

A Review On Pounded Yam In Nigeria: It's Quality And Sensory Attributes

State of Knowledge on Pounded Yam in Nigeria for RTBfoods Project

Iwo, Nigeria

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ABSTRACT

KEY FINDINGS

- Physico-chemical composition of yam tuber such as the granule morphology, pasting properties, swelling, water binding capacity of yam starch, nutrient composition such as proximate, minerals, vitamins, and anti-nutritional factors (phytates, tannins, saponins and oxalates) in the yam tuber describes the food quality in yam.
- Textural quality is an important index of yam quality.
- Textural qualities important in boiled yam are mealiness, waxiness, sogginess, stickiness and hardness.
- Textural attributes important in pounded yam are: Stretchability, smoothness, cohesiveness, moderately adhesive and moderately soft.
- Varieties of yam affected the quality and acceptability of pounded yam.
- Storage of yam tubers improve the textural quality of pounded yam
- Consumers prefer Pounded yam produced from stored yam tubers than pounded yam made from fresh yam tubers

GAPS IN KNOWLEDGE

- There is the dearth of knowledge of what farmers perceive as food quality characteristics, along with differences by gender or ethnicity. This is a gap that the RTBfoods project aims to address. According to the literature food quality to farmers is commercial profitability, that is the amount of derivable income they can get as a result of selling the particular yam variety and ability of that variety to produce the preferred yam food product.
- Farmers, processors and consumers do not have specific food quality indicators in yam tubers that can predict the quality of pounded yam, according the review of literature and key informant interviews.

1. INTRODUCTION

Yam, a staple and ceremonial crop, is intimately integrated into the socio-cultural, economic and religious customs of several West African countries, including Nigeria. Yam, *Dioscorea* (spp.), is an important source of carbohydrate for many people of the sub-Saharan region, especially in the yam zone of West Africa (Nigeria, Ghana, Togo, Benin) (Akissoe *et al.* 2003). Babaleye (2003) reported that yams contribute more than 200 dietary calories per capita daily for more than 150 million people in West Africa, and serve as an important source of income to the people. Food quality in yam tuber is important in determining the utilization and acceptability of yam's food products by farmers, processors and consumers to ensure sustainable food security (Otegbayo *et al.*, 2010). Physico-chemical composition of yam tuber such as the granule morphology, pasting properties, swelling, water binding capacity of yam starch, nutrient composition in terms of proximate, minerals, vitamins, and anti-nutritional factors (phytates, tannins, saponins and oxalates) in the yam tuber describes the food quality in yam which is directly associated to the degree of yam food product's acceptability and significance in determining its utilization (Otegbayo *et al.*, 2010).

Nigeria is the largest producer of yam in the world (FAO, 2002). And increasingly, efforts are being made to characterize the different yam landraces. In Nigeria, this is being carried out through farmers' perception of food quality in yams to provide baseline information on their food quality and end use suitability (Otegbayo *et al.*, 2010). However, there is the dearth of knowledge on end-user's attitudes, beliefs and perception about food quality in yam food products, including boiled yam, in Nigeria and West Africa generally.

2. METHODOLOGY

Literature review of previous studies relating to food quality in yam generally and also on yam food products. Key informant interviews were also conducted to supplement knowledge.

The research questions that the food science module of the State of Knowledge reports aims to address are:

1. What are the characteristics of the raw material that will give a good quality product noting differences between processing methods, regions, ethnicity etc.?
2. What are the key steps in processing and preparation that will give a good quality product noting differences between processing methods, regions, ethnicity etc.?
3. What are the known quality characteristics of the raw material associated with each stage of processing and preparation, to the final product?
4. What are the know quality characteristics of the final product?

3. QUALITY ATTRIBUTES OF YAM AND IT PRODUCTS

Yam is consumed in different forms, mainly boiled, fried, or roasted. Tubers are often dried and milled into flour for various products. Boiled yam could also be pounded and eaten with sauce. Yam can be fried or roasted as snacks. Another processed product is pottage which is usually prepared with other ingredients such as onions, pepper, a protein source, oil, and so on (Baah, 2009). Boiled yam, pounded yam and amala are the forms in which yam is mostly consumed in West Africa, especially in Nigeria and Benin (Akissoe *et al.*, 2001). The processing of yams traditionally depend on the species. Ajibola *et al.* (1988), stated that *Dioscorea alata* is usually preferred for use in preparing porridge, while *Dioscorea rotundata* is always preferred for boiled yam and pounded yam.

Boiled yam is considered an important all-time (breakfast, lunch or dinner) food product made by peeling the yam, slicing and boiling the pieces in water until the cores are soft. Boiled yam is processed by peeling,

cutting into slices and cooked in water with a bit of salt. The textural qualities important in boiled yam are mealiness, waxiness, soggy, stickiness and hardness (Otegbayo et al., 2005). Dry yam tubers/slices are processed by peeling, sometimes slicing, parboiling in hot water (at 40–60°C for 1–3 h), steeping for about a day and sun-drying which results in a product referred to as “gbodo” in the Yoruba land of Nigeria (Onayemi and Potter 1974) and when milled into flour, it is called “elubo,” which when stirred into boiling water to make a thick paste is known as “amala” usually eaten with soup (Akingbala et al. 1995; Akissoe et al. 2001).

“Pounded yam” is a glutinous dough made by peeling, boiling, pounding and kneading yam tubers. It is a very popular food product in the yam production zone of West Africa, and it is the dish of choice served to honored guests during festivals, weddings and various traditional ceremonies (Otegbayo et al., 2005). Texture is an important index of yam quality for all stakeholders (Farmers, processor, consumers). Over the years, researchers involved in comparative assessment of food quality of yam products had to rely on qualitative and quantitative sensory evaluation as a means of assessing the texture attributes of pounded yam pinpointing differences in specific characteristics such as cohesiveness, adhesiveness and springiness telling whether the sample has more or less of a given characteristic than another and to what degree (Otegbayo et al., 2005; Szczesniak et al. 1963). A consumer of pounded yam will normally want to feel the food to find out if the feel or touch is acceptable before considering the taste or aroma of the product. Hahn et al. (1987) reported that in pounded yam, hand feel is more important than mouth-feel, and Ayernor (1976) also explained that a defect in the perceived texture of the food would have an extremely negative impact on the consumer’s hedonic responses to the product. Wilkinson et al. (2001) stated that texture determines the identity of the food product and is often cited as a reason for liking or not liking a food and an indicator of food quality. Report from Otegbayo et al, (2012) and Akissoe et al., (2009), showed that storage of yam tubers can affect the food quality of yam food products. It was reported that pounded yam made from stored yam tubers were more stretchable, deformable, not sticky/adhesive compared to that made from fresh yam tubers which was described as not very stretchable, rigid, sticky or adhesive. Boiled yam were described as sweeter.

4. STUDIES ON POUNDED YAM

Below are the various reported studies on boiled and pounded yam ranging from the physicochemical studies to its nutritional composition and sensory attributes, quality/ characteristic indicators of pounded yam as well as the processing and consumption of pounded yam.

S/N	Author & Title	Location	Study Design/methodology	Findings
to	Otegbayo et al., 2010 Perception of food quality in yams among some Nigerian farmers	Nigeria	Survey was carried out at two major yam producing communities in Nigeria: FCT, Abuja representing transition between forest and savannah ecological zones. Focus Group Discussion method and key informants interview were used to collect focused and consistent qualitative information on farmer’s attitudes, beliefs and perception about food quality in yams. 40 respondents participated in the FGDs in the two study areas and they were mainly male farmers and marketers.	Farmers do not have definite food quality indicators in the yam tubers that can determine or predict the quality of the product. They perceive food quality in terms of the commercial value, sustainable derivable income from cultivating a particular variety/ species and suitability of yam for its best food product (pounded yam).

S/N	Author & Title	Location	Study Design/methodology	Findings
2.	Obidiegwu and Akpabio (2017) The geography of yam cultivation in Southern Nigeria: Exploring its social meanings and cultural functions.	Nigeria	A comparative approach and utilized in-depth, semi-structured interviews, local narratives, and our experiential background to understand the similarities and differences in the local notions of yam and their impacts on the general societal structure across three ethnic regions in southeastern Nigeria.	Yam still represents an important food crop, much more than other crops, for the people in southeastern Nigeria, while the processes of its cultivation and ownership throw much insight on issues of shared ancestry and cultural tradition. The ethnological study of traditional concepts and practices relating to yam cultivation will add to the understanding of the historical development of production systems while serving as a guide towards future development.
3.	Otegbayo <i>et al.</i> , 2005 Microstructure of boiled yam (<i>Dioscorea</i> Spp.) and its implication for assessment of textural quality	Nigeria	The effects of boiling on the microstructure of yams and their association with the textural quality of boiled yam , were studied using six varieties with variable cooking qualities from each of the two species, <i>Dioscorea alata</i> L. and <i>D. rotundata</i> Poir. Histological studies were conducted on both raw and boiled yam tissues to examine the cell wall, cell shape and arrangement of starch granules in the cell.	The microstructure of the boiled yam samples in both yam species showed the characteristic loss of structural integrity with cellular disorganization. Those that were mealy showed clear loss of the typical reticular microscopic structure with cell wall distension and complete cell separation at the middle lamella while in the waxy varieties, the microstructure showed no cell separation and some cells were still partly attached to each other instead of separating while some tended to round off towards spherical shapes but remained partly attached to each other.
4.	Adeola <i>et al.</i> , 2012 Preliminary Studies on the Development and Evaluation of Instant Pounded Yam from <i>Dioscorea alata</i>	Nigeria	The study investigated the potential of developing and evaluating the suitability of <i>Dioscorea alata</i> in the production of instant poundo yam blanched at 5min and 10 min.	Blanching of <i>Dioscorea alata</i> at 70°C for 10 min ensured adequate enzyme inactivation, and prevented excessive softening and loss of flavour in instant poundo yam. It also resulted in instant poundo yam of higher sensory qualities than that produced from blanching at 70°C for 5 min. It compared fairly well with the reference sample produced from <i>D. rotundata</i> .

S/N	Author & Title	Location	Study Design/methodology	Findings
5.	Adepoju <i>et al.</i> , 2018 Effects of processing methods on nutrient and anti-nutrient composition of yellow yam (<i>Dioscorea cayenensis</i>) products	Nigeria	The study determined the nutrient composition of raw yellow yam and effects of processing methods on nutrient and anti-nutrient content of some of its products (Raw yam, Roasted yam, Fried yam, Boiled yam , Porridge, Pounded yam with ordinary water, Pounded yam with cooking water, Ojojo, and Amala).	The percent apparent nutrient retention in Roasted yam had the highest level of retention for most of the nutrients followed by boiled yam Pounded yam with the cooking water retained more nutrients compared with pounded yam with ordinary water while Amala had the lowest nutrient retention among all samples. The levels of anti-nutrients present in the products were very negligible, and are unlikely to constitute any hindrance to utilization or bioavailability of the nutrients.
6.	Adeyeye and Oluwatola, 2014 Quality Assessment and Acceptability of Pounded Yam from Different Varieties of Yam	Nigeria	Pounded yam was produced from four yam varieties, <i>Dioscorea esculenta</i> (TDE 170), (TDR 179), <i>Dioscorea cayenensis</i> (TDC 760), and <i>Dioscorea alata</i> (OMD 840 and a traditional protocol for the production of pounded yam was simulated in the laboratory. Samples of the pounded yam produced were analyzed for yield, lump quantity, proximate composition, flavour and textural acceptability.	Observations suggested that varieties affected the quality and acceptability of pounded yam. <i>Dioscorea esculenta</i> (TDE 170) which is less known in Nigeria produced the most acceptable and preferred pounded yam sample.
7.	Otegbayo <i>et al.</i> , 2005 Sensory texture profiling and development of standard rating scales for pounded yam	Nigeria	The study evaluated sensory texture profile analysis (STPA) as an objective method for characterizing the texture attributes of "pounded yam," prepared from six varieties of <i>Dioscorea rotundata</i> and six of <i>Dioscorea alata</i> obtained from the International Institute of Tropical Agriculture (IITA): <i>D. rotundata</i> : TDr 99-12, TDr 93-79, TDr 131, TDr 93-31, TDr 96/02229 and TDr 99-9; and <i>D. alata</i> : TDa 291, TDa 297, TDa 95/00328, TDa 92-2, TDa 85/00250 and TDa 93-36.	It was reported that the dominant textural parameters for pounded yam were identified as cohesiveness, adhesiveness, stretchability, smoothness and hardness. Pounded yam samples from <i>D. rotundata</i> were mostly cohesive, slightly adhesive, stretchable (except TDr 131), smooth and moderately soft, while those from <i>D. alata</i> were not cohesive, adhesive, not stretchable, lumpy and very soft. The STPA also showed that not all the pounded yam samples made from <i>D. rotundata</i> had good texture attributes and the <i>D. rotundata</i> varieties that produced pounded yam with good texture attributes were TDr 93-31, TDr 99-9 and TDr 99-12.

S/N	Author & Title	Location	Study Design/methodology	Findings
8.	Ezeocha <i>et al.</i> , (2015). Evaluation of the Chemical, Functional and Sensory Properties of Pre-release White Yam (<i>Dioscorea rotundata</i>) Genotypes in Umudike, Southeast, Nigeria.	Nigeria	Tubers from ten genotypes of white yam: 99/Amo/03, 99/Amo/XA, 99/Amo/080, 99/Amo/109, 99/Amo/064, 99/Amo/060, 99/Amo/010, 99/Amo/95A, 99/Amo/056 and 99/Amo/144) and two local checks (Adaka and Ameh) obtained from the yam programme experimental field of National Root Crops Research Institute, Umudike were used for this study. Sensory evaluation was conducted on the boiled and pounded yam samples from the different genotypes.	Most of the yam genotypes produced pounded yam of acceptable quality. However, the genotypes 99/Amo/144 and 99/Amo/109 were the most preferred for the preparation of pounded yam while the genotypes 99/Amo/060, 99/Amo/95A and 99/Amo/056 were the least preferred for pounded yam production.
9.	Maziya-Dixon <i>et al.</i> , (2017) Retention of iron and zinc in yam flour and boiled yam processed from white yam (<i>D. rotundata</i>) varieties	Nigeria	Fifteen landrace varieties of <i>D. rotundata</i> from the IITA yam breeding program collection were used in this study for investigating the impact of processing on retention of iron and zinc after processing the fresh tubers into boiled yam and yam flour.	The amount of iron and zinc retained in boiled yam positively correlated with the amount in raw samples, $r = .80$ and $r = .90$, respectively. A similar positive and strong correlation was observed in yam flour, $r = .82$ and $r = .69$ for iron and zinc, respectively. This suggests that yam varieties containing higher amounts of iron and zinc are likely to retain more in their products.
10.	Olaoye, and Oyewole, 2012. Optimization of some “poundo” yam production parameters.	Nigeria	The study was carried out to determine the optimum drying and blanching parameters of “poundo” yam in order to proffer solution to the problem of energy consumption during its preparation. The “poundo” yam produced from white yam (<i>Dioscorea rotunda</i>) using an experimental dryer was evaluated for the effect of drying temperature and blanching parameters on the nutritional quality.	Optimum retention of the nutrition quality parameters in “poundo” yam production from white yam (<i>Dioscorea rotunda</i>), yam was suggested to be best when blanched at 100°C for a period of 10 minutes and dried at 65°C.
11.	Otegbayo <i>et al.</i> , (2012) Effects of storage on the chemical composition and food quality of yam	Nigeria	The effects of storage (4 months) on the chemical composition of yam tubers and its relation to textural quality of a major yam food product (pounded yam) were studied using six varieties of <i>Dioscorea rotundata</i> and <i>D. alata</i> .	Storage influenced the textural quality of pounded yam made from <i>D. rotundata</i> more than that from <i>D. alata</i> . The higher proportion of lignin, coupled with higher starch content in <i>D. rotundata</i> , may be partly responsible for the formation of firm dough (preferred pounded yam) rather than a soft paste (poor-quality pounded yam) in <i>D. alata</i> in which they are in a smaller proportion.

S/N	Author & Title	Location	Study Design/methodology	Findings
12.	Baah <i>et al.</i> , (2009). Physicochemical and pasting characterisation of water yam (<i>Dioscorea</i> spp.) and relationship with eating quality of pounded yam	Nigeria	Fifteen varieties of <i>D. alata</i> and one control from <i>D. rotundata</i> were obtained from experimental plots of the yam breeding program at IITA, Ibadan, for this study to determine the physicochemical and pasting characteristics of <i>D. alata</i> tubers and also evaluate their relationships with the eating qualities of pounded yam.	This study showed that pounded yam prepared from <i>D. alata</i> varieties on the average is rated poor to that prepared from the control, <i>D. rotundata</i> , using multiple comparison sensory test. All the textural attributes: smoothness, consistency, elasticity and stickiness except hardness, were comparably poor relative to the control.
13.	Otegbayo <i>et al.</i> , (2007) Texture profile analysis applied to pounded yam	Nigeria	Pounded yam samples were prepared from fresh and stored (4 months) yam tubers from six varieties (three from <i>D. alata</i> and three from <i>D. rotundata</i>) selected at random. These were used for sensory and instrumental texture profile analysis.	Pounded yam samples from fresh <i>D. rotundata</i> were described as cohesive, moderately hard but stiff (rigid), stretchable, less deformable and smooth, while those from stored tubers were described as smooth, cohesive, moderately soft but firm, deformable and more stretchable than those from fresh tubers.
14.	Ezeocha <i>et al.</i> , (2014) Evaluation of the physico-chemical properties of twelve <i>D. rotundata</i> land races grown in south-east agro-ecology	Nigeria	This study was aimed at characterizing twelve land races of <i>D. rotundata</i> tubers: Ameh, Ekpe, Okpani, Jiaga, Adaka, Nwokpoko, Miyango, Gwari, Alosi, Hembakwase, Giwa and Dan Jaling) in terms of their physicochemical properties and textural quality of pounded yams made from them	The amylose content of the <i>D. rotundata</i> landraces ranged from 14.56 (for <i>Hembakwase</i>) to 32.72% (for <i>Okpani</i>). Pounded yam produced from most of the land races were liked by the panelists except <i>Okpani</i> , <i>Dan Jaling</i> and <i>Giwa</i> . <i>Hembakwase</i> had the highest rating for all the parameters. <i>Dan Jaling</i> ranked the lowest in smoothness while <i>Okpani</i> was rated the lowest in elasticity, mouldability and general acceptability.

5. CONCLUSION

From this state of knowledge review, textural quality is an important index of yam food quality to farmers, consumers and processors. Various studies have reported that a consumer of pounded yam will normally want to feel the food to find out if the feel or touch is acceptable before considering the taste or aroma of the product. Textural qualities important in boiled yam are mealiness, waxiness, sogginess, stickiness and hardness. Pounded yam of good textural quality were described as smooth, stretchable, cohesive, moderately adhesive and moderately soft, when it fulfils this description it is then farmers believe it has good food quality. It was also found out that consumers prefer food products; boiled and pounded yam from stored yam tubers than from fresh yam tubers.

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