or otherwise, pest, insect or virus damage or rot.

Step 3. Labeling:

- Attach labels to each sample appropriately. This labelshould be maintained throughout the preparation process to label retting buckets.

Fig 1. Labeled samples of different freshly harvested cassava varieties

Step 4. Washing and second selection

- Wash the roots properly with clean water in a basin (to remove any soil residue) and rinse.
- Select roots of about the same size, given the size range of the sample. (Cassava roots of weight 260-550g are considered heavy roots while those weighing between 0-250g may be classified as light weight roots). The essence of having the same size range of roots is to synchronize retting time with respect to weight. The roots should be of high integrity without any visible signs of damage, discolouration of inner root flesh or infection.

Step 5. Peeling

- Peel the selected roots with a high-grade stainless steel kitchen knife. Care should be taken to ensure minimal loss of the flesh.

Step 6. Root size reduction and final selection:

- Mark off 18cm on a plain white sheet of paper. Place the peeled root on the paper ensuring that the middle part of the root lies between the marks. Any extra end of the root should be cut off from either side to remain within the 18cm portion from the mid-section. A long root of uniform circumference may give two 18cm portions from the same root.
- Weigh the 18cm portions of the roots on a scale. Only portions that weighed maximum of 250g are regarded as light roots while weight of 260g and above are considered as heavy roots.
- Use a bulk of about 1kg weight of roots for each sample size in order to obtain a reasonable yield.
- Re-wash the adjusted roots to remove any dirt.

Fig 2: peeled and washed cassava roots

Step 7. Retting/softening (fermentation)

- Place the roots in a 24 diameter plastic bucket
- Measure about 2500ml to 3000ml volume of water and transfer into thebucket containing the roots(3000ml volume of water is adequate for heavy roots while 2500ml volume of water is adequate for light roots)
- Cover the buckets and leave to ferment at a temperature of about 28^0C-36^0C for 48 hours (until fermenting water becomes turbid and covered with bubbles and roots become slightly soft and tender when touched).

Fig 3. Pictures showing fufu fermentation process

Step8. Grating and Re-steeping

- Remove the partially fermented roots from the buckets and wash with clean water.
- Gradually add the fermented rootsinto a blender and add little quantity of water to aid grating. Grate for about 3-5 minutes until a fine pulp is obtained.
- Wash the fermenting buckets thoroughly with clean water and transfer the grated sample into the bucket.
- Cover the bucket and allow the grated sample to ferment for another 24 hours

Fig 4. Pictures showing Fermentated roots and its grating process

Step 9. Sieving

- With one hand, hold a 0.3cm pore size plastic sieve over a clean bucket.
- Transfer the fermented mash/ pulp onto the sieve, gradually add water and sieve with the other hand into the bucket for 2 to 5 minutes until only chaff is left in the sieve. (Add little quantity of water at intervals while sieving to aid passage of filtrate)
- Remove chaff and rinse the sieve (A total of 500ml to 1000ml volume of water is required for sieving).
- Cover the bucket and set the mixture aside for 1 hour to settle/ sediment (Until the supernatant is clear).

Fig 5. Sieving of grated mash

Step 10. Decanting and draining

- Carefully decant the clear supernatant to avoid loss of sediment
- Transfer the sediment into a muslin bag and tie it tightly to add pressure for water drain.
- When the water has stopped gushing out, tie the bag tighter and place some weights on it to squeeze out the last trace of water.

Fig 6. Sedimentation and dewatering of sieved mash

4.2 Final product preparation

Step 11. Cooking of Intermediate product (dewatered mash)

- Weigh about 100g of the dewatered fermented mash into a clean and dry bowel

- Measure about 70ml of clean water and pour into the weighed mash and using the finger tips, mix thoroughly to form a thick paste
- Transfer the paste into a clean cooking pot and place on heat. Allow it to pre-gelatinise for about 60 seconds undisturbed/ without stiring (start the timing once you place the cooking pot on heat; generally initial gelling temperature is about 40^0C

Fig 7: Pictures showingthe stages in preparation of fufu

- While still on heat, hold the cooking pot firmly with one hand and then stir the pre-gelled mash continously with the other hand using a wooden stirrer for about 4 minutes until a creamy-white homogenous stiff dough is formed at a final cooking temperature of about 80^0C. Total cooking time is about 5 minutes.
- Put off the heat and immediately scoop the cooked fufu into a food grade polythene and wrap.

Fig 8: Continuation of pictures showing fufu preparation and the final product

Step 12. Coding

- 3-digit codes were assigned to each sample. Labeling at this stage blinds the panelists and helps to minimize bias. These codes were maintained throughout the analysis of the products.

Fig 10: Picture of coded samples

Step 13. Sample storage conditions before tasting

- The cooked fufu samples were transferred to a styrofoam box(warmer) at40-450C till sensory evaluation session before they were served to the panelists.The temperature of the fufu sample dropped to 450C at the point where they were presented to the panelists for tasting. Thecooked fufu was moulded into small balls of about 20balls which may take about 2-5mins when handled by 2 persons
- The temperature of the cooked fufu immediately after stirring was about 800Cand dropped to between 65-500C while wrapping in preparation for sensory analysis
- The cooked fufu was kept at a temperature of 450C before analysis by putting it in a Styrofoam box(This can be connected to electricity to keep sample temperature constant prior to evaluation)

Fig 11: A Styrofoam box (warmer)

4.3 General Information

4.3.1 Test Responsible Person/Group Animator

Ugo Chijioke, NRCRI, Umudike

4.3.2 Date/Time Phase of the test

The tests were done on 11th July 2020 between the hours of 1:00 PM and 2.30PM.

4.4 Sample

4.4.1 Quantity of sample given to each panelist

Each panelist was served 20 g portion of fufu

4.4.2 Type of dish

The *fufu* samples were served using a white plastic disposable plate

4.4.3 Temperature of tasting

The samples were served at45^{0}C.

4.4.4 Repeated sample

Each variety is repeated to assess panel performance in terms of homogeneity and repeatability

4.4.5 Sample Codification: yet to be designed

Sample Code	***Replicate***	***Tasting Code***	***Cultivars***	***Tasting date***

4.5 Service

4.5.1 Number of sample tasted by session

5 samples were presented to the panellists during the morning session and their duplicate during the afternoon session.

4.5.2 Type of service (ex: monadic)

Monadic

4.6 Panel

4.6.1 Number of panelists who participate in this study

There were 12-15 trained panelists

4.7 Vocabulary/ descriptors of sensory attributes

Type	Attributes	Definition/Description	Measurement method	Scale
Visual aspect (Colour)	White	**Colour of cooked fufu being As white as a flip chart paper**	Visually inspect sample surface	1: white 2: Off-white 3: Grey 4: Light grey 5: light Cream **6: Light yellow** 7: **Yellow** 8: Light brown
	Off-white	**As off-white as soy milk colour**		
	Grey	**As grey as skin of sardine fish**		
	Light grey	**As light grey as cement colour**		
	Light Cream	**As cream coloured as peak evapourated liquid milk**		
	Light yellow	**As light yellow as Cooked egg yolk**		
	Yellow	**As yellow as skin of riped orange**		
	Deep yellow	**As brown in colour as Colour whole wheat meal**		

Type	Attributes	Definition/Description	Measurement method	Scale
Textural quality Texture by handfeel	Smoothness	Absence of lumps	Sample is pressed firmly between the fingers	0: big lumps **10: absence of lumps**
	Stickiness	This is when the fufu sticks or adhere to the fingers when it is touched with fingers or during moulding into bolus for swallowing.	Sample is touched with fingers or moulded in the hands	0: not sticky 5: slightly sticky **10: very sticky**
	Mouldable	Ability of the fufu to stick together easily without disintegrating or cohesive and being easy to mould.	Sample is put in the hands and moulded	0: not mouldable 5: slightly mouldable **10: mouldable**
	Hardness	Softness is when it is quite easy to compress the fufu sample, while hardness is when force is used to compress the sample or takes effort to compress the sample	Sample is pressed with the index finger	0: very soft 10: very hard
	Stretchability	Ability of fufu to stretch when pulled apart with fingers	The fufu is touched and pulled apart with the fingers	0: not stretchable 5: Medium stretchability 10: very stretchable
Aroma	Fufu odour			**0: No fufu odour** **5: Mild fufu odour** **10:Strong fufuodur**

5 CRITICAL CONTROL POINT

- Volume of water used for grating and quantity of fermented grated pulp affects sieving time and volume of water required for sieving.
- Weight of root determines the volume of water for soaking.
- Pre-gelling should not exceed 60 seconds to avoid formation of lumps

6 PICTURES ILLUSTRATING SENSORY EVALUATION TRAINING SESSION

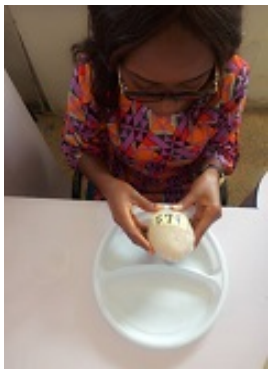

Fig 12: panelist in a tasting session.

Fig 13: Panelist showing fufu attribute “easy to cut”

Fig 14: Panelist showing the fufu attribute “mouldable”

Panelist showing the intensity of the attribute “stretch- ability”

7 APPENDIX

Template of the analysis report of the fresh cassava roots used for preparation of fufu

Sample code	Size of roots	Dry Matter	Moisture Content	Starch content
	Ba	25.1	74.9	25.38
	Bb	26.3	73.7	23.77
	Ma	33.5	66.5	27.56
	Mb	35	65	25.22
	Sa	44.6	55.4	28.26
TME 419	Sb	44.5	55.5	30.1
	Ba	34.8	65.2	27.26
	Bb	37.9	62.1	25.96
	Ma	29.2	70.8	18.12
	Mb	26.8	73.2	25.24
	Sa	41.2	58.8	
TMS 97/4779	Sb	39.1	60.9	24.97
	Ba	33.5	66.5	23.71
	Bb	32	68	21.95
	Ma	39.9	60.1	29.92
	Mb	39.5	60.5	28.51
	Sa	32.9	67.1	24.65
TMS 98/0581	Sb	34.7	65.3	24.97
	Ba	33	67	23.51
	Bb	43.5	56.5	25.06
	Ma	41.7	58.3	26.03
	Mb	40.5	59.5	28.64
	Sa	35.4	64.6	26.06
NR 87184	Sb	26.7	73.3	23.27
	Ba	24.3	75.7	18.4
	Bb	22.1	77.9	18.6
	Ma	25.2	74.8	17.49
	Mb	25	75	18.89
	Sa	23.9	76.1	14.45
TMS 96/0505	Sb	25.3	74.7	16.48

S: small sized roots; M: medium sized roots; B: big sized roots. a,b: duplicate of samples

Institute: Cirad – UMR QualiSud

Address: C/O Cathy Méjean, TA-B95/15 - 73 rue Jean-François Breton - 34398 Montpellier Cedex 5 - France

Tel: +33 4 67 61 44 31

Email: rtbfoodspmu@cirad.fr

Website: https://rtbfoods.cirad.fr/