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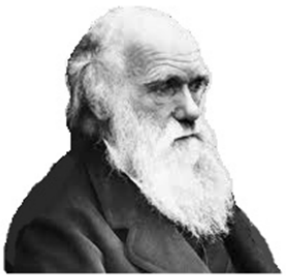

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# Profiling and Comparison of Fatty Acids in the Oils from the seeds of egusi melon (*Cucumeropsis mannii* Naudin) and watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai)

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**ABSTRACT**

The fatty acid profile of vegetable oil from seeds of egusi melon (*Cucumeropsis mannii* Naudin) and watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) collected from a local market in Imo State, Nigeria, were analyzed using the GC-MS technique. The study revealed the presence of six (6) fatty acids in each seed oil. Four fatty acids and three fatty acid methyl esters were detected. A total of five (5) similar fatty acids (three (3) saturated and two (2) unsaturated) were detected in both oil, and both seed oils contained one fatty acid not detected in the other. The percentage (%) concentration of saturated fatty acids compounds detected in both oil include Pentadecanoic acid methyl ester (EMO: 4.91; WMO: 4.43), Octadecanoic acid (Stearic acid) (EMO: 3.64; WMO: 41.77), and Methyl heptacosanoate (EMO: 39.16; WMO: 1.32) while the (%) concentration of unsaturated fatty acids detected in both oils includes 11-octadecenoic acid, methyl ester, (EMO: 46.05; WMO:46.28) and Oleic acid (EMO: 4.48; WMO: 3.97). Eicosanoic acid, methyl ester was detected at a concentration of 1.77% in Egusi melon seed oil alone while watermelon seed oil detected n-Hexadecanoic acid at a concentration of 2.22%. The fatty acid profiling of both seed oil revealed fatty acid compounds with therapeutic abilities. This study has provided the scientific backing for the therapeutic uses of both oil and also has compared both oil and predicts a future substitution of both oil in future utilization and at the same time influence their acceptability by the consumers.

***Keywords*:** Melon, Egusi melon, Watermelon, fatty acids, GCMS, *Cucumeropsis mannii*, *Citrullus lanatus*

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## 1. INTRODUCTION

The Nigerian local market can boast of vegetable oils processed from the seed of various plants for both human consumption and industrial applications [1, 2]. The vegetable oils are used by the local people in Nigeria as food, source of energy, medicine, cosmetic and industrial applications. Conversely, there are still hundreds of underexploited vegetable seeds whose oils are suitable for human consumption and industrial purposes [3]. One family of vegetables reportedly suffering underutilization of their seed oil is the Cucurbitaceae. The Cucurbitaceae is a large plant family which consists of nearly 100 genera and 750 species with great genetic diversity and widespread adaptation in tropical, subtropical regions, arid deserts, and temperate locations. Cucurbits are widely distributed in Nigeria, being closely identifiable with the traditional food crop production systems. The species cultivated for medicinal and consumption purposes include egusi-melon, gourd melons, watermelon, etc. [4]. The Egusi Melon (*Cucumeropsis mannii*) bears striking resemblance to the watermelon (*Citrullus lanatus*) as both are grown for their seeds; both plants possess deeply cut lobed leaves and exhibit a non-climbing creeping habit. However, the Egusi Melon has larger seeds when compared to watermelon seeds, and also the pulp fruits of the Egusi Melon are bitter and inedible while the watermelon fruit is sweet and edible.

The Egusi crop (*Cucumeropsis mannii*) locally called “egusi” in the Yoruba language, “Elegushi” in the Igbo language, and “agushi” in the Hausa language; has an egg-shaped or an elongated ovate shape fruit, which has a bitter juicy pale yellow or green flesh, with small black seeds embedded in the middle of the flesh. The Egusi plant itself is a tendril climbing or crawling annual crop with fibrous and shallow roots (Solomon Giwa et al, 2010; Mabalaha et al., 2007). Studies revealed that egusi seeds contain a good amount of oil that can be exploited, and a valuable amount of vegetable oil is extracted from the seeds, while the ground seed is used to prepare various delicacies including cake, soup, and condiments such as “ogiri” (Ogbonna and Obi, 2010). Reported research claims that the egusi oil is a good source of polyunsaturated fatty acids that protects the body against coronary heart diseases (CHD) and also improves insulin sensitivity when served as a table, cooking, and frying oil (Ogbonna and Obi, 2010). Results from some preliminary studies show that the oils are a good source of dietary oil and their defatted meals are exceptionally higher than in soya beans, peanut, or sunflower seed meals (Baker, 2008). Its nutritional properties make a way for it in the production of margarine (Redneck, 2005). They have also found use in local medicine where they are used in the treatment of urinary tract infection, hepatic congestion, intestinal worms, and abnormal blood pressure (Moerman, 1998; Abdulrazak *et al*., 2014). Despite the nutritional, commercial, and medicinal value of egusi seed oil, its production remains low, even with its good market price, it is still produced by farmers on a small scale.

Watermelon (*Citrullus lanatus*) also from the family *cucurbitaceae*, has seeds with smooth green exterior rind, and a juicy sweet dark red fleshy interior (Duduyemi *et al.*, 2013). The fruit has numerous small black seeds embedded in the middle of the flesh, while the embryo fills the seed. The fruits are widely harvested for juice and juice concentrate which is an excellent source of vitamin C and vitamin A while giving less regard to the seed which are normally discarded as inexpensive animal feed or thrown away (Duduyemi *et al.*, 2013). However, recently reported studies have claimed these disregarded seeds are a highly nutritional source of protein, vitamins, minerals, fat, as well as phytochemicals (Braide, *et al.*, 2012).

The seeds can be used to prepare several consumables including snacks, flour, and sauces (Tabiri *et al.,* 2016). Oil from the seeds is also good for cooking and can be incorporated into the production of cosmetics (Jensen *et al*., 2011). Several studies have shown that seeds of the watermelon are not only potential sources of nutrients such as protein, minerals, and lipids but as well as they are ingredients for native medicine (Braide, *et al.,* 2012; Imafidon *et al.,* 2018). Local medicine practitioners have made emulsions from a mixture of the grind seed and water to remedy catarrh infections, bowel disorders, urinary passage infections, and fever. The seeds have also been used as a worm expeller (Adedeji, 2018; Oladele *et al.,* 2020; Vishwa, 2015).

Investigation on the Antibacterial activity of Watermelon Seed (*Citrullus lanatus*) has been reported by Asoso Oluwakemi Sola, 2019. Others Investigations made on the seeds are Antioxidant ability (Neuza Jorge, 2015), Cardioprotective ability (O. Oluba, 2007), Hepatoprotective potentials (N. Sebbagh, 2007), Anti-diabetic potentials, and Effect on sex hormones (Margaret Akpana Agiang, 2015). Reports from studies claimed that the seeds have shown medicinal activity against these diseases in animal models. The fatty acid composition of both the egusi melon and watermelon has also been extensively studied. This study, therefore, projects a comparative study on the fatty acid composition of egusi melon and watermelon seed oil obtained from the Southeastern State of Nigeria. Specific objectives involve soxhlet extraction of the seed oils and Gas chromatography-mass spectrometry detection of fatty acid components of oils from both seeds. Information from this investigation will expand the knowledge on the relationship between oils processed by both plants, also give validity to the various utilization of oils in and outside the coast of West Africa.

## 2. MATERIALS AND METHOD

### 2. 1. Sample collection and preparation

Fruits of Egusi (*Cucumeropsis mannii*) and Watermelon (*Citrullus lanatus*) were harvested from a local farm in Owerri, Imo State, Nigeria. The fleshy part was removed and the seeds collected, washed, and dried for easy removal of the epicarp. After the removal of the epicarp, the seeds were dried for 7 days. The dried seeds were then ground with a blender to a fine powder.

### 2. 2. Extraction of seed oil

The ground sample was subjected to soxhlet extraction using n-hexane as the solvent, the extraction was done according to the method described in AOAC (1984).

### 2. 3. GC–MS analysis

The Gas chromatography-mass spectrometric (GC-MS) investigation of the oil fatty acids was done using GCMS-QP2010 PLUS (SHIMADZU, Japan). The machine comprises the injector, and GC interfaced to the mass spectrophotometer. The condition for the analysis is described as follows: Column oven temperature was at 70.0 °C, while the injection temperature was set at 250 °C, injection mode split ratio was at 20.0 °C, carrier gas (Helium) flow rate was 1.80 mL/min, the system temperature was programmed from 60 °C (at 10 °C/min) to 160 °C (held for 2 min) then (10 °C/min) to 250 °C and the injection volume was 0.5 µL. Mass spectrophotometer condition: Ion source temperature 200 °C and interface temperature 250 °C, solvent cut time 2.5 min, and the acquisition was in the scan mode.

### 2. 4. Identification of the fatty acids

Fatty acid components of the oils of the two plants were determined by comparing the peaks of candidate compounds generated from the GCMS analysis with the peaks in the database of NIST MS extended library (NIST 11, Version 2.0g). The retention indices and mass spectra of the candidates were critically compared to the stored information in the library, and the best hit was assigned as the most probable compound.

## 3. RESULTS AND DISCUSSION

The gas chromatogram of the oils from the fruits of egusi melon and water melon are shown in Figure 1 & 2.

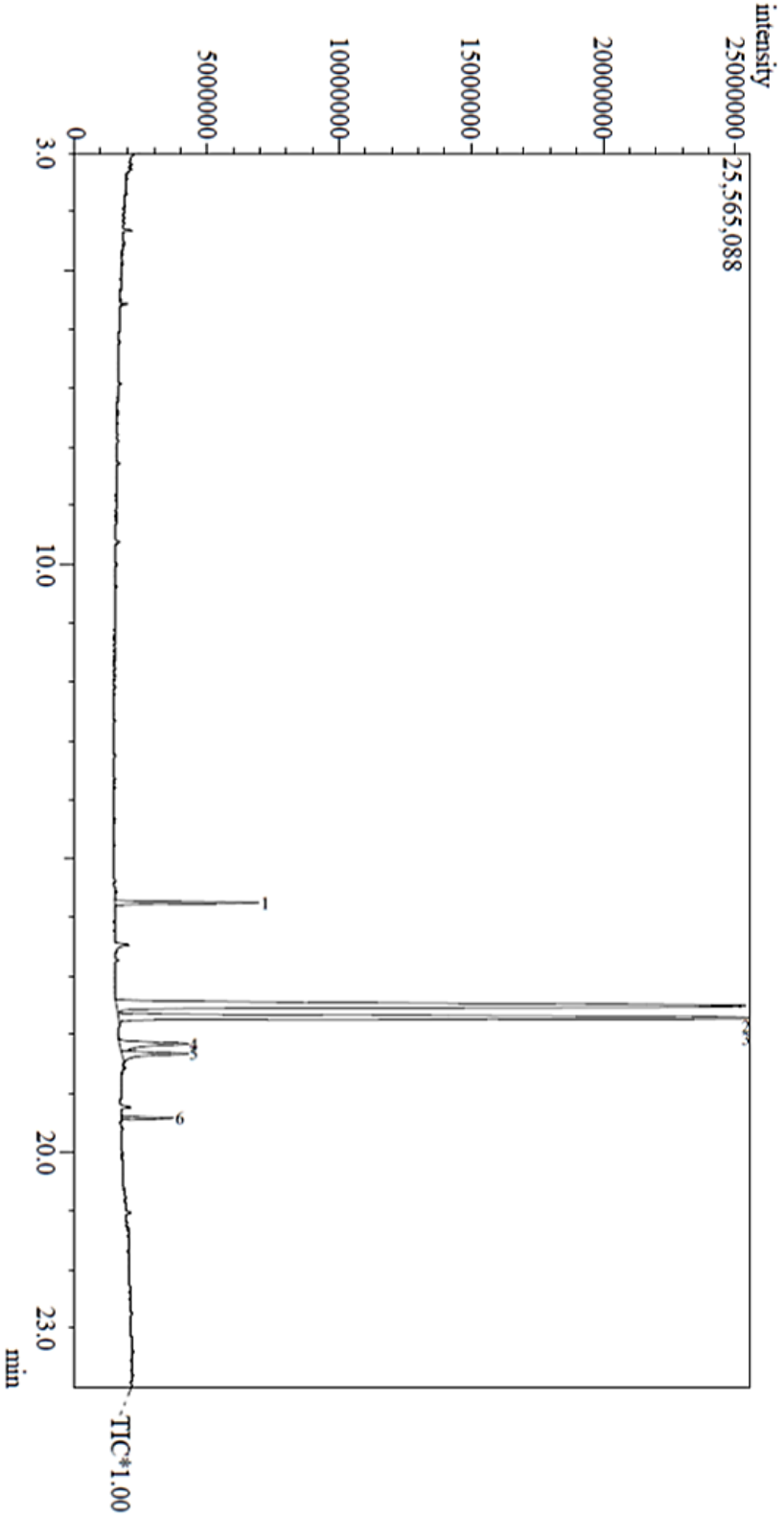
In our study, the fatty acid profiles of oil extracted from the seeds of two vegetative plants (egusi melon seed oil (EMO) and watermelon seed oil (WMO)) samples were investigated. Saturated and unsaturated fatty acids in the oils were detected and identified by the Gas chromatography Mass Spectroscopy (GCMS) procedure. A total of six (6) fatty acids were detected in each seed oil. The study revealed the presence of four fatty acids and three fatty acid methyl esters which were all characterized as fatty acids in this discussion. Five (5) fatty acids (three (3) saturated and two (2) unsaturated) were present in both oil, correspondingly both seed oils contained one fatty acid not detected in the other oil.

The percentage (%) concentration of saturated fatty acids compounds detected in both oil include Pentadecanoic acid methyl ester (EMO: 4.91; WMO: 4.43), Octadecanoic acid (Stearic acid) (EMO: 3.64; WMO: 41.77), and Methyl heptacosanoate (EMO: 39.16; WMO: 1.32) while the (%) concentration of unsaturated fatty acids detected in both oil includes 11-octadecenoic acid, methyl ester, (EMO: 46.05; WMO:46.28) and Oleic acid (EMO: 4.48; WMO: 3.97) as presented in Table 1; Eicosanoic acid, methyl ester was detected at a concentration of 1.77% in Egusi melon seed oil only while watermelon seed oil detected n-Hexadecanoic acid at a concentration of 2.22% which was not detected in egusi melon seed oil.

The fatty acid and fatty acid methyl ester components in the extracted oils are compared in Figure 2. The most abundant fatty acid compound detected in both plant oil was 11-octadecenoic acid, methyl ester with (%) concentration of 46.05 and 46.28 in egusi melon seed oil and watermelon seed oil respectively (Figure 2, Table 1), followed by Octadecanoic acid, whose concentration percentage was detected at a high 41.77 % in watermelon seed oil but low in the other oil and Methylheptacosanoate detected at a (%) concentration of 39.16 % in egusi melon seed oil but also low in the other oil. The other fatty acids were minor in concentrations (Figure 2, Table 1).

The result from the GCMS analysis has shown that the oils from the seeds also possess the therapeutic ability, derivatives of hexadecanoic acid (Palmitic acid) have been reported to prevent lipopolysaccharide-induced inflammation by suppressing the production of cytokines and NF-κB.

The anti-inflammatory property of the compound has been linked to their structures, the compound also poses as an active antimicrobial and antidiarrheal agent. (Aparna *et al.*, 2012). The presence of Oleic acid in good concentration shows that the oil can be used as an antiallergic agent, to promote the skin cells (Obonga *et al.*, 2019).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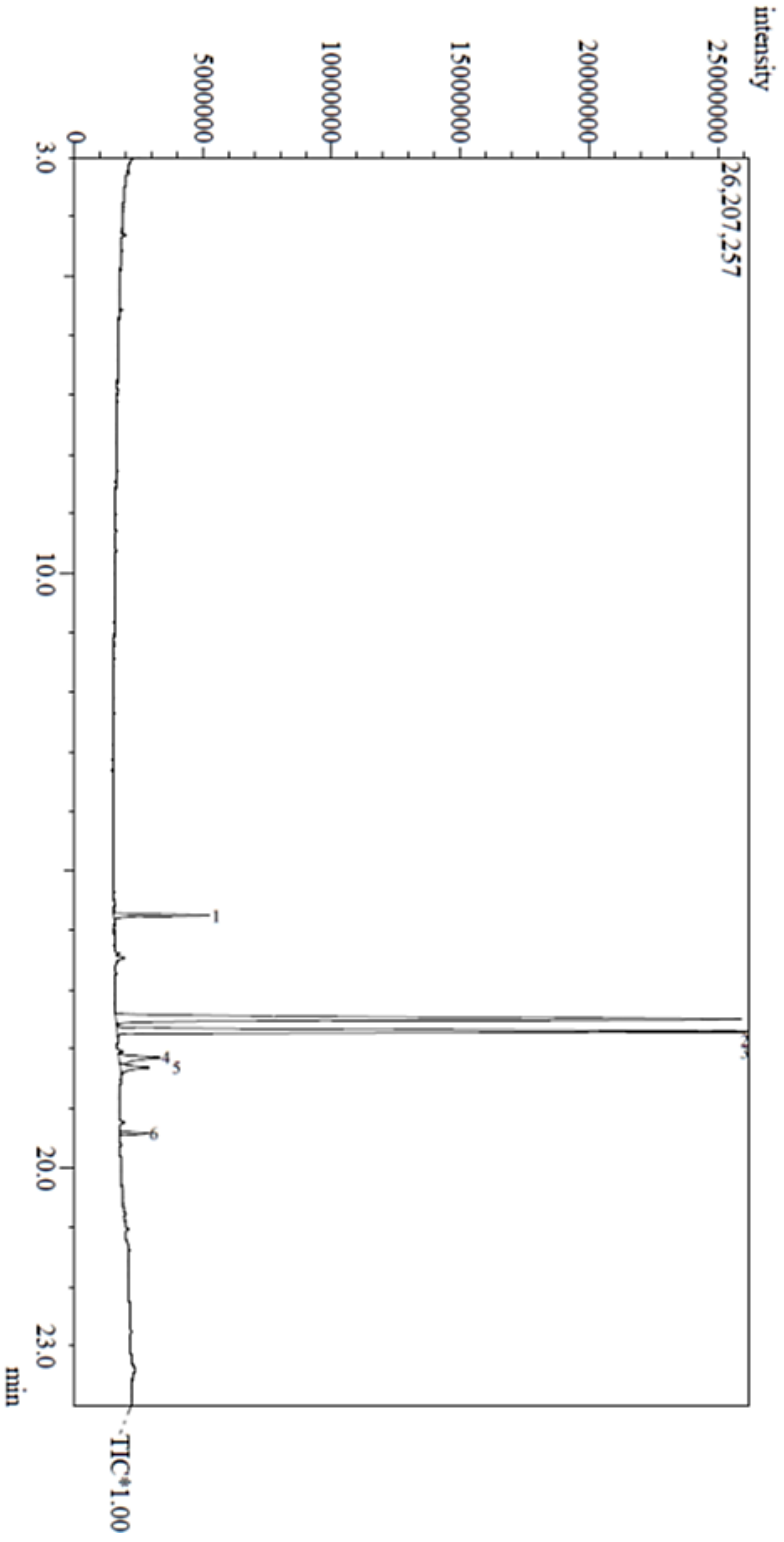



**(B)**

**Figure 1.** GC chromatogram of **(A)** egusi melon and **(B)** water melon.

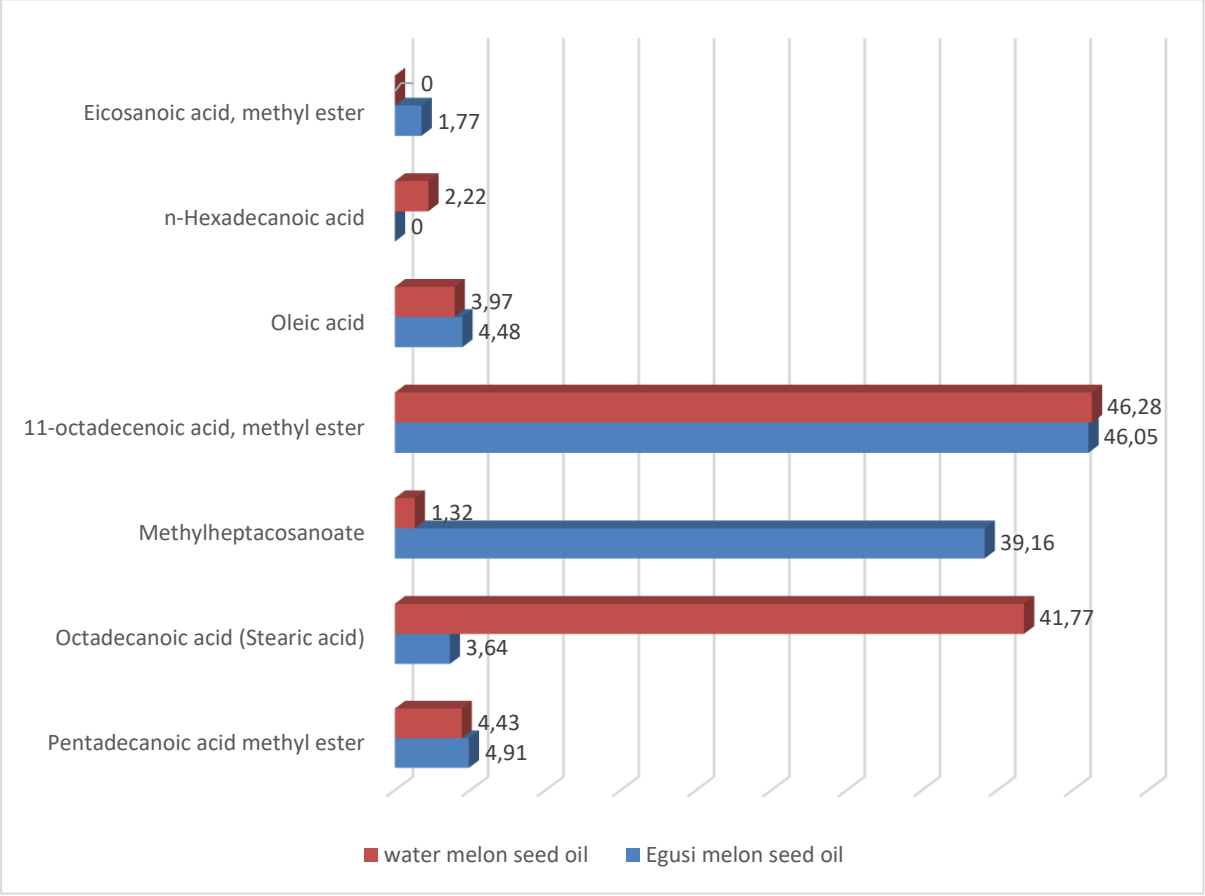
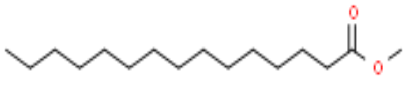
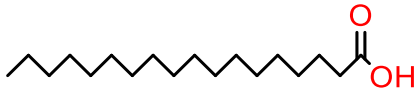
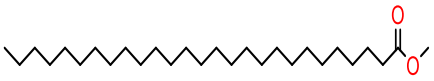
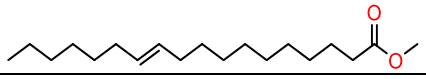
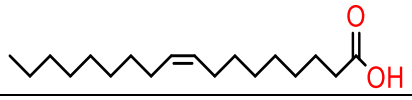
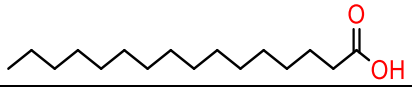



**Figure 2.** Comparison of extracted compounds from egusi melon seed oil and watermelon seed oil (%).

**Table 1.** Results from the GCMS analysis of egusi melon seed oil and watermelon seed oil

| S/N | Name | Mol formula | Mol mass | Concentration (%) | | Structure |
|---|---|---|---|---|---|---|
| | | | | ESO | WSO | |
| **Saturated fatty acids** | | | | | | |
| 1 | Pentadecanoic acid methyl ester | $C_{17}H_{34}O_2$ | 270 | 4.91 | 4.43 |  |
| 2 | Octadecanoic acid (Stearic acid) | $C_{18}H_{36}O_2$ | 298 | 3.64 | 41.77 |  |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Methylheptacosanoate | $C_{28}H_{56}O_2$ | 424 | 39.16 | 1.32 |  |
| **Unsaturated fatty acids** | | | | | | |
| 4 | 11-octadecenoic acid, methyl ester | $C_{19}H_{36}O_2$ | 296 | 46.05 | 46.28 |  |
| 5 | Oleic acid | $C_{18}H_{34}O_2$ | 282 | 4.48 | 3.97 |  |
| **Saturated fatty acids present in only one one oil** | | | | | | |
| 6 | n-Hexadecanoic acid | $C_{16}H_{32}O_2$ | 256 | ND | 2.22 |  |
| 7 | Eicosanoic acid, methyl ester | $C_{21}H_{42}O_2$ | 326 | 1.77 | ND |  |

## 4. CONCLUSION

The oils from egusi melon seed and watermelon seed were extracted, and the fatty acid compounds present were identified and compared. The findings in the present study, suggest the presence of seven fatty acid components which were identified in the seeds oil by the GC-MS analysis. The similarity of the fatty acid profile pattern of both oils portrays that the oils can be used for the same purposes and substituted during use. Overall, the results of this study indicated that the oils may have potential use as a dermo protective ingredient in skincare or cosmeceutical products, anti-inflammatory agent, antiallergic agent antimicrobial, and antidiarrheal agent.

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