

Evaluation of Consumers Acceptability of Cassava Cooked Paste (*EBA*) Using 9-Points Hedonic, Jar, and CATA Methods

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Abstract— This study aimed at identifying the desire quality attributes of gari-eba among the consumers with the aim of helping breeders to develop new cassava varieties that will meet the quality characteristics of good gari for eba as determined by consumers. Four (4) communities that are major producers of cassava and consumers of gari were selected in Benue State, Nigeria (Tyo-mu, Shangevya-koti, Nyamli, Al'Okete). Four selected cassava varieties (TMS-IBA011412, TMS14F1278PP0003, TMS14F1022P0003, banada) were processed to gari and turned to eba (using ratio 1:3 gari/water) for consumer's acceptability. A well structured questionnaire comprising of 9-points hedonic test, Just About Right test (JAR) and Check-All-That-Apply test (CATA) was administered to 150 consumers for consumer acceptability. The results which were statistically analyzed, indicated that the frequencies of good characteristics mentioned by Benue consumers on most preferred eba sample produced from banada showed that neatness had the highest with frequency of 146 out of 150 consumers, followed by smoothness (143), good taste (143), mouldable (140), good aroma (138), stretchy (137), white (126), moderately soft (116), fermented odour (79), not sour (78), and less lump (60). On the other hand, the frequencies of poor characteristics mentioned by Benue consumers on most preferred eba sample showed that too soft had the highest with frequency of 32, followed by no taste (17.0), not mouldable (15.0), not stretchy, 12.0, and sour (12.0). The findings will, therefore, help the breeders to develop improved cassava varieties that will be acceptable by multi end-users.

Keywords— End users, preference characteristics, cassava, "gari".

I. INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a major staple food for Africa (Cardoso *et al.*, 2005), and many nations of tropical origin and America. It is the most perishable roots and start deteriorating almost immediately after harvest due to its high moisture content. It plays a major role to alleviate the African food crisis because of its efficient production of energy food, year-round availability, tolerance to extreme stress conditions, and suitability to present farming and food system in Africa (Cardoso *et al.*, 2005).

The Food and Agriculture Organization (FAO) evaluated as at year 2016 that cassava creation was roughly 287 million measurement tones. Nigeria is the biggest producer of cassava on the planet where it represented 58 million measurement tones (FAO, 2016), followed by Thailand (31 million measurement tones), Brazil (24 million measurement tones), Indonesia (21 million measurement tones), Ghana (18 million

measurement tones) and so on (FAO, 2016). The main producing states of cassava in Nigeria are Benue, Imo, Anambra, Kogi, Osun, Enugu, Ogun, Ondo, Taraba, Delta, Osun, though it can be cultivated in other states of Nigeria but in smaller quantities.

In Nigeria, cassava has been processed into many fermented and unfermented products in many ways. Some of the fermented products include cassava flour, cassava flake ("gari"), "fufu". The quality of these fermented cassava products varies from one processor to the other and the length of fermentation employed. Some of the unfermented products include cassava bread, pasta, abacha, snacks, chips, paste and cassava starch (Sanni *et al.*, 2006). Major cassava based food products consumed in Nigeria are "gari", "fufu", and "lafun". Most of these cassava food products are made by farmers themselves, who process and consume the crop (IITA, 2012).

"Gari" is a granular meal which is consumed in many forms like soaking in water, mixed with cooked beans or made into dough (*eba*) by mixing in boiled water. It has a marginally harsh taste and could be white or cream in colour depending on the variety of cassava utilized and the preparation method. "Gari" is the most famous cassava product in most West African nations because of its comfort and variety of utilization. It is a familiar product in East and Southern Africa. Nigeria is the key producers, consumer and exporters of "gari" (FAO, 2017). "Gari" quality can be defined on the basis of its safety and fitness for use by the target consumer. According to the requirements of the Standard Organization of Nigeria (SON), a good "gari" should be well dried (10% moisture content), packaged (high density polythene bags), transported and stored in unused containers, which will safeguard the hygienic, nutritional and organoleptic qualities of the product with no bacteriological and other contamination (Sanni *et al.*, 2005). Processors and consumers have various indices for "gari" quality. These include taste (acidity or sourness), swelling capacity, color, texture, crispiness, and absence of foreign matter (cleanliness).

Sensory analysis can be considered to be an interdisciplinary science that uses human panelists' sensory perception related to thresholds of determination of attributes, the variance in individual sensory response experimental design to measure the sensory characteristics and the acceptability of food products.

The present study aims at conducting consumers acceptability with *gari-eba* consumers in some selected communities in Benue State (*Shangevyva, Al' Okete, Nyam II, Tyomu*), and to generate data that can produce useful information on end users traits preferences on “*gari-eba*”.

II. MATERIALS AND METHODS

Materials

An interviewer-administered questionnaire was used to collect information on food quality characteristics of cassava product *eba* and socio-economic characteristics of people in the community. A well structured questionnaire comprising of 9-points hedonic test, Just About Right test (JAR) and Check-All-That-Apply test (CATA) was administered to 150 consumers.

Methods

Study Site

The study was conducted in Benue State, Nigeria and it covered four communities (*Shangevyva-koti, Al' Okete, Nyam II, Tyomu*) in the three Senatorial Districts in Benue State of Nigeria with these GIS coordination: Tyomu (7040'30.4"N 8032'08.8"E), Shangevyva-koti (7040'38.5"N 8032'15.2"E), NyamII (7040'37.2"N 8032'14.0"E) and Al'Okete (7040'27.1"N 8032'10.6"E).

Production of *gari*

The selected improved cassava varieties (TMS14F1022P0003, TMS14F1278P0003, IITA-TMS-IBA011412) during pre-test were obtained from IITA Research and Training farm, Ago-Owu, Osun State and the local variety (*banada*) was obtained from farmers in Benue State. These varieties were processed into *gari* by four (4) processors at a processing centre in Benue State using traditional method of *gari* processing (Abass *et al.*, 2012).

Production of *eba*

Four cassava varieties (IBA011412, 1278PP0003, 1022P0003 and *banada*) that produced contrasting *gari* qualities were selected to produce *eba* for consumer's acceptability test. *Gari* were sprinkled into boiled water placed in a bowl using *gari*/water ratio of 1:3 *gari*/water and covered for few minutes, and then stirred with a stirring rod until it is smooth. It was wrapped in nylon and kept in a warmer prior to evaluation.

Consumers Acceptability

Consumers acceptability was carried out on *gari* produced from four cassava varieties (including three improved and one locally produced cassava varieties) and the final product (*eba*) across the four selected communities, one major town and a city. One hundred and fifty (150) consumers that are familiar with *eba* were selected. The four samples were coded and presented to the consumers to evaluate the sample using preference and descriptive tests. The questionnaire comprised of three (3) successive tests: a hedonic test to score the overall liking of the product using nine- points hedonic scale (1. “Extremely dislike” to 9. “Extremely like”), a 3-point JAR “Just About Right” scale (1= “Extremely low than I like”, 2= “Just About Right” and 3= “Extremely high than I like”) to understand why the consumer likes or dislike the product and a CATA test “Check-All-That-Apply” with a list of about twenty

five sensory descriptors (bad or good) collected during traits preferences survey (Ares *et al.*, 2010; Meyners *et al.*, 2013; Ares and Jaeger., 2013) . The consumers were asked to tick in front of the appropriate descriptors to better describe each product. Drinking water was provided to rinse the mouth after every tasting.

Data Analysis

The data obtained were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) and excel statistical package (XLSTAT) to generate frequencies and ANOVA.

III. RESULTS AND DISCUSSIONS

Overall Liking of the four selected samples by the consumers using Hedonic test and Just About Right (JAR) Test

Overall liking of the selected four *eba* samples in Benue State (Figure 1) showed that sample 900 (local variety: *banada*) is the most preferred, followed by sample 815(IBA011412), 606 (1278PP0003) while sample 409 (1022P0003) is the less preferred one. Just About Right test further confirmed sample 900 as the most preferred sample by 85% consumers in term of colour, 68% consumers like sample 900 as it is in-term of smoothness and also in-term of sourness, 59% consumers like it as it is (Figures 2, 3 and 4). JAR test showed that sample 900 is the most preferred sample in-term of colour, sourness, and smoothness, followed by sample 815, 606, and 409.

Good Quality according to Consumers in the selected location

Check-All-That-Apply test established the good quality characteristics and bad characteristics of *eba* sample focusing on the most preferred sample (900) by the consumers in Benue according to frequency distributions (Figure 5). This includes neatness, smoothness, good taste, mouldability, good aroma, stretchy, white, moderately soft, fermented odour, not sour and less lump. In this respect, *eba* is preferred either soft, little sticky, smooth and elastic, or firm, not sticky, less smooth and less elastic. This differentiation seems to be locality and cooking process dependent as previously observed by Teeken *et al.*, (2019) and is confirmed by appreciation of *eba* on eating, which, in mouth, is appreciated either for the strong or weak behavior of its texture. The significant difference in term of colour observed in the samples might be due probably to the heating during frying operation and due to addition of palm oil. These findings was similar to the work of Makanjuola *et al.*, 2012 during the comparative study on quality attributes of *gari* obtained from some processing centres in Southwest, Nigeria.

Bad quality according to consumers in Selected Locations

Check-All-That-Apply test was used to establish the bad quality characteristics of *ebas* sample focusing on the most preferred sample (900) by the consumers in Benue according to frequency distributions (Figure 6). By using frequencies descriptive statistics, too soft came first, followed by no taste, not mouldable, not stretchy, sour, fibre, dark/dull/brown, impurities, offensive odour, yellow and too hard. Dark colour and low shininess (brightness) of *eba* is a major indicator of low quality in Benue and other regions. The prominence of ‘not mouldable as low quality *eba* characteristic in Benue state is

related to the mode of preparation: In Benue, *eba* is prepared by mixing of boiled water and *gari* and turning into a paste with a spoon. This allows for less homogenous rehydration to take place providing the *eba* with a relatively more crumbly ‘airy’ structure. This method naturally creates more coincidences of mouldability problems (especially if starch levels in the *gari* are low) as the *eba* can fall apart (crumble) more easily if starch gets less change to rehydrate compared to *eba* that is prepared on fire which results into more homogenous rehydration where the *gari* particles are better merged because of the longer contact between hot water and *gari*.

Global lists of top quality characteristics for the final product (eba)

Figure 7 showed the descriptors of both good and poor characteristics of *eba* samples as identified by the consumers in Benue State, Nigeria with the use of check -all-that-apply test. These are neatness, smoothness, good taste, mouldable, good aroma, stretchy, white, moderately soft, fermented odour, not

sour, less lumps, slightly sour, sweet, swelled, too soft, cream colour, no taste, not mouldable, not stretchy, sour, fibre, dark/dull/brown, impurities, offensive odour, yellow, too hard. The good characteristics of *eba* are related to its texture, which translates both its starch behavior and the quality of root used in processing *gari*, and consequently its quality on eating. In this respect, based on the terms used by stakeholders, the texture characteristics of *eba* are related to density and granule structure (uniformity, non-powdery aspect and smoothness) of the *gari*. These characteristics of the *gari* impact on swelling, smoothness, stickiness, elasticity, and mouldability properties of the cooked *gari*. In this respect, the preferred characteristics of *eba* are in coherence with previous findings on *gari* characteristics. In this respect, *eba* or “*gari fufu*” is preferred either soft, little sticky, smooth and elastic, or firm, not sticky, less smooth and less elastic. This differentiation seems to be locality and cooking process dependent as previously observed by Teeken *et al.*, (2019).

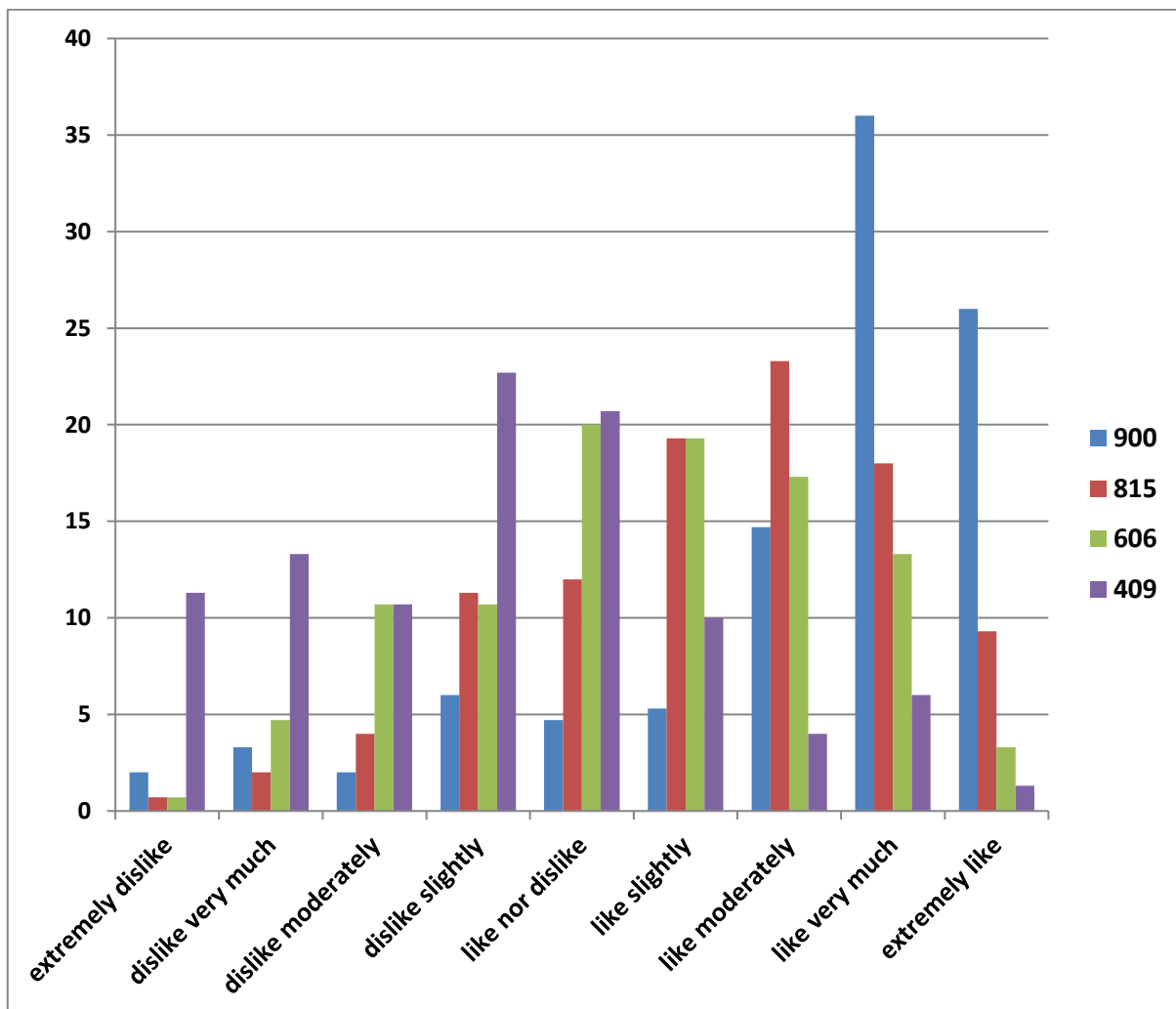


Fig. 1. Overall likings of the four *eba* samples by the consumers in Benue, Nigeria (900 = local variety: *banada*, 815 = TMS-IBA011412, 606 = TMS14F1278PP0003, 409 = TMS14F1022P0003)

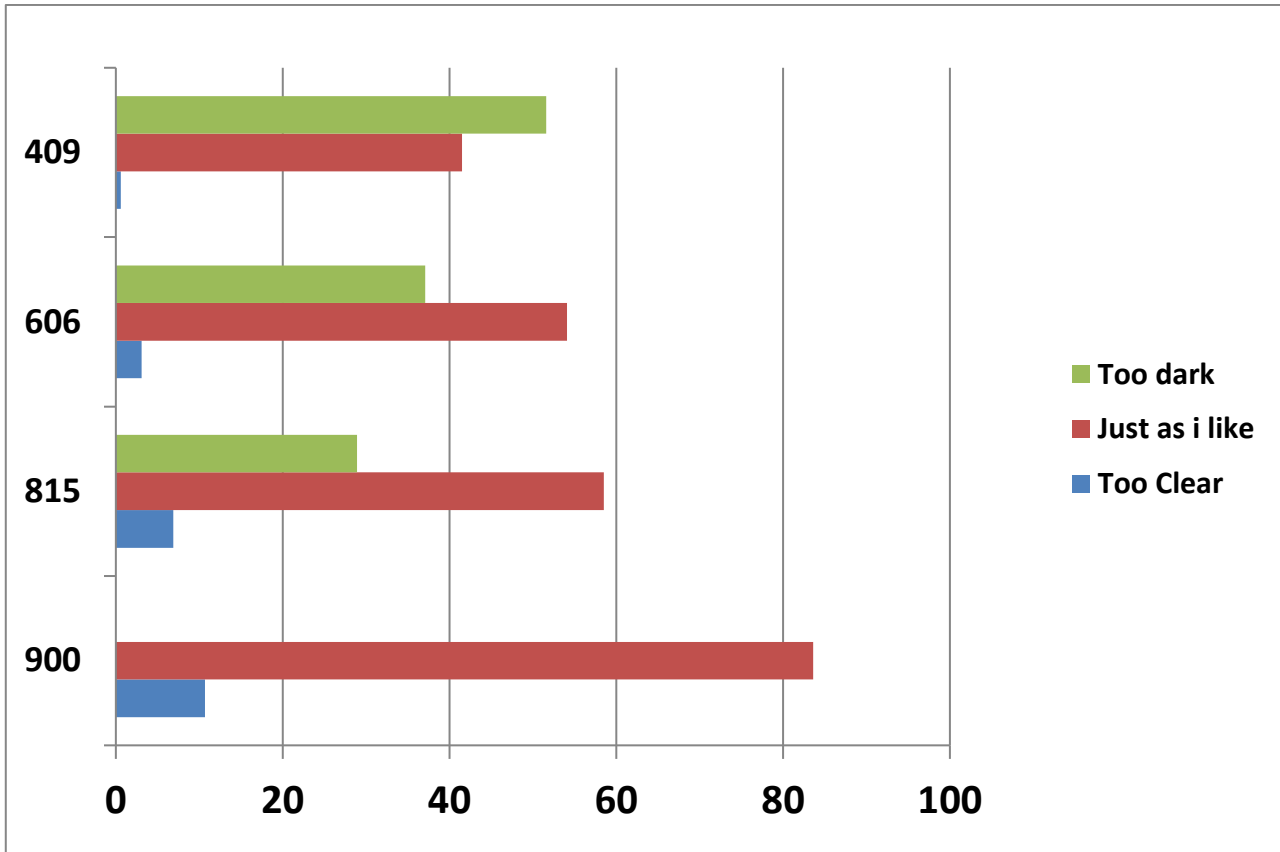


Fig. 2. Overall acceptability of the colour of the four *eba* samples in Benue using Just About Right Test (900 =local variety: *banada*, 815 = TMS-IBA011412, 606 = TMS14F1278PP0003, 409 = TMS14F1022P0003)

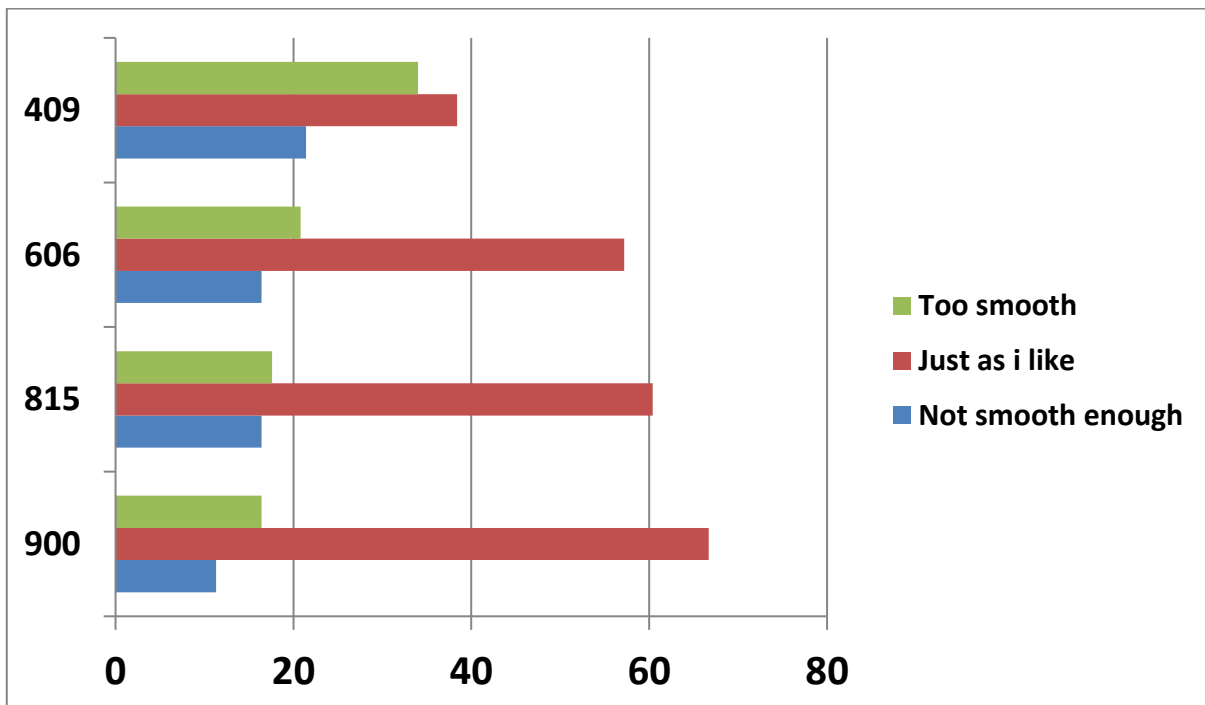


Fig. 3. Overall acceptability of the smoothness of the four *eba* samples in Benue using Just About Right Test (900 =local variety: *banada*, 815 = TMS-IBA011412, 606 = TMS14F1278PP0003, 409 = TMS14F1022P0003).

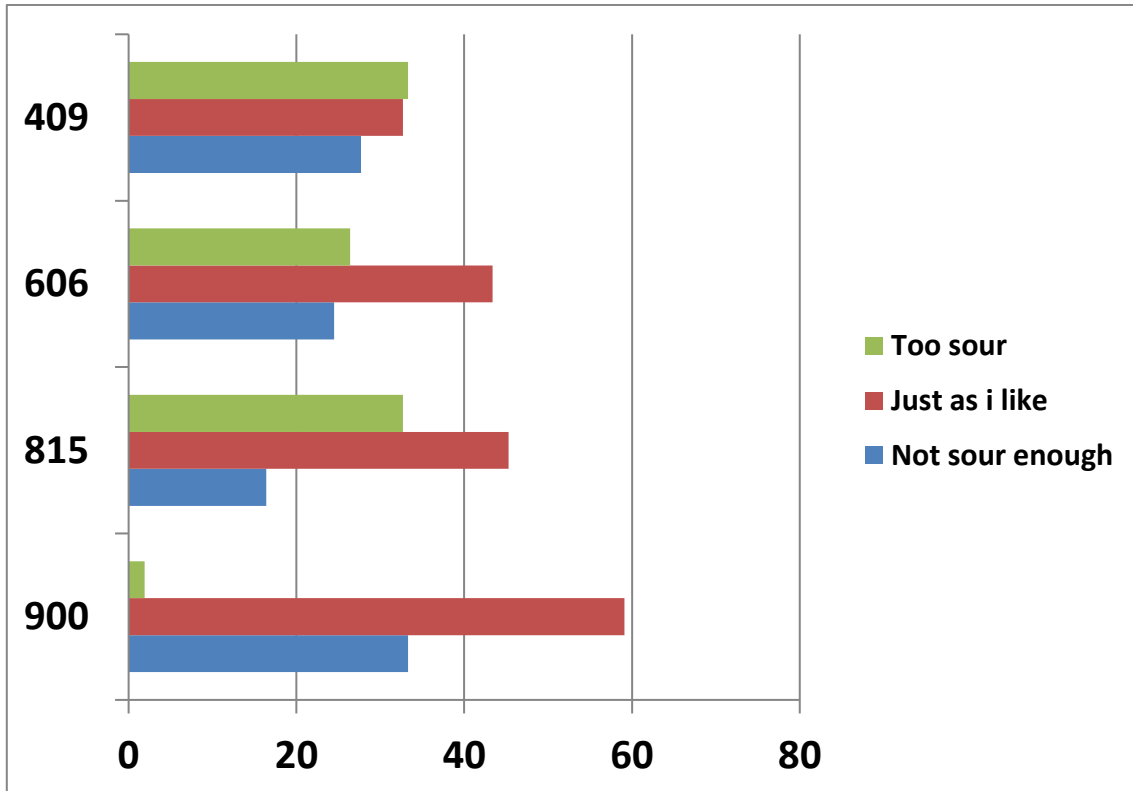


Fig. 4. Overall acceptability of the sourness of the four *eba* samples in Benue using Just About Right Test (900 =local variety: *banada*, 815 = TMS-IBA011412, 606 = TMS14F1278PP0003, 409 = TMS14F1022P0003).

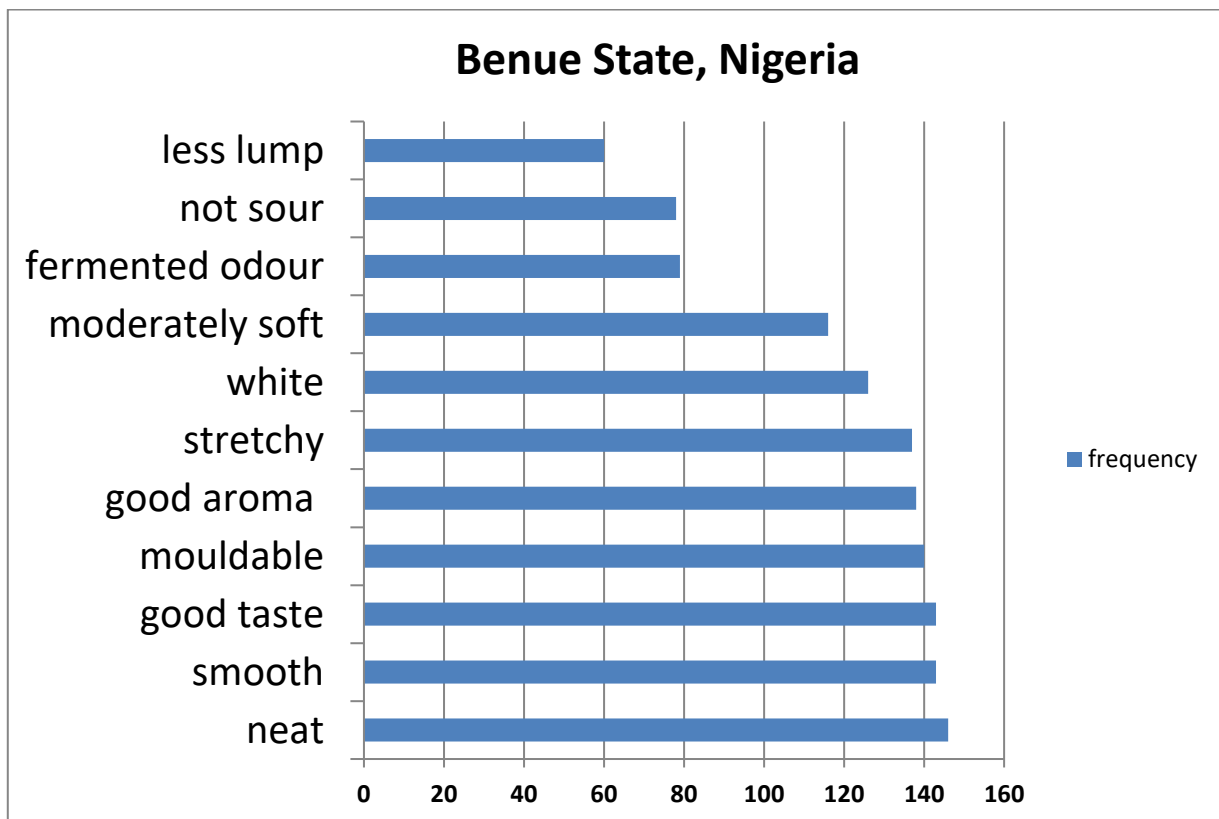


Fig. 5. Consumer testing: Frequencies of good characteristics mentioned on most preferred *ebasample*

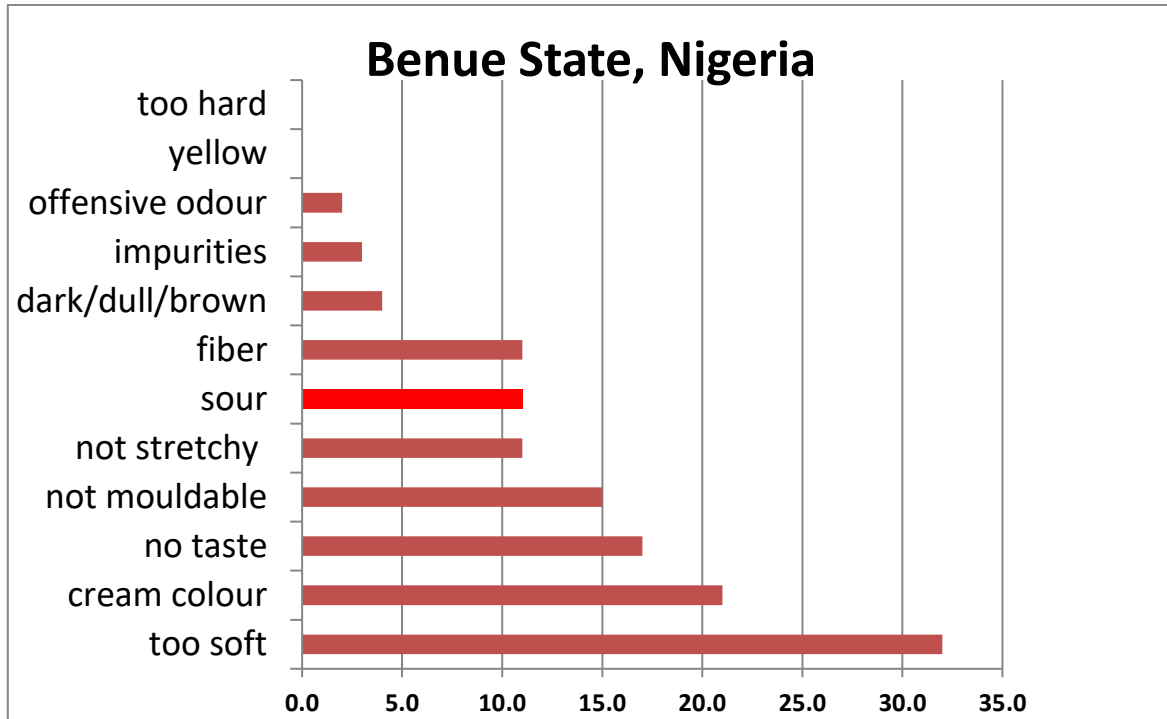


Fig. 6. Consumer testing: Frequencies of bad characteristics mentioned on most preferred *eba* sample

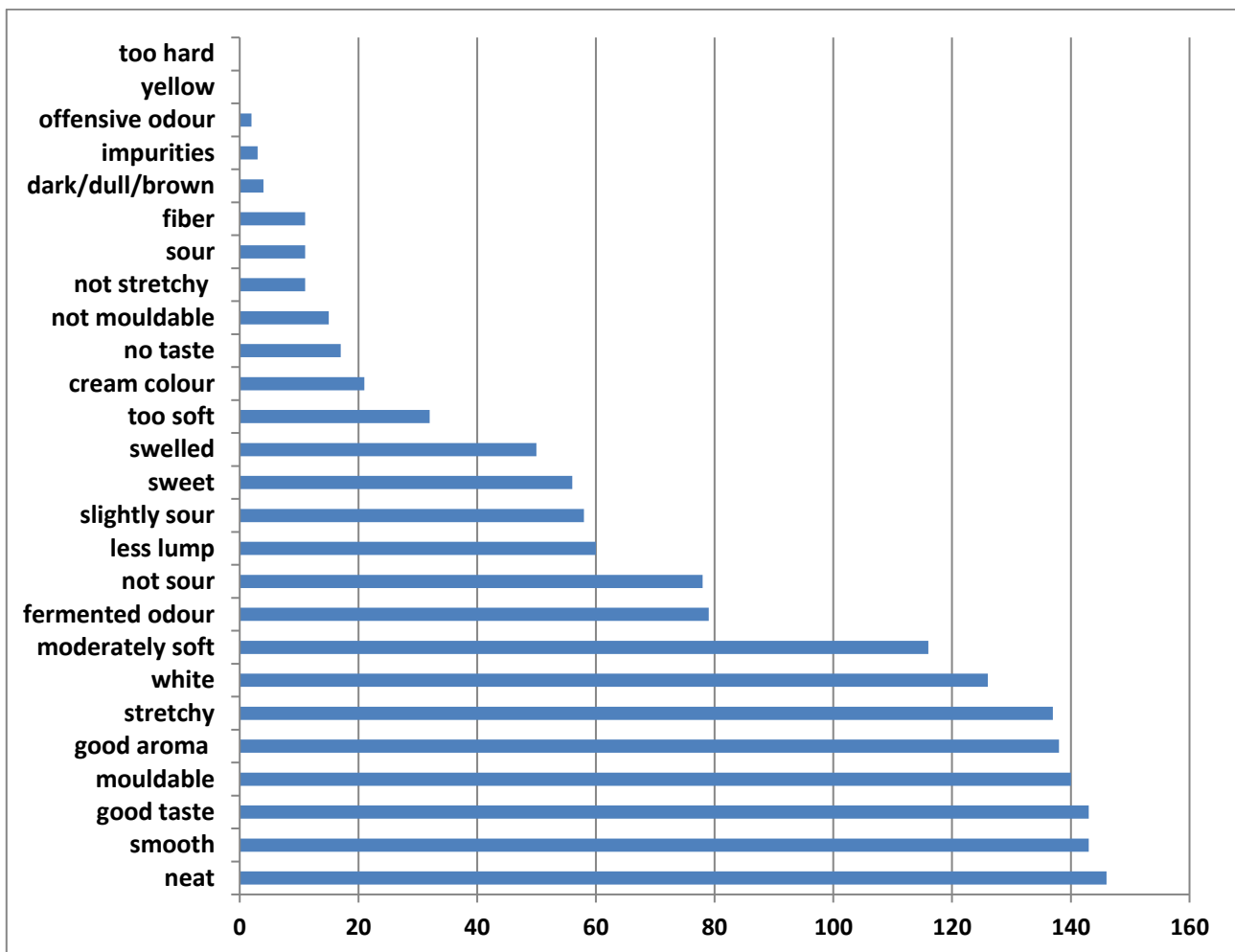


Fig. 7. List of quality Characteristics of *eba* in Benue State, Nigeria

IV. CONCLUSION

The findings from this research showed that consumers in Benue State, Nigeria preferred *eba* that is neat, smooth, has good taste, mouldable, with good aroma, stretchy, white, moderately soft with fermented odour and not sour. Benue consumers less preferred characteristics include sour *gari-eba*, too soft *ebawithno* taste, not mouldable, not stretchy, and *eba* that contain fibers, dark/dull/brown *eba*, with impurities and too hard, and *eba* that has offensive odour. This information with the in-dept characterization of chemical attributes of cassava roots will help the breeders to develop improved cassava varieties that will be acceptable by all the end-users.

Authors Contributions

Osunbade O.A: Conceptualization (equal); Writing-original draft (lead); Writing-review & editing (supporting).

Ajiboye T.S: Conceptualization (supporting); Writing-review & editing (supporting).

Adisa O.A: Conceptualization (supporting); Writing-review & editing (supporting).

Olatunji O.O: Conceptualization (supporting); Writing-review & editing (supporting).

Oyewo I.O: Conceptualization (supporting); Writing-review & editing (supporting).

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