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COMPARATIVE STUDY OF MINERAL AND FATTY ACID COMPOSITION OF OIL EXTRACTED FROM RAW AND ANAEROBIC FERMENTED TIGER NUT SEED (*CYPERURS ESCULENTUM*)

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ABSTRACT: Comparative study of raw and anaerobic fermented tiger nut seed oil was investigated to know whether the effect of anaerobic fermentation will alter the mineral and fatty acid composition of the oil from the sample. The mineral composition observed in mg/kg for oil from raw and anaerobic fermentation tiger nut were Potassium(K)(3265.48±0.50and22851.200±0.50),Sodium(Na)(20.210±0.10 and18.750±0.10),Calcium(Ca)(5.330±0.10and6.471±0.10),Lead(Pb)(0.130±0.05and 0.101±0.05)Copper(Cu) (2.024±0.10 and 3.530±0.10), Zinc(Zn) and manganese were very significant in both while Magnessium(Mg) had 121.120±0.20 and 147.470±0.20 respectively.The fatty acid present in the oil of raw and anaerobic fermentation were: Palmitic Acid (C16:0) (17.2689 and 17.8269), Palmitoleic Acid(C16:1)(0.1568 and 0.2138), Margaric Acid (C17:1) (0.0834 and 0.1130), Stearic Acid (C18:0) (2.7919 and 3.1444), Oleic Acid (C18:1) (64.9437 and 64.2864), Linoleic Acid (C18:2) (13.8846 and13.3413), Lenolenic Acid (C18:3) (0.3201and 0.4372), Arachidonic Acid (C20:0)(0.3507 and 0.3646) and Behenic Acid (C22:1)(0.1999 and 0.2725) respectively. Anaerobic fermentation increased the saturated fatty acid and reduced the monounsaturated and polyunsaturated in the oil sample as indicated in the raw oil sample. Oil from Anaerobic fermentation is prone to deterioration and oxidative rancidity due to the level of the saturated fatty acid.

KEY WORDS: Tiger Nut, Raw, Anaerobic Fermention, Oil, fatty acid,

INTRODUCTION

Tiger nut (*Cyperurs esculentum*) is a perennial grass – like plant with spheroid tubers, pale yellow cream kernel surrounded by a fibrous sheath. It is also known as yellow nut sedge, earth or ground almonds, "souchet" in fresh, "ermandein" in German and "chufa" in Spanish (TTSL, 2005). Grassman and Thomas (1998) reported that Chufa came to Spain form Africa. Tiger nut is found wild and cultivated in Africa, South America, Europe and Asia. Tiger nuts grow in the wild, along rivers and are cultivated on a small scale by rural farmers mostly in the northern states of Nigeria it is locally called "aya" in Hausa; "a kiawusa" in Igbo; "Ofio" in Yoruba and "isipaccara" in Effik. Tiger nuts are edible, sweet, nutly, flavoured tubers which contain protein, carbohydrate, sugars, and lots of oil and fiber (FAO, 1998). Grossman and Thomas (1998) showed that tiger nuts have been cultivated for food and drink for men and planted for hogs for many years in Spain and that the lovely milky elixir is served in health Spas, Pubs and restaurants as a refreshing beverage

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(competing successfully with other soft drink). Unfortunately, despite these potentials in tiger nuts it has been a neglected crop in Nigeria. This probably may be due to inadequate knowledge on its production, utilization and nutritional value. Nutritional quality of a food may be dictated mainly by its chemical composition and the presence of anti-nutritional factors, such as phytic acid, tannin and trypsin inhibitor. However, reports have been made by researchers that fermentation, hydrothermal treatment and some other processing methods are able to nullify or reduce this ant nutrient raw tiger nuts could be reduced by processing.

Tiger nut oil is 80% unsaturated fatty acid, mainly oleic (64.2 – 68.8%) and this shows that tiger nut oil has a good potential as a substitute for imported olive oil (Deatra, 1999, TTSL, 2005). Fat in diets provide twice much energy as carbohydrate or protein, this low fat diets are recommended effects on health and the risk of diseases states such as coronary heart disease (CHD). Saturated fatty acids (SFA) increase levels of blood cholesterol and should be avoided whenever possible. There is evidence that the replacement of SFA with monounsaturated fatty acid (MUFA) may have a favourable effect on the risk of CHD. Venho *et al*., (2000) Investigated types of fat intake in relation to CHD risk in women and reported that every increase of 5% in energy from MUFA there is a decrease in CHD relative risk of 0.81%.

Tiger nut is a good source of phosphorous, potassium and iron. It also contains Magnesium, Calcium, Zinc, copper, sodium and Manganese (TTSL, 2005). Phosphorus found in plant is usually bound to a compound called phytate meaning that it is poorly absorbed from the gut into the body. Phosphorus (P), together with Calcium, constitutes the bulk of the mineral substance of the bones and teeth. It plays a part in the formation in the body. It helps regulate acidity (alkalinity by acting as a buffer (Moore, 2004).

Potassium (K) is important in maintaining electrolyte and chemical balance between the tissue cells and the book K. is the most important neural element in intracellular behavior. It plays a part in numerous enzymatic reactions and in important physiological processes, such as cardiac rhythm, nervous conditional and muscular contraction. Iron (Fe) in food is often in a complex form. An acid medium also helps Fe absorption. Consequently, Fe helps prevent anemia Zinc has a wide variety of functions in the body and is found in all body tissues. It is involved in many enzyme reactions including those involved in energy generation from carbohydrate, fat and protein. It also has a role in cell division, the transport of carbon dioxide and oxygen in the blood and also in immunity. Since it has a wide range of role in the body, symptoms of Zinc deficiency are also wide ranging and include a delay in wound healing, poor appetite, a suppressed immune system and poor growth (Moore, 2004; Wardlaw and Kessel, 2002).

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Tiger nut could provide a basis for rural industries in Africa. It is an important food crop for certain tribes in Africa often collected and eaten raw, baked as a vegetable, roasted or dried and ground to flour. The ground flour is mixed with sorghum to make porridge, ice-creams, sherbet or milky drink. It is mostly consumed few as snack without knowledge of the food and nutritional quality (FAO, 1988). It has also been found to possess good therapeutic quality (Moore, 2004; Zimmerman, 1987; Farre, 2003; Bixquert, 2003; Valls, 2003). Moore stated that "the expansion of tiger nut milky drinks will significantly help the research linking tiger nut milk to healthier cholesterol levels and other non-dairy manufacturers. This could also gain a boast form an increased consumer internet in health foods"

Variety of food products can be derived from tiger nut tubers though there is little documentation at large. Various food processing techniques can be applied to tiger nut processing to modify its appearance, develop its natural flavor, stimulate the digestive juices, add variety to the menu make it easily digestible and bio-available, destroy harmful microorganisms improve its nutritional quality and prevent decomposition. In recent years, the need to increase the production and utilization of locally available food resources has been highlighted at different national and international form. Tiger nuts, one of the underutilized food crops locally available in Nigeria could be used in solving major nutritional problems through exploitation of its nutritional and economic potentials. This project work therefore basically evaluates the fatty acid composition of oil from extracted from raw and three days anaerobic fermented tiger nut. The objective of this work is to know the effect anaerobic fermentation for three days on the fatty acid composition of tiger nut oil to know whether anaerobic fermentation will favour the unsaturated fatty acids present in the tiger nut seed oil.

MATERIALS AND METHODS

Collection of plant material: Raw tiger nuts (*Cyperus esculentus L)* were bought from "Oja Oba"market in Owo town, Owo local government area, in Ondo state.

Preparation of the sample

Raw tiger nut (*Cyperus esculentus L)* samples were manually sort and then divided into two equal parts. One part was sundried for three days before milling and the second half was fermented anaerobically for three days, oven dried and milled. The two samples were reduced to fine powder with the aid of a mechanical grinder to pass through 40 mesh sieves to increase the surface area

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for proper analysis. The milled powder samples were collected and stored in glass jars, tightly covered and kept for analysis.

Procedure for Oil Extraction: The extraction method used for this research was soxhlet extraction method described by AOAC, 2000

Characterization of the Extracted Oil: In evaluating the quality of the extracted oil, part of the oil was digested for mineral analysis using atomic absorption spectrophotometer (AAS). The fatty acid composition of the oil was analyzed using Gas Chromatography respectively.

FATTY ACID METHYL ESTER ANALYSIS

50mg of the extracted fat content of the sample was saponified (esterified) for five (5) minutes at 95^0C with 3.4mlof the 0.5m KOH in dry methanol the mixture was neutralized by using 0.7MHCL 3ml of the 14%boron triflouride in methanol was added. the mixture was heated for 5 minutes at the temperature of 90^0C to achieve complete methylation process. The fatty acid methyl esters were thrice extracted from the mixture with redistilled n-hexane. The content was concentrated to 1ml for gas chromatography analysis and 1µ was injected into the injection port of GC.

RESULT AND DISSCUSION

RESULT

Table1 mineral composition of oil from raw and fermented tiger nut (*Cyperus esculentus L)*

Parameter (mg/kg)	RTN	A FTN
Potassium(K)	3265.48 ±0.50	22851.200±0.50
Sodium(Na)	20.210±0.10	18.750±0.10
Calcium(Ca)	5.330±0.10	6.471±0.10
Lead(Pb)	0.130±0.05	0.101±0.05
Copper(Cu)	2.024±0.10	3.530±0.10
Zinc(Zn)	1.510 ±0.10	1.340±0.10
Magnessium(Mg)	121.120±0.20	147.470±0.20
Manganese(Mn)	0.350 ±0.05	0.250±0.05

±Mean values of duplicate analysis

RTN-Raw tiger nut, AFTN- Anaerobic Fermented tiger nut for three days

Table1 Results of fatty acid composition of oil from raw and Anaerobic fermented tiger nut (*Cyperus esculentus L)*

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Parameter (%)	RTN	AFTN
Palmitic Acid (C16:0)	17.2689	17.8269
Palmitoleic Acid (C16:1)	0.1568	0.2138
Margaric Acid (C17:1)	0.0834	0.1130
Stearic Acid (C18:0)	2.7919	3.1444
Oleic Acid (C18:1)	64.9437	64.2864
Linoleic Acid (C18:2)	13.8846	13.3413
Lenolenic Acid (C18:3)	0.3201	0.4372
Arachidonic Acid (C20:0)	0.3507	0.3646
Behenic Acid (C22:1)	0.1999	0.2725

Note: C:0= Number of Carbon atoms and level of saturation or unsaturation

RTN-Raw tiger nut, AFTN- AnaerobicFermented tiger nut for three days

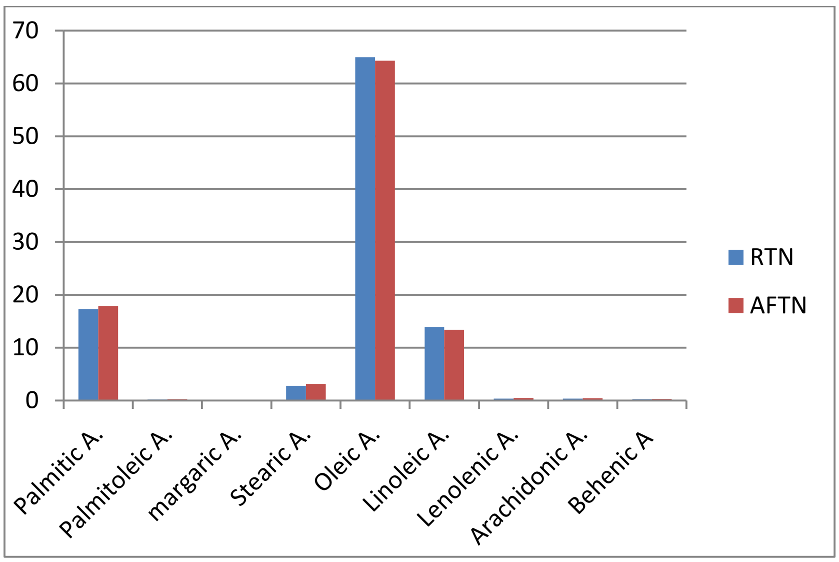

Fig1:Chart of fatty acid composition from raw and anaerobic fermentation of tiger nut oil

DISCUSSION

The results obtained from the mineral composition of oil extracted from raw and three day fermentation of tiger nut (*Cyperus esculentus L*) as indicated in table 1 revealed that the oil from raw sample(3265.48±0.50) was higher than the oil from anaerobic fermentation (22851.200±0.50).potassium has been associated with reduction of high blood pressure in humans by maintaining the normal water balance, conservation of osmosis and acid balance in the body. Calcium is important in bone development and teeth formation. This was found to be higher in AFTN (6.471±0.10) than RTN (5.330±0.10) . Sodium in the RTN oil sample was 20.210±0.10 while the oil from AFTN was18.750±0.10 respectively. High level of sodium in the had negative

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effect on osmosis and water balance and increase saturated fat deposition in the blood vessels leading to high blood pressure. There was insignificant difference in the composition of lead was observed from 0.130±0.05 for oil from raw to 0.101±0.05 for oil from anaerobic fermentation tiger nut. Increase in the level of copper(2.024±0.10 to 3.530±0.10) and Magnessium(Mg) (121.120±0.20 to 147.470±0.20) were equally observed for raw oil sample and anaerobic fermented oil sample respectively. Manganese(Mn) showed insignificant difference) for RTN(0.350 ±0.05) and AFTN(0.250±0.05) respectively.

The results of fatty acid Composition of oil from raw and three days anaerobic fermented tiger nut (*Cyperus esculentus L)* were as shown in the table2.The fatty acid composition of a given sample oil indicated how useful the oil industrially, pharmaceutically and if employed as one of the convectional oil for human consumption. The percentage saturated palmitic acid(16:0) was higher in the three day anaerobic fermented oil(AFTN)(17.8269) than raw sample oil(RTN)(17.2698), though the results were very close but higher than the values obtained by Agbaje *et al*,2015,which were10.23 for raw oil sample and 9.51 for traditional fermented milled oil. The results indicated that fermentation favours increment in saturated palmitic acid, Also other higher values observed were for monounsaturated oleic acid(C18;1), with RTN 64.9437% and AFTN 64.2864% respectively. RTN value was higher than AFTN, these values were lower than the values obtained by Agbaje *et al,* 2015 with 69.77% for raw oil sample and 70.61% for traditional fermented milled oil. It has been reported that high oleic acid reduced the risk of coronary heart disease (key *et al*, 1986). Linoleic Acid (C18:2) was another high value of unsaturated fatty acid detected with RTN 13.8846 and AFTN 13.3413, RTN was higher than AFTN. These values were higher than the values obtained by Agbaje *et al*, 2015 for raw 9.00% and traditional fermented milled oil 10.12%. The saturated stearic acid were lower in RTN than AFTN which were (C18:0)2.7989 for RTN and 3.1444 for AFTN respectively. This values showed no significant difference from the values obtained by Agbaje *et al,* 2015 . Other values obtained were lesser than one (1<) and the lower value in lenolenic acid reuced the off-flavour and oxidation of some harmful product as reported by Warner and Gupta (2003).Figure1 indicated the variation in the level of saturated and unsaturated fatty acid in the two oil samples.

CONCLUSION

The results obtained for the mineral composition of oil from raw tiger nut and anaerobic fermentation tiger nut indicated that RTN and AFTN are good for human consumption due to the benefits of different composition in them, Higher value of potassium in RTN 3265.48 ±0.50 and Clacium (6.471±0.10)and magnesium(147.470±0.20) in AFTN respectively. fatty acid composition of oil from raw and anaerobic fermentation of tiger nut (*Cyperus esculentus L)* indicated that oil from raw sample showed good qualities in terms of its unsaturated values than

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anaerobic fermentation tiger nut oil for convectional uses. The higher value obtained of saturated palmitic acid for anaerobic fermentation tiger nut oil sample favoured its industrial application for soap production, but are prone to oxidative rancidity.

RECOMMENDATION

Both oil can be recommended for convectional purposes in terms of their mineral composition while the appreciable values obtained in anaerobic fermented tiger nut oil fatty acid compositions has many industrial applications over raw samples such as soap production and their logistic values when the need for oil in saturated palmitic acid is needed industrially.

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