FATTY ACID COMPOSITION OF FICUS SUR SEED OIL (moraceae) OBTAINED IN ENUGU STATE, NIGERIA.

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ABSTRACT

In order to reduce the use of industrial trans fat in food processing for human consumption, as recommended by the World Health Organization (WHO), and to dramatically reduce cardiovascular disease as a result of its effects. The fatty acid profile of Ficus sur oil seeds was examined in order to consider an alternative to trans fat in meals. The composition of fatty acid methyl ester (FAME) extracts of Ficus Sur, a member of the Moraceae family, was determined using GC-MS. The results showed the percentage composition of the various constituents of the seed oils as follows: carbonic acid (4.594%), octadecanoic acid (1.341%), olean-12-en-3-ol, acetate (3β) (40.780%), 1-hexadecanol, 2-methyl-(3.342%), lupeol (15.904%), 1-eicosanol or arachidic alcohol (2.39%), eicosyl octyl ether (1.328%), octadecane, 1-chloro-(7.368%) and nonacos-1-ene (1.378%). Stearic acid was observed to be the only fatty acid present in the oil seeds. The presence of stearic acid in the seed oil is promising and inductive of being an alternative replacement in the gradual phasing out of trans fat in human diet.
Keywords: Fatty Acid, Ficur sur seed oil, Stearic acid, Trans fat

INTRODUCTION

According to the World Health Organization, Trans fat consumption causes more than 500,000 deaths each year due to cardiovascular disease [1]. Nigeria had approximately 854,000 deaths in 2019, according to the Global Burden of Disease data (GBD) result tool of the Institute for Health Metrics and Evaluation (IHME), around 137,000 deaths were attributed to cardiovascular diseases, with 3,229 deaths attributed to TFA-related cardiovascular deaths [2]. Trans fats from industrial sources are found in hardened vegetable fats like margarine and ghee, as well as snack foods, baked goods, and fried foods. Manufacturers frequently use them because they have a longer shelf life than other fats. However, there are healthier alternatives that will not affect the taste or cost of the food [1].

Scientists are currently evaluating various plants, seeds, and oils as viable substitutes for saturated fats, which are becoming increasingly popular among consumers. *Pachira aquatica* seed oil [3], Bambara groundnut oil [4], fluted pumpkin seed oil [5], *Diospyros mespiliformis, Albizia lebbeck, Caesalpinia pulcherrima* [6] have shown promising outcomes in replacing the trans fats in foods.

Ficus sur (forssk), formerly known as Ficus capensis, is a medium-sized moraceae tree with a cylindrical growth habit that extends to the ground, brown bark with small scales, white sap that turns darker, and 2.5-15cm long foliage leaves [7]. Fig tree fruits, roots, and leaves are known for a variety of therapeutic properties; including their use in traditional medicine to treat cardiovascular, respiratory, and gastrointestinal disorders [8-9]. Its, crushed fruit in water is used to support lactation in pregnant women during childbirth and after delivery. To treat snakebites, the fruits are combined with other plants such as *Terminalia macroptera*. To treat thyroid fever, the Ficus sur fruit is ground into flour and mixed with red potassium and a small amount of water, as well as sugar or honey, and taken for up to four weeks. The bark, on the other hand, is applied to boils as a compress [10]. Skin rashes and mouth sores are treated with powdered bark. Fever and cough are treated by drinking bark maceration. The sap from the leaves is used to treat wounds, and the leaves are chewed to treat peptic ulcers. Chest problems are treated with leaf maceration. Leaf decoctions are used as a disinfectant wash and for ophthalmic treatment. Tonsillitis and stomach pain are treated with leaf infusions. Against gonorrhoea, the sap of young shoots is used. [11] reported the presence of some antioxidant compounds such as alkaloids, flavonoids, saponosides, glucosides, tannins, sterols, terpenoid and anthocyanins in some parts of the Ficus sour tree such as ripe fruits, unripe fruits, leaves, bark and root.

The World Health Organization (WHO) released the REPLACE action package in 2018, which is a step-by-step guide for removing industrially produced Trans Fat acid from the global food supply chain. The REPLACE action package consists of six strategic action areas designed to ensure that industrially produced Trans Fat acid is removed quickly, completely, and permanently. Reviewing dietary sources of industrially produced Trans Fat acid and the policy landscape for needed policy change, promoting the replacement of industrially produced Trans Fat acid with healthier fats and oils, legislating or enacting regulatory actions to eliminate industrially produced Trans Fat acid, and other measures are among the action areas [12]. The purpose of this research is to determine the fatty acid composition of ficus sur seed oil collected from Akpugo, Enugu State, Nkanu West Local Government Area. There are little or no research on the fatty acid composition of Ficus sur seed oil in Nigeria. This research could help to improve and expand on the existing information in the literature about the fatty acid composition of ficus sur seed oil from its tree and available healthy fatty acids edible for consumption.

MATERIALS AND METHODS

Materials

All chemicals were purchased from Sigma Aldrich Company Limited, Irvine, United Kingdom.

Methods

In this study, fresh ficus sur seeds from its tree grown in Mgbowo, Awgu Local Government Area, Enugu State, Nigeria was harvested. The harvested seeds were washed several times with water, after which they were left to dry at room temperature for one week [13].The obtained sample were stored at 4 ºC until analysis.

Methanolic Extraction

In a 100cm^3 glass jar, 10 g of the powdered Ficus sur plant fruits seeds were weighed separately, and 50ml of methanol was added. The mixtures were stirred for 20 minutes before being sealed and left undisturbed for 72 hours. The homogenates were then filtered into separate sterile containers using a vacuum filtration apparatus aided with a vacuum pump. The methanolic filtrates were separated into separate clean beakers and concentrated in a water bath for 24 hours by evaporation to dryness [14].

Fatty acid profile determination of Ficus Sur seed oil

A 50mg portion of the extracted sample oil was esterified with 3.4 ml of 0.5M KOH in dry methanol for five minutes at 95˚C. 0.7M HCl and 3 ml of 14 percent boron triflouride in methanol were used to neutralize the mixture. To complete the methylation process, the mixture was heated to 90°C for 5 minutes. The fatty acid methyl esters were extracted three times with redistilled n-hexane from the mixture. For gas chromatography analysis, the content was

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concentrated to 1 mL and injected into the injection port of the Gas Chromatography (Agilent Technologies, 7890A GC system) [15].

Gas chromatography-MS analysis

The NIST, 2008 library was used to identify the chromatogram's peaks. The injector was set to 250°C, while the detector was set to 310°C. The samples were heated to 310ºC with a 10ºC/min heating ramp for 16 minutes after being heated to 40ºC for 2 minutes. Standard and sample injector volumes were 1.5 l, respectively.

RESULTS AND DISCUSSION

Figure 1 and Table 1.0 show that the fatty acid composition of ficus sur contains 9 (nine) components, including fatty acids, esters, alcohols, and hydrocarbons. The percentage composition of the various constituents of the seed oils was determined as follows: carbonic acid (4.594%), octadecanoic acid (1.341%), olean-12-en-3-ol, acetate (3β) (40.780%), 1-hexadecanol, 2-methyl-(3.342%), lupeol (15.904%), 1-eicosanol or arachidic alcohol (2.39%), eicosyloctyl ether (1.328%), octadecane, 1-chloro-(7.368%) and nonacos-1-ene (1.378%).

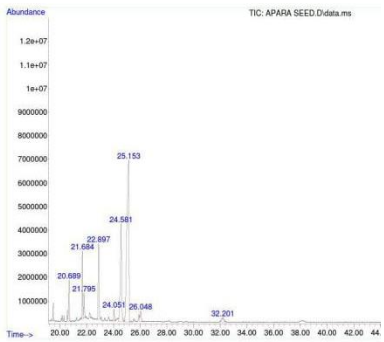

Figure 1. Chromatogram of Fatty acid composition of Ficus Sur seed oil.

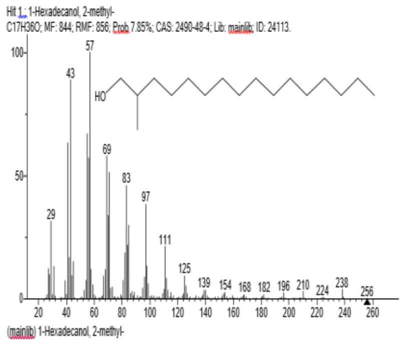

Figure 3. Gas chromatogram of 1-Hexadecanol, 2-methyl-

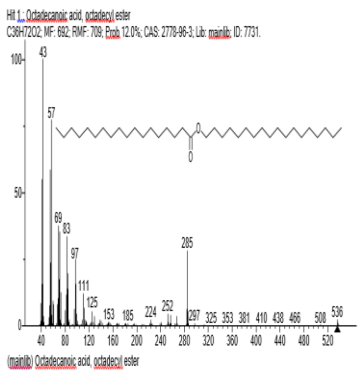

Figure 2. Gas chromatogram of Octadecanoic acid

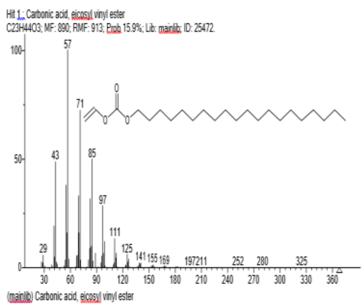

Figure 4. Gas chromatogram of Carbonic acid

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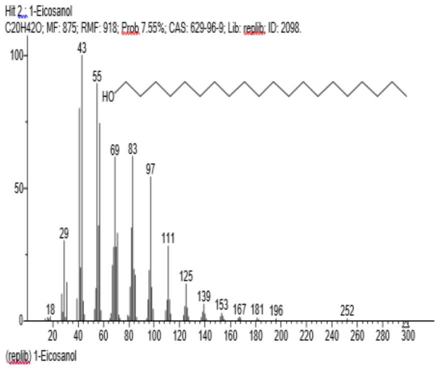

Figure 5. Gas chromatogram of 1-Eicosanol

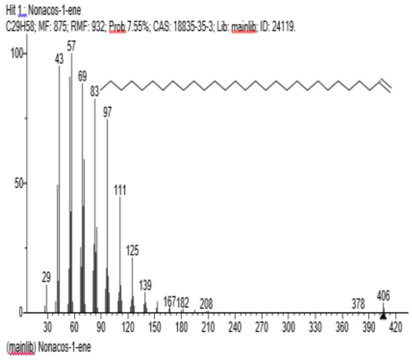

Figure 6. Gas chromatogram of Nonacos-1-ene

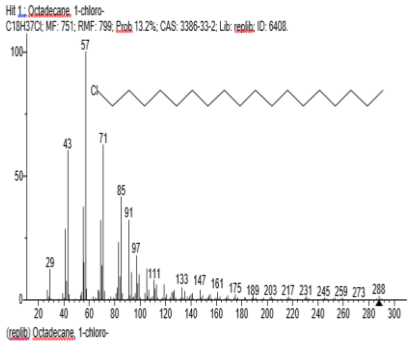

Figure 7. Gas chromatogram of Octadecane, 1-Chloro-

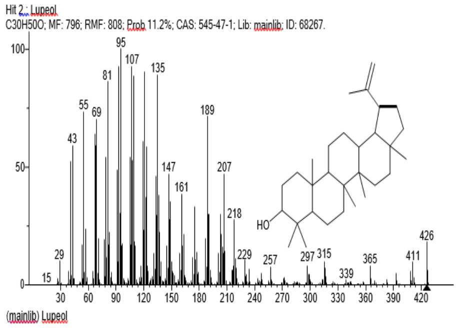

Figure 9. Gas chromatogram of Lupeol

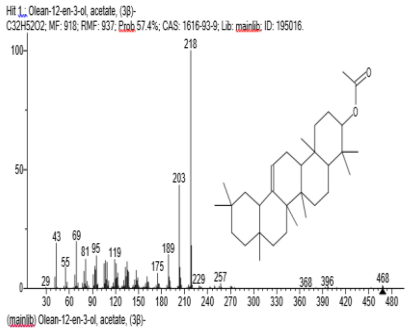

Figure 8. Gas chromatogram of Olean -12-en-3-ol, acetate, (3β)

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Table 1. **Compounds identified in Ficus sur seed oil using gas chromatography mass spectrometry (GC-MS)**

Peak	**Retention Time (min)**	**Area**	**Percentage Composition (%)**	**Name of Compounds**
1	20.689	3.38	3.342	1-Hexadecanol, 2-methyl-
2	21.684	4.65	4.594	Carbonic acid,
3	21.795	2.42	2.391	1-Eicosanol
4	22.897	7.45	7.368	Octadecane, 1-chloro-
5	24.051	1.39	1.378	Nonacos-1-ene
6	24.581	16.08	15.904	Lupeol
7	25.051	41.24	40.780	Olean-12-en-3-ol, acetate, (3β)-
8	26.048	1.36	1.341	Octadecanoic acid (Stearic acid)
9	32.201	1.34	1.328	Eicosyl octyl ether

The gas chromatogram of the various constituents were represented in (figure 2 – 9). The fatty acid chromatogram revealed that the only accessible fatty acid in the seed oils was stearic acid (octadecanoic acid) (1.341%). [16] reported the presence of palmitic acid C16, stearic acid C18:0, oleic acid C18:1 (n-9), linoleic acid C18:2 (n-6), α-linolenic acid C18:3 (n-3) , γ-linolenic acid C18:3 (n-6), arachidic acid C20:0, eichosenoic acid C20:1 (n-9) and behenic acid C22:0 fatty acids in Fig seed oil obtained in Turkey. [11] identified the following fatty acids such as α-parinaric acid, dihydrovaltrate, palmitic acid, ceriporic acid and stearic acid in various organs of Ficus sur tree. Although stearic acid had a very low percentage composition of 1.341 percent, [11] and [16] found that it was not far off from the low composition of 2% to 4%. In humans, dietary stearic acid has been proven to lower LDL cholesterol and the risk of atherosclerosis, whereas palmatic acid has been shown to raise both [17].

CONCLUSION

According to the findings of this study, the oil extracted from the seed of Ficus Sur in the sampled location contains numerous compounds, with stearic acid (1.341%) being the only fatty acid in the oil's chemical composition. The presence of stearic acid in the oil clearly indicates that it was a very good source of lowering certain health risks, substituting for transfat, and providing information on the fatty acid composition in Ficus sur.

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REFERENCES

[1] World Health Organization, WHO plan to eliminate industrially-produced trans-fatty acids from global food supply. (2018). Retrieved from https://www.who.int/news/item/14-05-2018-who-plan-to-eliminate-industrially-produced-trans-fatty-acids-from-global-food-supply

[2] Adediran, Cardiovascular Diseases: Nigerian CSOs want trans-fatty acids eliminated in foods. Premium Times. (2021, May 26). Retrieved from https://www.premiumtimesng.com/news/more-news/463985-cardiovascular-diseases-nigerian-csos-want-trans-fatty-acids-eliminated-in-foods.html

[3] S.S. Afolayan, O.G. Igbum and O.J. Igoli (2019), Fatty Acid Composition of Seed Oil from Pachira aquatic Grown in Nigeria. *Journal of Agriculture and Ecology Research International*, 1.

[4] A. J. Alhassanm, M. S. Sule, H. Abubakar, T. M. Abdulmumin, and M. A. Dangambo (2014), Fatty Acids Composition of Bambara Groundnut (*Vigna Subterranean (L) Verd C*) Grown in Madobi, Kano State-Nigeria. *European Scientific Journal*, 10, 24.

[5] B. S. Chibor, D. B. Kiin-Kabari and J. Eke-Ejiofor (2018), Comparative Assessment of the Physicochemical Properties and Fatty Acid Profile OF Fluted Pumpkin Seed Oil with Some Commercial Vegetable Oils in Rivers State, Nigeria. *Journal of Zoological Research*, 2 ,32.

[6] A. Adewuyi and R.A. Oderinde (2014), Fatty Acid Composition and Lipid Profile of *Diospyros mespiliformis*, *Albizia lebbeck*, and *Caesalpinia pulcherrima* Seed Oils from Nigeria, *International Journal of Food Science*, vol. 2014, Article ID 283614, 6 pages, 2014. https://doi.org/10.1155/2014/283614

[7] G. O. Solomon-Wisdom, G. A. Shittu and Y. A. Agboola (2011), Antimicrobial and Phytochemical Screening Activities of Ficus Sur (Forssk). *New York Science Journal*, 4 ,15.

[8] S. Mawa, K. Husain and I. Jantan (2013) , *Ficus carica L.* (Moraceae): phytochemistry, traditional uses and biological activities. *Evidence-Based Complementary and Alternative Medicine*, 1.

[9] N.Amessis-Ouchemoukh, S. Ouchemoukh, N. Meziant, Y. Idiri, D. Hernanz, C. M. Stinco, F. J. RodríguezPulido, F. J. Heredia, K. Madani and J. Luis (2017), Bioactive metabolites involved in the antioxidant, anticancer and anticalpain activities of *Ficus carica L.*, *Ceratonia siliqua L.* and *Quercus ilex L. extracts*. *Industrial Crops and Products*, 95 , 6.

[10] A. Blom van Staden and N. Lall (2020) , Ficus sur. Underexplored Medicinal Plants from Sub-Saharan Africa, 139.

[11] K. I. Saloufou, P. Boyode, O Boyode, K. Eloh, K Idoh, , M. Melila, O. Toundou, Kpegba, K and Agbonon, A (2018), Chemical composition and antioxidant activities of different parts of Ficus sur. *Journal of Herbmed Pharmacology*,7, 185.

[12] Global Alliance for Improved Nutrition (GAIN), Mapping of Industrially-Produced Trans- Fatty Acids (ITFA) In Nigeria: A report on sources and replacement solutions for iTFA in Nigeria. Geneva, Switzerland. (2020). Retrieved from https://www.gainhealth.org/sites/def

ISSN 0795 - 22066

ault/files/publications/documents/mapping- industrially-produced-trans-fatty-acids-in-nigeria.pdf

[13] E. N. Tas (2019), Biochemical Characterization of Fig (Ficus carica L.) Seeds. *Journal of Agricultural Sciences*, 25 , 232.

[14] K.O. Ajeigbe, M.A. Adebayo, S.S. Enitan, W.M. Owonikoko and E. Igogo (2017) , Haematinic Properties of Methanolic Stem Bark and Fruit Extracts of Ficus Sur in Rats Pre-exposed to Phenylhydrazine-induced Haemolytic Anaemia. *Afr. J. Biomed. Res.*, 20 ,85.

[15] M. Abdul-Hammed, M.O. Bello, J.A. Adewusi, A.O. Esan and A.A. Tiamiyu (2014), Nutritional Composition and Fatty Acids Profile of Ficus Exasperata Fruit and Fruit Oil. *Journal of Natural Sciences Research*, 4 , 25.

[16] N. Güven, A. Gökyer, A. Koç, N.N. Temiz, S. Selvi, B. Koparal, D.B. Dedeoglu, B.S. Öztürk, H.F. Büyükhelvacigil, R. Büyükhelvacigil and C. Erman (2019), Physiochemical Composition of Fig Seed Oil from Turkey. *Journal of Pharmacy and Pharmacology*, 7, 541.

[17] D. Senyilmaz-Tiebe, D.H. Pfaff, S. Virtue, K.V. Schwarz, T. Fleminng, S. Altamura, M.U. J.G. Muckenthaler, A. Okun, N. P, Vidal-Puig and A.A. Teleman (2018) , Dietary stearic acid regulates mitochondria in vivo in human *Nature Commun*. 9, 3129.

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