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Evaluations on the Physicochemical and Fatty Acid Composition of Raw and Toasted Melon (*Egusi*) and Dika Nut (*Ogbono*) Seeds.

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ABSTRACT: This study aimed to investigate the physicochemical and fatty acid composition of raw and toasted melon seed (*Citrullus vulgaris*) and dikanuts (*Irvingia gabonensis*) commonly known as egusi and ogbono respectively. The oil extracted was evaluated for its physical properties; oil yield, refractive index, specific gravity, flash point, melting point and viscosity. Also the chemical properties were determined such as iodine value, saponification value, free fatty acid, acid value, peroxide value, unsaponifiable matter. The fatty acid profile analysis of the oils were analyzed using GC-MS technique. The oil had refractive indices in ranges of 1.46 and 1.45 and specific gravity within the ranges of 0.94 and 0.92. The melting points ranged from 34.46 and 38.58. All analysis were carried out in triplicates and the results were subjected to statistical analysis using analysis of variance (ANOVA). Regression analyses of the data were conducted. Significance differences among the means were established at 5% level of significance using Duncans multiple range tests. The results obtained showed significant differences ($P<0.05$) among some of the parameters analyzed; physical, chemical and fatty acid profiles of the oils. The samples of toasted *egusi* with value 42.85 had the highest yield (%) of oil among the other oil seeds samples studied. The chemical property values were within recommended ranges for edible oils, indicating that the oils can be used for edible and industrial purposes.

KEYWORDS: *Egusi, ogbono*, melon, dika nut, oil, fatty acid, toasting, raw.

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1. INTRODUCTION

Melon, *Citrullus vulgaris* belongs to the family *Curcubitaceae*. They are widely cultivated in Nigeria especially in the southern part and usually inter-planted with yam and cassava where melon serves as a cover crop (Ogueke & Nwagwu, 2007). It is one of the most important vegetable crops in the tropical, subtropical, and Mediterranean zones of the world (Shippers, 2000). A native of Africa, and has been introduced to Asia, Iran and Ukraine (Schippers, 2000). Its common names include *egusi* in Yoruba, *agushi* in Hausa, *epingi* or *paragi* in Nupe and *eashi* in Gwari. Melon seeds have been classified into various varieties according to the thickness of the seed coat and the flatness of the edges. They are classified into three groups based on oil extraction characteristics (Oyolu, *et al.*,1977a). The seeds usually are white or cream color and can be of different sizes (Oyolu *et al.*, 1977b).

In Nigeria, the seeds are boiled in salted water, roasted or the roasted seeds ground and added to meals. It is a major soup ingredient and a common component of daily meals in West Africa. The vegetable oil extracted from the seeds is expensive and nutritious; this oil is used for cooking and cosmetics purposes and of interest to pharmaceutical industries (Jacob *et al.*, 2015). The residue from the oil extraction is made into balls that are fried to produce local snack in Nigeria, or is used as cattle feed (Schipper, 2002). In many parts of Africa, where farmers lack access to meat or dairy, the high oil and protein content can make an excellent dietary supplement. (Aidoo, 1986)

Studies conducted showed melon seed contain about 50% oil (Olaofe *et al.*,1994), 42-57% oil (Fokou *et al.*, 2009), 44-53% oil (Achu *et al.*, 2005) for seeds cultivated in different bioclimatic regions of Cameroon. These studies showed that melon seeds contain good amounts of oil that can be used as edible oil and for industrial productions.

Dika nut (*Irvingia gabonesis*) also known as African bush mango belongs to the family *Irvingiace* because the branches, leaves and inflorescence are entirely glabrous. It is widely used in Nigeria as a soup thickener because of its viscous properties. It is small mango-like fruit sometimes called wild-mango or bush mango (Idowu *et al*., 2013).

It is a very important indigenous fruits tree originating from West and Central Africa and its geographic range is from Nigeria to Congo. The kernels of *Irvingia gabonesis* seed is widely marketed domestically, nationally and between countries in West Africa for their thickening properties (Idowu *et al*., 2013). It is regarded as an oil seed and contains 54% percentage of oil. (Simons and Leakey, 2004).

Irvingia gabonesis fruit is edible, can be eaten fresh and resembles mango in appearance, varying from green to yellow when mature. In Nigeria, the most valuable part of *Irvingia gabonesis* is the kernel. The dried kernel is locally known as *ogbono* and contains high levels of fats and oils and is therefore classified as oil seed Ekpe *et al*. (2007). It is reported that dika nut kernel contains 5.20% moisture, 9.50% ash, 7.60% crude protein, 66.60% crude fat and 1.90% crude fibre Ejiofor *et al.* (1987). He further said that the fat extracted from the kernel can be used in both food (e.g. margarine or cooking oil) and non-food (cosmetics and pharmaceuticals) products.

This paper is aimed at investigating the oil characteristics and fatty acid composition of raw and toasted melon and *ogbono* seed.

2. MATERIALS AND METHODS

2.1 Sources of materials.

Freshly harvested *Citrullus vulgaris* which is Egusi (Melon seeds) and *Irvingia gabonesis* (Dika nut) *Ogbono* seeds used for this analysis were obtained from a local market in Ekeukwu Owerri in Imo State.

2.2 Sample preparation

The seeds were dehulled manually, cleaned and sorted to remove bad ones and divided into two portions. One part is the raw samples of egusi and ogbono which were pounded in a morter, while the remaining portions were toasted for 30 minutes at 105^{0}C (using aluminum pan). The toasted samples were milled finely (using attrition Globe corn mills (Bhojson, China) and sieve of 0.5mm mesh size to obtain the flour samples of *egusi* and *ogbono*. The samples of both raw and toasted samples were labelled separately for oil extraction.

2.3 Oil Extraction

Oil from the flour samples of raw *egusi* and *ogbono* and toasted *egusi* and *ogbono* were extracted by continuous extraction in soxhlet apparatus (cehmglass) for 8 hours using petroleum ether (60 – 80^{0}C boiling range) as solvent according to the method described by (AOAC, 1980). The extracted oils were stored in light proof, airtight and moisture proof container at 40^{0}C for further analysis.

2.4 Determination of Physical and chemical Properties of the oils

The physical properties of the oils were determined by the method reported by AOAC (2010) while the chemical properties of the oils; saponification value, peroxide value, iodine value, acid/free fatty acid values were determined by the methods described by Lotfy *et al*. ((2015). All experiments were carried out in triplicates.

2.5 Determination of fatty acid profile of raw and toasted *egusi* and *ogbono* seed oil using gas chromatography – mass spectrometry.

The sample was analyzed using an Agilent system (Agilent technologies 7890A, Network GC-System, Wilmington, USA) and 5977B MSD with Experimental conditions of GC-MS system.

2.6 Statistical analysis

All data obtained were subjected to analysis of variance (ANOVA) using SPSS statistical package and DUNCAN' S multiple range test was used to examine significant differences among experimental mean values (p<0,05).

3. RESULTS AND DISCUSSION

Table 1: Physical properties of raw and toasted *Egusi* and *Ogbono* seed.

Samples	Yield %	Specific gravity (g/ml)	Refractive index	Flash point (^{0}C)	pH	Melting point (^{0}C)	Viscosity
A	$41.34^c \pm 0.03$	$0.91^a \pm 0.00$	$1.46^a \pm 0.00$	$282.66^a \pm 0.05$	$6.66^a \pm 0.01$	$37.00^b \pm 0.00$	$37.32^a \pm 2.71$
B	$35.65^d \pm 0.06$	$0.89^c \pm 0.01$	$1.45^b \pm 0.00$	$238.90^c \pm 1.06$	$6.59^b \pm 0.00$	$35.00^c \pm 0.00$	$37.14^a \pm 0.26$
C	$39.21^b \pm 0.25$	$0.90^b \pm 0.01$	$1.44^c \pm 0.00$	$220.70^d \pm 1.11$	$6.47^c \pm 0.00$	$38.00^a \pm 0.00$	$37.43^a \pm 0.05$
D	$42.85^a \pm 0.73$	$0.90^b \pm 0.00$	$1.45^b \pm 0.00$	$267.24^b \pm 2.85$	$6.67^a \pm 0.01$	$35.00^c \pm 0.00$	$35.14^b \pm 0.26$

Value are means + standard deviation of duplicate samples. Means in the same column with different superscripts are significantly different ($p<0.05$).

Code**s:**

A - Raw egusi,

B -Raw *ogbono*

C - Toasted *Ogbono.*

D - Toasted *Egusi,*

The oil yield showed significant difference ($p< 0.05$), in the ranges of 42.85 to 35.65%. The result showed that toasted *egusi* had the highest oil yield than other samples. Toasting may have resulted to the increase in the oil yield. The oil content of *egusi* from this study is in line with the works of (Fokou *et al.*, 2009) who recorded oil from *egusi* to be between 42-57% while the oil content of *ogbono* is far lower than the values of crude fat (66%) recorded by Ejiofor *et al.* (1987).

The specific gravity of the oil samples obtained were between 0.89 to 0.91g/ml for raw *egusi*, raw *ogbono*, toasted *egusi*, and toasted *ogbono* and did not differ significantly ($p<0.05$). The results of the specific gravity were in line with the works of Ukom *et al*., 2018 for selected vegetable oil brands which were in the ranges of 0.87 and 0.91g/ml and also in line with the works of Nwachukwu *et al*. (2019) for bullet pear oil samples in the ranges of 0.89 to 0.91g/ml.

Specific gravity of vegetable oils in the ranges of 0.85-0.91g/ml indicates that they are less dense than water and can be advantageous in processes like cooking where oils need to spread evenly on the cooking surface.

The refractive index for raw *egusi,* raw ogbono, toasted *ogbono,* and toasted *egusi* are in the ranges of 1.44 to 1.46 and did not vary significantly ($p<0.05$). These results agreed with the findings of Welter (2004) on the refractive index of refined vegetable oils (1.46). Refractive index is said to be related to degree of unsaturation, fatty acid and conjugated bonds. Refractive index has been shown as one of the most important aid for classifying fatty oils in terms of its purity and application. It is closely related to the nature of the product (i.e. molecular height and degree of unsaturation). The refractive indexes of the samples studied are within the range of those reported for most conventional edible oils (Rossell, 1991, Codex Alimentarius, 1993).

The values of flash point of the oils in this study varied significantly ($p<0.05$) and at the ranges of 220.70 to 282. 66^{0}C. The values of flash point obtained in this study agrees with the values of 220.00 and 270.00^{0}C reported for soya bean and plantain peel oil (Oladiji *et al*. (2010) and in line with the works of Ukom et al.(2018) of selected vegetable oil brands which were in the ranges of 229.55 to 300.50^{0}C.

The pH values of the samples did not vary significantly ($p>0.05$), with ranges of 6.47 to 6.67. Oils are generally considered to be neutral with pH values close to 7. The pH values are important in determining the stability and shelf life of oils and oil products (Shahidi, 2020).

The melting point of the oils were in the range of 35.00 to 38.00 and differed significantly ($p<0.05$). It is the temperature at which the oil transitions from a solid to a liquid state. Oils with higher melting point such as coconut oil or palm oil are solids at room temperature and are commonly used in cooking and baking and they are more stable and have a longer shelf life than others Gunstone *et al*., 2007.

The viscosity of the oils did not differ significantly ($p>0.05$). Viscosity of oils refers to their resistance to flow and is a crucial property that influences their behavior and application. Oils with high viscosity is used as a lubricant Gunstone, et al. (2007).

Table 2: Chemical properties of raw and toasted ogbono and melon seed oil.

Sample	Parameters					
	Iodine value (g/100g)	**Peroxide value (mg/100g)**	**Saponification value (mgKOH/g)**	**Unsaponification value (%)**	**Free fatty acid (%)**	**Acid Value (mgKOH/g)**
A	102.11^a + 0.08	3.24^c + 0.01	192.28^a + 0.01	1.05^b + 0.01	0.67^c + 0.23	1.25^b + 0.01
B	54.67^c + 0.46	4.24^b + 0.01	190.12^b +0.12	1.10^a + 0.10	0.70^b + 0.00	1.43^a + 0.09
C	53.15^d + 0.51	4.24^b + 0.01	189.05^c + 0.54	0.94^d + 0.01	0.71^a + 0.00	0.30^d + 0.01
D	101.90^b + 0.04	4.60^a + 0.01	189.25^c + 0.04	0.96^c + 0.01	0.56^d + 0.00	1.01^c + 0.01

Values are means + standard deviation of duplicate samples. Means in the same column with different superscripts are significantly different ($p<0.05$).

Codes:

A = Raw *Egusi*

B = Raw *Ogbono*

C = Toasted *Ogbono*

D = Toasted *Egusi*

The iodine values in the oils samples showed significant difference (p<0.05). The values were in the range of 53.15 to 102.11g/100g. The iodine value of oils is a measure of the degree of unsaturation and is a useful indicator in quantifying the amount of double bonds present in the oil which in turn reflects its susceptibility to oxidation (Bello *et al.*, 2011). It is used to assess the stability and suitability of oils for various applications. Higher iodine value indicates higher levels of unsaturation (Gunstone *et al*., 2007). The high iodine values of both raw and toasted *egusi* suggests that *egusi* contain unsaturated fatty acids. Oils with high iodine value are useful as raw materials in the manufacture of vegetable oil-based ice cream (Buono *et al.*, 2014).

The peroxide value is an index of determining rancidity in oils, thus a high peroxide value of oil indicates a poor resistance of oil to oxidation during storage and suggests a high level of oxidative rancidity. (Mohammed and Bader, 2015).

The peroxide values obtained from this study ranges from 4.60mg/100g and 3.24mg/100g indicating that oils of raw and toasted *egusi* and *ogbono* will be stable against oxidative rancidity. However, (Roiaini *et al.*, 2015) reported a much higher value for blend of olive, palm olein and canola oil. Low peroxide values confirm the stability of an oil while higher values between 20 and 40m Eq/kg result to a rancid taste (Akubugwo *et al.*, 2007). A maximum limit of 10m Eq/kg has been set by Codex Alimentarius Commission for nuts and seed oils. (SON, 2000).

The saponification values of the oils of raw *egusi*, raw *ogbono*, toasted *ogbono*, toasted *egusi*, *ogbono* obtained for this study were in the ranges of 189.05mgKOH/g to 192.28mgKOH/g. The values are however, closer to 175.78mgKOH/g for groundnut seed oil reported by (Musa, *et al.*, 2012) and 193.00mg KOH/g for seed oils reported by (Elizabeth, *et al.*, 2012).

The saponification value of oil is a measure of its oxidation during storage and also indicates deterioration of the oils. It is the measure of the average molecular weight of the fatty acids in the oil and helps to identify the type of fatty acids present in the oil (Gunstone, *et al*., 2007). It provides information on the average molecular height and hence, chain length of a lipid (Ardabili, *et al.*, 2011). Saponification values of raw *egusi*, raw ogbono, toasted *egusi*, and toasted *ogbono* oils were in the range of all edible oils (NIS, 2001).

The unsaponification values from this studies were in the range of 0.94 and 1.10% and the values showed significant difference (p<0.05). These values are in agreement with the works of Nwabueze and Okocha (2006) who reported that most oils of normal purity contain less than 2% unsaponifiable matter.

The acid values obtained in this study showed significant difference (p<0.05). Acid values measures the percentage content of free fatty acids in a given amount of oil. It also provides information on the extent of the decomposition of triglycerides in the oil by lipase action into free fatty acids and other physical factors such as light and heat, it depends on the degree of rancidity which is used as a measure of freshness (Ochigbo and Paiko, 2001). The acid value of the oil suitable for edible purposes should not exceed 4mgKOH/g. The acid values obtained in this study are lower than the recommended limit for edible oils. The low acid values indicates that the triacylglycerols have not been hydrolyzed, which could indicate a good stability. Also, oils with a lower acid values are more edible and acceptable for edible applications. The lower acid values indicates that the oil can be stored for a long period without deterioration. (Musa *et al.*, 2012).

Significant differences (p<0.05) were observed in the values obtained during the study and were in the ranges of 0.56 to 0.71% with toasted *ogbono* recording the highest free fatty acid value of 0.71%, while toasted *egusi* recorded the least value of 0.56%

This study showed that the oils of *egusi* and *ogbono* in raw and toasted forms contain lower free fatty acid. Oils with low free fatty acid values may not be easily prone to hydrolytic rancidity. The low FFA values obtained in this study suggest that the oils are of good quality and can be used for domestic purposes.

Table 3: Fatty Acid Composition of Raw and Toasted *Egusi* and *Ogbono* seed.

Sample	Parameter (%)					
	Palmitic acid	Oleic acid	Lauric acid	Myristic acid	Linoleic acid	Cis-vaccenic acid
E	$9.49^{b} \pm 0.02$	$4.59^{c} \pm 0.12$	$3.70^{c}\pm0.01$	$0.02^{c}\pm 0.11$	$82.2^{a}\pm0.01$	$0.04^{c}\pm0.00$
F	$28.28^{a} \pm 0.01$	$50.12^{a}\pm0.00$	$0.11^{d}\pm0.01$	$17.23^{a}\pm0.11$	$0.12^{c}\pm0.13$	$4.33^{a}\pm0.00$
G	$0.08^{d}\pm 0.01$	$34.92^{b}\pm0.03$	$65.07^{a} \pm 0.17$	0.03^{c}-± 0.00	$0.11^{c}\pm0.14$	$0.07^{b}\pm0.01$
H	$4.39^{c} \pm 0.03$	$1.16^{d}\pm 0.01$	$57.34^{b} \pm 0.11$	$2.24^{b} \pm 0.17$	$34.8^{b}\pm0.17$	$0.03^{c}\pm0.13$

Codes:

E = Toasted *Egusi*

F = Raw *Egusi*

G = Toasted *Ogbono*

H = Raw *Ogbono*

The oil contains important fatty acid which are major sources of energy and also needed in the body for proper functioning. (Makeri *et al.*, 2016).

Saturated and unsaturated fatty acids in the oils were detected and identified by the Gas Chromatography Mass spectroscopy [GC-MS] procedure. A total of 6 (Six) fatty acids were detected in all the seed oil; 3 (three) saturated fatty acids, palmitic acid, Lauric acid, mystric acid, 2(two) monosaturated fatty acids (oleic acid, cis vaccenic acid), and (one) 1 polyunsaturated fatty acid (linoleic acid).

Vegetable oils have an important functional sensory role in food products because of their fatty acids composition and the fat-soluble vitamins (A, D, E, and K)

They are also sources of energy and essential fatty acids like linoleic acid and linolenic that are responsible for growth and health of organisms. (Emmanuel and oghene, 2008). Oil that contains fatty acids with short chain have lower melting point and are soluble in water. Whereas, the oils that contain fatty acids with longer chains have higher melting point compared to saturated fatty acid of similar chain length. (Fashina, 1971)

From the gas chromatography mass spectrometry result, toasted *egusi* recorded the highest value of linoleic acid (82.20%) followed by raw *ogbono* (34.85%) having the lowest composition of linoleic acid (34.58%) and trace quantity were found in raw *egusi* and toasted *ogbono*. The linoleic acid value for toasted *egusi* (82.20%) was higher than one obtained from melon seeds by (Olaofe *et al.*, 1994) which was (67.7%). The higher value of linoleic acid recorded by toasted *egusi* could have been as a result of heat treatment. With respect to modern diets, the amount of linoleic acid consumed has increased exceptionally in the past 100 to 150 years (Piomelli, 2000). Linoleic acid has the ability to reduce the risk of coronary heart diseases by lowering blood cholesterol levels and also used to reduce mastalgia (breast pain) and oleic acid could act as anti allergic agent. (Gouk *et al.*, 2011)

In a descending order, palmitic acid esters were present in raw *egusi* (28.20%), toasted *egusi* (9.49%), Raw *ogbono (*4.39%) and was almost absent in toasted *ogbono*. Palmitic acid is one of the most common saturated fatty acids which can increase unhealthy low density lipoprotein (LDL) cholesterol level. Miserey (2010). Palmitic acid is the most common saturated fatty acid found in the human body and can be provided in the diet or synthesized endogenously from other fatty acids, carbohydrates and amino acids.

Being one of the most prevalent saturated fatty acids in body lipids, it could constitute a major risk factor for heart attacks and strokes. Diets high in saturated fatty acids increase the production of acetate fragments in the body which, in turn, leads to an increase in the production of cholesterol. When consumed, saturated fats tend to clump together and form deposits in the body, along with protein and cholesterol. They get lodged in blood cells and organs, leading to many health problems, including obesity, heart diseases and cancers of the breast and colon. However, since the dietary effects of high-fat diet, mainly in saturated fatty acids, have been focused on the reduction of cardiovascular diseases, Aranceta and Perez-Rodrigo, (2012), Assmann *et al, (*2014), obesity-related diseases and, recently, cancer prevention.

Oleic acid as a monounsaturated fatty acid were found present in all the oil samples. Oleic acid dominates the fatty acid present in the oil with the value of (50.12%) in raw *egusi*, (34.92%) in toasted *ogbono*, (4.59%) in toasted *egusi* and raw *ogbono* (1.16%) with the least. Since the unsaturated fatty acid has the highest percentage in raw *egusi*, it simplies that the oil may be desirable for cooking. Since unsaturated fatty acid may lower blood serum cholesterol Hegsted (1993). Oleic acid, an omega-9 fatty acid found in significant amount in oils, is very good for food, medicinal and health purposes.

Lipid soluble form of oleic acid is also widely used as solvent for steroids (Makeri, *et al*., 2016). Oleic and linoleic acids are the most concentrated fatty acid in raw *egusi* and toasted *egusi*. The presence of Oleic acid shows that the oil can be used as an anti-allergic agent, to promote the skin cells (Gouk *et al.*, 2013).

Lauric Acid is a saturated medium-chain fatty acid with a 12-carbon backbone. Lauric acid is found naturally in various plant and animal fats and oils, and is a major component of coconut oil and palm kernel oil. Lauric acid was present in significant amount in toasted *ogbono* (65.07%), raw ogbono (57.34%), and trace amount in raw *egusi* (3.70%) and absent in raw *egusi*.

Leakey (2005) reported the fatty acid composition of 151 dika nut kernels from 24 dika nut trees of Cameroon and Nigeria which contained lauric acid (33.5- 42.1%), and myristic acid (48.7-55.5%) as the major fatty acids. Okolo (2000) reported that kernel fat from Sierra Leone contained 33.5% and 58.6% of myristic and lauric acids respectively. Slight variations may exist normally in the composition of agricultural. Products from one place to another depending on the varietal differences, soil types and agro climatic changes (Leakey *et al,* 2005). The fatty acid profile of the studied oil samples fat was observed to be similar to that of coconut and palm kernel oils (O'Brien, 2005).

Myristic acid, a long-chain saturated fatty acid (14:0), is one of the most abundant fatty acids in milk fat (above 10%) (Makeri *et al.*, 2016). This fatty acid is known because it accumulates fat in the body, however, its consumption also impacts positively on cardiovascular health. This behavior is largely influenced by the balance between saturated fatty acid and simple dietary carbohydrates in the diet (Gouk, *et al*., 2013).

Mystric acid was present in raw *ogbono* (17.23%) and raw *egusi* (2.24%).

The clear and slightly pale appearance of the oil and its greasy white colour at room temperature conditions might probably be due to its high myristic acid content.

Myristic acid exists at room temperature as white or yellowish glossy crystals with a faint, waxy-oily odor. O'Brien (2005) reported that the melting point of myristic acid is about 54.4 % which explains why the oil solidifies at room temperature. This behaviour may be attributed to its high myristic acid and lauric acid contents. Burdock and Carabin (2007) reported that myristic acid has several applications in food systems; it is a multi-purpose food additive, flavor ingredient, de-foaming agent and useful for coating fresh citrus fruits in the food industry. It is also a key ingredient in the manufacture of alkali salts, synthesis of perfume esters and cutting agent in various flower absolutes and essential oils. Nangue *et al.* (2011) observed that myristic acid showed a low order of acute oral toxicity in rats; however, excessive intake of saturated fats (with myristic acid as the major fat) may increase blood triglyceride and cholesterol levels. Kiyasu , (1952) reported that *Irvingia gabonensis* kernel fat increases the amount of HDL-cholesterol (good cholesterol) in blood and liver lipids; this may be credited to the presence of lauric acid and myristic acid which metabolized faster through portal absorption. This has been earlier validated by Rioux (2000) who reported that myristic acid is more rapidly metabolized in cultured hepatocytes than palmitic acid. With 79% myristic acid in its fatty acid profile, nutmeg is the richest known source of myristic acid (Makeri *et al*., 2016).

Furthermore, Cis-Vaccenic acid was found present only in raw *egusi* and was absent in toasted ogbono toasted *egusi* and raw *ogbono*. It is a monounsaturated fatty acid (one Trans double bond; shorthand nomenclature cannot be used to name Trans fatty acids) member of the sub-group called long chain fatty acids (LCFA) (from 14 to 18 carbon atoms). Most studies on vaccenic acid in animal models and cancer cell lines have demonstrated a beneficial reduction in cell growth and/or tumor metabolism. (Kojima *et al*., 2010). Data from some short-term animal studies indicate that vaccenic acid may have a positive influence on immune response. However, health benefits could be derived from the long-term consumption of vaccenic acid. In a 16-week trial involving rodent models, a diet enriched with vaccenic acid significantly improved immune function (Wang *et al.*, 2008).

Generally, plants with high quantity of unsaturated fatty acids in their oils have a great advantage in nutritional and health aspects. Since its consumption covers the risk of heart related diseases whereas foods with high saturated fatty acid are associated with cardiovascular disorders such as atherosclerosis, aging and cancer (Kojima *et al*., 2010).

4. CONCLUSION

The results obtained from this work compared favorably with conventional edible oils. The high oil yield made them economically and industrially useful. The findings highlighted on the significant alterations in some parameters due to toasting. The research underscored the importance of processing methods in influencing the nutritional composition of these seeds, which are commonly used in traditional culinary practices and hold potential as valuable food resources. Further research could explore the potential implications of these compositional changes on the sensory, nutritional and health-related aspects of the seeds.

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