ASSESSMENT OF QUALITY OF CASSAVA TMS 01/1371 (-UMUCASS 38) YIELD IN OKIGWE IMO STATE NIGERIA USING SENSORY INDICES

IGBOZURUIKE CHRISTOPHER IFEANYI

DEPARTMENT OF SOIL SCIENCE AND ENVIRONMENT, IMO STATE UNIVERSITY, OWERRI
email: farstdc@yahoo.com

ABSTRACT

Improved yellow cassava TMS 01/1371 (UMUCASS 38) fortified with vitamin A rapidly gained production and consumption in Okigwe LGA, consequently, a study was conducted to assess the yield quality through Proximate analysis, over quantity using parameters such as taste, aroma, texture, color and general acceptability. Mineral content, anti-nutrient levels and vitamins were also analyzed for nutrient composition and anti-nutritional content. Fresh UMUCASS 38 tubers were harvested at maturity from five (5) locations in Okigwe LGA namely: Amuro, Ihube, Nneato, Umuna and Uturu; and the collected cassava tubers processed for both proximate compositions in the laboratory and sensory evaluations using 9 man panelists. Results were significantly different between locations and the mean value ranges were: Ash (1,31-3.12), - Crude lipid (0.52% - 0.91%), Carbohydrate (30.95% - 63.65%), Energy (134.52% - 162.16%), Moisture (46.25% -62.44%), Dry matter (26.34% - 31.52%), Crude protein (0.62% - 1.64%), Crude fiber (2.51% - 3.14%), Phosphorus (21.06 - 26.05 mg/100g), calcium (12.52 -17.15 mg/100g, Potassium (231.04-258.06 mg/100g), Vitamin A (08.62-13.64). Vitamin C (15.21-20.31 mg/100g). There were significant differences in anti-nutrient compositions. A mean value of 36.88mg/kg cyanide, 6.06 Mg/100g alkaloid and 1.46 Mg/100g Tannin. The quality of the cassava samples was significantly different when compared between locations. For sample Amuro, the mean value is 40.96%, Nneato 40.32% , Uturu 37.68 % , Ihube 30.67% and for Umuna, 30.65%. The mineral values were 69.73 for Umuna; 69.79 Mg/100g for Ihube; 75.82 Mg/100g Uturu; 78.23 Mg/100g Amuro; and 78.58 Mg/100g fir Nneato respectively. General acceptability was high but were not significantly different between locations when compared and correlated with proximate composition, mineral content and anti- nutrient levels of the cassava. The farmers were advised to improve soil fertility and agronomical management practices as sensory indices alone are not an adequate tool for determining nutritional quality of crop yield. The results were discussed in line with mean values of the samples from locations.

Key words:, Cassava TMS 01/1371, Soil fertility, Soil degradation, Quality

I. INTRODUCTON

The launch of HarvestPlus in 2010 in Nigeria shifted many farmers from over reliance on native cassava variety to varieties biofortified with Vitamin A, yet high yielding. According to Omodamiro *et al*. (2011), these biofortified, climate-smart crops sustainably improve the health and livelihoods of smallholder farming households and low-income consumers because of the addiction of daily required vitamins for children, reproductive women and young adults. This global step was in line with many scientists who advocated for the quality of yield, for instance Burrell (2003) indicated the need to consume food as a preventive medicine. Eka (1998), also advised on the over -reliance on quantity of food consumed over the quality.

For food to satisfy above functions, such food should be rich in essential nutrient elements required by human body, and at the same time, free from significant levels of toxics (Onimawo and Akubor, 2005). In reference to above assertions' Ayodeji (2005) highlighted the need for improved farming pattern when he revealed that low carbohydrate levels are associated with plant type, soil nutrient composition and soil management practices during active growing time. This was supported by Paterson (2002) who posited that the deficiency of zinc for instance, to tuber crops, reduces the quality of carbohydrate in the tubers likewise nitrogen deficiency, which reduces protein content in grains (Havlin*et al*., 2006).

Okigwe local Government area are producing and consuming TMS 01/1371 (UMUCASS 38) cassava biofortified with vitamin A on a large scale prompting the evaluation of the quality of the yield of the cassava. Many individuals assesses the quality of produce by physical appraisal, taste and color, however, the quality is revealed through the analysis of produce especially when the yields involved are without distinctive color differences that separate quality of produce. The study determined the quality of yield of TMS 01/1371 (UMUCASS 38) cassava (*MANIHOT ESCULENTA* CRANTZ) grown in Okigwe LGA using Flavor and Texture profile Analysis of sensory indices.

2. MATERIALS AND METHOD

The study area

The study was conducted in Okigwe LGA area of Imo State Nigeria. The coordinates of Imo state is 5.5720° N, 7.0588° E. The new yellow cassava TMS 01/1371 were sampled from different cassava farmers field in the five (5) areas. The areas sampled were Ihube, Umuna, Amuro, Uturu and Nneato. Okigwe area are predominantly farmers but are not the major cassava production zone in Imo state like Ohaji/Egbema. However, the launch of vitamin A fortified cassava increased the production of the UMCASS 38 in the area. Cassava is an extremely adaptable crop in the area. The new varieties are also high yielding and resistant to major diseases and pests. Flour from the cassava is eaten by 95% of the population of the study area.

UMUCASS 38 GARRI

Production of UMUCASS 38 garri was done using the tubers. Matured TMS 01/1371 Cassava tubers were manually harvested from various farmers locations in the 5 areas mentioned above, bagged and transported to processing center. The roots were manually peeled with steel knife, washed and chunks (5.0-7.0cm length) produced for mash (pulp). Pulps were collected for fresh cassava proximate analysis and the cassava floor produced as showed by FAO/WHO (2003).

Chemical Analysis

Standard methods and procedure for moisture, protein, ash, crude fiber, DM, CF, CL, carbohydrate and EV content of the samples were followed and analysis done as described by Nielsen (2010). The minerals, Potassium (k) and Phosphorus (P) were determined by atomic absorption spectrophotometer (AAS). **Dried Matter** content was determined routinely as described earlier. The pulp was sun dried after filtration and kept at 10-12% moisture for making flour. After sieving, Flour was obtained after grinding the dried pulp and sieving repeated.

Sensory assessment- Flavor and Texture Profile Analysis

As described by (Ihekoronye and Ngoddy, 1985) A 9-point hedonic scale was used for the flavor and texture profile analysis (acceptability) tests of the TMS 01/1371 (UMUCASS 38) samples using 20 member panelists. Score 9 is given for a parameter extremely liked and 1 for extremely disliked. The samples were evaluated for some characteristics as color, taste, texture, aroma and general acceptability.

Data Collection and Analysis

Data from proximate analysis and descriptive analysis were compiled, analyzed and statistical significance obtained. The means for all the collected data were calculated and evaluated using descriptive statistics and procedure as described by Stone (2012).

3. RESULTS AND DISCUSSION

Proximate composition of the fresh (raw) TMS 1371 Cassava tuber

As presented in table 1, the proximate composition of the raw cassava varied significantly: Moisture contents varied accordingly and were significantly different. In samples Nneato and Uturu, the cassava moisture content was lowest when compared to other samples. This is in accordance with Eka (1998), who revealed that location, season and moisture content of the soil can significantly affect moisture and nutrient levels in soluble saps. The Dried Matter content followed same pattern and the lowest levels occurring in C and E locations (samples) respectively.

As reported by Pimentel (2015). Cassava is highly carbohydrate food low in protein and this reflected in the cassava having Crude protein low and insignificant when compared in all locations. However, Nwagbara (2008) reported that for significant protein availability, heat processing is important as it improves the digestibility of proteins by opening up of the protein helix through denaturation. Lipid content was also low and insignificant. This justifies the report that fat content of cassava root is so low and of no nutritional significance (Purseglove, 1991). Though Crude fiber were low but significantly different between sample but it does not contribute nutrients to the body, but helps in preventing many gastrointestinal diseases in man but for bowel movement (Gordon, 1999).

Cassava is widely known for its richness n starch, and Adebowale (2008). reported that the major uses of cassava is the carbohydrate which provides energy. Samples were significantly high in carbohydrate content and significantly between locations Nneato and Uturu. The levels in sample Ihube and Umuna were significantly different when compared with the rest. Ayodeji (2005) revealed that low carbohydrate levels is associated with plant type, soil nutrient composition and soil management practices during active growing time. The CHO levels reflect the Energy Value (EV). The higher the CHO, the higher the EV (Ihekoronye, 1985). Because cassava is needed for its energy stock, the overall quality (mean Quality) of the cassava showed significant difference and this is critical. It reveals the quality of the yield.

Table 1: Proximate composition of TMS 01/1371- (UMUCASS 38) Cassava

Umucass 38 Samples	MC	DM	CP	CF	CL	ASH	CHO	EV (KCAL)	Mean (quality)
	………………………………………			%	…………………………………………				
Uturu	59.37^{a}	29.28^{b}	1.24^{c}	3.14^{a}	0.71^{a}	2.61^{a}	42.15^{a}	161.83^{a}	**37.68^{b}**
Ihube	46.25^{a}	26.34^{c}	0.62^{d}	2.51^{c}	0.52^{a}	1.31^{b}	31.14^{b}	136.71^{b}	**30.67^{c}**
Amuro	62.44^{a}	31.52^{a}	1.55^{a}	3.04^{a}	0.91^{a}	3.12^{a}	63.65^{a}	161.47^{a}	**40.96^{a}**
Umuna	47.79^{a}	26.37^{c}	0.71^{d}	2.61^{c}	0.63^{a}	1.66^{b}	30.95^{b}	134.52^{b}	**30.65^{c}**
Nneato	59.63^{a}	31.41^{a}	1.64^{a}	2.73^{b}	0.84^{a}	3.05^{a}	61.15^{a}	162.16^{a}	**40.32^{a}**

Within column and row (mean quality) with same superscript are not significantly different at ($p<0.05$) when compared with each other.Key - MC (moisture content); DM (dry matter); CP (crude protein); CF (crude fibre); CL (crude lipid); CHO (carbohydrate); EV (energy valu**e).**

Mineral Composition

As showed in table 2. The mineral compositions of the cassava varied significantly and Nneato and Uturu recorded the highest overall levels when compared with other locations. As reported by Onimawo, and Akubor (2005) ash levels shows the amount of total mineral content of the food material and unless samples are processed into garri, which results in more mineral retentions. The minerals though low and different when compared between locations, but are not low when compared with established critical nutrient levels.

Table 2: Mineral content of TMS 01/1371 (UMUCASS 38) samples

Umucass 38 Samples	**Ca (quality)**	**NA**	**P**	**K**	**Mean**
	………………………………	**……Mg/100g……**		**………………**	
Amuro	17.15^{a}	14.26^{b}	25.51^{a}	256.03^{bc}	**78.23^{b}**
Ihube	13.55^{c}	13·51^{c}	21.06^{d}	231.04^{d}	**69.79^{c}**

Vitamin Composition

Table 3 showed the result of vitamins compositions. The various vitamin contents were high and significantly different between samples with the lowest vitamin levels occurring at samples Ihube and Umuna respectively. The TMS (UMUCASS) are fortified with vitamin A. This is remedying Vitamin A deficiency (VAD) in the Agro-Ecological zone, since cassava is a major source of people's diet in the area. This is about 25% of the daily recommended vitamin A intake (Wrenmedia, 2012). The high retention of Vitamin A among products may be also due to the high vitamin C content (Joshi, 2011).

Table 3. Vitamins content of FRESH TMS 01/1371 (UMUCASS 38)

Umucass 38 Samples	Vitamin B_1 (mg/100g)	Vitamin B_2 (mg/100g)	Vitamin C (mg/100g)	Vitamin A (μg/g)
Uturu	$0.34^a \pm 0.03$	$0.06^a \pm 0.04$	$15.21^d \pm 0.10$	$13.43^a \pm 0.11$
Ihube	$0.29^a \pm 0.91$	$0.05^a \pm 0.01$	$18.42^b \pm 0.10$	$09.11^b \pm 0.01$
Amuro	$0.32^a \pm 0.22$	$0.06^a \pm 0.02$	$20.28^a \pm 0.11$	$12.58^c \pm 0.01$
Umuna	0.31a± 0.04	$0.07^a \pm 0.03$	$17.65^c \pm 0.12$	$08.62^b \pm 0.01$
Nneato	$0.35^a \pm 0.02$	$0.6^a \pm 0.02$	$20.31^a \pm 0.10$	$13.64^a \pm 0.11$
STD	1	1	20	13

Within column mean with same superscript are not significantly different at ($p<0.05$) when compared with each other. STD- Standard.

Anti-nutrient Composition.

Table 4 showed Anti-Nutrient Content. There were significantly difference of cyanide content which were high especially Ihube and Umuna but low values in alkaloid and tannin observed. Cyanide is a respiratory inhibitor and can kill if high levels are consumed from unprocessed cassava (Padmaja, 2004). Samples from the result of this study, yellow cassava had low anti nutrient content and therefore should be recommended for consumption when cyanide is reduced.

Table 4. Anti-nutrient content of fresh TMS 01/1371 (UMUCASS 38)

Umucass 38 Samples	Alkaloid Mg/100g	Cyanide Mg/Kg	Tannins Mg/100g
Amuro	5.27^{b}	36.27^{b}	1.95^{c}
Umuna	6.77^{a}	37.67^{a}	1.26^{a}
Nneato	5.82^{b}	36.38^{b}	1.36^{b}
Ihube	6.90^{a}	37.61^{a}	1.52^{a}
Uturu	5.57^{b}	36.46^{b}	1.22^{c}
Mean	**6.07**	**36.88**	**1.46**

Within column mean with same superscript are not significantly different at ($p<0.05$) when compared with each other

Flavor and Texture Profile Analysis

Taste, Aroma, Color, Texture and General acceptability were slightly different between samples but not significantly different. There were differences in taste (Amuro) and color (Ihube) but were not significant at ($p<0.05$). Omodamiro*et al*. (2011). emphasize that people expect foods to be the color, taste and aroma that they are known for until significant difference occurred through spoilage. Except for rare sensitive cases, nutritional quality of food can only be known through laboratory analysis as maturity is not a full indication of quality of produce (Nwagbara and Iwe, 2008).

Table 5. Flavor and Texture Profile Analysis of TMS 01/1371 (Garri)

	Locations				
	Amuro	**Ihube**	**Nneato**	**Umuna**	**Uturu**
Taste	8.54^{a}	9.85^{a}	8.93^{a}	8.83^{a}	9.20^{a}
Aroma	6.48^{a}	6.44^{a}	6.58^{a}	6.73^{a}	6.81^{a}
Texture	7.86^{a}	7.78^{a}	7.30^{a}	7.96^{a}	7.45^{a}
color	7.79^{a}	7.32^{a}	7.40^{a}	7.81^{a}	7.72^{a}
General acceptability	9.93^{a}	9.30^{a}	9.31^{a}	8.44^{a}	9.82^{a}
Mean (quality)	**8.12**	**8.13**	**7.90**	**7.95**	**8.20**

Within row, mean(s) with same superscript are not significantly different at ($p<0.05$).

4. CONCLUSION

The improved Vitamin A fortified yellow cassava (TMS 01/ 1371) general acceptability rate were high and also tastes real good as shown by results. For economic reasons, this high acceptability levels is very important for marketability and demand as will attract more people into the business of buying and selling the product. However, as revealed by results, locations affected the quality of the cassava TMS 01/1371 yield and these were evident through proximate compositions, mineral levels and vitamin content. The method of cassava production, different soil types, fertility status of the soil and soil management practices during the active growth stages of the cassava may have contributed to the quality of yield observed. These were significantly different between locations. As revealed by processing, the GARRI appeared the same in terms of color, aroma, texture even in taste, yet they were of different nutritional qualities as indicated by the minerals concentrations and other parameters measured. Consequently, an increase in production without corresponding increase or improvement in quality of yield makes the produce less healthy and hidden hunger may occur in consumers consuming it. When quality is poor, and consumers regularly consumes such produce (product), it results to malnourishment which may be detrimental to health. As reported above, many scientists and nutritionist warned against over-reliance on quantity against quality of produce. While different processing and packaging strategies may improve taste, texture and aroma, quality of cassava produce should begin from the field, which will involve fertility and soil management practices. Comparing tables 1, 2 and 5 with all the nutritional differences, sensory test was not sensitive to the differences between them. The deficiency of zinc for instance, to tuber crops, reduces the quality of carbohydrate in the tubers. Food low in essential nutrient elements does not offer adequate nutritional need of man, or help in diseases preventions and control. The result has showed that Quantity of produce is good, but quality is better. Let food be your medicine, and medicine your food. Farmers are advised to improve soil fertility and agronomical management practices as sensory indices alone are not an adequate tool for determining nutritional quality of crop yield. The results were discussed in line with mean values of the samples from locations.

5. REFERENCES

Adebowale, A. A., Sanni, L. O., and Onitilo, M. O. (2008). Chemical Composition and pasting properties of tapioca grits from different cassava Varieties and roasting methods. African Journal of food Science. (2), pp. 77-82

Adepoju, O. T. (2010), Effect of processing methods on nutrient retention and contribution of cassava to nutrient intake of Nigerian consumers. African Journal of Food Agriculture, Nutrition and Development. ISSN : 1684-5358 EISSN : 1684-5374. Vol. 10, No. 2. Pp. 2099-2111.

Ayodeji,K. (2005) Nutrient Composition and processing effects on cassava leaf (Manihot esculenta, Crantz) antinutrients. Pakistan Journal of Nutrition; 4(1): 37-42

Eka, O.U. (1998): Root and tubers, in nutritional FAO quality of plant foods, post-harvest research unit, UNBEN, Nigeria, pp 1-30.

FAO Production. Year book. (1998). FAOSTAT data base (http://faostate.fao.org/site/339/default. espx).

FAO/WHO. Assuring Food Safety and Quality. Guidelines for Strengthening National Food Control Systems: FAO Food Nutr Pap 76; 2003.

Grundon, N.J. (1997). Hungry crops*: A guide to nutrient deficiencies in field crops*. Brisbane, Australia: Queensland Government. 246 p.

Havlin, J.L., J.D. Beaton, S.L. Tisdale, and Nelson, W.L. (2006). *Soil Fertility and Fertilizers, 6th Edition.* Upper Saddle River, N.J. Prentice-Hall, Inc. 499 p.

Ihekoronye, A. I., and Ngoddy, P. O. (1985). Tropical root and tuber crops in: Integrated food science and technology for the topics, Macmillian publishers London, UkPp 270-274.

Mochizuki Y. Texture Profile Analysis. In: Handbook of Food Analytical Chemistry. ; 2005. doi:10.1002/0471709085.ch26

Nwagbara, L. L. and Iwe, M. O. (2008), critical points in the processing of cassava tubers for ighu production. In: Nigerian food J. 26(2) : 114-124.

Nwokoro, S. O., Orheruata, A. M. and Ordiah, P.M. (2002) Replacement of maize with cassava sievates in cockerel starter diets: Effect on performance and carcass characteristics. *Tropical Animal Health and Production; 34* (2): 163-167.

Omodamiro, R., Oti, E., Etudaiye, H., Egesi, C., Olasanmi, B. and Ukpabi, U. (2011). Production of fufu from yellow cassava roots using the odorless flour technique and the traditional method: Evaluation of carotenoids retention in the fufu. Pelagia Research Library.

Onimawo, I. A. and Akubor, P.I. (2005), Food Chemistry. 1st edn, Ambik press ltd, Benin City, Edo State, Nigeria. Pp 222-223.

Stone H, Sidel JL. Sensory Evaluation Practices: Third Edition. 2004. doi:10.1016/B978-0-12-672690-9.X5000-8

Padmaja, G. (2004). The culprit in cassava toxicity; cyanogens or low protein? Cyanide Detoxification in cassava for food use and feed uses. Grit Rev. fd science Nutri: 293

Paterson, J.M. (2002). *The need for copper and zinc supplementation in Montana*. In Beef: Questions and Answers, Vol. 8, # 3. Bozeman, MT. Montana State University Extension.

Purseglove, T. W. (1991). Tropical crops: Dicotyledons; Longman scientific and technical. Co-published in the United States with Willey and sons New York.

Pimentel TC, Gomes da Cruz A, Deliza R. Sensory Evaluation: Sensory Rating and Scoring Methods. In Encyclopedia of Food and Health. 2015. doi:10.1016/B978-0-12-384947-2.00617-6
CrossRef

Rosenthal AJ. Texture profile analysis – How important are the parameters? J Texture Stud. 2010; 41: 672-684

Wrenmedia, H. (2012) Green light for yellow cassava. New Agriculturalist. New Agriculturalist-Green light for yellow cassava