Assessment of Proximate and Sensory Properties of Gari and Fufu Flour from Cassava Roots Stored for 14 Days

ABSTRACT

Aims: To investigate the proximate composition *gari* and *fufu* flour and the sensory attributes of reconstituted *gari* and *fufu* dough processed from cassava roots stored for a period of 14 days.

Study design: Complete randomized design (CRD)

Place and Duration of Study: Product Development Programme, National Root Crops Research Institute, Umudike, Umuahia, Abia State, Nigeria, between October, 2022 and March, 2023

Methodology: Four cassava varieties, two white – fleshed (TME 419, NR 87/184), and two bio- fortified varieties (TMS 01/1368 and TMS 07/0539) were stored at ambient conditions for a period of 14 days on shelves. *Gari* and *fufu* flour were processed on days 0, 7 and 14 using standard methods. The acceptability of reconstituted *gari* and *fufu* dough was determined using a nine-point hedonic ranking scale ranging from 9 (liked extremely) to 1 (disliked extremely).

Results: Proximate composition of the stored roots showed significant decrease in moisture contents with highest percentage of 70.12 ± 0.04 at day 0 and 50.05± 0.04 at day 14 across varieties. Opposite trend was observed in carbohydrate contents of the varieties across the period of storage with values in the range 24.03 ± 0.01 to 44.45 ± 0.01. *Fufu* flour recorded moisture contents between 7.44 ± 0.03 - 9.03 ± 0.03 while *gari* had moisture values between 4.12 ± 0.01 to 12.15 ± 0.05 % across all four varieties. Moisture and ash contents of *fufu* flour and *gari* were within acceptable maximum limits of 12 % and 3 % Codex Alimentarius standards. Sensory evaluation results showed that storage of cassava roots of varieties NR 87/184, and TME 419 for up to 14 days gave acceptable *gari* quality while f*ufu* from variety NR 87/184 was most acceptable.

Conclusion: Cassava varieties NR 87/184 and TME 419 could be promoted for *gari* and *fufu* processing for longer period up to 14 days after harvest.

Keywords: Cassava varieties, proximate, sensory, gari, fufu flour, processing.

1. INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is grown extensively in tropical and subtropical regions of the world. It is a vital staple food for millions in Africa, including Nigeria (Lokko et al., 2007; Oishimaya, 2017). Post-harvest physiological deterioration is a major barrier to the use of cassava roots. It results in a considerable loss of storage roots and lowers the crop's food, feed, and market value (Rahmawati et al., 2021; Zainuddin et al., 2018). *Gari* and *fufu* are products derived from cassava roots and are popularly consumed in West Africa. *Gari* is the most commercial and useful product from cassava roots, it is granular, partially gelatinized by toasting, has a slightly sour taste and fermented flavor (Fadeyibi et al., 2011; Uchechukwu-Agua et al., 2015a). Cassava *fufu* is a fermented white paste made from cassava and it is ranked next to *gari* as an indigenous food of most Nigerians in the South West and South East. The shelf life of cassava *fufu* is short and deterioration rate is high because it is processed as a wet paste with moisture content of about 50 % therefore, not suitable for large-scale and commercial purposes (Uchechukwu-Agua et al., 2015b). A modern technology developed to extend the shelf life and market quality of cassava *fufu* is obtained by drying at high temperature of about 60 – 65°C to produce flour which can be further reconstituted with hot water (Bamidele et al., 2015). *Gari* quality: taste (acidity or sourness), swelling capacity, color, texture, crispiness, and absence of foreign matter (cleanliness) is based on certain indices judged by both processors and consumers alike (Abass et al., 2013; Bechoff et al., 2018). The quality of *fufu* is known to vary from one location to another and processing technique plays a vital role in the variation in quality (Owolarafe et al., 2018). Factors such as cassava variety, differences in dry matter content and the quality of the roots influence the quality of *fufu* (Ume et al., 2020). Other factors that could affect the physical quality of *fufu* are delay in processing cassava roots after harvest and increase in the length of soaking time during processing (Ume et al., 2020).

Freshly harvested cassava roots deteriorate two to three days after harvest as a result of post-harvest physiological deterioration (PPD), this deterioration has been linked with microbiological and physiological changes within the root (Oyeyinka et al., 2019; Sanchez et al., 2013; Tomlins et al., 2021; Uarrota et al., 2016). Studies have shown that the physical and sensory attributes of *gari* from cassava roots stored in trench and polythene bags were acceptable and comparable to *gari* from freshly harvested cassava roots (Akingbala et al., 2005). Another study showed that in terms of composition, insignificant changes were found in the acidity and moisture content of *gari* and *fufu* from cassava roots stored for varying period of storage ranging from 0–4 days (Idowu & Akindele, 1994). Recent research have shown that certain cassava varieties have improved postharvest storage characteristics such as increased shelf-life for up to fourteen days after harvest(Sanchez et al., 2013).

There is no much information reported on the quality of *gari* and *fufu* flour from cassava roots tolerant to PPD stored for up to 14 days. The main focus of this investigation was to study the quality of processed gari, fufu flour made from cassava roots that were kept for 14 days. Hence determining the proximate and sensory properties were crucial.Availability of such information would guide in selection of cassava varieties that are suitable for marketing and utilization in enterprises requiring fresh cassava roots.

2. MATERIALS AND METHODS

2.1 Material selection

Four cassava varieties were used for this study. Two white fleshed cassava roots (NR87/184 and TME 419) and two yellow fleshed cassava roots(TMS 01/1368and TMS 07/0539). Root samples were obtained from plants grown at the Cassava Programme Research field of the National Root Crops Research Institute Umudike, Umuahia, Abia State, Nigeria. The cassava roots were manually harvested at 12 months after planting and great during harvesting was taken to avoid injuries to the roots as root injury accelerates the onset of PPD (Venturini et al., 2015). 30 kg each of cassava roots of the four varieties NR87/184, TME 419, TMS 07/0539 and TMS 01/1368 without mechanical damage or pre-harvest rot were selected. Each of the 30 kg harvested cassava roots was divided into 3 equal parts of 10 kg each which represented day 0, day 7 and day 14. Samples were drawn from each of the 10 kg on each of the sampling days (0, day 7 and day 14) for laboratory analysis and the remaining roots were subsequently processed into *gari and fufu* flour on the respective days.

2.2Cassava roots processing

2.2.1Processing cassava roots into *Gari*

G*ari* was processed on days 0, 7 and 14 using the method as described by (Abass et al., 2013). The roots of each variety were peeled, washed and grated into a mash. The mash was placed in a hessian sack, and left for 48 hours to ferment at ambient temperature. After 48 hours, the fermented mash was dewatered and the resulting cake was then sieved. The pulverized cake was toasted. The resulting toasted granules (*gari*) were allowed to cool and packaged in polyethylene bags for further analysis.

2.2.2Processing of Cassava roots into *fufu*

Fufu flour was processed on days 0, 7 and 14 using the method as described by (Aniedu & Omodamiro, 2012). The roots of each variety were peeled and washed. The washed roots soaked in clean water and left for 48 h after which the submerged roots were removed and grated into a fine mash. The grated mash was left for 24 h before dewatering. The dewatered mash was sifted, dried and allowed to cool. The resulting granules were milled and sieved to obtain fine flour which were subsequently packed in polyethylene bags for further analysis

2.3Proximate composition of cassava roots, *gari* and *fufu* flour

The proximate composition of cassava roots on days 0, 7 and 14, *gari* and *fufu* flour processed at the same days 0, 7 and 14 were determined using standard methods (Horwitz et al., 1970)

2.4Reconstitution of *gari* and *fufu* flour into dough

Gari and *fufu* flour processed at days 0, 7 and 14 were reconstituted into a dough using the modified method described by (Udoro et al., 2014). The *Gari* dough was prepared by adding about 100 g of *gari* to 195 mL of boiled water (100 ℃) and continuously stirred to form a smooth thick paste, while the fufu dough was prepared by adding about 200 g of *fufu* flour to 195 mL of boiling water (100 ℃) while on the heat source and continuously stirred for two minutes to form a smooth thick paste.

2.5Sensory evaluation

Sensory evaluation was carried out on reconstituted *gari* and *fufu* (from *gari* and *fufu* flour). A twenty-man panelist familiar with *gari and fufu* was drawn from staff of NRCRI, Umudike and students of Michael Okpara University of Agriculture, Umudike. The criteria for selection was that panelist were 18 years of age, regular consumers of *gari and fufu* and were neither sick nor allergic to any of the foods. The panelists were trained in the use of sensory evaluation procedures. *Gari* and *fufu* samples were served on white disposable plates, properly coded with 3-digit random numbers to prevent bias. The reconstituted *gari and fufu* flours samples were assessed for aroma, taste, texture, colour, mouldability, and general acceptability. In each case, the samples were rated according to a 9-point hedonic scale of preference with ratings ranging from 1 (dislike extremely) and 9 (like extremely) as described by (Iwe, 2002). Precautions were taken to avoid transfer of flavour during the analysis by ensuring that panelist rinse their mouth with potable water after each evaluation.

2.6Statistical Analysis

Analyses were done in triplicate and all data obtained were subjected to Analysis of Variance (ANOVA) R- Statistics, (R-programming language version 3.4.4). Statistical significance was established using analysis of variance (ANOVA) and means were separated using least significant difference (LSD) at $p \leq 0.05$.

3. RESULTS AND DISCUSSION

Table 1 shows the proximate composition of four cassava root varieties stored at ambient conditions for 14 days. Moisture content of cassava roots ranged from 50.05 to 70.12% across the storage period. TMS 07/0539 had the highest initial moisture content (70.12%) while NR 87/184 had the lowest initial moisture content (54.35%). All varieties showed a significant decrease in moisture content throughout storage (from Day 0 to Day 14). This decrease could be attributed to respiration and drying processes of the roots after harvest. This observation agrees with the reports of (Omosuli et al., 2017) who had moisture of 68.40% in fresh cassava (day 0) and 58.80% on day 10.

Commercial cassava varieties have poor protein of about 1-2% (Bayata, 2019). The protein content of cassava varieties varied from 0.42 to 1.10 % across the storage period (Day 0 to 14). Protein content of roots for all varieties increased from day 0 to 7, and then decreased on day 14. The increase in protein from day 0 to 7 might have been slightly enhanced by fermentation as reported by (Tivana et al., 2007). All varieties showed a decrease in protein content by Day 14. The decrease in protein content of cassava varieties during storage could be due to enzymatic activity as cassava naturally contains enzymes that can degrade proteins over time (Falade & Akingbala, 2010). Protein content obtained in this research is within range of 0.4 and 1.5 g/100 g fresh weight reported by (Bradbury & Holloway, 1988; Charles et al., 2005).

Crude fiber content of cassava roots varied from 1.71 to 3.20 % across storage days. The white fleshed varieties NR87/184 and TME 419 had higher crude fibre values than the yellow fleshed varieties TMS 07/0593 and TMS 01/1368.

Reports have shown that compared to yellow-and cream-flesh cassava varieties, the roots of white-flesh variants have a comparatively greater fiber content of 0.62-2.92 % (Ukenye et al., 2013). Little increase in fiber content was observed for all varieties by day 7 and then decreased by day 14.The results obtained for this work is within the range of value obtained from results of 2.08 and 4.53 reported by (Tivana et al., 2007).

Cassava roots are known to have low fat content (Bayata, 2019). Fat content obtained in this study varied between 0.72 to 1.24 %. The fat content in roots slightly decreased consistently across storage period for all varieties. The results of fat content obtained in this study are higher than results of 0.1 - 0.3 % reported by (Bayata, 2019). This could be attributed to cassava varietal differences.

Ash content of cassava roots varied from 1.58 to 2.12 % across the storage period. There was a trend of consistent decrease of ash content during the storage period. This could be attributed to the fact that during the period of storage, cassava roots continue to respire during which they burn sugars and starches for energy, releasing carbon dioxide and water vapor. This process can lead to the breakdown of some minerals that contribute to the ash content. The results of ash content reported in this study are higher compared to those reported by (Ikujenlola & Opawale, 2007) who had ash content values between the range (0.60 – 1.30 %) and lower than ash content values of 2.29 to 2.67 % reported by (Koko et al., 2014). The differences in ash content of cassava roots could be attributed to varietal differences.

Carbohydrates the dominant component was observed to increase throughout storage. This likely reflects the decrease in moisture content.

Table 1: Proximate composition of cassava roots during storage

Variety	Storage Period (Days)	Moisture	Crude protein	Crude fibre	Fat	Ash	CHO
TMS 01/1368	0	68.42 ± 0.03	0.86 ± 0.01	2.04 ± 0.01	1.17 ± 0.02	2.11 ± 0.01	25.42± 0.01
	7	57.56± 0.03	0.91± 0.01	2.11 ± 0.01	1.03 ±0.01	2.05 ± 0.01	36.35 ±0.01
	14	54.75 ± 0.42	0.71 ± 0.01	1.76 ± 0.21	0.72 ± 0.01	1.71 ± 0.01	40.37± 0.01
TMS 07/0539	0	70.12 ± 0.04	0.97 ±0.01	1.93 ± 0.02	1.07 ± 0.01	1.89 ± 0.01	24.03± 0.01
	7	65.62 ± 0.02	1.10 ± 0.01	1.98 ± 0.01	0.98 ± 0.01	1.83 ± 0.02	28.50 ±0.01
	14	53.33± 0.42	0.75 ± 0.01	1.71 ± 0.01	0.79± 0.01	1.61 ± 0.01	41.82 ± 0.01

NR 87/184	0	54.35 ± 0.35	0.75 ± 0.07	3.05 ± 0.01	1.24 ± 0.01	2.12 ± 0.01	38.50± 0.08
	7	52.37 ± 0.03	0.88 ±0.01	3.20 ± 0.01	1.18 ± 0.01	2. 06 ± 0.01	40.31 ± 0.00
	14	51.12 ± 0.02	0.51 ±0.01	2.27± 0.01	0.82 ± 0.01	1.79 ± 0.01	43.49 ± 0.01
TME 419	0	64.05 ±0.35	0.73 ± 0.02	2.58 ± 0.01	0.98 ± 0.01	2.02 ±0.01	30.10 ± 0.72
	7	60.45 ±0.04	0.78 ±0.01	3.14 ± 0.70	0.92 ± 0.03	1.85 ± 0.02	32.72 ± 0.70
	14	50.05± 0.04	0.42 ± 0.02	2.41 ± 0.01	0.85 ± 0.01	1.58± 0.71	44.45 ± 0.01
	LSD	**5.01**	**NS**	**NS**	**0.11**	**NS**	**4.52**

*NS= Not Significant

Table 2 and 3 show the proximate composition of *fufu*flour and *gari*samples processed at day 0, 7 and 14 from stored cassava roots.

The moisture content of *fufu* flour and *gari*processed from the cassava varieties ranged from 7.44 % to 9.03 % and 4.12 to 12.15 % respectively. Therewas decrease in moisture content of both *fufu* flour and *gari* in all varieties throughout processing days. This confirms the moisture loss observed in roots during storage period of roots.Moisture content of cassava products determine to a large extent the ability of floury product to store well. The moisture content of *fufu* flour and *gari* were within acceptable limits of 12 %. With this moisture content, *fufu* flour and *gari* processed from stored roots will store for a reasonably long period.

The protein content showed some variation across varieties and processing days. The protein content of *fufu* flour was in the range of 1.06 to 1.71 % while that of *gari* was in the range of 0.23 to 2.16 % across processing days . Generally, the protein content for both *fufu* flour and *gari* increased from day 0 to 7 and then decreased on day 14. This was observed also observed in the roots during storage. *Fufu* and gari are not protein-rich foods, but this variation might be relevant for dietary considerations.

Fat content of *fufu*flour and gari were in the ranges 0.37 to 0.83 % and 0.37 to 0.91 %. Fat content of *fufu* flour and *gari* remained fairly stable across processing days.

Crude fiber content varied significantly (p ≥ 0.05).The crudefibre content of *fufu* flour was in the range2.02 to 2.74 % while the crude fibre content of *gari* was in the range 0.72 to 2.06 %.The Codex Alimentarius maximum values for crude fibre of edible flour and *gari* is 2 %(Abass et al., 2013). The crude fibre content values of *gari*obtained in this study were within the codex Alimentarius maximum value while *fufu* flour crude fibre values were slightly above the standards. Ash content values of *fufu*flour and gari varied significantly (p ≥ 0.05). The ash content values of *fufu* flour and *gari* obtained in this study are within 3 % Codex Alimentarius standards. Carbohydrates content had values ranging from 84.79% to 87.67% for *fufu* flour and 86.07 to 90.07 %.There was a general increase in carbohydrate content of *fufu* flour for all varieties across the period of storage. The increase in carbohydrate content likely reflects the decrease in moisture content during storage.

Table 2: Proximate composition of *fufu* flour

Variety	Day of processing	Moisture	Crude protein	Crude fibre	Fat	Ash	CHO
NR87/184	0	9.03 ± 0.03	1.66 ±0.02	2.38 ±0.01	0.63 ±0.01	1.52 ±0.01	84.79±0.01

	7	8.02 ±0.03	1.74 ±0.01	2.31 ±0.01	0.83 ±0.01	1.48 ±0.01	85.64±0.02
	14	7.44 ±0.03	1.06 ±0.01	2.05 ±0.02	0.37 ±0.03	1.31 ±0.04	87.67±0.05
TME419	0	8.72 ±0.03	1.51 ±0.01	2.45 ±0.02	0.58 ±0.02	1.51 ±0.01	85.25±0.01
	7	8.38 ±0.02	1.71 ±0.01	2.38 ±0.01	0.78 ±0.02	1.45 ±0.01	85.31±0.00
	14	8.02 ±0.03	1.12 ±0.01	2.02 ±0.01	0.43 ±0.01	1.22 ±0.02	87.21±0.00
TMS 01/1368	0	8.93 ± 0.03	1.47 ± 0.01	2.46 ±0.01	0.73 ±0.02	1.38 ±0.01	85.71±0.00
	7	8.24 ± 0.03	1.31 ± 0.01	2.61 ±0.01	0.61 ±0.01	1.27 ±0.03	85.29±0.02
	14	7.83 ± 0.03	1.16 ±0.02	2.18 ±0.01	0.44 ±0.01	1.27 ±0.01	87.13±0.00
TMS 07/0539	0	8.82 ±0.04	1.59 ±0.01	2.23 ±0.02	0.82 ±0.02	1.46 ±0.01	85.36±0.02
	7	8. 57 ±0.03	1.28 ± 0.01	2.74 ±0.01	0.52 ±0.02	1.33 ±0.01	85.32±0.01
	14	7.87± 0.04	1.12 ±0.02	2.13 ±0.02	0.47 ±0.01	1.23 ±0.02	87.20±0.01
LSD		0.06	0.03	0.31	0.34	0.04	0.04

Table 3: Proximate composition of *gari*

Variety	Day of processing	Moisture	Crude protein	Crude fibre	Fat	Ash	CHO
NR87/184	0	9.64±0.01	0.52 ±0.01	2.06 ± 0.02	0.50 ±0.01	1.31 ±0.04	87.85±0.01
	7	4.21±0.02	2.08 ±0.01	1.21 ±0.01	0.70 ±0.02	1.52 ±0.01	89.80±0.01
	14	4.14±0.03	2.05 ±0.01	2.31 ±0.01	0.82 ±0.01	1.48 ±0.01	89.66±0.00
TME419	0	10.05 ±0.03	0.57 ±0.01	0.72 ±0.02	0.54 ±0.01	0.62 ±0.01	87.50±0.01
	7	4.56 ±0.01	2.16 ±0.07	1.22 ±0.01	0.74 ±0.01	2.15 ±0.01	89.18±0.42
	14	4.12 ±0.01	2.01 ±0.01	1.22 ±0.01	0.76 ±0.01	1.89 ±0.01	90.02 ±0.04
TMS 01/1368	0	10.36±0.02	0.49 ±0.01	0.73 ±0.02	0.62 ±0.02	0.78±0.01	87.05±0.02
	7	4.47 ±0.03	1.93 ±0.01	1.12 ±0.01	0.78 ±0.13	1.90 ±0.01	90.07±0.01
	14	4.22 ±0.02	2.11 ±0.01	1.12 ±0.02	0.85 ±0.02	1.96 ±0.01	89.51 ±0.03
TMS 07/0539	0	12.15±0.05	0.23 ±0.03	0.81 ±0.01	0.37 ±0.04	0.38 ±0.03	86.07±0.01
	7	4.86 ±0.02	2.06 ±0.01	1.18 ±0.02	0.86 ±0.1	2.02 ±0.01	89.04±0.01
	14	4.53 ±0.03	2.14 ±0.02	1.16 ±0.02	0.91 ±0.01	2.03 ±0.01	89.25±0.04
LSD		**0.06**	**0.03**	**0.04**	**0.04**	**0.03**	**0.05**

Table 4 shows the results of the sensory evaluation of reconstituted *fufu* at days (0, 7, and 14) from stored cassava varieties. Scores ranged from 1 (disliked extremely) to 9 (liked extremely) for appearance, aroma, texture, and general acceptability. All varieties showed a decrease in hedonic scores (sensory liking) as storage time increased (from Day 0 to

Day 14). This suggests a decline in *fufu* quality during storage. At (Day 0) scores for most varieties fell between "liked slightly" (6) and "neither liked nor disliked" (5), indicating a more neutral initial perception Scores decreased further towards "disliked slightly" (4) or even "disliked moderately" (3) by Day 14 for most sensory attributes. Variety NR87/184 maintained the highest hedonic scores throughout storage. TME419 showed a significant decline, especially after Day 7. By Day 14, most attributes scored below "neither liked nor disliked" (5), indicating a clear negative perception. This suggests a very short shelf life for TME419 *fufu* based on consumer preference. **TMS01/1368 and TMS07/0539** had the lowest hedonic scores across all storage days, with scores dropping to "disliked moderately" (3) or even "disliked very much" (2) by Day 14 for some aspects. This indicates that consumers generally disliked these varieties, especially after storage..

Tale 4: Sensory qualities of reconstituted *fufu* flour

Variety	Day of Processing	Appearance	Aroma	Texture	General Acceptability
NR87/184	0	6.60	5.70	5.60	6.00
	7	5.70	5.10	5.20	6.00
	14	5.80	5.60	5.80	6.20
TME419	0	6.20	6.20	6.30	6.60
	7	3.90	5.30	5.10	5.10
	14	2.50	2.60	4.30	3.50
TMS01/1368	0	6.50	5.90	5.90	6.50
	7	4.80	5.70	4.80	5.70
	14	5.60	5.80	3.30	5.50
TMS07/0539	0	5.60	5.30	4.50	5.40
	7	3.80	4.70	4.90	5.00
	14	1.90	4.20	1.90	2.90
LSD		**0.70**	**0.70**	**0.80**	**0.70**

The results for sensory evaluations of *gari* prepared from cassava varieties stored for 0, 7 and 14 days are presented in Table 5. It was observed that storage of cassava roots of varieties NR 87/184, TME 419 and TMS 01/1368 for up to 14 days gave acceptable *gari* characteristics above 5 points (hedonic scale) in terms of colour, aroma, texture and general acceptability, though the colour for TMS 01/1368 was below 5. Variety TMS 07/0953 gave acceptable gari characteristics only after 7 days of roots storage. The results also showed that as the period of cassava roots storage progressed, there was a gradual decrease in scores the of the quality attributes. Nevertheless, the scores were within the acceptable range for a good quality *gari* characteristics.

Table 5: Sensory qualities of reconstituted *gari*

Variety	Days of Processing	Appearance	Aroma	Taste	Texture	General Acceptability
NR87/184	0	7.40	7.20	6.80	7.70	7.30

	7	6.30	7.40	7.30	7.60	7.80
	14	6.40	6.40	5.60	6.40	6.40
TME419	0	7.70	7.90	7.40	7.90	7.90
	7	6.60	6.60	7.10	7.30	6.80
	14	5.50	5.40	5.40	5.50	5.70
TMS01/1368	0	7.30	6.90	7.00	7.20	7.30
	7	3.90	5.80	5.80	6.20	5.90
	14	5.90	6.40	6.40	6.30	6.30
TMS07/0539	0	7.20	7.10	7.00	7.40	7.50
	7	6.10	6.30	5.80	5.20	6.30
	14	2.50	2.60	5.00	4.10	4.40
	LSD	**0.50**	**0.50**	**0.40**	**0.50**	**0.40**

4. CONCLUSION

The analysis of cassava roots, *gari*, and *fufu* revealed that cassava roots are a carbohydrate-rich food source with moderate protein content and low fat content. During ambient storage, the roots experienced significant moisture loss, increasing carbohydrate content being the dominant nutrient of the roots.

Gari and *fufu* are processed cassava products with similar nutritional profile to the roots, but have slightly lower moisture contents due to processing. Protein contents of both *fufu* flour and *gari* showed some variations across varieties, which might influence their overall nutritional value. Proximate composition remained fairly stable across varieties, with carbohydrates being the dominant component.

Sensory evaluation scores for *fufu* and *gari*across varieties showed a decrease in hedonic scores (sensory liking) as storage time increased (from Day 0 to Day 14). This suggests a decline in fufu and gari quality during storage. Based on the scale (1-9), most initial scores (Day 0) fell between "liked slightly" (6) and "liked moderately" (7), indicating a generally favorable initial perception for all varieties. However, scores decreased towards "neither liked nor disliked" (5) by Day 14 for most sensory attributes. Variety **NR87/184**maintained relatively high hedonic scores throughout storage compared to others. This suggests this variety might have a longer shelf life or better storage characteristics.TMS07/0539 had the most significant decline in hedonic scores across storage, with all attributes dropping below "neither liked nor disliked" (5) by Day 14. This suggests a rapid decrease in consumer liking for*fufu* and*gari* processed from this variety.

Recommendations

Alternative storage methods can be explored to minimize moisture loss and extend shelf life while maintaining cassava root quality. Further work could be done to investigate the relationship between *fufu* and *gari* proximate composition and sensory characteristics preferred by consumers.

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