academicJournals

Vol. 8(11), pp. 984-994, 28 March, 2013
DOI: 10.5897/AJAR12.1837
ISSN 1991-637X ©2013 Academic Journals
http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Processing and preservation of African bread fruit (*Treculia africana*) by women in Enugu North agricultural zone, Enugu State, Nigeria

C. S. Ugwu and J. C. Iwuchukwu*

Department of Agricultural Extension, University of Nigeria Nsukka, Enugu State, Nigeria.

Accepted 11 March, 2013

The study examined methods used in processing and preservation of African bread fruit by women in Enugu North Agricultural Zone of Enugu State, Nigeria. A total of seventy two women were used for the study. Frequency, percentage and mean score were used for data analysis. Majority of the respondents engaged in processing and preservation of African bread fruit as their primary occupation and earned monthly income of ₦9,876 (about 61 US Dollars) on average. They engaged in these activities for mainly family consumption and their mean years of experience in the business was 31 years. Fermentation method of 7 to 14 days duration was the extraction method used by the respondents while the seeds were threshed with grinding or milling machine. Sun drying and keeping in bottle/air tight container without preservative was preservation method of choice. Water scarcity was a major problem encountered in processing while bad weather condition was a major problem encountered in preservation of African bread fruit. The study points out the need to encourage women to use good/modern methods of processing and preservation so as to get high quality seeds of African breadfruit that will attract more demand and income.

Key words: Processing, preservation, African breadfruit, rural women.

INTRODUCTION

Agriculture sector of a developing economy performs the primary role of provision of food to nourish the populace (Njoku, 2000). In Nigeria, agriculture employs about two-third of the total labour force, contributes 42.2% of the Gross Domestic Product (GDP) and provides 88% of non-oil earnings (World Bank, 2005). Crops contribute immensely to agricultural GDP. Apart from its contribution to the agricultural GDP, they are important to humans for it is a part in the food chain.

Some plants/crops resources have been widely exploited and used as food crops, while others, mainly the tree crops of which *Treculia Africana* (African breadfruit) is an important member have been under exploited and still harvested from the wild. The seed of african bread fruit (*T. Africana*) is variously named by different/ethnic tribes across the continent (Africa). In Nigeria, it is known as “ukwa” by the Igbo and the Yoruba refer to it as “bere – foo-foo” or “afou”, “ediang” by Efik and Ibibio, “ize” by Bini and “bafafuta” by Hausa (Baiyeri and Mbah, 2006). It is referred to as “mwaya” in Swahili, “muzinda” by Lugadan and “brebretim” by Wolof (Enibe, 2006). It is widely cultivated in the southern states of Nigeria where it serves as low cost meat substitute for poor families (Badifu and Akubor, 2001).

*Corresponding author. E-mail: julieiwuchukwu@yahoo.com.

According to Baiyeri and Mbah (2006), African breadfruit is an important natural resource for the poor, contributing significantly to their income and dietary intake. Hence African breadfruit does not only help to ensure food security by meeting the protein need of people but also provides income to rural poor households that produce, process and/or preserve this crop**.** The plant produces large, usually round compound fruit covered with rough pointed outgrowths. The seeds are buried in spongy pulp of the fruit (Keay, 1989; Osuji and Owei, 2010). The seeds are variously cooked as porridge alone or mixed with other food stuff such as sorghum (Onweluzo and Nnamuchi, 2009) or roasted and sold with palm kernel (*Elaeis guineensis*) as a roadside snack. The flour has high potential usage for pastries (Onyekwelu and Fayose, 2007). The seeds are highly nutritious and constitute a cheap source of vitamins, minerals, proteins, carbohydrates and fats (Osuji and Owei, 2010). Proximate analysis shows that the seed contain 17 to 23% crude protein, 11% crude fat and other essential vitamins and minerals (Akubor et al., 2000). The seeds are used in preparing pudding and as a thickener in weaning food for children (Onyekwelu and Fayose, 2007). As a tree crop, there is significant carbon sequestration benefit. It is expected that local sustainability will be bolstered by the increased food security that breadfruit stands to provide in the face of climate change (Pacific Agribusiness Research for Development Initiatives, 2011). Breadfruit is an important staple crop and makes substantive contributions to food security especially in rural communities. In countries like Nigeria, they serve as nutritious feed for livestock. In Malawi, blue monkey are very fond of the fruits and extract the seeds for food while in Tanzania the leaves are used as fodder (Enibe, 2006).

National survey in Nigeria showed that 40% of all household surveyed in all zones across the country and in all sectors were food insecure (Maziya-Bixon et al., 2004). There are classes of essential nutrients which must be combined in appropriate portion to ensure an adequate food intake. These include: Carbohydrate, proteins, fats and oil, vitamins and minerals (Mohammed, 2003). Therefore to achieve the goal of promoting good health, a cheap source of protein remains an ultimate step (FAO, 2002). African breadfruit serves as a cheap source of protein to the rural poor who cannot afford the luxury of buying meat or other sources of animal proteins. Also an attempt to achieve food security by increasing output requires a corresponding increase in processing and preservation of the food in order to avoid food losses.

Enugu North Agricultural Zone of Enugu State Nigeria has a favourable climate (low relative humidity, annual rainfall of 1680 to 1700 mm) for agriculture especially crop farming. Despite the socio-economic importance of African breadfruits in meeting the protein need as well as generation of income to a large population of the country, they are mainly found around homestead in the area as wild and protected crops. As a result of this and other factors, demand for the crop has not been met. Processing and preservation of the crop become inevitable in order to increase its consumption among rural households especially during off-season. The ultimate goal of processing, however, is to preserve the nutrients in order to make them available to the consumers and to remove or reduce the levels of phytochemicals which interfere with nutrient digestion and absorption (Hassan et al., 2005). Processing and preservation help to supply wholesome, safe and nutritious food throughout the year for the maintenance of health as well as generation of income for the producers.

Poor processing and preservation leads to high post harvest losses. For example boiling and drying significantly reduced the selenium and iodine content of breadfruit seeds (Ijeh et al., 2010). They may also cause total loss of the seeds, imparts undesirable properties to the processed seeds such as offensive odour, variation in colour and in duration of cooking. These variation and undesirable qualities affect the nutritional and economic value of the crop and may not allow its preservation and storage for a long time. While minimally processed pulp has the appearance, texture, and taste of fresh breadfruit (Ragone, 2011).

In view of the aforementioned facts, the study sets out to characterize women involved in processing and preservation of African bread fruit in the area, identify methods used by them in processing and preservation of African breadfruit, ascertain reasons, sources of information and seeds they processed and preserved as well as problems they encountered in processing and preservation of African bread fruit.

METHODOLOGY

The study was carried out in Enugu North Agricultural Zone of Enugu State, Nigeria. The zone is located at the northern part of Enugu State and it is made up of eight blocks.

All women involved in processing and preservation of African bread fruit in the zone constituted the population for the study. Out of the 8 blocks in the zone, Nsukka 1 and 2 were purposively selected because of high level of involvement of the women in the area in processing and preservation of African bread fruit. Out of the eight cells in each of the blocks, three cells were randomly selected from each of the blocks giving a total of six cells. Twelve women who were involved in processing and preservation of African bread fruit were purposively selected from each of the cells making a total of seventy-two (72) respondents for the study.

Data were collected in July and August 2010 through the use of interview schedule. This was administered by the researcher and a research assistant to the respondents. Some of the variables contained in the instrument were: Marital status, level of education, primary occupation, reasons and frequency of processing and preservation of African breadfruit, sources of seed and information as well as processing and preservation methods used by these women in processing and preservation of African breadfruit. Respondents were requested to state their age in years, household size, years of experience in processing and preservation of African bread fruit, and their monthly income which were later classified/grouped.

Data on problems encountered in processing and preservation of

Table 1. Percentage distribution of the respondents base on their socio-economic characteristics.

Socio economic characteristic	Frequency	Percentage	Mean
Age (years)			
21-40	28	38.9	
41-60	36	50.0	47
61-80	7	9.7	
Above 80	1	1.4	
Marital status			
Married	45	62.5	
Widowed	22	30.6	
Divorced	4	5.5	
Single	1	1.4	
Household size			
1-5 persons	25	34.7	
6-10 persons	40	55.6	8
11-15 persons	7	9.7	
Level of education			
no formal education	24	33.4	
Primary education	20	27.8	
Secondary education	14	19.4	
Tertiary education	14	19.4	
Primary occupation			
Farming/processing of agricultural product	45	62.5	
Trading	21	29.2	
Artisan	4	5.5	
Civil service	2	2.8	
Monthly income (₦)			
1,001 - 10, 000 (6-62 US Dollars)	42	58.4	
10,001 - 20, 000 (63-125 US Dollars)	18	25.0	9,876 (61.7 Us Dollars)
>20,000 (125 US Dollars)	12	16.6	

Africa breadfruit were collected using a four point Likert type scale of 'not at, all'(0), 'occasionally' (1), 'often '(2) and 'very often' (3), with a mean of 1.5. Any variable with a mean equal or greater than 1.5 was regarded as a major problem, any variable with a mean less than 1.5 but greater than 1 was regarded as a minor problem while any variable with a mean equal or less than 1 was regarded as no problem to processing and preservation of African breadfruit. Some of the problems considered under processing were: Water scarcity, labourious nature of processing activities, bad odour and others. Bad weather condition, extra energy required in cooking preserved seeds, undesirable taste of preserved seeds, and others were problems considered under preservation. Data for the study were analysed using percentage and mean score. The statistical package for the social sciences (SPSS) version 16.0 was soft ware used for analysis.

FINDINGS AND DISCUSSION

Socio-economic characteristics of respondents

Data in Table 1 show that half (50%) of the respondents were within the age range of 41 to 60 years while 38.9% of them were between 21 and 40 years. The mean age was 47 years. This indicates that the respondents were in their middle age hence may be energetic to undertake task involved in processing and preservation of African breadfruit which according to Etoamaihe and Ndubueze, (2010) are labourious, time consuming and unhygienic in nature.

Majority (62.5%) of the respondents was married while 30.6% of them were widowed (Table 1). About 56% of the respondents had household size of 6 to 10 persons, 34.7% of them had household size of 1 to 5 persons while the mean house hold size was 8 persons (Table 1). This relatively large household size may be advantageous because they are likely to provide family labour for agricultural activities especially processing and preservation of African breadfruit.

Table 1 also shows that greater percentage (33.4%) of the respondents had no formal education while 27.8% of them had only primary education. This finding points at

Table 2. Percentage distribution of respondents based on processing and preservation characteristics of African bread fruit.

Factors in processing/preservation	Frequency	Percentage	Mean
Years of experience (years)			
1 - 10	14	19.4	
11 - 20	35	48.6	
21 - 30	10	13.9	31
31 - 40	11	15.3	
41 - 50	1	1.4	
51 - 60	1	1.4	
Reason for processing and preserving			
Income generation	35	48.6	
Family consumption	37	51.4	
Sources of seed			
Purchased	20	27.8	
Received as gift	19	26.4	
From own farm	33	45.8	
Frequency of processing and preservation			
Daily	1	1.4	
Twice a week	30	41.7	
Monthly	29	40.3	
As the need arises	12	16.6	
Sources of information			
Neighbor	30	41.7	
Friends	24	33.3	
Parents	11	15.3	
Extension agent	0	0	
Self	7	9.7	

the poor literacy level of respondents which is common in many rural communities especially among women. Thus, it hampers their socioeconomic status and accessibility to agricultural innovation irrespective of their enormous contribution to agriculture. It is also evident in Table 1 that majority (62.5%) of the respondents engaged in farming/processing of agricultural products as their primary occupation while 29.2% of them engaged in trading as their primary occupation. The table further reveals that greater proportion (58.4%) of the respondents had monthly income of ₦1,001 to ₦10, 000 (about 6 to 62 US Dollars) only, 25% of them had between ₦10,001 and ₦20,000 (about 63 to 125 US Dollars) as their monthly income while their mean monthly income was ₦9,876 (about 62 US Dollars).

This finding shows that these women are low income earners. Child bearing and caring as well as engagement of women in domestic works at home in developing countries might be a factor limiting the interest and deployment of women in activities that will earn them high income. In line with this, United Nations (1989) observed that female workers invariably predominate when production work involves mostly unskilled or semi skilled jobs and relatively low wages.

Processing and preservation characteristics of African breadfruit

Years of experience

Entries in Table 2 show that 48.6% of the respondents had 11 to 20 years of experience while 15% of them had 31 to 40 years of experience in processing and preservation of Africa breadfruit. The mean years of experience were 31 years. The many years of experience implies that processing and preservation of the crop is not new in the study area and that the women are well experienced in the tasks. Experience is the first determinant of profitability (Yusuf, 2000) and perfection.

Reasons for processing and preservation of African bread fruit

The respondents indicated that their reasons for

engaging in processing and preservation of African breadfruit were: Family consumption (51.4%) and income generation (48.6%) (Table 2). This finding corroborates with Baiyeri and Mbah (2006) who noted that African bread fruit is an important natural resource for the rural poor households, contributing significantly to their income and dietary intake.

Sources of African breadfruit processed and preserved

Table 2 also indicates that 45.8% of the respondents sourced the African breadfruit from their own farm, 27.8% of them purchased while 26.4% of them received the one they processed and preserved as gift. Also greater proportion (41.7%) of the respondents processed and preserved African breadfruit twice a week, 40.3% processed and preserved on monthly basis while only about 1% of the respondents processed and preserved African bread fruit on daily basis. Since processing and preservation of African bread fruit were done for mainly family consumption and the fruits were gotten mainly from the farms of respondents, it is unlikely that the processing and preservation of this crop will be done often or on daily basis.

Sources of information on processing and preservation of African bread fruit

Table 2 further shows that respondents' sources of information on processing and preservation of African bread fruit were: Neighbors (41.7%), friends (33.3%), parents (15.3%) and self (9.7%). This means that there were no major sources of information on processing and preservation of African bread fruit. The few that existed were informal/interpersonal; hence, the knowledge generated is likely to be local or indigenous and may not be reliable. In view of this, the respondents may not keep pace with the modern or the scientific methods of processing and preservation of agricultural products especially African breadfruit when they rely solely on these information sources.

Methods used in processing African breadfruit

Extraction method

Table 3 reveals that majority (79.1%) of the respondents extracted African bread fruit using fermentation method while only 13.9% practiced fresh extraction method. Among these respondents that used fermentation method, 59.7% allowed a fermentation period of 7 to 14 days, 40.3% of them allowed 15 to 21 days, 6.5% allowed 6 to 7 days while only 1.6% allowed more than a month fermentation period before they extracted the seeds (Table 3). In contrast with this finding, Ragone (2011) observed that fruits of breadfruit quickly ripen in just 1 to 3 days after harvest.

Reasons for using fermentation method

Table 3 also reveals that the reasons given by the respondents for using fermentation method were: It makes seeds easy to wash (54.8%), no reason (25.8%) and it reduces water requirement (9.7%). Reason given by the respondents for using fresh extraction method was that breadfruit seeds produced using the method gives better quality seeds (100%). This may be because of the cleanliness of the seeds produced through fresh extraction since the fruit did not undergo decaying or fermentation process. However, fermentation method has been known as a valuable preservation method because it does not only create more palatable food from less than desirable ingredients but produce vitamins through micro organism responsible for fermentation (FAO, 2002).

Table 3 further indicates that majority (80.5%) used clean water in washing their seeds, 11.1% used any available water, while 4.2% each accounted for respondents that washed their seeds with water from fermented cassava and water got from ground after rain. In as much as majority of the respondents used clean water in washing their seeds, it is important to note that for health reason, using dirty water as indicated by some of the respondents in washing the seeds after extraction or fermentation is not ideal as this predisposes consumers to diseases.

Parboiling of African breadfruit

In Table 4, greater percentage (50.0%) of the respondents indicated that they parboiled African bread fruit seeds for 10 min, while 40.3% parboiled them for 15 min after washing or before threshing. Also majority (97.2%) of the respondent did not add alum while only 2.8% added alum when parboiling the seeds. Reasons given by the respondents for not adding alum were: They dislike addition of alum (52.9%), it prolongs cooking time (22.8%), it changes the real taste (15.7%), and changes the colour (8.6%) (Table 4). These findings tend to contradict the fact that local producers claim that addition of alum into water used for parboiling breadfruit seeds increases the keeping quality of the product by extending the storage period and by leaving the cotyledons intact without breaking, thereby enhancing the appeal (Ihediohamma, 2009).

It is also obvious in Table 4 that the effects of parboiling on the seeds as indicated by the respondents were: Easy dehulling (65.3%) and prevention of the breakage of the cotyledons (30.7%). According to Nwabueze (2009) huge losses are encountered in most mechanical or traditional dehulling of parboiled African breadfruit seeds when the

Table 3. Percentage distribution of respondents based on extraction methods used in processing Africa bread fruit.

Methods	Frequency	Mean
Extraction processing methods		
Fresh extraction	10	13.9
Fermentation	57	79.1
Both methods	5	7.0
Duration of fermentation (n=62)		
6 - 7 days after cutting	4	6.5
7 - 14 days after cutting	37	59.7
15 - 21 days after cutting	25	40.3
More than a months	1	1.6
When to carryout fresh extraction (n=15)		
Immediately after cutting	13	86.7
2 days after cutting	2	13.3
Reasons for using fermentation method (n=62)		
Production of better quality of seeds	4	6.5
It requires less water	6	9.7
Makes washing of seed easy	34	54.8
Convenience	2	3.2
No reason	16	25.8
Reasons for using fresh extraction method (n=15)		
Quality of seed produced is better	15	100.0
Sources of water used for washing seeds		
Clean water	58	80.5
Water from fermented cassava	3	4.2
Any available water	8	11.1
Water got from ground after rain	3	4.2

Table 4. Percentage distribution of respondents based on parboiling and threshing methods.

Parboiling and threshing methods	Frequency	Percentage
Duration of parboiling (Min)		
5	6	8.3
10	36	50.0
15	29	40.3
No specific time	1	1.4
Addition of alum during parboiling		
Number that added alum	2	2.8
Number that did not add alum	70	97.2
Reasons for not adding alum (n = 70)		
It prolongs cooking time	16	22.8
It changes the colour	6	8.6
It affects the real taste	11	15.7
Dislike putting it	37	52.9

Table 4. Contd.

Threshing methods		
Manual (threshing on hard board/concrete floor)	11	15.3
Mechanical (using grinding/milling machine)	31	45.0
Both methods	30	41.7
Separating seeds from the hull		
Hand picking method (on hardboard/concrete floor/flat-broad plate)	2	2.8
Winnowing method (using flat-broad plate)	1	1.4
Both methods	69	95.8
Effect of parboiling		
Easy dehulling	47	65.3
Prevents breakage of the cotyledon	25	30.7

seeds are either over or under parboiled because of poor processing conditions. This points out the inefficiency of current methods of processing used by these women which may not afford them control over the temperature in which these seeds are parboiled.

Threshing of African breadfruit

After parboiling the seed, threshing is done to remove the hulls from the seeds before separating them. Greater proportions 43.0 and 41.7% of the respondents in their respective order threshed African bread fruit seeds with mechanical (using grinding/milling machine) and manual (threshing on a hard board, concrete floor using bottle, mortar) (Table 4). In Table 4 also, majority (95.8%) of the respondents separated seeds from the hulls by both hand picking (on hard board, concrete floor or flat-broad plate) and winnowing methods (using mainly flat-broad plates). The respondents might have combined these methods to ensure thorough and easy removal of the hull from the seeds.

Methods used in preservation of African breadfruit

Table 5 shows that greater percentage (45.8%) of the respondents preserved Africa breadfruit after processing by sun drying and keeping it in bottle/air tight container; 34.7% of them sun dried and kept in basin, 13.9% sun dried and kept in bag while only 4.2% sun dried and spread in open floor/mat. Also majority (88.9%) of the respondents asserted that the best duration of drying is when the seeds are completely dried while 11.1% asserted that it is when the seeds are moderately dried (Table 5). These findings are in line with what is found in rural communities especially in developing countries like Nigeria where preservation of agricultural products are done through traditional method of sun drying. Grains, legumes like African breadfruit are foodstuff that are preserved and stored using the technique FAO (2002). Also, rural women may have resorted to sun-drying because it is economical in the sense that they incur little or no cost in using this preservation method.

Table 5 also reveals that majority (99.6%) of the respondents did not use preservative in preserving African breadfruit. Some of the reasons given by them for not using these preservatives were: Preservatives are not necessary/needed (71.8%), preservative impart undesirable characteristic on the seeds (14.1%) while another 14.1% could not adduce any reason for not adding preservative (Table 5). This may mean that only few of the respondents could give tangible reason for not using preservatives. Thus, pointing at the ignorance of these rural women even in some of the technologies/practices they adopt. This may be attributed to their poor literacy level (Table 1) which will invariably affect their activities, output and income.

Effects of preservation (drying)

The effects of preservation (drying) on African breadfruit seeds as indicated by the respondents were: It makes it last longer (82.0%), makes it easy to cook (8.3%), and reduces its attack by insects/rodents and other micro-organisms (8.3%) (Table 5). In Table 5 also, it can be inferred that the life span of well preserved seeds was 3 to 7 months as indicated by majority (68%) of the respondents. Usually, processing and preservation of agricultural products like African bread fruits are done locally in rural households of developing countries like Nigeria without any preservative thereby making the preserved food to last for a limited time. In as much as these local/indigenous methods of processing and preservation of African breadfruit have disadvantages, there are positive attributes inherent from them due to the fact that food processed using these methods do not pre dispose consumers to diseases like cancer, heart problems, arthritis etc.

Table 5. Percentage distribution of the respondents based on methods used in preservation of Africa breadfruit.

Methods	Frequency	Percentage
Preservation methods		
Sun drying and keeping in bas	10	13.9
Sun drying and keeping in bottle/air tight container	33	45.8
Smoking and keeping above fire	1	1.4
Sun drying and keeping in basin	25	34.7
Sun drying and spreading on open floor/mat	3	4.2
Best duration of drying		
Till it is fully dried	64	88.9
Till it is moderately dried	8	11.1
Preservative used		
Alum	1	1.4
None	71	98.6
Reasons for not using preservatives (n = 71)		
Preservative are not necessary/needed	51	71.9
They impact undesirable characteristics on the seeds	10	14.1
No reason	10	14.1
Effects of preservation by drying		
Makes the seed last longer	56	82.0
Makes seeds easy to cook	6	8.3
Reduces attack by insect, rodent and other micro organisms	6	8.3
No effect	1	1.4
Life span of well preserved seeds		
12 months	11	15.3
1 month	12	16.7
3 to 7 months	49	68.0

Table 6. Mean score of major problems encountered in processing of Africa breadfruit (n=72).

Problems	Mean	S. D
Water scarcity	2.27	0.66
Laborious nature of processing activities	2.42	0.95
Takes long time	2.32	0.96
Difficulty in picking the seeds after threshing	2.28	1.1
Bad odour	1.93	1.17
Makes the environment dirty	1.86	1.04
Poor knowledge of improved processing methods	1.68	0.90
Lack of money to purchase seeds	1.64	1.13
Unavailability of processing equipment/machines	1.50	0.90
Poor storage facilities	1.40	0.73
Loss of seeds during processing	1.39	1.40
Decaying of seeds during fermentation	1.37	1.90
Long duration of fermentation	1.32	0.85
Poor price of finished products	0.96	1.02
Scarcity of energy for parboiling	0.86	0.86

Table 7. Mean score of problems encountered in preservation of African breadfruit (n=72).

Problems	Mean score	SD
Bad weather condition	2.62	0.78
Preserved seed require extra energy in cooking	2.01	1.01
Undesirable taste of preserved seed	1.97	0.96
Unacceptability of preserved seeds by consumers	1.81	1.21
Undesirable colour of preserved seed	1.79	0.95
Contamination preserved seeds by impunities	1.69	0.62
Poor knowledge on preservation methods	1.60	0.82
Poor storage facilities for preserved seeds	1.51	0.75
Attack of preserved seeds by insects and rodents	1.50	0.77
Poor return after preservation of seeds	1.29	0.19
Absence of good preservative	0.40	0.71
Lack of money for purchasing preservatives	0.39	0.80

Problems encountered in processing of African breadfruit

Data in Table 6 show that the major problems encountered by the respondents in processing African breadfruit were: Water scarcity (M = 2.71), laborious nature of the activities (M = 2.42), time consuming (M = 2.32), difficulty in picking the seeds after threshing (M = 2.28), bad odour produced by the seeds during processing (M = 1.93), makes the environment dirty (M = 1.86), poor knowledge of improved processing methods (M = 1.68), lack of money to purchase seeds for processing (M = 1.64) and unavailability of processing equipment and machine (M = 1.50). Water scarcity may be reason for using bad water in processing the fruit as indicated by some of the respondents in Table 3.The finding agrees with Nwabueze (2009) that traditional method of processing is very tedious, time consuming, wasteful, unhygienic and depends on climatic conditions. It also agrees with Onweluzo and Odume (2007) who asserted that traditional methods of extraction impacts characteristic offensive odour to the seeds.

Some minor problems facing processing of African breadfruit were: Poor storage facilities (M = 1.40), loss of seeds during processing (M = 1.39) and decaying of seeds during fermentation (M = 1.37). While poor price of finished products (M = 0.96) and scarcity of energy for parboiling of the seed (M = 0.86) were no problem to processing of African breadfruit in the area. The standard deviation for each of the constraints enumerated in the table was high (approximately one). Thus indicating disparity in the responses of the respondents which result to differences in the constraints they face in processing Africa breadfruit.

Problems encountered in preservation of African breadfruit

Table 7 shows that the major problems encountered by these respondents in preservation of African breadfruit were: Bad weather condition (M = 2.62), preserved seed require extra energy during cooking (M = 2.01), undesirable taste of preserved seed (M = 1.97), unacceptability of the products by consumer (M = 1.81), undesirable colour of preserved seeds (M = 1.79), contamination of preserved seeds by impurities (M = 1.69) , poor knowledge on preservation methods (M = 1.60), poor storage facilities for the preserved seeds (M = 1.51) and attack of preserved seeds by rodents and insects (M = 1.50). Truly bad weather condition can constitute problem to preservation of agricultural products like African bread fruit because farmers/ rural women can no longer predict weather of their environment due to climate change. In line with this, loss of crops under preservation and storage has also been perceived by extension workers in Anambra State Nigeria as one of the effects of climate change (Iwuchukwu and Onyeme, 2012). Secondly, although, processing and preservation of agricultural products aim at improving taste and consumer acceptance (Okafor, 2009), these benefits may be lost when these tasks are done in the wrong ways thereby constituting problems to marketing and consumption of the products.

A minor problem encountered by the respondents in preservation of Africa breadfruit was poor return after preservation of seeds (M = 1.29). Low standard deviation of 0.19 observed in ‘Poor return after preservation of seeds’ shows uniformity of responses of the respondents in relation to this variable as a constraint to preservation of African breadfruits which was not the case with other variables in the table that have high standard deviation of approximately one.

Conclusion

The study has revealed that majority of women involved in processing and preservation of African bread fruit in the area were married, middle aged with relatively large

household size and poor educational background. They were also low income earners with long years of experience in processing and preservation of African breadfruit. These women sourced the bread fruit they processed and preserved from their own farm mainly for family consumption. There were no major sources of information on processing and preservation of African breadfruit in the area while the few that existed were informal.

Fermentation method was the processing method used by majority of the respondents. The seeds were washed with clean water after fermentation/extraction and parboiled for few minutes without alum so as to ensure easy dehulling of the seeds. Both manual and mechanical methods were used in threshing the seeds while separation of seeds from the hull was done by a combination of handpicking and winnowing.

Sun drying and keeping in bottle/air tight container was the preservation method used by greater percentage of the respondents. Also majority of the respondents did not preserve the seeds with preservative because they are not necessary or needed in preservation of African breadfruit. Water scarcity, laborious nature of the activities and the fact that processing of African breadfruit is time consuming were some major problems facing processing of African breadfruit. Bad weather condition, extra energy needed for cooking preserved African breadfruit seeds and undesirable taste of preserved seeds were some major problems facing preservation of African breadfruit in the area.

RECOMMENDATIONS

It is expected that the high level of experience of these women in processing and preservation of African breadfruit will be translated to high income but this is not true probably because processing and preservation of the crop was done at subsistent level (family consumption). There is need to boost quantity of this fruit head processed and preserved by encouraging these women not to rely solely on the fruit head gotten from their own farm but to purchase from market or people that have these fruit heads. Commercial processing and preservation of African breadfruit will invariably be translated to source of livelihood and higher income for these women.

Researches should be undertaken to invent better methods of processing and preservation of agricultural products generally and African breadfruit specifically. These methods should aim at improving upon the indigenous methods because of their inherent attributes. Extension through women in agriculture (WIA) programme should educate the women on these methods that will be less laborious and produce cleaner and higher quality seeds to attract more demand and income. Above all, social infrastructure/amenities especially water; processing, preservation and storage facilities for African breadfruit should be provided by the government or through community development projects in the area. In a situation where this cannot be provided by the aforementioned bodies, women involved in processing and preservation of African breadfruit should form co-operative and pool their resources towards provision of these facilities. This will be of immense help in encouraging and enhancing processing, preservation, storage and even marketing of African breadfruit among these women, eliminate or reduce wastes/losses and invariably lead to availability of the food all year round at affordable price and reasonable profit.

REFERENCES

Akubor PI, Isolukwo PC, Ugbabe O, Onimawo IA (2000). Proximate composition and functional properties of African breadfruit Kernel and Wheat Flour Blends. Food Res. Int. 33:707-712.

Badifu GIO, Akubor PI (2001). Influence of PH and sodium chloride on selected functional and physical properties of African breadfruit (*Treculia Africana* Decen) kernel flour. Plant Foods Hum. Nutr. 56:105-115.

Baiyeri KP, Mbah BN (2006). Effect of soil-less and soil-based nursery media on stress of African breadfruit (*Treculia Africana* Decene). Afr. J. Biotechnol. 5:1405-1410.

Enibe SO (2006). Propagation, early growth, nutritional and engineering development project on African bread fruit (*Treculia Africana* Decne). J. Eng. 6:34-51.

Etoamaihe UJ, Ndubueze KC (2010). Development of motorized African breadfruit dehuller. J. Eng. Appl. Sci. 5:312-315.

Food and Agricultural Organization (FAO) (2002). Food and nutrition service. p. 13. No. 2 http://en.wikipedia/wiki/preservation.ng.

Hassan AB, Osman GA. Babiker EE (2005). Effects of domestic processing on antinutrients and availability of protein and minerals of lupin (Lupinus termis) seeds. J. Food Technol. 3:263-268.

Ihediohamma NC (2009). Effect of treatment with alum on the keeping quality of African breadfruit (*Treculia Africana*) seed. Nig. Food J. (27)2:129-135.

Ijeh IF, Ejike CE, Nkwonta OM, Njoku BC (2010). Effect of traditional processing techniques on the nutritional and phytochemical composition of African breadfruit (*Treculiaafricana*) Seeds. J. Appl. Sci. Environ. Manage. 14(4):169-173.

Iwuchukwu JC, Onyeme F N (2012). Awareness and Perceptions of climate change among extension workers of Agricultural Development Programme ADP in Anambra State, Nigeria. J. Agric. Exten. in press p. 16.

Keay RWJ (1989). Trees of Nigeria: A Revised Version of Nigerian Trees vol 1and2 Oxford, Standfield D.P, Clarendon Press.

Maziya-Dixon B, Akinyele IO, Oguntina EB, Nokoe S, Sanusi RA, Harris E (2004). Nigeria food consumption and nutrition survey 2001-2003. Summary International Institute of Tropical Agriculture (IITA), Ibadan. Nigeria.

Mohammed A (2003). Food insecurity vulnerability and information mapping system. A paper presented at the annual meeting of the inter-agency working group, Abuja, Nigeria, 1-3 October, 2003.

Njoku PCM (2000). Nigeria Agriculture and challenges of the 21st century agro-science. J. Trop. Agric. Food Environ. Exten. 5(1):22-23.

Nwabueze T (2009). Kernel extraction and Machine efficiency in dehulling parboiled African breadfruit (Trecullia Africana Decne) whole seeds. J. Food Qual. 32:669-683.

Okafor GI (2009). Economy of Nigeria: The role of food industries. In: Echezona, B.C (ed) *General Agriculture: principles and practices*. Nsukka, University of Nigeria press Ltd. pp. 93-99.

Onweluzo JC, Nnamuchi OM (2009). Production and Evaluation of porridge-Type Breakfast product from *Treculia Africana* and

Sorghum Bicolor flours. Pak. J. Nutr. 8(6):731-736.
Onweluzo LJC, Odume L (2007). Methods of extraction and demucilagination of *Treculia Africana*: effect on composition. Nig. Food J. 25(1):90-99.
Onyekwelu JC, Fayose OJ (2007). Effect of storage methods on germination and proximate composition of *Treculia africana* seeds. Conference on International Agricultural Research for Development. University of Kassel-I-Witzen-hausen and University of Gottigen.
Osuji JO, Owei SD (2010). Mitotic index studies on *Treculia africana* Decne in Nigeria. AJAE 1(1):25-28.
Pacific Agribusiness Research for Development Initiative(PARDI) (2011). Developing commercial breadfruit production in the South Pacific Islands Livai Tora livai@kokosiga.com.
Ragone D (2011) (revised). Farm and forestry production and marketing profile for breadfruit. In:Elevitch, C.R.(ed). Specialty Crops for Pacific Island AgroForestry. Permanent Agriculture Resource (PAR), Holualoa, Hawaii.http://agroforestry.net/scps.
United Nations (UN) (1989). 1989 World Survey on the Role of Women in Development. United Nations, New York.
World Bank, (2005). Getting agriculture going in Nigeria: Framework for a national strategies. Report P. 34618-NG.
Yusuf JF (2000). Economic analysis of millet production in Alkalari Local Government Area of Bauchi State. Unpublished M.Sc.Thesis, Abubakar Tafawa Belewa University Nigeria.