

Farmers' Indigenous Knowledge of Breadfruits' Nutritional, Medicinal, and Fodder Values in Southeast Nigeria

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ABSTRACT

*This study investigated farmers' indigenous knowledge gap of Traditional breadfruit (*Treculia africana*) nutritional, medicinal, and utilization values in Southeast Nigeria. Data for the study were collected via a structured questionnaire administered to 260 farmers from 13 communities in the Anambra and Enugu States of Southeast Nigeria. Data collected were analyzed using descriptive statistics such as percentage, mean, and standard deviation. The result inter alia reveals that: a majority of the farmers (89.2%) have indigenous knowledge of breadfruit seeds as very good nutritional and medicinal food items, and farmers use the seeds' after-cook residues as beverage drinks. The general tendency is greater use of the seeds as against other body parts of the tree. The factors limiting farmers' consumption of breadfruit in the study area include lack of finance (55.1%) and its processing drudgeries (10.2%). The study concludes that while some breadfruit body parts are used as food, feeds, and medicine, its other parts are highly underutilized and under-researched. The paper recommends policy intervention for the crop's increased research and production for food security and development of different important industrial sectors such as beverage drinks, animal feeds, and pharmaceutical industries.*

Keywords: Breadfruit, indigenous knowledge, food, industries, policy

INTRODUCTION

Many crop species and tree species are through indigenous knowledge known and used inside their native lands. Nigerian crops and diets have been studied from different perspectives such as in medicine, public health, and biology [1]. In different parts of the world, people are noted to access different values from tree species and such values include food, medicine, snacks, and symbols of love [2]. There is little sociological research on what Nigerian diets includes, how diets differ in population groups and sub groups, and how to crop's values and uses change or evolve over time among consumers [3].

Hunger, poverty, and malnutrition problems in vulnerable countries are revealed to be attracting the attention of international institutions and humanitarian agencies [4]. Such agencies include the United Nations World Food Programme (WFP) and the Food and Agricultural Organization (FAO). This is why the United Nations Organization (UNO) is reported to have made it a crucial target issue in its sustainable

development goals (SDGs) to be realized by 2030. According to [5], reports gotten so far from various countries are not encouraging, suggesting that the hunger, poverty, and malnutrition problems may not be solved in those vulnerable countries as targeted. There is, therefore every need to increase efforts for addressing the problems which were reported to worsen in developing countries due to the increased unemployment situations, low-calorie consumption, lack of attention to food diversity, and climate change problems [6]. Africa's efforts to address the problems are reported to be suboptimal and inadequate irrespective of her 2003 signing of the Maputo Declaration on Agriculture and Security and adequate (52%) available arable land [7]. In consideration of the above, there is a need to research further on multipurpose and nutritious food crops and tree species to find out how they can be used to improve calorie consumption and decrease malnutrition.

This is important because consumption of staple foods in middle-low income countries favors high-energy, high-fat, and high-sugar processed foods [8]. Such food items in the study area include yam, cassava, rice and maize. This suggests that more nutritious food items are neglected and underutilized and that there is a need to change consumption patterns and move towards increased consumption of more meat or animal products and nutritious food crops that are available in different agricultural areas and lands. But there is the need to understand: how such traditional food crops or animal species are used, and why some of them are underutilized even in their native lands where the people may have adequate indigenous knowledge of their socio-economic, nutritional, and medicinal values. How their values can be added may be known through the ways farmers or native people use them.

This idea is striking for Nigeria as Africa's most populous country because she is noted to: rank 98th out of 107 countries on the world's 2020 Global Hunger index, second rank among countries with stunted children, and her high estimated number of people (41% - 87 million) who live below international poverty line [9]. In addition, consumption research in Nigeria is found to be inadequate and they concentrated on purchasing power, nutrient deficiency, overweight or obesity, and household diversity [10]. [11] reported that the current food system is not sustainable and

contributes to the climate crisis.

In the study area, [12] argued that the uses and potential values of breadfruit position it as a good crop species for farmers to use in building resilience and adaptation to climate stress. African Breadfruit referred is further revealed to be the crop that is first remembered when considering all the food crops of nutritional importance with market potentials, and cultural values [13]. The crop has nostalgia connections and this may be why it is demanded by African consumers in different parts of the world as noted by [14]. The Breadfruit referred here is *Treculi africana* which is a native of South-eastern Nigeria that can be found as forest trees in some tropical African countries such as Cameroun, Ghana, and Sudan. It is a member of the plant classification family Moraceae and of the genus *Treculia* [15]. It is one of the important tree crops in traditional agroforestry systems of Southeast Nigeria where it is integrated into a mixed cropping system with other tree crops such as oil palm, pear, and coconuts and also with food crops such as yam, coco-yam, plantain, and bananas. The seed is an important traditional staple food of South Eastern Nigeria where it is popularly called "Ukwa" [16].

A series of studies have been conducted on breadfruit. Such studies reveal that the seed contains 12% oil; 18% protein and 50% carbohydrate and several important vitamins and minerals such as potassium (K), magnesium (Mg), and zinc (Zn) [17]. It is reported that little or no research has been conducted on the crop's sociology of production [18], and the production process is known to end at the consumers' level. Studies also reveal that breadfruit can be used to produce several by-products [19].

The problem is that the aspects of the breadfruit tree parts that are used and those underutilized have not been clearly distinguished. The result may give insight to researchers and industrial operators on the potential areas of research and value addition to the crop. The other problem is that farmers in the study area have not been adequately segregated in various ways as they relate with breadfruit and such areas include indigenous knowledge of the crop, season and off-season consumption of the crop, and in other ways they differ on the crop's utilizations. Understanding of these issues may provide information on the other areas of the crop needing further research and on factors contributing to its limited production, consumption, and utilization.

In consideration of the above, the following pertinent research questions are raised: How do consumers differ in their breadfruit season and off-season consumption? Why do consumers not increase breadfruit consumption in the study area? Do farmers differ in their minds while consuming breadfruit as nutritious and medicinal food? Are there differences among farmers in their utilization of breadfruit tree parts as medicine and fodder? Stratify farmers according to their use of breadfruit body parts as medicine and fodder. The broad objective of the study is to examine farmers' indigenous knowledge of breadfruit use values in Southeast Nigeria. The specific objectives are to: Assess farmers' differences in their breadfruit season and off-season consumption. Identify the reasons for low breadfruit consumption in the study area. Understand farmers' indigenous knowledge of breadfruit as a nutritious and medicinal food item. Assess farmers' indigenous knowledge of breadfruit body parts' herbal uses. Identify the parts of breadfruit trees that are still under-researched and underutilized. Stratify farmers according to their use of breadfruit in ruminant animal feeding.

syndrome individuals which indicates that there various genes on the X chromosome alone that are associated with ASD phenotypes expression. Since there is only one X chromosome in male, any mutations in the X chromosome will affect all the cells while females will require more mutations to show ASD symptoms [11]. SHANK 3, TSC1 and TSC2 are other genes which are involved with autism.

MATERIALS AND METHODS

2.1 Study Area

The study was done in the Anambra and Enugu states of the Southeast Nigerian political Zone. The zone is located within latitude 4°47'1 N and 7°7'1 N and longitude 7°54'1 E and 8°27'1 E. Southeast Nigeria is in the tropical rainforest region of Nigeria. It comprises these five states: Abia, Anambra, Enugu, Ebonyi and Imo states. Anambra and Enugu States were purposively selected for the study because breadfruit is one of their major home garden and farm field food security tree crops. Anambra State situated between latitude 5°38'1 N to 6°47'1 N and longitude 6°36'1 to 7°21'1. It shares boundary with Enugu State in the east, River Niger and Delta State in the west, Kogi State in the North and Imo State in the South. Anambra State is subdivided into four agricultural zones and 21 Local Government Areas (LGA). Enugu State situates between latitudes 5°56'1 North and 7°06'1 North and longitude 6°53'1 and 7°55'1 East. The State is bounded: in the east by Ebonyi State, in the West by Anambra State, in the North by Benue and Kogi States and in the South by Abia and Imo States [19]. The State is subdivided into 17 LGAs. Thirteen communities selected from ten LGAs of the two states were utilized for the study. The town communities and the LGAs are presented in Table 1. The LGAs and the communities were purposively selected because Agricultural Development Programme (ADP) staff who assisted the researcher considered them suitable. In addition, Igbariam which is one of the study communities was purposively selected because it contains farmers from different areas of Anambra and from other states of Southeast Nigeria. This is because it contains the remains of the farm settlement established in the 1960s by the Eastern Nigerian regional government headed by Michael I. Okpala.

2.2 Data Collection

A pre-tested questionnaire was used for the study's data collection. The questionnaire *inter alia* contained questions on farmers': season and off-season consumption of breadfruit, weekly, fortnightly, and monthly consumption of breadfruit, reasons why farmers do not consume more breadfruit, farmers' mind on breadfruit consumption, kind of drink farmers serve while consuming breadfruit and medicinal uses of the different body parts of breadfruit. The questionnaire was also used to access farmers' ownership of ruminant animals and their utilization of the crop for feeding of their ruminant animals.

Twenty (20) respondents selected purposively from two communities were used for the pre-test. Experience gained from the pre-test helped in the modifications of some of the questions in the research questionnaire and this added value to the study's validity and reliability. The questionnaire was used to collect information on: the frequency of breadfruit consumption during its season and off-season, why farmers do not consume more breadfruit as they do to other food items, farmers' mind while consuming breadfruit, the kind of drink

served during consumption of the crop, medicinal uses of the crop ruminant ownership of the farmers and their fodder uses of breadfruit parts.

2.3 Sampling Method

In sample selection for the survey, a well-designed questionnaire involving multi-stage purposive sampling techniques adopted in the selection of respondents for the study. Three stages were involved. In the first stage, five (5) local government areas (LGAs) were selected from the two study states (Anambra and Enugu States). In the second stage, one (1) town community was selected from each of the LGAs except Nsukka and Anambra LGAs where two (2) and three (3) town communities were respectively selected. The LGAs and the communities were purposively selected because of their prominence in the production and marketing of breadfruit seeds in the assembly markets of the communities. Two communities were selected from Nsukka LGA because of the aforesaid reason. Moreover, Nsukka LGA is a model one which may be a better representative of the other LGAs in the state because it has one of the biggest breadfruit seeds markets in the LGAs selected from Enugu State. The following communities listed in Table 1 were purposively sampled from Enugu State: Udi, Obinofia Ndiuno, Nguru, Edem Ani, Umuozzi and Orba. For four major reasons, three communities were selected from Anambra East LGA. First, the LGA contains important agricultural towns and village communities. Second, the Igbariam farm settlement of the 1960s set up by the Eastern Nigerian government is in the LGA and improved breadfruit trees were found to have been adopted in the farms of the settlers. Third, two of the important agricultural products markets respectively called Eke Otuocha and Oye-farm are some of the LGA's notable landmarks. Fourth, there is the need to study one of the many riverside town communities of the LGA for a better understanding of their breadfruit production and marketing situation. The same purposive sampling process was adopted in the selection of the Anambra State communities alphabetically listed in Table 1: Amawbia, Umunachi, Oko, Ukpok, Igbariam, Nando and Aguleri. In the third stage, 20 farmers selected via a simple random sampling process from each of the 13 communities drawn from the 10 LGAs of the two states were interviewed using the pretested questionnaire and trained enumerators. This gave a grand total of 260 respondents to the survey.

2.4 Data Analysis

The data collected were interpreted and summarized as they affect the objectives of the objectives. Objectives 1 to 4 were analyzed using basic descriptive statistics such as frequency distribution, percentages, mean, standard deviation, and Tables.

3. RESULT AND DISCUSSION

3.1 Breadfruit Consumption

Table 2 shows that 29.8% of the respondents consume breadfruit once a month in its fruiting seasons while 41.7% do not consume it out of season. Table 2 also shows that in season, 26.3% consume the seed once a week while 21.9% consume it twice a week. Also, out-of-season consumption of breadfruit is 2.9% a week and twice a week, 5.9% every two weeks, 7.2% twice a month, 39.1% once a month. Another striking result of the study is that while none of the farmers are none breadfruit consumers during its fruiting season, a large proportion of

them do not consume the crop during its off-seasons. The result suggests that breadfruit consumption in the study area is irregular and varies from one household to another in its seasons and off seasons. An in-depth interviewee reported that the seeds are available in the markets during the off seasons, but sold at very high prices which poor people cannot afford to spend just to feed or their family in a meal.

The result suggests that: all farmers consume breadfruit during its fruiting season, its consumption is respectively limited to once a month (29.88%), once a week (26.29%), and twice a week (21.91%), and that consumption of the crop tends to increase from zero during the seasons to a large proportion (41.70%) during its off-seasons. The result implies that seasonality and the high price of the seeds are the significant factors affecting increased consumption of the crop. The result is in agreement with [20] who reported that the crop's seed is in constant demand, but scarce most times. The result further agrees with Enibe (2017) who found that the seed is sold in assembly markets at an average price of N438.00 per Kg and N1, 500.00 Per Kg during its high price seasons such as December and January months. The result supports [21] who concluded that household demand for breadfruit's diverse usages constitutes useful grounds for the crop's planting expansion.

Table 2: Frequency of breadfruit consumption in and out of season (n=251; 235)

Variable	Frequency	% of total	Mean	SD
On season Breadfruit consumption			41.43	28.44
Once per week	66	26.29		
Twice per week	55	21.91		
Once per Fortnight	31	12.35		
Twice a Month	24	9.56		
Once a Month	75	29.88		
Non-Breadfruit consumer	0	0		
Total	251	100		
Out of Season Breadfruit Consumption			39.17	432.47
Once per week	7	2.98		
Twice per week	7	2.98		
Once per Fortnight	14	5.96		
Twice a Month	17	7.23		
Once a Month	92	39.15		
Non-Breadfruit consumer	98	41.70		
Total	235	100		

3.2. Reasons for not consuming more breadfruit

Table 3 shows that the majority (55.1%) of the respondents were limited from consuming more breadfruit by finance, a significant proportion of the respondents (28.9%) could not consume more of it because they preferred to generate income with it while 10.2% of them were limited from consuming more of it due to the drudgeries involved in its processing. The result suggests that the three major factors which limit the majority of the respondents from consuming more breadfruit were respectively: lack of finance, desire to use it for income generation, and the drudgeries in its processing. The implication of the result is that: breadfruit is an important food security and income generating crop whose consumption is mostly limited by lack of finance, farmers receive its high price signal which should have induced them for increased planting of the trees, processing technologies on the crop will add values that will increase its production, consumption and utilization potentials.

The result supports reports of researchers on the crop who found that breadfruit has: wide acceptance as a staple food crop in Nigeria and overseas (Omobuwajo, 1999b; Nwabueze et al 2008; become a very high-income earner (Nuga and Ofodile, 2010), emerged to be a cash crop, and is the most costly food

seed item sold in South Eastern Nigeria (Enibe, 2007). The result is in agreement with Enibe (2019) who in a study of farmers' improved breadfruit awareness and adoption status recommended that adequate policy decisions should be taken for the exploitation of its comparative production, processing, and marketing advantages. The result supports Ohajianya and Osuafor (2017) who concluded that household demand for breadfruit's diverse usages constitutes useful grounds for the crop's planting expansion. The result also agrees with Enibe (2019) who recommended that awareness creation should be made by agricultural development agencies on breadfruit and its technologies made available to farmers and investors at affordable costs. In addition, Chukwuone and Okeke (2012) reported that increasing demand for Breadfruit has made it the highest income earner to rural dwellers when compared to other non-wood forest products (NWFPs) of savannah and rainforest regions of Southern Nigeria.

Table 3: Reasons for not consuming more breadfruit (n=176)

Variable	Frequency	% of total	Mean	SD
Reasons For not consuming more BF			25.14	26.40
Lack of Finance	97	55.11		
Prefer to Sell it to get money	51	28.98		
Drudgeries in its processing	18	10.23		
Long cook time of breadfruit	5	2.84		
Hate of breadfruit taste	1	0.57		
Preference for other food items	4	2.27		
Total	176	100		

Source: Field Survey, 2014.

3.3. Farmers' mind on breadfruit consumption, meal serving combination and medicinal uses:

Table 4 shows that 52.2% of the respondents were served a breadfruit meal with drinking water while 47.8% were served the meal along with its residues as a beverage drink. Table 4 also shows that 89.2% of the respondents have nutrition and medicinal food in their minds when consuming breadfruit meals. On the other hand, Table 4 shows that 70.5% of the respondents do not traditionally use breadfruit or its body parts as medicine. The result suggests that: farmers in the study area have indigenous knowledge of breadfruit as a nutritional and medicinal food item, a significant proportion of the farmers consume breadfruit residues as beverage drinks indicating that it has the potential to be used for the production of beverage drinks which can be widely accepted by consumers in the study area and beyond.

The result also suggests that aspects of breadfruit body parts are most likely to be medicinally underutilized and that lack of adequate knowledge of the medicinal values of breadfruit could be a significant factor influencing planting more of the crop's trees. Hence standard deviation (73.54) and mean (127) in Table 4 suggest that there is a significant difference between the number of respondents that use the crop medicinally and those that were not using it. This implies that many inhabitants of the study area were yet to have adequate medicinal knowledge of the crop.

This result is in agreement with the finding of [23] who in their study of the efficacy of *Treculia africana* in the nutritional rehabilitation of children with protein-energy malnutrition reported that the crop among others is still neglected due to inadequate knowledge of their nutritional values. Also, the result agreed with the work of [24] who reported that the decision of households to have trees in their homestead farms was influenced by knowledge of the economic and environmental values of the trees. The result also suggests that

breadfruit could be good raw material in pharmaceutical and brew or beverage industries for the production of drugs and beverage drinks of an acceptable standard. This is mainly because the crop has been severally reported to contain important vitamins and mineral elements and because farmers have indigenous knowledge of its high nutrient composition and hence have been employing it as a beverage drink in the crop's meals.

The result is in conformity with existing literature on the crop because several researchers reported that breadfruit contains many important vitamins and mineral elements. In support of high nutrient composition of breadfruit [25] reported that "The seeds have an excellent polyvalent dietetic value whose biological value exceeds even that of soybeans". Indeed, *Treculia africana* is reported a rich source of oil (12%), protein (18%), and carbohydrate (50%) in addition to very many other minerals and vitamins (Omobuwajo et al 1999a; Lawal, 1986). *Treculia africana* oil is found to be of comparable quality to that of groundnut, sunflower or palm kernel [26-27] reported that "Proximate analysis shows that the seeds of *Treculia africana* contain protein, fat, iron, ash, calcium, phosphorus, carbon, hydrogen, magnesium, iron, crude fiber, carbohydrate, and other minerals including zinc, lead, copper, phytate, oxalate and tannin".

Table 4: Farmers' mind on breadfruit consumption, meal serving combination and medicinal uses (n=245; 249; 254)

Variable	Frequency	% of total	Mean	SD
Breadfruit serving meal Drink			81.67	90.94
Poor Man's food	6	2.41		
Breadfruit and drinking water	128	52.24		
Breadfruit meal, its residues and water	117	47.76		
Total	245	100		
Farmer's Mind on breadfruit consumption			62.25	106.56
Nutritional and medicinal food	222	89.16		
One of those food items	14	5.62		
Food taken when other foods items such as Rice, beans and cassava are not available	7	2.81		
Total	249	100		
Breadfruit medicinal uses			127	73.54
Yes	75	29.53		
No	179	70.47		
Total	254	100		

3.4. Farmers ruminant animals' ownership and fodder uses of breadfruit body parts

Table 5 shows that 61.5% of the respondents were owners of ruminant animals while 38.5% of them were not owners. Also, Table 5 shows that 79% of the ruminants' owners feed their animals mainly with breadfruit leaves and pulps (44.9%). The result suggests that the majority of the ruminants' owners in the study area (79%) use breadfruit leaves and pulps in feeding their ruminant animals. The result also reveals that ownership of ruminant animals could be one of the factors encouraging rather than discouraging planting more of breadfruit trees in both home gardens and in farm fields. The result further reveals that there is no significant difference between the uses of any of those breadfruit body parts by farmers in feeding their ruminant animals. The implication of the result is that while breadfruit leaves and pulps appears to be the most important breadfruit body parts which farmers feed to their ruminant animals any of the pulps, leaves and seeds are good fodder and could be harnessed as feed supplement for the ruminant animals or employed as raw materials in ruminant animals' feed industries.

The result of a negligible proportion of the farmers (1.87%) feeding their farm animals with breadfruit seeds is

understandable because studies reveal that it is the seeds of the crop that are used by consumers for food and snacks. This is unlike *Artocarpus* utilise whose pulp is also consumed fresh by a man just as the ruminant animals do to the pulps of *Treculia africana*. The result about farmers' combined use of breadfruits' seeds, leaves and pulps is also understandable because observation reveals that farmers collect the leaves and immature breadfruit heads which contain both immature seeds and pulps and feed their ruminants after breaking the heads. The result is in conformity with [12] who in their study reported that "*Treculia africana* could be harnessed as feed supplements for ruminant animals"

Table 5: Ruminants ownership and fodder uses of readfruits' body parts (n=244; 167; 107)

Variable	Frequency	± of total	Mean	SD
2 μ ≠ 0P / A O / E ≤ 000			566	7 ³ . ⁰ 4
9 * ≥	590	661.48		
. 0	38	7 ² .96		
4 0P"	688	544		
" < ° § § μ ≥ ° ≥ ° μ ≥ § * ≤			2 7.9	0 ² .9 ³
9 * ≥	576	1 ³ .04		
. 0	79	64. ³ 0		
4 0P"	5 ⁰ 1	544		
0 ° ≤ ° 0 μ ≥ ° μ ≥ § ° ≥ ° μ ≥ § * ≤			5 ¹ .27	5 ² .4 ²
3 * § ≥	6	5. ² 1		
. ° 0 * ≥	67	65.50		
0 μ ∞	3	2.85		
. ° 0 * ≥ ° AS 0 μ ∞	8 ²	88.86		
3 * § ≥ W * ° 0 * ≥ ° AS 0 μ ∞	69	67.7 ⁰		
4 0P"	54 ¹	544		

Source: Field Survey, 2014.

Summary and Conclusion

The study found that: farmers in the study had indigenous knowledge of breadfruit as a nutritive and medicinal crop, breadfruit is a costly food item preferred in the study area than other crops such as rice, beans, and maize, and breadfruit consumption is limited by lack of finance, farmers desire to generate income from the seeds and there are drudgeries in its processing; breadfruit has numerous potentials and could be raw material in different industries such as food, feed, beverage drinks, and pharmaceutical industries.

The study concluded that breadfruit is an important, but underutilized food, a medicinal and industrial crop whose increased production is desirable for food security and the development of various industries.

Recommendation

Based on the findings of the study the researcher recommends that:

1. Increased breadfruit research and planting by farmers should be encouraged by industries, governments, non-governmental organizations, and international agencies in agriculture.
2. Food, feeds, snacks, beverages, and pharmaceutical industries should innovate and produce new products with breadfruit body parts.
3. Proximate analysis of other body parts of breadfruit trees for determination of their in-depth medicinal properties should be done by various industries and researchers.

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