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Archives of Applied Science Research, 2014, 6 (6):1-6
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-508X
CODEN (USA) AASRC9

The effect of defatting on the sliminess and shelf-life of Ugiri Cotyledons

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ABSTRACT

This study is an investigation into how the cherished characteristics (sliminess, taste and aroma) and shelf life of ugiri cotyledon (Irinvigia gabonensis) can be retained through defatting of the cotyledons. Fresh ugiri fruits were cracked open to remove the ugiri seed (cotyledons), clean, wiped and ground. The ugiri chaff extracted from ugiri cotyledon through solvent extraction using petroleum spirit (60-80)^{o}C was stored in desiccators and black polyethylene bags. The defatted ugiri chaff was compared with the stored undefatted chaff. The results indicate that ugiri cotyledon can be defatted and preserved to retain the cherished characteristics without moulding or fungal growth. It is recommended that ugiri cotyledons be defattied and preserved for food preparations.

Keywords: Defatting, Ugiri, Sliminess, Chaff, Shelf-life, and cotyledon.

INTRODUCTION

Ugiri, the tree that bears *ugiri* cotyledon, botanically called *Irinvigia gabonensis* is popularly grown in moist dense gallery and semi deciduous lowlands/forests of African countries (Haris, 1999), but most commonly found in West African countries (Ejiofor, 1987). There are two varieties of *ugiri* cotyledon (*Irinvigia gabonensis and Irinvigia wombolu(excelsa)*) which are frequently mistaken for each other, but are differentiated by their fruits. While the former bears fruits with sweet mesocarp, low fibrosity, better fruit weight possessing medium sized cotyledons and shell brittleness, the latter does not (Haris, 1996, Lesley and Nick, 2004).

Irinvigia gabonensis which belongs to the family *Irinvigianceacce*, is severally known and called 'Bush mango, Bulukutu, Eniok, Ebi, Borborou, kaklou, Wanini, Andok, Meba, Mueba, Oro, Obaá duiker nut, Manguer sauvage, Irvingia, Tenuifolia and Irvingia barteri. Table 1 indicates different names most tribes in Nigeria and mostly Rivers State called *ugiri* cotyledon.

Irinvigia gabonensis produces a juicy fruit pulp rich in vitamin C and utilized in production of fruit jam and fruit juice at the age of 8-10 years. It is widely consumed raw as a dessert fruit in western and central Africa (Lesley and Nick, 2004; Festus and Nwala, 2012), for its good aroma, nutrients and taste (Ejiofor, 1994).The cotyledons of *ugiri* when cracked and removed (whether dried and fresh) has applications in soup thickening (Ohochuku, 2005), cake preparation (Lesley and Nick, 2004). The fat contents extracted from the *ugiri* cotyledon have been reported to gain uses in cooking oil, soap, cosmetics, margarine making and pharmaceuticals (Ejiofor *et al.*, 1984; Lesley and Nick, 2004).

Table 1: Common Names for *Ugiri* Cotyledon in Nigeria

State	Tribe	Common Name
	Etche	*Ugiri*
	Ikwerre	Agbolo
Rivers	Bonny	Ogbolo
	Gokana	Tenom
	Ogba	Egbolo
Cross Rivers	Efik	Uyo
Akwa-Ibom	Nanang	Ndukpak-uyo
Edo	Benin	Ogwi/Ogui
Imo	Mbabise	Ogbono
Jos	-	Goronorbiri
Oyo	Yoruba	Apon
Kaduna	-	mangoronkurmi

Source: Oral Interview 2014.

Tonye (2004) asserts that *ugiri* cotyledon is one of the most cherished condiments (soup thickeners) used in preparing soup especially in African communities. Some other condiments with their basic properties are presented in Table 2 below.

Table 2. Basic properties of some condiments (soup thickeners)

Local Name	Botanical Name	Thickening Ability %	Protein Content (%)	Fat Content (%)	Other Properties (%)
Ugiri	*Irvingia gabonensis*	64.01	8.65	71.97	19.38
Agbono	*Irvingia excelsa*	91.05	8.66	72.01`	19.34
Akpalata	*Afzelia Africa*	43.08	-	-	-
Achi	*Brachystegia*	37.00	3.93	14.10	82.07
Ofor	-	32.01	2.81	16.0	49.98

Sources:Tonye, 2004; Festus and Nwala, 2012.

Once *ugiri* cotyledon is milled with grinding machine or ground with pestle and mortar into powder, or on a stone into a paste or cake called *dika* bread, the basic characteristics depreciate very fast to nil within days/weeks due to fat contents in the warm cotyledons. *Irvingia gabonensis* (*ugiri* seed) is rich in fat (white solid at room temperature), made up of high carbon content- C18:2(21.5%), C18:3(21.3%), C18:1(20.5%), C16:0(14.6%), C18:0(8.6%), C16:1(5.5%) and very minor quantities of C20:1(1.3%), C14:0(1.0%) and organic residue (5.7%) (Omogbai, 1990). Research reports (Okafor, 1975; Festus and Nwala, 2012) have shown that drying of cotyledons (*Brachystegia, Irvingia excelsa, etc*) is essential, since in the dried state the cotyledons still retain their basic characteristics of drawability, aroma, colour, and taste up to six months (a shelf life common to most dried foods). The latter do not apply to *ugiri* cotyledons because whether dried or not, stored *ugiri* cotyledons become discoloured, rancid (salty), develop lumps with unpleasant taste due to the high content of fat (54-67%) and also prone to fungal attack which are determinants of its quality (Ohochuku, 2005; Haris, 1996). Research reports (Dattilo and Kris-Etherton, 1992; Bray and Popkin, 1998) have shown that high levels of fat are factor in the development of obesity hence reducing fat contents in diets would be expected to produce weight loss. Okafor (1975) maintains that *ugiri* cotyledons must be used as a soup thickener mostly when fresh since they are too mucilaginous. Consequently the basic aim of this research is to determine how the essential characteristics of *ugiri* cotyledon can be preserved by defatting the cotyledons as well establish the effect of defatting on *ugiri* cotyledon shelf life.

MATERIALS AND METHODS

2.1 Cleaning of *Ugiri* Cotyledons

Fresh *ugiri* fruits picked at the Riverside of Afara village were cracked open to remove the *ugiri* seed (cotyledons, four cups) and washed with clean water. The cleaned *ugiri* cotyledons were removed of piles and coats using kitchen knife. The cotyledons were milled with manual grinder into powder. Afara is a village with six communities in Etche Local Government Area of Rivers State of Nigeria located between latitude 4.3^{o}N and longitude 5.9^{o}E and bounded by four villages; Egwi (north), Mba (south), Nihi (east) and Ulakwo (west).

2.2 Petroleum Spirit (60-80)^{o}C Extraction

Milled *ugiri* cotyledons (400 g) were gradually turned into an extraction soxhlet (1 L) thimble apartment and were submerged with distilled petroleum spirit (60-80)^{o}C. The contents were refluxed into a 2 L flask. The refluxing of

the set-up with its contents on a water bath continued, with the vapour condensing into the soxhlet compartment until the liquid and the extracted fat refluxed into the flask again. The refluxing was allowed to take place for eight times (4hr) for complete fat removal as developed and reported by Ohochuku, 2005.

2.3 Drying and Sealing
Using the methods adopted and reported by Festus and Nwala (2012) the defatted *ugiri* chaff were dried and sealed.

2.4 Calcined calcium chloride (CaCl) preservation
With laboratory desiccators, the dried *ugiri* chaff placed in flat plate were preserved and stored in laboratory cupboard (Ohochuku, 2005; Festus and Nwala, 2012).

2.5 Undefatted Cotyledon Preservation
The undefatted *ugiri* cotyledons were milled into powder usingmanual grinder and stored in a brown container and placed in a cupboard.The brown bottle storage protects the milled cotyledons from photo damage.

2.6 Determination of Defatted Chaff Sliminess
Using a method reported by Festus and Nwala (2012). Into a 250 mL of boiling water, 10 g of measured defatted *ugiri* chaff from the desiccators stored was neatly added and stirred until a homogeneous mixture was formed. The solution was allowed to cool to room temperature (27^oC) and the sliminess determined as follows. 50 cm^3 of the solution was poured into a ford's cup stoppered with the finger. The stoppered hole was opened for the solution to flow and simultaneously the stop watch was started. The stop watch was stopped immediately the flow of the solution stopped (when the liquid thread first breaks). This was repeated three times and the mean taken. The solution was kept for five days with warming every morning and evening and the sliminess determined every morning on the cooled solution. This same process was also carried out on other packets of preserved defatted *ugiri* chaffer, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330 and 360 days from the day of preservation. Each of the black polyethylene stored and the undefatted stored samples (10g content each) were similarly treated at appropriate intervals.

2.7 Examination for Moulding and Fungal Growth
Three stored samples in each case (desiccators, polyethylene and undefatted stored) were visually examined for black spots which are indicative of moulding and also examined through the microscope for fungal growth and moulding. The samples were further wetted with sterile water and kept for four days in a disinfected covered petri dishes after which the samples were examined under microscope (Ohockuhu, 2005; Festus and Nwala, 2012).

RESULTS AND DISCUSSION

3.1 Cleaning and Extraction of *Ugiri* Cotyledons
Tasta removal from the fresh cotyledons gave neat material when grinded and dried, unlike the usually brown coloured mass obtained from uncleaned cotyledons. This implies that cleaning of *ugiri* cotyledons before use gives neater material for preparation of soup. The yellowish solution obtained on extraction shows the presence of *ugiri* wax (fat). The later on evaporation of the excess solvent gave a whitish mass of *ugiri* wax, while the chaff which was insoluble in the solvent was recovered from the thimble, recrystallized and air dried for total solvent removal. Its colour was light and the chaff devoid of the extracting solvent odour.

3.2 Sealing and storage of the Dried chaff
The drying of the chaff gave a light solid material which agrees with Willey *et al.*, (2011) assertion that alteration of temperature conditions, drying and addition of chemicals helps in preservation of foods. While storage of the defatted chaff (200 g) in amber coloured bottle reduced the action of ultra violet light on the defatted chaff. Both dark plastic bags (4x4cm) and desiccator stored chaff exhibited lighter, buff colours and drier with the chaff on drying retaining their cherished basic characteristics (Festus and Nwala, 2012).

3.3 Sliminess determination: Polyethylene stored chaff
From the results observed, the slimy nature of the solution from each stored sample generally increased as the solution is stored and depreciated on further storage. The latter can be explained on the basis of dissolution of more lumps during the solution process in the first day making the solution more slimy (Festus and Nwala, 2012). The depreciation of the solution's sliminess on further storage is explained on the basis of exposure to air, knowing that

air and water deteriorate sliminess. One would expect a decrease in sliminess as the solution is stored, and this is what was observed. The results are presented in Table 3.

3.4 Desiccator Stored Chaff.

Perfect removal of water and partial avoidance of day light served as factors in the production of more slimy solution from the desiccator stored chaff. The sliminess of the sample increased gradually from the first day as the lumps in the solution got dissolved with the depreciation setting in mostly from the fifth day as air, water and day light acted on the sliminess of the solution (Ohochuku, 2005b). The results are contained in Table 4.

3.5 Undefatted Stored Samples

Due to the presence of water, air, day light and high content of fat, the observed sliminess for undefatted stored samples gave a less slimy solution (Okafor, 1974; Ohochuku, 2005a)with fast depreciation setting in from the third week (21st day). The results are contained in Table 5.

Table 3: Sliminess Determination for Black Polyethylene Stored Chaff

Storage Days	Sample	Days: Mean of each day's sliminess determination					Mean of 5 days measurement
		1	2	3	4	5	
01	B_{p0}	15	16	13	10	07	12.2
30	B_{p1}	12	17	20	09	10	13.6
60	B_{p2}	10	15	24	21	15	15.0
90	B_{p3}	19	22	20	24	13	19.6
120	B_{p4}	22	20	21	21	20	20.8
150	B_{p5}	19	24	22	27	19	22.2
180	B_{p6}	21	23	24	25	20	22.6
210	B_{p7}	18	19	25	22	21	21.2
240	B_{p8}	21	22	20	24	22	21.8
270	B_{p9}	17	20	23	22	18	21.0
300	B_{p10}	18	18	26	25	17	20.8
330	B_{p11}	23	21	23	18	12	19.4
360	B_{p12}	20	22	17	14	11	16.8

Note: Bp = Defatted ugiri chaff stored in black polyethylene bag.

Table 4: Sliminess Determination for Desiccator Stored Chaff

Storage Days	Sample	Days: Mean of each day's sliminess determination					Mean of 5 days measurement
		1	2	3	4	5	
01	Ds_0	15	18	16	17	15	16.2
30	Ds_1	18	21	20	17	14	18.0
60	Ds_2	16	24	18	20	17	19.0
90	Ds_3	20	19	21	18	18	19.2
120	Ds_4	19	22	21	19	17	19.6
150	Ds_5	24	22	20	20	18	20.8
180	Ds_6	24	21	19	17	20	20.2
210	Ds_7	23	24	21	22	18	21.6
240	Ds_8	23	24	24	23	21	23.0
270	Ds_9	24	25	23	24	21	23.4
300	Ds_{10}	22	25	21	23	19	22.0
330	Ds_{11}	20	21	19	21	18	19.8
360	Ds_{12}	19	20	21	19	17	19.2

Note: Ds = Defatted ugiri chaff stored in desiccator.

3.6 Moulding and Fungal Growth.

The best way to determine fungal presence and growth in foods is usually through visual and microscopic examinations. However, morphology and spores are better used to identify various fungi in foods (Willey *et al.*, 2011). These were carried out on the stored samples at intervals during the experiment. The results revealed negative observations mostly for the undefatted chaff. This conforms to Willey *et al.*, (2011) report that modified atmosphere packaging is vital in microbial growth control and to extend product's shelf life. While the black polyethylene and desiccators' stored chaffers/samples kept in petri dishes for four days failed to show any signs of moulding, fungal presence or growth, the undefatted chaff/sample grew mouldy, became blackish with the presence and growth of *Aspergillis* and *Rhizopus spp.* (Ostry *et al.*, 2013) and produced unpleasant odour. These results showed that the

polyethylene and desiccators storage processes were efficient and adequate and that the samples were safe for food making and consumption.

Table 5: Sliminess Determination for Undefatted *Ugiri* Stored Chaff

Storage Days	Sample	Days					Mean of 5 days measurement
		Mean of each day's sliminess determination					
		1	2	3	4	5	
01	Ud_0	17	17	15	19	14	16.4
30	Ud_1	11	14	15	09	05	10.8
60	Ud_2	10	11	09	10	04	8.8
90	Ud_3	07	09	08	06	03	6.6
120	Ud_4	08	05	06	03	02	4.8
150	Ud_5	06	04	05	03	02	4.0
180	Ud_6	05	05	04	02	01	3.4
210	Ud_7	04	04	03	02	02	3.0
240	Ud_8	04	03	04	01	02	2.8
270	Ud_9	04	03	03	02	01	2.4
300	Ud_{10}	05	03	03	01	01	2.6
330	Ud_{11}	03	03	02	01	00	1.8
360	Ud_{12}	03	01	02	00	00	1.2

Note: U_d = Undefatted Ugiri paste

CONCLUSION

The results of this research showed that *ugiri* cotyledons can be defatted and stored in dry condition especially out of direct sunlight for long shelf life. The defatted cotyledon stored for more than twelve months still retained all the basic cherished characteristics and without moulding or fungal growth. The defatted chaff stored desiccators gave consistent sliminess indicating efficient storage. These desiccators are not within common man's reach, hence packing the desiccators dried sample in polyethylene bags will make for easier making of the defatted products. The authors therefore recommend that:-

- that *ugiri* cotyledons be defatted before use in soup/food making since such retains their basic cherished aroma, taste, and drawability (sliminess) for a longer time.
- removal of fat from *ugiri* cotyledons by solvent extraction is a simple process which can be commercialized for the production of *ugiri* chaff as cubes, tablets or powders, preserved for long shelf life. This will boost the *ugiri* trade.
- that more extracting methods such as decantation should be used for defatting of *ugiri* cotyledons because in a laboratory where there is no soxhlet extracting set-up, other methods becomes the alternative.
- that other natural food products be defatted to find out if their shelf-life can be elongated.

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