

## PROFILING THE TEXTURAL ATTRIBUTES OF FUFU FROM CASSAVA-PLANTAIN FLOUR USING SENSORY PROFILE ANALYSIS

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*Texture is one of the key desirable sensory attribute of fufu, a cassava-based staple of most West Africans. As part of an optimization of the processing parameters for cassava-plantain fufu flour, a convenience form of traditional pounded fufu, a sensory texture profile analysis (STPA) was carried out to assess and characterize the textural attributes of the reconstituted fufu flour with the help of a trained panel of ten individuals. Local foods that are common in Ghana were used as descriptors to exemplify the texture attributes being assessed. Pounded fufu was used as a control. Sensory attributes assessed include hardness, adhesiveness, gumminess and stickiness. Additional parameters assessed were rate and type of breakdown and mouth coating. Data were analyzed by analysis of variance and mean separations were calculated by the general linear model procedures. Typical ranges of some attributes were hardness (1.24- 1.99), gumminess (2.43-4.00) and adhesiveness (1.57 -2.71). With the exception of type of breakdown, all the residual textural attributes of the reconstituted fufu from the cassava-plantain flour samples were comparable with the pounded fufu. The study thus established that STPA can be effectively used as an objective method for assessing the textural attributes of cassava -plantain fufu.*

**Keywords:** *cassava -plantain fufu flour, sensory texture profile analysis, textural parameters.*

### 1. INTRODUCTION

Fufu flour has been developed as a convenience form of the traditional pounded fufu. Its preparation involves efficient dehydration of pre-cooked cassava (*Manihot esculenta crantz*) and plantain (*Musa AAB*), followed by milling and mixing usually with either cassava starch. This product has become popular among middle income working families [1]. One of the key desirable sensory attribute of fufu is its texture. Like any other food, textural parameters like finger-feel and mouth-feel are important to the consumer in judging whether the reconstituted fufu flour is acceptable. Indeed, one could say that the texture determines the identity of a food product and is often a reason for liking or not liking a food and is an indicator of food quality

[2].The purpose of this work was to apply sensory texture profiling to describe the sensory properties of fufu made from cassava- plantain flour using pounded fufu as the control.

## 2. EXPERIMENTAL

### 2.1 Materials

Fresh cassava (*Manihot esculenta* Crantz), variety Yebeshie and matured-green plantain(*Musa AAB*) variety Apentu and cassava starch, again from the variety, Yebeshie were used for the study. The raw materials were obtained from an experimental farm by Ministry of Food and Agriculture, Pokuase near Accra.

### 2.2 Sample preparation

Pounded Cassava-plantain fufu

Yebeshie cassava (2.6kg) and Apentu plantain (2kg) were cooked for 35minutes and pounded in the proportion of 50:50 with a 10kg pestle at an appropriate rate of 10beats per minutes for about 20minutes.

Cassava-plantain fufu flour

Hundred grams of different samples (Table1) were prepared in proportions determined by an optimization process for producing fufu flour from cassava and plantain [3]. These fufu flour samples were then reconstituted by adding 333ml of water and cooking for 10minutes on an electric stove (General Electric) with the gauge set at medium heat. The fufu samples were hand-moulded into spherical balls and covered with an aluminium foil to prevent dehydration. The samples were then allowed to cool for at least 30minutes before testing.

### 2.3 Sensory Texture Profile Analysis (STPA)

STPA was carried out as described by [4] and [5]. The non-oral method was used because most consumers assess the texture of fufu manually.

### 2.4 Training of Panelists

Ten panelists were trained in assessment of the various textural parameters to be used. The textural parameters were rubberiness, stickiness, hardness, gumminess and adhesiveness. A pre-screening exercise was conducted in which the panelists were evaluated for normal sensory acuity through basic taste test and intensity ranking tests (using the hardness scale) as described by American Standard Testing Methods [6]. The panelists who passed the pre-screening test were selected for further training.

In particular, panelists were made to appreciate the differences between mechanical and geometrical textural parameters; using a number of foods as



standards. All the standard ratings were presented one at a time. A modified version of the standard rating scale was used [4]. The differences in the score were discussed until the entire panelists could rate the product within 0.5 point of each other. The mechanical and geometrical texture parameters were rated on an intensity scale.

Each cassava-plantain fufu flour sample and the pounded fufu were presented to the panelists at room temperature in partitioned booths under white light for assessment.

Table 1. Weight Proportions of Plantain flour, Cassava flour and Cassava starch Used for the study.

Samples	Cassava flour (g)	Plantain flour (g)	Cassava starch (g).
C <sub>50</sub> P <sub>50</sub> S <sub>30</sub>	50.00	50.00	30.00
C <sub>0</sub> P <sub>50</sub> S <sub>30</sub>	0	50.00	30.00
C <sub>50</sub> P <sub>50</sub> S <sub>40</sub>	50.00	50.00	40.00
C <sub>50</sub> P <sub>50</sub> S <sub>20</sub>	50.00	50.00	20.00

Legend: C50P50S30 represents flour sample with cassava: plantain: starch in the ratio 50:50:30.

## 2.5 Statistical Analysis

Data were analysed using the statistical Analysis system (SAS) package (version 10, SAS Institute, Inc., Cary, NC) Analysis of variance and mean separations were calculated by the general linear models procedures.

## 3. RESULTS AND DISCUSSION

Tables 2 to 4 indicate the sensory textural ratings vary significantly from the initial stage of first bite through the chewing stage, to the final stage of swallowing. The dominant textural parameters for the cassava-plantain fufu flour were identified as gumminess, adhesiveness, stickiness and smoothness. Of the four fufu flour samples, C50P50S30 appears to be comparable to the pounded fufu in terms of finger-feel characteristics such as stickiness and rubberiness.

Table 2. Initial sensory textural rating of reconstituted cassava-plantain fufu flour as compared with pounded fufu during first bite

Sensory textural parameters	Reconstituted fufu made from different proportions of cassava-plantain flour and starch				Pounded fufu
	C <sub>50</sub> P <sub>50</sub> S <sub>30</sub>	C <sub>0</sub> P <sub>50</sub> S <sub>30</sub>	C <sub>0</sub> P <sub>50</sub> S <sub>20</sub>	C <sub>50</sub> P <sub>50</sub> S <sub>40</sub>	
Finger-feel	v. s, m. r	m. s, l.r.	v. s. l.r	m. s,m. r	v.s,m.r
Hardness	1.71	1.99	1.24	1.71	1.83
Geometrical	smooth	smooth	m. smooth	v. smooth	smooth

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Table 3. Sensory textural rating of reconstituted cassava-plantain fufu flour as compared with pounded fufu during mastication.

/ ters	Reconstituted fufu made from different proportions of cassava-plantain flour and starch				Pounded fufu
	C <sub>50</sub> P <sub>50</sub> S <sub>30</sub>	C <sub>0</sub> P <sub>50</sub> S <sub>30</sub>	C <sub>0</sub> P <sub>50</sub> S <sub>20</sub>	C <sub>50</sub> P <sub>50</sub> S <sub>40</sub>	
ness	2.54	4.00	2.43	2.71	3.51
ness	2.71	1.57	1.71	1.86	2.5
ical	smooth	smooth	m. smooth	v. smooth	smooth

Table 4. Sensory textural rating of reconstituted cassava-plantain fufu flour as compared with pounded fufu before swallowing

/ ters	Reconstituted fufu made from different proportions of cassava-plantain flour and starch				Pounded fufu
	C <sub>50</sub> P <sub>50</sub> S <sub>30</sub>	C <sub>0</sub> P <sub>50</sub> S <sub>30</sub>	C <sub>0</sub> P <sub>50</sub> S <sub>20</sub>	C <sub>50</sub> P <sub>50</sub> S <sub>40</sub>	
ness	2.54	4.00	2.43	2.71	3.51
ness	2.71	1.57	1.71	1.86	2.5
ical	smooth	smooth	m. smooth	v. smooth	smooth

Legend: v=very, s= sticky, m= moderately, r= rubbery, l =less

Fufu flour COP50S30 had gumminess value which was greater than that for the control in the masticatory phase. Moderate gumminess and adhesiveness are however desirable features for paste like foods [7]. The remaining fufu flour samples were preferred because their adhesiveness values were comparable to the control. All the other residual parameters were very similar except for the type of breakdown where it was observed that almost all the reconstituted forms of the cassava-plantain fufu flour broke down usually into paste-like substance while the pounded fufu did not. Pounded fufu rather changes from chunky bolus to less dense liquid. However, the reconstituted cassava-plantain fufu flours were like the pounded fufu in terms of gumminess, stickiness and smoothness which are usually strong consumers' desire. Thus, one could say that the good textural attributes of cassava- plantain fufu flours, when reconstituted, are their gumminess, smoothness and a reasonable degree of adhesiveness.

#### 4. CONCLUSIONS

The standard rating scales that were developed and used enabled the panelists to carry out quantitative evaluation of the textural parameters of cassava-plantain fufu flour eliminating personal bias. The use of local foods to serve as rating scales and descriptors of textural parameters for the cassava-plantain fufu



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flour enabled the panelists to carry out the proper evaluation of the food. The results were reproducible and consistent and the judgements of the panelists were close. STPA is therefore recommended for use in evaluating the texture attributes of cassava-plantain fufu flour and other paste like products. The STPA has thus been used to establish that reconstituted cassava-plantain fufu flour has the same sensory textural characteristics as pounded fufu.

### 5. REFERENCES

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### 6. ACKNOWLEDGEMENT

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