Laboratory Standard Operating Procedure

Standard Operating Protocol for Textural Characterization of Eba

Biophysical Characterization of Quality Traits, WP2

Ibadan, Nigeria, 2022

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

To be cited as:

Busie MAZIYA-DIXON, Michael ADESOKAN, Emmanuel ALAMU, Awoyale WASIU, Ugo CHIJIOKE, Oluwatoyin AYETIGBO, Layal DAHDOUH, Oluwatoyin AYETIGBO, Christian MESTRES (2022). *Standard Operating Protocol for Textural Characterization of Eba. Biophysical Characterization of Quality Traits, WP2.* Ibadan, Nigeria: RTBfoods Laboratory Standard Operating Procedure, 16 p. https://doi.org/10.18167/agritrop/00604

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: SOP for Textural Characterization of Eba

Date: 25/02/2022	Release: 2

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ABSTRACT

Eba is a staple food commonly consumed in Nigeria and other West African countries. It is prepared by constituting gari (a pregelatinized, fine to coarse granular flour, made from fermented cassava mash) in hot water and stirred until a consistent dough is formed. The quality and overall acceptability of the product are linked mainly to the quality characteristics of cassava varieties from which it is prepared and variability in processing methods. Standardizing the processing, preparations, and instrumental textural profile analysis of gari/Eba is pertinent to establish a basis for discriminating the products based on the diversity of quality characteristics of the cassava varieties. This SOP covers the materials requirements for the standardized preparations, processing, and instrumental textural profile analysis of Eba in the laboratory. It also included the calibrations and operations of the texturometer used for the measurements and the critical points such as the temperature control, replications of the measurements, and uniform dimension for samples presentation.

Keywords: Cassava, Gari, Eba, Fermentation, Textural Profile Analysis, Quality characteristics

1 SCOPE AND APPLICATION

This SOP describes the preparation of Eba samples for texture analysis and the related texture analysis.

The objective of this SOP is to measure the texture of Eba using a texture analyser.

2 GENERALITIES AND DEFINITIONS

The three main acceptability factors for evaluating foods are appearance, flavour, and texture (Bourne, 1990). This standard operating procedure (SOP) describes the preparation and texture analysis of "Eba" (cooked gari dough). Gari is a roasted fermented mash from cassava root. Fermentation as an unit operation in gari production brings about certain biochemical changes of starch due to the actions of lactic acid bacteria, consequently giving rise to organic acids and a significant reduction in pH. This process of fermentation primarily aims to optimize the textural attributes of the products, impacting sensory characteristics, such as taste and aroma, and reducing the cyanide content of the product. Gari is a convenient food and extremely popular among urban dwellers in Nigeria and other West African countries. Eba is the most widespread method of gari consumption, which involves pouring the gari into a measured quantity of boiling water to form a paste. The paste is popularly eaten in Nigeria by making a small ball of it and dipping into a soup or stew and swallowing with or without mastication.

3 PRE-REQUISITE

Using and managing a texture analyzer:

The Stable Microsystems TA. XT Texture analyser (Serial No: 2-P6-Z10447-01-V0038D577) is equipped with a 50-kg load cell, keypad and a personal computer. The instrument is kept in a cool, dry room on a level surface with no vibrating instruments in proximity. All necessary cables are connected to a power supply before starting the analysis, and the equipment can warm up for at least 15 mins. During the analysis, the hands and laboratory coat of the operator have kept a distance from the probe and platform area (to avoid injuries). The red stop button on the bottom right side of the instrument is pressed in the event of any emergency. After the analysis, the platform and probes are cleaned with a moist, soft cloth and often with ethanol to avoid staining.

4 APPARATUS

a) Texture analyser with load cell able to measure forces at least 50 kg (the model used for the development of this SOP is a TA-XT.Plus by Stable Microsystem) equipped
b) Gas cooker as a source of heat
c) Thermometer to check the temperature of boiling water and the sample
d) Weighing scale
e) Cylindrical sampling cup (2.2 cm long x 3.6 cm)
f) Planetary 30 Litre Dough mixer
g) Plastic Bowl
h) Aluminium foil

i) Stop watch

5 PRODUCT PREPARATION

5.1 Sampling and preparation of Eba

Step 1. About 100 g of each gari samples was weighed into plastic bowl in duplicate

Figure1: Weighing gari into a plastic bowl

Step 2. About 300 mL of the boiled water was measured into a clean container (**Note that in Nigeria, preference for consumption of Eba differs amongst regions; therefore, in the South-Eastern part of the country; 250 ml of boiled water is added to 100 g of gari**)

Step 3. The weighed gari was then gradually poured into the boiled water and covered for 60 seconds to gelatinize.

Figure 2: Preparation of *Eba* covered for 60 seconds to gelatinize

Step 4. The sample was transferred into a 30 L Planetary Dough mixer at 142 rpm for homogenous stirring of the Eba for 60 seconds until the stiff dough (Eba) is formed

Figure 3: Planetary Dough Mixer

Step 5. The Eba was immediately scooped into aluminium foil, wrapped, and placed inside a styrofoam box to insulate from heat loss. The temperature was monitored using a thermometer before analysis.

Fig. 4. Eba was kept in a warmer

Fig 5: Monitoring temperature with a thermometer

Step 6. A cylindrical open-ended plastic ring with a dimension of 2.2 cm length x 3.6 cm diameter was adapted to mould the sample to obtain as uniform sample geometry as possible.

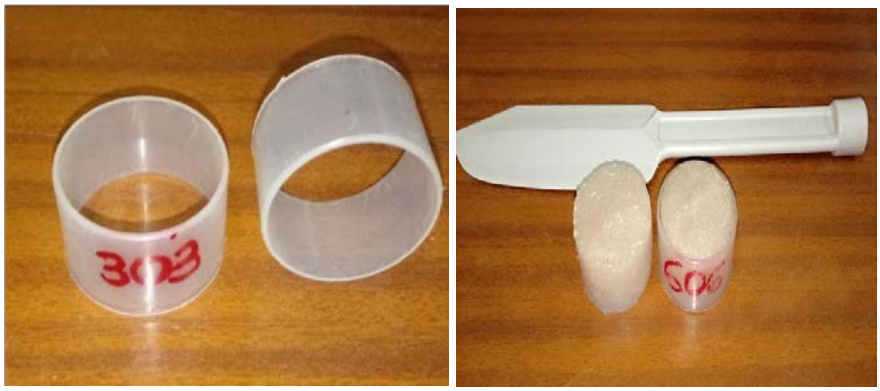

Figure 6: Cylindrical cup (2.2 cm long x 3.6 cm diameter) for sample presentation

Important points to note:

- Each sample was prepared in duplicate, and five measurements were taken for each.
- Samples were wrapped in aluminium foil and transferred into a Styrofoam box to minimize heat loss from sample.
- Sample temperature was monitored using digital thermometer.
- Similar samples preparation procedures and temperature of 35 0C was used for both instrumental and sensory analysis.

6 TEXTURE MEASUREMENT

Equipment: TA-XT Plus (Stable Microsystems) Texture Analyzer

Probe type: 30mm diameter cylindrical compression plate

Table 1: Instruments parameters

Pre-test speed	**1 mm/s**
Test Speed	**1.75 mm/s**
Trigger force (when the probe touches the surface of the sample)	**5g**
Strain	**40 % strain**
Temperature of test	**35 °C**
Interval between compressions	**10 seconds**

- The Textural Profile Analysis (TPA) of Eba was measured using a Stable Microsystems TA. XTplus equipped with a standard compression cylindrical plate of 30 mm diameter

Figure 7: A cylindrical compression platen probe of 30 mm diameter

- The texture analyser was switched on using the main switch located at the rear end, and the PC was connected appropriately.
- TPA test settings were selected from the library, and a project folder was created to recover analysis data.
- The probe height and force were calibrated following the instructions in the operation manual.
- Sample of uniform dimension 2.2 cm long x 3.6 cm diameter and temperature of 35°C was placed at the center of the instrument platform.

Figure 8: Sample placed on the platform for analysis

- ✓ The analysis was initiated by clicking the Run button on the instrument software.
- ✓ Double compression of the samples was done automatically with a 5g trigger load and 10 seconds interval between each compression.

7 EXPRESSION OF RESULTS

7.1 Summary of parameters from texture profile analysis

The TPA results are expressed as presented in Figure 9. The parameters/attributes measured are Hardness, Cohesiveness, Adhesiveness, Springiness, Gumminess, Chewiness and Resilience.

Cohesiveness = Area 2/Area 1, Adhesiveness = Area 3

Figure 9: A graph showing the calculation of TPA parameters

8 VALIDATION

The SOP validation was carried out by preparing eba based on the SOP for preparation of eba (RTBfoods_E.6.7_SOP) used with no modifications. Four varieties, two preparations or cooking replicates per variety, and 5 measurements per cooking replicate were considered. The textural attributes for the varieties showed good repeatability with no significant differences between the cooking replicate means. ANOVA revealed significant ($P<0.05$) differences between varieties based on the textural parameters. See Table 2 for an example of ANOVA for effect of cooking replicate and variety.

In Figure 10, the first two components of the PCA explained 71.9 % of the variation. The PCA shows that the varieties were fairly grouped separately between the components, thereby showing differences between the varieties' textural attributes. The textural quality attributes that contribute the most to variation among the varieties are hardness, cohesiveness, springiness, chewiness, and gumminess.

Table 2: Analysis of Variance (ANOVA) by variety and cooking replicate for attribute Hardness

By Variety	By cooking replicate
Analysis of Variance Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F Variety | 3 | 46633.222 | 15544.4 | 11.7365 | <.0001* Error | 36 | 47680.105 | 1324.4 C. Total | 39 | 94313.327	**Analysis of Variance** Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F Cooking replicate | 1 | 5246.413 | 5246.41 | 2.2384 | 0.1429 Error | 38 | 89066.914 | 2343.87 C. Total | 39 | 94313.327
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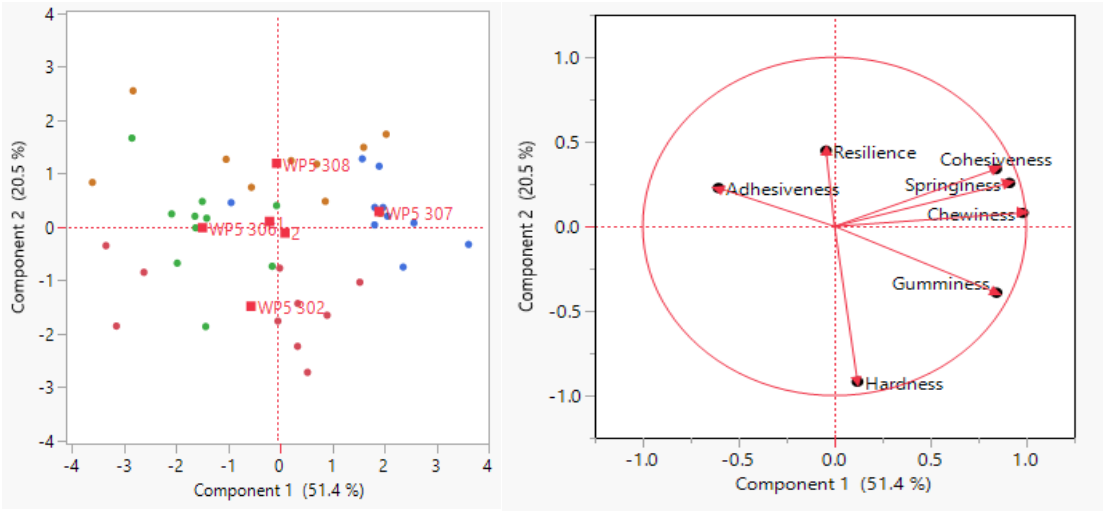

Figure 10. Principal component analysis and canonical plot for eba

In conclusion, cooking replication did not significantly affect the textural attributes of the varieties. However, significant varietal effects on textural characteristics were found. Instrumental texture profile using texture analyser may be considered as a tool to discriminate cassava genotypes based on the textural attributes of eba. Particularly, the hardness, cohesiveness, gumminess, springiness and chewiness are most discriminatory. A minimum of 2 cooking replicates and about 5 measurements per replicate is required.

9 CRITICAL POINTS AND NOTES ON THE PROCEDURE

- ✓ Analysis of the Eba sample needs to be conducted as quick as possible, as the texture of Eba changes significantly with time during cooling.
- ✓ The same serving temperature must be maintained for both instrumental and descriptive sensory analysis.
- ✓ The trigger force of the compression probe must be carefully adjusted to forestall the total collapse of the sample at the first compression cycle.
- ✓ The descriptive sensory and instrumental texture analysis must be conducted simultaneously for the excellent correlation of sensory and instrumental results.
- ✓ Each sample must be replicated to obtain a true representative.

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DOI.https://doi.org/10.1007/978-1-4613-0861-4_6.

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