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Effect of storage facilities on chemical composition of fermented Castor Oil Bean condiment

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ABSTRACT

Castor oil seed were dehulled, sorted, washed, boiled, and fermented mashed and packaged. The samples were divided into three portions. One portion was stored in a room and second portion was stored in freezer for eleven weeks while the third portion was the fresh fermented castor oil seed which served as control. The samples were analyzed for proximate and mineral composition. There was significant ($p<0.05$) increase in protein content, ash and fat content of the fermented castor oil seed stored in the deep freezer from 35.08% to 35.50%, 6.00% to 6.70% and 46.30%to 48.50 respectively while the ash content, crude fibre and fat content of the sample stored in a room significantly ($p<0.05$) increase from 6.00% to7.96%, 0.88% to 3.86% and 46.36% to 50.03% respectively. Carbohydrate content significantly decreases from 4.02% to 3.15%. There was no significant ($p<0.05$) difference in calcium, copper, iron, magnesium and zinc of the samples but there was a significant ($p<0.05$) difference in sodium and potassium among the samples.

Keywords: *Ogiri, Castor oil seed, Onugbu, Preservation, Fermentation.*

INTRODUCTION

'Ogiri' is a food condiment produced from castor oil seed, melon or fluted pumpkin. It is used for flavouring bitter leaf (Onugbu) and orha soup which are peculiar to the Ibos in the southern parts of Nigerian. They are usually eaten with staple food such as garri, abacha, akpu among others thereby forming an essential component of the diet. This indigenous condiment added in fairly small quantities improves sensory properties, they also improves nutritional value, providing dietary fibre, energy, minerals and vitamins (Kolapo *et al.,*2007). 'Ogiri' is prepared by traditional methods of uncontrolled solid substrate fermentation resulting in extensive hydrolysis of the protein and carbohydrates component (Eka, 1980). Fermentation decreases ant nutritional factor in oil seed and develops compounds that impart antinutritional property to the condiment (Mensah *et al.,* 1990). The microorganisms predominately involved in the fermentation of castor oil seed into ogiri are *Bacillus* species such as *B. substillus, B. pumillus* and *B. licheniformis* which are normally grown in temperature of 30^{o} C (Omafuvbe *et al.,* 2000 and 2004). Fermentation actually holds promise as a food processing method that can used to diversify the food uses of some underexploited plant foods like castor oil seeds, soybean and African locust bean among others. Castor oil seed (*Ricinus communis*) is a member of spurge family *Euphorbiaceae.* Castor oil seed contain 21.87% protein, 55.5% fat and 8.86% carbohydrates (Annongu and Joseph, 2008). The protein of the castor oil seed contains ricin and ricinoleic which are toxic substance nevertheless they reduced or eliminate during fermentation (Odunfa, 1985). The traditional condiments have not attained worldwide commercial statue due to short shelf life, objectionable packaging material, stickiness and the characteristics putrid odour (Arogba, 1995). In most African countries including Nigerian, the problem of food security is not just

that of inadequate food but it is also a problem of losses of food due to spoilage. Lack of adequate food preservation methods is a major problem contributing to food insecurity in Africa (Ibe and Orabuike, 2009).

Food preservation is the process of treating and handling food to stop or slow down spoilage (loss of quality, edibility or nutritional value), thereby increasing its shelf life. According to Sivasankar (2009), the basic principles of food preservation primarily involve the process of inhibiting such processes as the growth and activity of microorganisms, activity of endogenous enzymes, chemical reaction which may deteriorate the quality of food and invasion and spoilage by insects and rodents. Reasons for preserving food include extension of the safe storage life of food, its safety, acceptability, nutritive value, availability and economic viability (Anon, 2012). The methods of food preservation are drying, refrigerating, freezing, addition of salt or sugar, smoking, canning, high heat processing (pasteurization), ionizing radiation, chemical preservatives among others. Freezing process is generally regarded as the best method of long-term food preservation when judged on the basis of retention of sensory attributes and nutrient (Onwuka, 2014). The main preservation principle of freezing process is to eliminate liquid water as necessary nutrient for micro-organisms (Ihekoronye and Ngoddy, 1985). Freezing selectively suppress microorganisms by inactivating enzymes system, vital to cell, slowing or stopped growth thereby preserving the nutrient in the food. At temperature range of -7^{o}C to -18^{o}C which home freezer normally operate (Tressler *et al.,*1963) stopped the growth of microorganisms and provide good protection against nutrient loss for year with exception of ascorbic acids and vitamin (Anon, 1974). Ojimelukwe *et al.* (2011) reported that lime and sodium chloride were used to inhibit the growth of micro-organisms, this antimicrobial are most often used with other preservative technique such as refrigeration or freezing in order to inhibit the growth of spoilage and pathogenic microorganisms (Ademola *et al.,*2011). For these reasons, this study was to seek the effect of storage facilities on proximate and mineral composition of fermented castor oil seed condiment.

MATERIALS AND METHODS

The castor oil seed used in this research were purchased from Eke Ekwulobia market in Anambra state, Nigeria.

PREPARATION OF OGIRI FROM CASTOR OIL SEED

The 2kg of dehulled castor oil seed were washed boiled in clean pot for 8hrs in 6litres of water. The boiled seed were also dehulled again to remove the white coat of castor oil seed, wrapped in clean treated plantain leaves and boiled again for 2hrs in 3litres of water. The wrapped castor oil seeds were left in room temperature to ferment for four day fermented castor oil seed were ground into paste and wrapped in small portion for 2 day to complete fermentation.

The samples were divided into three portions. One portion was stored in a room and 2nd portion was stored in freezer for eleven weeks while the third portion was the control (fresh Ogiri).The samples were analyzed for proximate a mineral composition (Fig.1).

PROXIMATE COMPOSITION ANALYSIS

The moisture, protein, fat, ash and crude fibre contents of the fermented castor oil seed samples was carried out according to the methods of AOAC (2010) and this were determined in triplicates. The carbohydrate was determined by difference.

DETERMINATION OF MINERALS

The method of AOAC (2010) was used for the determination of minerals. One gram of each of the samples was weighed into a crucible and dry- ash in the furnace at 550^{o}C for 7 hours. The ash was dissolved in 10 HCl in a conical flask. The solution was filtered into a 100ml standard flask and made up to the mark with distilled water. The individual mineral element was measured from the solution. Calcium was determined using flame photometer while iron, zinc, sodium, copper and magnesium was determined using 'Atomic Absorption Spectrophotometer'.

STATISTICAL ANALYSIS

The data obtained from nutritional composition analysis were subjected to 'Analysis of Variance' (ANOVA) using the statistical package for Social Sciences (SPSS) Version 17.0. Duncan's Multiple Range Test (DMRT) was used to compare the treatment mean. Statistical significance was accepted at ($p<0.05$).

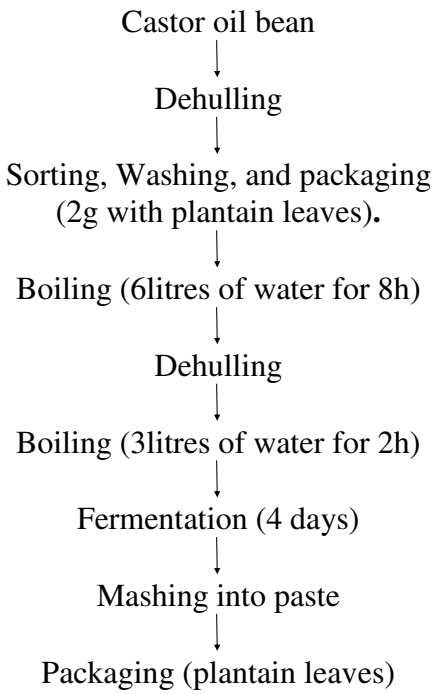

Fig.1: Flow diagram of production of the castor seed Ogiri

RESULTS AND DISCUSSION

Table 1
Effect of Storage on Proximate Composition of Fermented Castor Oil Seed (%)

Samples	Moisture content	Protein	Ash content	Crude fibre	Fat	Carbohydrates
Fresh ogiri	7.50^{a}±0.01	35.08^{b}±0.01	6.06^{c}±1.00	0.88^{b}±0.01	46.30^{c}±0.10	4.02^{a}±0.01
Ogiri room	3.53^{c}±0.01	34.78^{c}±0.01	7.96^{a}±0.01	3.86^{a}±0.01	50.03^{a}±0.01	3.84^{b}±0.01
Ogiri deep freezer	5.93^{b}±0.01	35.50^{a}±0.10	6.70^{b}±0.20	0.24^{b}±0.01	48.50^{b}±0.10	3.15^{c}±0.11

The proximate composition of fresh and stored fermented castor oil seed is presented in Table 1. The moisture content of the samples ranged from 3.53% to 7.50% the lowest value was recorded in fresh castor Ogiri while the highest was recorded in ogiri stored in a room. The low moisture content of the stored samples implies that it will have a longer shelf life (Laseken *et al.,* 2004). The value of moisture content of fresh fermented castor oil seed in this present study was lower than the value reported by David and Aderibigbe (2010) in fermented melon seed 33%. Fermented castor oil seed stored in deep freezer was significantly ($p<0.05$) higher (35.08%) than fresh fermented castor oil seed stored in a room (34.78%). Higher value of protein content recorded in fermented castor oil seed stored in the freezer. This could be as a result that freezing process preserve nutrient of the food. Increase in protein content of fresh fermented castor oil seeds from 35.08% to 35.50% in fermented castor oil seed could be due to the activities of proteolytic enzymes which hydrolyzed inherent to the constituent amino acids and peptide (Omafuvbe *et al,* 2000 and 2004). Freezing gradual decline the number of microorganisms involved in fermentation. These micro-organisms do not utilize the protein content.

There was a significant increase ($p<0.05$) in total ash content with storage time. Fermented castor oil seed stored in the room had the highest value of ash content of 7.96% while fresh fermented castor oil seed had lowest value of ash content of 6.00%. The observed increase in ash content was attributed to possible losses of dry matter and volatiles which normally occur during fermentation (Nnam, 1999 and Nnam and Obiakor, 2003). The significant ($p<0.05$) difference was observed in the fat content of the samples. The fat content of the fermented castor oil seed ranged from 46.30% to 50.03%. The fermented castor oil seeds stored in a room had the higher (50.03%) fat content than fresh sample (46.30%) and sample stored in the deep freezer (48.50%). The increase in the fat content of the stored samples might be attributed to increase in the activities of lipolytic enzymes which hydrolyzed fat into glycerol and fatty acids. Similar observation was reported by Obizoba and Atii (1990) in the sorghum seed. This increase could be attributed to the additional release of some non-lipid ether extractable materials released by fermenting microorganisms. There was a significant ($p<0.05$) difference in carbohydrate content of fermented castor oil seed. Carbohydrates content ranged from 4.02% to 3.15. Carbohydrate content significantly ($p<0.05$) decrease with the storage time of fermented castor oil seed. The observed change in the carbohydrate with storage time agrees with the report of Nnam (1995) on fermented cowpea. The apparent decreases were attributed to increased activity of amylolytic enzyme which hydrolyses starch and other complex carbohydrates to simpler sugar. This could be also attributed that microorganism involved in fermentation utilized simpler sugar for their metabolic activities.

Table 2
Effect of Storage methods on Mineral Composition of Fermented Castor Seed (Mg/100g)

Samples	Calcium	Sodium	Potassium	Copper	Iron	Magnesium	Zinc
Fresh ogiri	$0.50^{a}\pm0.10$	$0.40^{b}\pm0.10$	$0.73^{a}\pm0.01$	$0.80^{a}\pm0.10$	$0.90^{a}\pm0.10$	$0.32^{a}\pm0.02$	$2.00^{a}\pm1.00$
Ogiri room	$0.50^{a}\pm0.10$	$0.33^{b}\pm0.01$	$0.66^{b}\pm0.10$	$0.80^{a}\pm0.10$	$0.90^{a}\pm0.10$	$0.32^{a}\pm0.02$	$1.80^{a}\pm0.10$
Ogiri deep Freezer	$0.50^{a}\pm0.10$	$0.55^{a}\pm0.01$	$0.39^{c}\pm0.01$	$0.80^{a}\pm0.10$	$0.90^{a}\pm0.10$	$0.32^{a}\pm0.10$	$2.00^{a}\pm1.00$

There was no significant ($p<0.05$) difference between the mineral content of fresh and stored fermented castor oil seed except for sodium and potassium. The storage methods did not affect the calcium, copper, iron, magnesium and zinc of the fermented castor oil seeds. A significant increase ($P<0.05$) was observed in sodium content of the samples stored in deep freezer 0.55ppm when compared with the control sample (Table 2).

CONCLUSION

Fermented castor oil seed stored in a room increase the ash content, crude fibre and fat content while fermented castor oil seed stored in deep freezer increase the protein, fat and ash content. The storage methods did not significantly affect the calcium, copper, iron magnesium and zinc content of the fermented castor oil seed. The fermented castor oil seed stored in the deep freezer preserved the sodium content of the sample while there was a decrease in the sodium and potassium content of the sample. Therefore it is concluded that storing the fermented condiment in the deep freezer retain nutritional content because it increases protein content and improve its storage stability.

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