

Sensory Characteristics of Gari Produced from Cassava Stored in Moist Sawdust

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Abstract

Freshly harvested cassava was stored in moist sawdust for twelve weeks and processed into gari every two weeks throughout the period of storage. Sensory evaluation in terms of sensory attributes and acceptability were evaluated using 30 semi-trained panelist. The consumable form of gari (dried gari, soaked gari and Eba paste) were evaluated. For the sensory attribute test, score difference test was used with each attribute on a scale of five. The consumer acceptance was evaluated using a nine-point hedonic scale. The result of the analysis shows that, there were significant difference ($P < 0.05$) in taste of dried gari, and mouldability of eba while for the hedonic test there were significant difference ($P < 0.05$) in colour and granularity in dried gari, taste and appearance of soaked gari and aroma of eba. The study shows that stored cassava roots produces gari with acceptable sensory attributes.

Key Words: Cassava, gari, storage, sawdust and sensory

1.0 Introduction

Cassava (*Manihot esculenta*, Crantz), is a major staple root crop in many tropical and subtropical developing countries, especially in West Africa (Babarinsa *et al.*, 2020). According to FAO estimates, the total world cassava production in the year 2017 was 291 million tonnes. Africa accounted for 60.9%, Asia for 29.4%, and Americas and Oceania for 9.7% of the total world production. In 2017, Nigeria produced about 59.5 million metric tonnes (MT) per annum (FAOSTAT, 2019), making her the highest cassava producer in the world, producing a third more than Brazil and almost double the production capacity of Thailand and Indonesia. In Nigeria, the crop can be processed into gari, fufu, lafun, pupuru, and cassava grit for direct human/livestock consumption. Gari as described by Sanni *et al.*, (2008) is a creamy-white, partially gelatinized roasted free flowing granular flour, which has wide consumption due to its long shelf life compared to other food products from cassava, as well as its ease of preparation for eating (Sanni *et al.*, 2005). It is consumed as processed or reconstituted with hot water to give a dough-like paste called Eba (Babarinsa *et al.*, 2018). Cassava roots are not organs of dormancy which naturally favours storage after harvest. Hence, they deteriorate rapidly and have a shelf life of 24 to 48 h (Westby, 2002). Different storage methods have been used for cassava, one of which is the used of moist sawdust. The knowledge gap which is the focus of this current study is to determine whether length of storage had any effect on the sensory quality, in terms of sensory attributes and consumer preference, of gari prepared from the stored cassava roots stored in moist sawdust. Knowledge obtained from this study will guide in decision making on the optimum storage time for the stored cassava if their roots are to be processed into gari.



2.0 Materials and Method

2.1 Sample Storage and Preparation

12-months-old (var. TME 7), was harvested from a farm settlement in Kwara State, Nigeria. The storage was done using the storage method described by Babarinsa and Oluwalana (2018), the roots were carefully arranged in layers and surrounded with moist sawdust so that no two tubers touched one another. Gari was produced using the process as described by Onyekwere *et al.* (2004). The gari samples were prepared by only one experienced commercial gari processor in order to reduce variability.

2.2 Sensory evaluation

The Gari samples were subjected to organoleptic evaluation using 30 semi trained panelists for scoring difference test and hedonic (acceptability) test. The tests were conducted on consumable form of gari (dried gari, soaked gari and Eba paste). For dried gari the color aroma, taste and granularity (crispness) were evaluated, while for soaked gari, the water retention capacity, taste and appearance were evaluated and for Eba the mouldability, taste, aroma and appearance were evaluated. The scale were portioned for each attribute on a five scale with low and high anchor at the beginning and end of the scale for the particular attribute. Colour was rated on a scale, were 1= extremely white and 5= Not white, Taste on scale where 1= highly sour and 5= Not sour, for Granularity 1= Very fine and 5= coarse, for aroma, 1= extremely different from typical and 5= Non different from typical. For water retention capacity of soaked gari, 1= extremely retained and 5= Non retained and for mouldability in the stiff paste (Eba) 1= easily mouldable and 5=not mouldable. Each panelist's score was reflected on a nine point scale ranging from nine (like extremely) to one (dislike extremely).

2.3 Statistical analysis

Results from scores from the sensory evaluation were subjected to analysis of variance. The Duncan (1955) multiple range test was then used to separate means. Statistical analysis was done using SPSS 17.

3.0 Result and Discussion

3.1 Dried Gari

3.1.1 Taste of gari: There were significant difference ($P>0.05$) in the taste of the Gari. The mean scores for taste of the gari during the 12 week storage from week 0-week 12 samples ranged between 1.8 -4.5 indicating a range between moderately sour to sour (Table 1). The preference means were not significantly different ($P>0.05$) with a range of 2.8-4.5 (Table 2). Week 4 had the highest preference and week 8 had the lowest preference, this shows that people prefer Gari that is sour. The interaction between the weeks in score rating shows no significant difference between weeks 0-6 and week 8-12 respectively (Table 1).

3.1.2 Colour of Gari: There were no significant differences ($P<0.05$) in the colour of the Gari. The mean scores ranges from 3.3-4.1(Table 1) indicating moderately white to slightly white. It should be noted that colour of the gari change as the storage time increase, the gari was gradually changing from creamy-white to grey tinge colour, the degree of tinge grey colour intensifies as the storage time increased. These compared favorably what was reported by Akingbala *et al.* (2005).

3.1.3Aroma: There were no significant differences between the aromas of the gari samples. It ranges from 2.7-3.5 (Table 1) indicating between 'very different to typical' to 'moderately different from typical'. This also reflected in the degree of likeness were there were no significant differences between the samples (Figure



2), its acceptability ranges from ‘like very much’ to ‘neither like or dislike’, which decreases as the storage time increases (though not significantly). Research (Akingbala *et. al.*, 2005) shows that aroma of gari is contributed by the natural aroma of the root and the aroma developed by the activities of *Corynebacterium manihot*, *Geotrichum candida*, *Lactobacillus* and *Streptococcus* spp. *Aspergillus flavus*, *Fusarium*, *Oligosporium*, *Saccharomyces cerevisiae* and *Rhodotorulaminuta* during fermentation of the cassava mash

3.1.4 Granularity: There were no significant differences between the granularities of the Gari. The samples ranges from 2.2-3.2 (Table 1), i.e. ranging from ‘fine’ to ‘granular’, with higher preferences going to fine ones rather than the granular one. Week 8 sample which is assessed to be more granular has the lowest likeness rating (4.7) (Table 2)

Table 1: Mean Scores for sensory attributes of Dried Gari

	COLOUR	TASTE	AROMA	GRANULARITY
WEEK 0	4.10 ± .99 ^a	2.50±1.18 ^b	2.70±.82 ^a	2.60±1.17 ^a
WEEK 2	3.70 ± 1.77 ^a	1.80±.92 ^b	3.20±.92 ^a	2.20±1.23 ^a
WEEK 4	3.90 ± 1.29 ^a	2.70±1.34 ^b	2.90±1.10 ^a	2.20±1.23 ^a
WEEK 6	3.90 ± 1.29 ^a	2.78±1.39 ^b	3.00±1.12 ^a	2.22±1.30 ^a
WEEK 8	3.30 ± .25 ^a	4.20±1.32 ^a	2.70±.95 ^a	3.20±1.32 ^a
WEEK 10	4.10 ± 1.29 ^a	4.50±.85 ^a	3.20±.92 ^a	2.20±1.03 ^a
WEEK 12	4.00 ± 1.70 ^a	4.50±1.08 ^a	3.50±1.72 ^a	2.70±1.34 ^a

Values are means of triplicates and standard deviation. Mean values having different superscript within column are significantly different ($P < 0.05$).

Table 2: Hedonic Rating for sensory attribute of Dried Gari

	COLOUR	TASTE	AROMA	GRANULARITY
WEEK 0	2.80±1.55 ^c	4.10±2.02 ^{ab}	3.90±2.08 ^{ab}	3.70±2.00 ^{ab}
WEEK 2	3.00±.94 ^{bc}	3.00±1.25 ^b	2.30±1.16 ^b	2.60±.70 ^{bc}
WEEK 4	2.70±1.16 ^c	2.80±1.32 ^b	3.20±1.69 ^{ab}	2.30±1.06 ^c
WEEK 6	2.67±1.22 ^c	4.00±1.83 ^{ab}	3.22±1.79 ^{ab}	2.30±.95 ^c
WEEK 8	4.30±1.83 ^{ab}	5.00±2.00 ^a	4.40±2.59 ^a	4.70±1.64 ^a
WEEK 10	3.90±1.20 ^{abc}	3.50±1.90 ^{ab}	4.60±2.01 ^a	2.90±.88 ^{bc}
WEEK 12	5.30±2.16 ^a	4.50±2.64 ^{ab}	4.70±2.71 ^a	2.60±1.17 ^{bc}

Values are means of triplicates and standard deviation. Mean values having different superscript within column are significantly different ($P < 0.05$).





Plate 1: Shows dried gari samples

3.2 Soaked Gari

3.2.1 Water retention: There were no significant differences in the water retention capacity of the samples. Mean scores for water retention of the soaked Gari from week 0 to week 12 samples ranged between 2.2-3.7 (Table 3), indicating a range between 'very much retained' to 'moderately retained'. Samples from week 10 had the highest preference while that of week 2 had the lowest preference, though there were no significant difference between the samples (Table 4).

3.2.2 Appearance (Colour): Table 3 shows there were no significant differences in the appearance of the soaked gari. The colour ranges from 'very white' to 'slightly white' (2.7-4.4) but there were significant differences in the acceptance of the gari with week 2 having the highest and week 12 having the lowest (Table 4).

3.2.3 Taste: The taste of the Gari samples ranged from 2.6-3.4 (Table 3) with no significant difference. This indicated that the soaked gari ranges between 'moderately sour' to 'slightly sour'. Comparing the result from the dried Gari, shows that the presence of water makes the panelist in assessing the sourness of the Gari, because the result from the soaked Gari showed more sourness compared to that of the dried form. There were significant differences ($P>0.05$) in the preference. The preference for week 2 was highest and that of week 12 was the lowest (Table 4).



Table 3: Mean Scores for sensory attributes of Soaked Gari

	WATER RETENTION	APPEARANCE	TASTE
WEEK 0	3.70±1.42 ^a	3.60±1.71 ^a	3.20±1.14 ^a
WEEK 2	2.20±1.23 ^b	2.70±.95 ^a	3.20±1.23 ^a
WEEK 4	2.30±.67 ^b	3.00±1.76 ^a	2.80±1.14 ^a
WEEK 6	2.33±.71 ^b	3.11±1.83 ^a	2.89±1.17 ^a
WEEK 8	2.90±1.29 ^{ab}	4.40±1.07 ^a	3.40±1.17 ^a
WEEK 10	3.00±1.15 ^{ab}	3.60±1.35 ^a	2.60±1.07 ^a
WEEK 12	3.10±1.29 ^{ab}	4.10±1.29 ^a	3.40±1.51 ^a

Values are means of triplicates and standard deviation. Mean values having different superscript within column are significantly different ($P < 0.05$).

Table 4: Hedonic Rating for sensory attribute of Soaked Gari

	WATER RETENTION	APPEARANCE	TASTE
WEEK 0	3.30±1.57 ^a	2.70±1.16 ^b	2.80±2.25 ^{cde}
WEEK 2	3.33±1.32 ^a	2.40±1.43 ^b	1.60±.70 ^e
WEEK 4	2.60±1.17 ^a	2.80±.92 ^b	2.50±1.18 ^{de}
WEEK 6	2.50±1.27 ^a	3.60±1.58 ^{ab}	4.60±2.76 ^{abc}
WEEK 8	2.80±1.32 ^a	3.50±1.18 ^{ab}	5.00±2.11 ^{ab}
WEEK 10	2.30±.82 ^a	3.40±2.22 ^{ab}	3.60±1.90 ^{bcd}
WEEK 12	3.30±1.42 ^a	4.80±2.30 ^a	6.00±2.49 ^a

Values are means of triplicates and standard deviation. Mean values having different superscript within column are significantly different ($P < 0.05$).

3.3 Eba (stiff paste):

3.3.1 Mouldability: There were significance differences in the mouldability of eba ($P < 0.05$). It ranges between 2.0-3.3(Table 5) indicating ‘easily mouldable’ to ‘slightly mouldable’ but there were no significant different ($P > 0.05$) in the degree of likeness, this is due to the wide variation in the mouldability preferences of gari consumers. The range of the mouldability preference was 2.5-4.3(Table 6) which represents ‘Like very much’ to ‘Like slightly’.

3.3.2 Taste: There were no significance differences ($P > 0.05$) in the taste of Eba which range from 2.9-4.0(Table 5) which indicates ‘moderately sour’ to ‘sour’. But there were significance differences ($P < 0.05$) in the panelist preference, ranging from 2.7-4.8 (Table 6) with week 2 having the highest preference and week 8 having the lowest. This shows that unlike the dried gari, panelist preference is on eba that is less sour.

3.3.3 Appearance: There were no significant differences ($P > 0.05$) in appearance of Eba. The mean scores of the Score rating ranges from 2.5-3.3 (Table 5), which represent ‘very white’ to ‘moderately white’. The



preference ranges between 2.4-4.4 (Table 6) indicating 'Like very Much' to 'Like Slightly', with Week 4 having the highest preference and Week 12 having the Lowest preference.

3.3.4 Aroma: There were no significant differences ($P > 0.05$) in the Aroma of the Eba. The mean score of the Score rating ranges from 2.4-3.6 (Table 5) which represent very white to moderately white. The preference ranges between 2.4-5.4 (Table 6) indicating 'Like very Much' to 'neither Like or Dislike'. There were no significant differences ($P > 0.05$) between week 0, 2, 4, and 6, and week 6, 8, and 10 respectively. The preference decreases with increasing Storage time.

Table 5: Mean Scores for sensory attributes of Eba

	MOULDABILITY	TASTE	APPERANCE	AROMA
WEEK 0	2.00±.82 ^b	3.50±1.35 ^a	3.10±1.20 ^a	2.70±1.57 ^a
WEEK 2	2.00±1.05 ^b	3.00±1.49 ^a	2.60±1.07 ^a	2.90±1.52 ^a
WEEK 4	2.40±.84 ^{ab}	2.90±1.45 ^a	2.40±.84 ^a	2.60±1.58 ^a
WEEK 6	2.44±.88 ^{ab}	3.00±1.50 ^a	2.67±1.66 ^a	3.33±1.66 ^a
WEEK 8	3.10±.88 ^a	4.00±1.25 ^a	3.00±1.49 ^a	3.00±1.76 ^a
WEEK 10	2.80±.92 ^{ab}	3.00±1.33 ^a	3.50±.53 ^a	3.00±1.05 ^a
WEEK 12	3.30±.95 ^a	3.10±1.52 ^a	3.60±1.43 ^a	2.50±1.43 ^a

Values are means of triplicates and standard deviation. Mean values having different superscript within column are significantly different ($P < 0.05$).

Table 6: Hedonic Rating for sensory attribute of Eba

	MOULDABILITY	TASTE	APPERANCE	AROMA
WEEK 0	3.00±1.33 ^a	2.90±1.45 ^b	2.50±1.27 ^b	2.40±1.43 ^c
WEEK 2	2.50±1.35 ^a	2.70±1.25 ^b	2.70±1.06 ^b	2.30±.82 ^c
WEEK 4	3.00±1.33 ^a	3.30±1.25 ^a	2.40±.70 ^b	2.50±.97 ^c
WEEK 6	3.00±1.15 ^a	3.50±1.35 ^{ab}	3.50±1.65 ^{ab}	3.00±1.05 ^{bc}
WEEK 8	4.20±2.30 ^a	4.80±2.04 ^a	3.90±2.13 ^{ab}	4.20±1.75 ^{ab}
WEEK 10	3.00±1.56 ^a	4.10±1.79 ^{ab}	3.00±0.94 ^{ab}	4.30±1.42 ^{ab}
WEEK 12	4.30±2.83 ^a	4.20±2.39 ^{ab}	4.40±2.72 ^a	5.40±2.88 ^a

Values are means of triplicates and standard deviation. Mean values having different superscript within column are significantly different ($P < 0.05$).





Plate 2: Shows Eba samples

4.0 Conclusion

The study shows that stored Cassava roots produces gari with acceptable physical and sensory quality.

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