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CHEMICAL CHARACTERIZATION AND LIPID PROFILE OF *MORINGA OLEIFERA* SEED OIL IN MAKURDI BENUE STATE, NIGERIA

[*1]Omaji G.O., [1]Osibemhe M., [2]Utu-Baku A. B.

[1]Department of Biochemistry and Molecular Biology, Faculty of Science, Federal University Dutsin-Ma, Dutsin-Ma, Katsina State, Nigeria.
[2]Department of Medical Biochemistry, Faculty of Basic Medical Science, Cross River State University of Technology, Cross River State, Nigeria.
[*]Email of Corresponding Author: globlings@gmail.com
Tel: +234 (0) 8104639613

ABSTRACT
The oil extracted from *Moringa oleifera* seeds using n-hexane was analysed for the chemical properties and lipid profile. The seed exhibited an oil yield of 41.16%. The extracted seed oil revealed an Iodine value of 67.56 ± 0.10, Saponification value of 174. 40 ± 0.20, Acid value of 3.13 ±0.01 and Peroxide value of 1.80 ± 0.00. It also had a Free Fatty Acid value of 1.58 ± 0.70 and Ester value of 171.27 ± 0.19. The oil contain many important fatty acids with high level of oleic acid up to 69.67%. The sterol and α-tocopherol content were 0.70 and 10.25 respectively. The result from this study suggest that the oil can be used for both edible and commercial purposes.

Keywords: *Chemical characterization, edible oil, lipid profile, oil yield, Moringa oleifera,*

INTRODUCTION

The demand for edible oils have increased tremendously in recent years. This is due to the ever increasing world's population and their industrial applications. Edible oils can be gotten from both plants and animals. However, about 80% of the edible oils are obtained from plants sources (Damude and Kinney, 2008), most especially plant seeds.
Edible oils obtained from plant seeds have wide applications, they are used as cooking oils, or they may be solidified to make fat in food industries (Adebayo *et al.,* 2012). This makes them an important component of diet. They contain lipids and fatty acids that are important for human health, though in varying quantities (Dyer *et al*., 2008). In addition, some fatty acids in these oils also make them useful for cosmetic production in industries due to their beneficial properties. For example, linoleic acids helps to moisturize the skin when used in cosmetic products, it also aids healing of dermatoses and sun burns (Vermaak *et al*., 2011).

Moringa oleifera Lam. is a small graceful deciduous and fast growing tree with sparse foliage that is widely cultivated in different part of Nigeria. It belongs to the family *Moringaceae* and grows up to 8 m in height (Ambi *et al*., 2011). Every part of the plant is edible and have nutritional and commercial uses (Fahey, 2005). The major source of moringa oil is the seeds. The seeds are round with a brownish semi-permeable seed hulls with an average weight of 0.3g. Each tree can produce 15 000 and 25 000 seeds per year (Pant, 2016). The pods are used in culinary preparation, and the seeds can be fried and eaten. Moringa seeds have been reported to have a high content of methionine and cysteine similar to those found in milk (Leone *et al*., 2016), in addition to having antimicrobial activity. The *Moringa oleifera* seed oil is known as 'Ben oil' and is used in salad, and also as lubricant (Anwar *et al*., 2006).

The use of edible seed oils for nutritional, industrial and pharmaceutical purposes has increased demand on the need to characterize and provide information on the lipid composition of more under explored seed oil, in order to meet the demand of the growing population. This study therefore, aim to characterize and provide information on the lipid content of *Moringa oleifera* seed oil.

MATERIAL AND METHODS

Seed Collection and Identification

The seeds of *Moringa oleifera* were collected from house yards around Federal Locust Makurdi, Benue state, Nigeria. The seeds were identified at the Department of Biological Sciences, University of Agriculture Makurdi, Benue State, Nigeria while the research was conducted at the Department of Biochemistry, Kogi State University, Nigeria. The seeds were sun dried and the seed coat removed manually. The dehulled seeds were further dried at 60°C in an oven for 48 hours.

Oil Extraction

The oven dried seeds were ground to fine powder using a mortar and pestle. Oil was extracted from the ground seed by Soxhlet extraction method using n-hexane. To extract the oil, 100g of sample, 50g each was accurately weighed into a Watman filter paper, wrapped and the weight taken. The weighed sample were then fed into a Soxhlet apparatus fitted with a 500ml round bottom flask. About 300ml of n-hexane was used and extraction carried out for 6 hours. After which the solvent was completely evaporated over a water bath.

Percentage (%) Yield

After complete evaporation of the solvent, the weight of the extracted oil was taken and the percentage yield calculated as:

$$\text{Percentage (\%) yield} = \frac{weight\ of\ extracted\ sample}{original\ weight\ of\ sample} \times 100$$

Chemical Analysis

Saponification value, iodine value, acid value were determined by the methods described by Amadi *et al*. (2004). The free fatty acid value and ester value were determine by standard methods recommended by A.O.A.C (1980). Peroxide value was determined by the method described by Pearson (1962).
High performance liquid chromatography (AKPA HPLC) was used to determine the fatty acid profile and α-tocopherol content.

Sample Preparation

To prepare the sample for HPLC analysis, 0.5g of *Moringa oleifera* seed sample was weighed into 10ml capped bottle

and 10ml of n-hexane (BDH HPLC grade) added. The mixture was left overnight after shaking. The content was then centrifuged and supernatant pipetted and kept for fatty acid and α-tocopherol analysis.

Determination of fatty acid composition

The fatty acid composition was done by method described by Friday *et al*. (2011). An amount (2.0 ml) of *Moringa oleifera* oil was measured into a test tube and 0.3 ml of 1 M sodium methoxide was mixed thoroughly and left overnight and centrifuged. The clear solution was decanted and evaporated to dryness and then 2.0ml of acetonitrile (BDH HPLC grade) was added to dissolve the precipitate. Then 2.0µl was injected into the HPLC with column ODS-2 (18) detector, UV at 215 nm and F/R = 1 µl/min. the fatty acids was calculated with reference to the standards using this formula:

Conc. of sample = $\frac{Peak\ area\ (in\ AU\ mi) of\ sample}{Peak\ area\ (in\ AU\ Mi)\ of\ Standard}$ x conc. of standard

Determination of α-tocopherol content

The α-tocopherol content was determined by the method described by Friday *et al*. (2011). The extracted moringa oil (2.0ml) was measured into a test tube and the hexane evaporated through nitrogen gas. Methanol (HPLC grade) (2.0 ml) was added to dissolve the vitamin then 20 µl of the mixture was injected into the HPLC with ODS-2 C18 detector, UV at 290 nm and F/R = 10 µl/min

Determination of Sterol Composition

The sterol composition was determined by A.O.A.C (1990)

Statistical analysis

Analysis of *Moringa oleifera* seed sample was carried out and results were reported as mean ± SD. Samples were prepared and measured separately in triplicate. The results of the lipid profile were in percentages.

RESULTS AND DISCUSSION

The oil yield *and* chemical properties of the seed oil of *Moringa oleifera* are shown in Table 1. The oil extracted from the *Moringa oleifera* seeds has a yellow colour, liquid at room temperature with an agreeable and characteristic odour. The oil content of *Moringa oleifera* seed from Makurdi was not so different from those reported by Anhwange *et al.* (2004) and Ogbunugafur *et al*. (2011) which were 41.58% and 41.47% respectively. However, the oil was slightly higher than those reported (38.30%) by Lalas and Tsakins (2002). The variation in the oil yield of *M. oleifera* seeds might be attributed to the genetic composition of the plant or variation in geographic conditions.

Table 1: Percentage Yield, Organoleptic and Chemical Parameters of *Moringa oleifera* Seed Oil

Parameters		*M. oleifera* oil
Organoleptic	Colour	Yellow
	Odour	Characteristic
	State at room temperature	Liquid
Yield (%)		41.16
Iodine value (g/100g of oil)		67.56 ± 0.10
Saponification value (mg of KOH/g)		174.40 ± 0.20
Acid value (mg/KOH/g)		3.13 ± 0.01
Peroxide value (meq/kg)		1.80 ± 0.00
Ester value		171.27 ± 0.19
Free fatty acid (%)		1.58 ± 0.70

Each value is mean of three replicate ± SD (Standard deviation

Iodine value indicate the degree of unsaturation of oil. The iodine value of the *Moringa oleifera* seed oil was 67.56 ± 0.10. The saponification value was 174.40± 0.20. The saponification value was comparable to those obtained (178.11) by Tsaknis *et al*. (1999). Saponification value provides information about the fatty acids present and the ability to make soap. The high saponification value of the oil suggest that the oil is suitable for making soap, lather shaving creams, shampoos, oil based ice-cream and cosmetics (Adebayo *et al.*, 2012). In addition, the high saponification value also indicates that the oil contains a high proportion of lower fatty acids, and therefore can be regarded as an edible oil. The acid value was 3.13± 0.01. The low acid value indicates a possible low free fatty acid composition which suggest lesser susceptibility to hydrolysis (Li *et al*., 2007). The peroxide value 1.80± 0.00 obtained for the *Moringa oleifera* seed oil is comparable to those from Kenya (Tsaknis *et al*., 1999) but different from those of Pakistan and Malawi (Anwar and Rashid, 2007). Since peroxide value indicate the oxidative rancidity of oil, the low peroxide value show that the oil is less prone to rancidity and it is stable (Adebayo *et al*., 2012). In addition, the peroxide value was observed to be lower than the stipulated FAO/WHO (2009) standard. The lower peroxide value therefore suggest that the oil is suitable for consumption.

The ester value obtained was 171.27 ± 0.19. The high ester value of the oil show that high proportions of glyceride are intact and that the oil is of appreciable quality (Anhwange *et al*., 2004). The free fatty acid value was 1.58 ± 0.70. Free fatty acid value indicates the deteriorating condition and edibility of the oil. The low free fatty acid value suggest that the oil is edible. The low free fatty acid also indicate that the oil is suitable for refining. This is because oil with high free fatty acid result in loss of neutral oil during the refining process (Aremu *et al*., 2015). High amount of free fatty acids can also lead to the development of objectionable flavour and odour and reduction in the half-life of the oil.

The lipid profile of *Moringa oleifera* seed oil is shown in Table 2. The following fatty acids were identified from the analysis: oleic acid, stearic acid, myristic acid, palmitic acid, linoleic acid and linolenic acid. Oleic acid has the highest percentage among the fatty acids with a percentage of 67.67%. This result is comparable to those reported by Abdulkarim *et al*. (2005). The value of α-tocopherol obtained in this study was 10.25%. Oleic acid is an unsaturated fatty acid with one double bond. The high percentage of oleic acid

in the oil makes it desirable for cooking and frying. Vegetable oils such as those obtained from canola, corn and sunflower with high oleic content have demonstrated a strong stability to oxidation when used in frying (Bouanga-Kalou *et al*., 2014).

Table 2: Lipid Profile of *Moringa oleifera* Seed Oil

Lipid profile	Composition (%)
Oleic acid	69.67
Stearic acid	1.99
Myristic acid	1.01
Palmitic acid	6.96
Linoleic acid	1.60
Linolenic acid	1.30
Sterol	0.70
α-tocopherol	10.25

Each value represents percentage (%) composition of the lipid profile

Oleic acid in diet is important for human health. Oleic acid in olive oil has been reported to be associated with prevention of breast cancer (Win, 2005). Tocopherols have antioxidant activity, the present of tocopherol in the oil can offer some protection during storage and processing. Alpha tocopherols also play several biochemical function in the body. They have been reported to modulate expression proteins involved in cholesterol metabolism and cell proliferation and inhibition (Grilo *et al*., 2014).

CONCLUSION

The analysis of the chemical characteristics and lipid profile of the *Moringa oleifera* seed oil confirm that the oil has potential as both an edible and industrial oil. The oil should be fully exploited for nutritional, industrial and pharmaceutical use.

REFERENCES

Abdulkarim SM, Lai OM, Muhammad SKS, Long K and Ghazali HM (2005). Some physico-chemical properties of *Moringa oleifera* seed oil extracted using solvent and aqueous enzymatic methods. *Food Chem.*, 93: 253-263.

Adebayo SE, Orhevba BA, Adeoye PA, Musa JJ and Fase OJ (2012). Solvent extraction and characterization of oil from star apple (*Chrysophyllum albidum*) seeds. *Acad. Res. Int.,* 3(2):178-183.

Amadi BA., Agomuo EN and Ibegbulem CO (2004). Research methods in Biochemistry. Supreme Publishers.

Ambi AA, Abdurahman EM, Katsayal UA, Sule MI, Pateh UU and Ibrahim NDG (2011). Toxicity evaluation of *Moringa oleifera* leaves. *Int. J. Pharm. Res. Inno.,* 4: 22-24.

Anhwange BA, Ajibola VO and Oniye SJ (2004). Chemical studies of the seeds of *Moringa oleifera* (lam) and *Detarium microcarpum* (guill and sperr). *J. Biol. Sci.*, 4: 711-715

Anwar F and Rashid U (2007). Physicochemical characteristics of *Moringa oleifera* seeds and oil from a wild province of Pakistan. *Pak. J. Bot*., 39: 1443-1453

Anwar F, Zafar SN and Rashid U (2006). Characterization of *Moringa oleifera* seed oil from drought and irrigated regions of Punjab Pakistan. *Grasas Y Aceites,* 57 (2): 160-168.

A.O.A.C (1990). 15th edition AOAAC Inc. suite 4000 Virginia USA

A.O.A.C (1980). 13th edition London AOAC, Washington DC.

Aremu1 MO, Ibrahim H and Bamidele TO (2015). Physicochemical characteristics of the oils extracted from some Nigerian plant foods – A Review. *Chem. Pro. Eng. Res.,* 32.

Bouanga-Kalou G, Dhellot JR, Matos L, Kimbonguila A, Mountou-Tchitoula D and Malela KE (2014). Characteristic physicochemical of oil extract from *Moringa oleifera* and the kinetics of degradation of the oil during heating. *Res. J. App. Sci., Eng. Technol.,* 7(17): 3649-3655

Damude HG and Kinney AJ (2008). Enhancing plant seed oils for human nutrition. *Plant Physio*l., 147(3): 962-968.

Dyer JM, Stymne S, Green AG and Carlsson S (2008). High-value oils from plants. *The plant Journal*, 54: 640-655.

Fahey JW (2005). *Moringa Oleifera:* A review of the medicinal evidence for its nutritional, therapeutic and prophylactic properties. Part 1. *Tree for Life Journal*.

FAO/WHO (2009). Report on the 21st session of the Codex Alimentarius Committee on fats and oils. Kola Kinabalu, Malaysia.

Friday ET, Omale J, Olupiyo O and Adah G (2011). Investigation on the nutritional and Medicinal potential of *Ceiba pentandra*. *Int. J. Plant physiol. Biochem.*, 3(6): 95-101

Grilo EC, Costa PN, Gurgel CSS, Lima Bessera AF, Almeida FNS and Dimenstein R (2014). Alpha-tocopherol and gamma-tocopherol concentration in vegetable oils. *Food Sci. Technol. (campinas),* 34 (2).

Lalas S and Tsaknis J (2002). Characterization of *Moringa oleifera* seed variety 'Periyakulam 1'. *J. Food Compos. Anal.*, 15(1): 65-77.

Leone A, Spada A, Battezzati A, Schiralsdi A, Aristil J and Bertoli S (2016). *Moringa oleifera* seeds and oil: Characteristic and uses for human health. *Int. J. Mol. Sci.*, 17(2141): 1-14.

Li SG, Zhang H and Xue WT (2007). A novel method for the determination of acid value of vegetable oils. *Eur. J. Lipid Sci. Tech.,* 109: 1088-1094.

Ogbunugafor HA, Eneh FU, Ozumba AN, Igwo-Ezikpe MN, Okpuzor J, Igwilo IO, Adenekan SO and Onyekwelu OA (2011). Physicochemical and antioxidant properties of *Moringa oleifera* seed oil. *Pak. J. Nutr.,* 10(5): 409.

Pant P (2016). Sanja-A green super food. *Bull. Env. Pharm. Life Sci*., 5(3): 98-102.

Pearson D and Cox HE (1962). The chemical analysis of food chemical. Publish CO Inc. New York.

Tsaknis J, Lalas S, Gergis V, Dourtoglou and Spiliots V (1999). Characterization of Moringa oleifera variety Mbololo seed oil of Kenya. *J. Agric. Food Chem.*, 47: 4495-4499.

Vermaak I, Karmatou GPP, Komane-Mofokeng B, Viljoen AM and Beckett K (2011). African seed oils of commercial importance-cosmetic applications. *S. Afr. J. Bot.*, 77: 920-933.

Win DT (2005). Oleic Acid – The Anti-Breast Cancer Component in Olive Oil. *AU J.T.,* 9(2):75-78