Journal of Agriculture and Food Sciences
Volume 22, Number 1, April 2024, pp 31 - 40

FATTY ACID PROFILE OF OIL EXTRACTED FROM THE SEEDS OF WATERMELON (*Citrullus lanatus*) AND AVOCADO (*Persea americana*)

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ABSTRACT

Watermelon (Citrullus lanatus) and Avocado (Persea americana) seeds are often considered as byproducts or waste in the food industry. This study investigated the fatty acid profile of oil derived from the seeds of watermelon (Citrullus lanatus) and avocado. Soxhlet extraction protocol was used to extract the oils, and their fatty acid compositions were analyzed using Gas Chromatography-Mass Spectrometry (GC-MS). The main fatty acids identified and quantified include saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs). The investigation revealed that the oil derived from Watermelon seeds (Citrullus lanatus) contained more unsaturated fatty acids than the oil from Avocado seeds (Persea americana). However, oil extracted from avocado seeds (Persea americana) has a larger percentage of monounsaturated fatty acids than oil extracted from watermelon seeds (Citrullus lanatus). As a result of its high concentration of essential oils, the oil derived from these two seed sources has the potential to be used in the food and cosmetics industries. The study's findings also shed light on the nutritional significance of these oils, particularly critical fatty acids like omega-3 and omega-6. In conclusion, the study on the fatty acid profile of oils extracted from watermelon and avocado seeds holds promise for uncovering valuable information with implications for nutrition, health, agriculture, and industry.

Keywords: Watermelon, Avocado, Fatty acid profile, GC-MS, polyunsaturated fatty acids.

https://dx.doi.org/10.4314/jafs.v22i1.3

INTRODUCTION

Recently, researchers have become more interested in understanding the composition and qualities of oils generated from different plant sources (Kalemba & Kunicka, 2003). Understanding the fatty acid profile of these oils is crucial as it provides valuable apprehension of their nutritional contents and beneficial impacts on health. Watermelon *(Citrullus lanatus)* seeds, often discarded as waste, have gained attention owing to their beneficial impacts on health

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(Tabiri et al., 2016). Watermelon is part of the Cucurbitaceae family (Zhu et al., 2016). The juice or pulp is consumed by humans, whereas the rind and seeds are considered solid trash. The rind is used for goods such as pickles and preserves, as well as the extraction of pectin, while its seeds are potential lipids and protein sources. Watermelon is particularly significant in Africa, where it is often taken in replacement of water during thirst (Olanrewaju & Moriyike, 2013). Also, the seeds from watermelons are utilized by numerous African nations in oil manufacturing (Sultana & Ashraf, 2019).

Avocado pear (*Persea americana*) is popular throughout the tropical world. Meena et al. (2022) identified the plant as belonging to the Lauraceae family. It is a climacteric fruit, meaning it matures on the tree but ripens away from it. High quantities of Persea americana were recognized to exert favorable impact on the cholesterol level of the blood serum (Pahua-Ramos et al., 2012). The seed is usually discarded as a byproduct. It is finally eliminated as part of the pulping process. This may be an environmental hazard, but it could also benefit industry by offering a source of bioactive compounds. The seed has several biological actions, including antioxidant, antihypertensive, fungicidal, and hypolipidemic properties (Bahru et al., 2019). It is also identified as a good source of tannins and carotenoids (Ejiofor et al., 2018). Avocado processors currently consider the seed as an untapped resource and a waste concern. Avocado seeds, which are generally overlooked, are reported to contain a range of nutrients (Taylor et al., 2019).

However, comprehensive studies exploring the fatty acid composition of these seeds' oil are limited. By analysing the fatty acid content of oils extracted from the seeds of Watermelon, and Avocado, we can gain a good knowledge of their nutritional profiles (Morais et al., 2017). Examining the fatty acid composition will reveal the existence of critical fatty acids, like omega-3 and omega-6, as well as other beneficial substances that may help to general health (Dyall et al., 2022). Exploring the fatty acid profiles of these oils may also provide insight into the potential health benefits associated with their consumption, such as cardiovascular health, anti-inflammatory properties, and skin health (Djuricic & Calder, 2021).

This research aimed to augment the existing information about the fatty acid composition of oil extracted from watermelon, and avocado seeds. By understanding the unique fatty acid profiles of these oils, we can uncover their nutritional value, potential health benefits, and explore their versatile applications in various industries.

MATERIALS AND METHODS

Sample collection and preparation

In September 2023, during the rainy season, the fruits (watermelons, and avocados) were bought from the Iyana-Iba Market, Alaba, Lagos State and Lusada Market, Ogun State. At the lab, the fruits' seeds were removed from each matured watermelon and Avocado fruits respectively. Spoilt seeds were discarded. One kilogram of seeds was weighed and air-dried to reduce the

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moisture, noting the difference in weight due to weight loss through the evaporation process. The air-dried seeds were then blended using a silver Crest German Industrial 8500W blender. The powdered form of the seeds was retained in small sample bags, and stored at four degrees Celsius.

Oli Extraction process

Oil was extracted from the seeds using Soxhlet equipment in accordance with the American Oil and Chemical Society Official procedure (1998) and the AOCS Ba 3-38 (1998) technique. Initially, 100g of powdered seed was placed in the Soxhlet chamber's thimble, and 250ml of hexane was added to a round bottom flask attached to the main chamber. The solvent was evaporated using a heating mantle, with reflux aided by the condenser linked to the main chamber. This process lasted approximately 2 to 3 hours. The solvent was then recovered with a rotary evaporator, and the extracted oil was measured and stored in a clean reagent bottle.

Fatty acid analysis

To examine the fatty acids in seeds, fatty acid methyl esters (FAME) were prepared to increase volatility and reduce peak tailings. The analysis was then carried out using GC-MS, which ensures consistent precision and repeatability (Cert et al., 2000). The various fatty acids in the oils were measured using the AOAC (Horwitz, 1975) procedures outlined by Samuel et al. (Samuel et al., 2018).

Identification of photo components

To interpret the Mass Spectrum, the National Institute of Standards and Technology (NIST) database with more than over sixty-two thousand patterns was utilized, as well as that of the National Centre for Biotechnology Information. The unknown components form the spectrum were identified by comparing them with the known components from the NIST database.

RESULTS AND DISCUSSION

As seen in Table 1, the fatty acid profile showed that the watermelon seed oil had more percentage of saturated fatty acids (SFFA) compared to the avocado seed oil, However, the avocado seed oil had more percentage of the monounsaturated fatty acids (MUFFA) and polyunsaturated fatty acids) PFFA compared to the watermelon seed oil.

The exploration of the fatty acid profile of oils derived from watermelon (*Citrullus lanatus*) and avocado (*Persea americana*) seeds presents a captivating avenue for scientific investigation. The relevance of this study rests in its potential to untangle the nutritional complexities of these seed oils, giving light on their health advantages and applications in numerous industries (Harland, 2014). Anticipated findings may reveal distinct profiles for each oil, offering insights into their potential health implications and culinary applications. Beyond the laboratory, these findings

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could have far-reaching implications, influencing dietary choices, agricultural practices, and economic opportunities.

The watermelon fatty acid profiling analysis showed that the oil contained arachidonic acid, a polyunsaturated fatty acid (PUFFA) in high quantity (18.08mg/L). Arachidonic acid (ARA) is an essential omega-6 fatty acid that plays crucial roles in various physiological processes (Tallima & El Ridi, 2018). Some potential advantages associated with arachidonic acid include serving as cell membrane component, helping in brain development, serving as a precursor to produce signaling molecules called eicosanoids, including prostaglandins and leukotrienes, all of which are responsible for inflammatory responses, they also play a role in cardiovascular health as well as skin health (Piomelli, 2013).

Oleic acid (8.54 mg/L) was also found to be present in oil extracted from watermelon seed. Oleic acid is a monounsaturated omega-9 fatty acid with an 18-carbon chain. It is abundant in various dietary sources, including olive oil, nuts, and seeds. Oleic acid serves numerous functions in the body, contributing to overall health (Chaliha et al., 2019). It plays a role in heart health, anti-inflammatory properties, cell membrane integrity, brain function and skin health (Harland, 2014). In a study conducted by Sabahelkhier et al. (2011), the chromatography column results showed the concentration of oleic acid to be 11 mg/L. The difference can be attributed to variations in extraction techniques, sample sizes, and watermelon varieties, resulting in yield variability. The fatty acid profile of oil extracted from watermelon seeds also revealed the presence of octanoic acid, which has a concentration of 0.14 mg/L. In a study conducted by Arellano Gálvez et al. (2019), the chromatography column results showed the concentration for octanoic acid to be 0.09 mg/L. Additionally, in a study by Alves et al., (2021) (Alves et al., 2021), using spectrophotometry, a fatty acid concentration of 0.08 mg/L was obtained for octanoic acid. The difference in the retention time of octanoic acid, which can be attributed to variations in extraction techniques, sample sizes, and watermelon varieties, resulting in yield variability. However, the concentration of octanoic acid found in this study remains consistent with previous studies, indicating the generally low levels of octanoic acid present in watermelon. Octanoic acid (OA), which is said to be naturally present as food preservatives in various foods such as human milk, coconut oils, fruits and vegetables, is reported to have antimicrobial ability against *Escherichia coli* O157:H7, Listeria monocytogenes, and indigenous microflora (Kim & Rhee, 2015).

The oil extracted from the seeds of Avocado (*Persea americana*) had a higher concentration of Gamma-linolenic acid (GLA) (102.49mg/L), which is an essential omega-6 fatty acid with numerous health benefits (Gazem & Chandrashekariah, 2014). Gamma-linolenic acid is a polyunsaturated fatty acid with 18 carbon atoms and three double bonds, with the first double bond located at the sixth carbon from the omega end of the fatty acid chain. Some advantages associated with gamma-linolenic acid include anti-Inflammatory properties, skin health, hormonal balance, cardiovascular health, immune system support and also plays a role in nervous system (Innes & Calder, 2018). Incorporating dietary sources rich in GLA, such as

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Avocado can be beneficial for individuals seeking to harness the advantages associated with this essential omega-6 fatty acid. Additionally, GLA supplements are available for those looking to address specific health concerns or conditions.

The fatty acid profile of Avocado (*Persea americana*) seed oil also had the presence of cis-11-Eicosenoic acid, which has a retention time of 8.844 minutes, a concentration of 2.49 mg/L, and a quality grade of 15. The chromatography column results for cis-11-Eicosenoic acid in a study conducted by Akusu et al., (2021) revealed a concentration of 2.58 mg/L, which was similar to our findings. As shown in Table 1, the fatty acid composition of avocado (*Persea americana*) seed oil includes oleic acid, (18.52mg/L), which is quite a considerable amount; also, the quality of 76 indicates that it is good grade oleic acid.

CONCLUSION

In conclusion, the fatty acid profile revealed the high presence of Polyunsaturated fatty acid (PUFA) in both the Avocado and watermelon seed oils which makes it a rich source of essential fatty acids which is safe and nutritionally healthy for human consumption. Therefore, watermelon and avocado seeds hold promise for uncovering valuable information with implications for nutrition, health, agriculture, and industry. It aligns with the growing interest in functional foods and sustainable practices, making it a relevant and timely research endeavor.

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APPENDICES

TABLE 1: Fatty acid composition of oil extracted from the seeds of Avocado *(Persea Americana*) seed oil (%) watermelon (*Citrullus lanatus*) seed oil (%)

Fatty acid methyl esters	**Avocado Seed oil (%)**	**Watermelon seed oil (%)**
Octanoic acid	1	17
Capric acid	1	74
Undecanoic acid	1	1
Dodecanoic acid	1	87
Tridecanoic acid	1	36
Methyl tetradecanoate	86	30
Pentadecanoic acid	88	89
Hexadecanoic acid	83	85
Heptadecanoic acid	1	1
Methyl stearate	1	82
Eicosanoic acid	1	89
Heneicosanoic acid	1	45
Docosanoic acid	35	90
Tricosanoic acid	60	93
Tetracosanoic acid	16	92
Saturated FFA (%)	**377**	**911**
Methyl myristoleate	28	33
cis-10-Pentadecanoic acid	33	33
9-Hexadecanoic acid	1	1
cis-10Heptadecenoic acid	59	58
Oleic acid	74	76
cis-11-Eicosenoic acid	85	15
13-Docosenoic acid	59	59
15-Tetracosenoic acid	61	12
gamma-Linolenic acid	1	80
Arachidonic acid	67	87
5,8,11,14,17-Eicosapentanoic acid	70	74
cis-11,14-Eicosadienoic acid	63	1
4,7,10,13,16,19-Docosanoic acid	17	28
Unsaturated FFA (%) (**MUFA** & **PUFA**)	**618**	**557**

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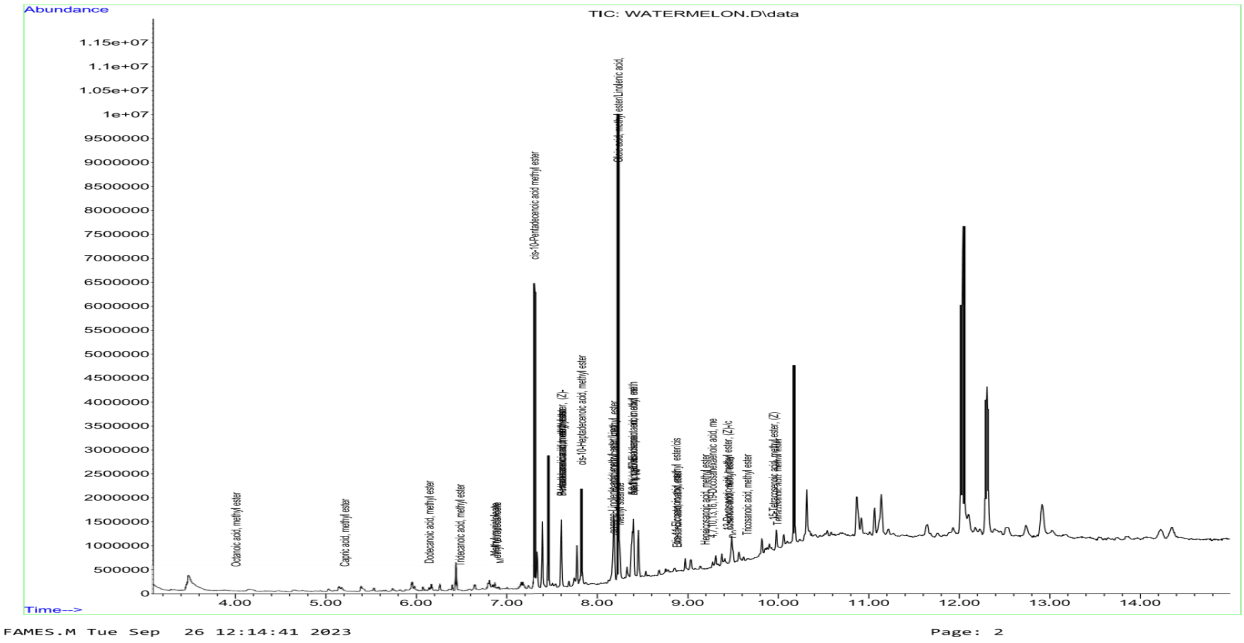

Figure 1. Fatty acid Gas Chromatogram of Watermelon Seed Oil

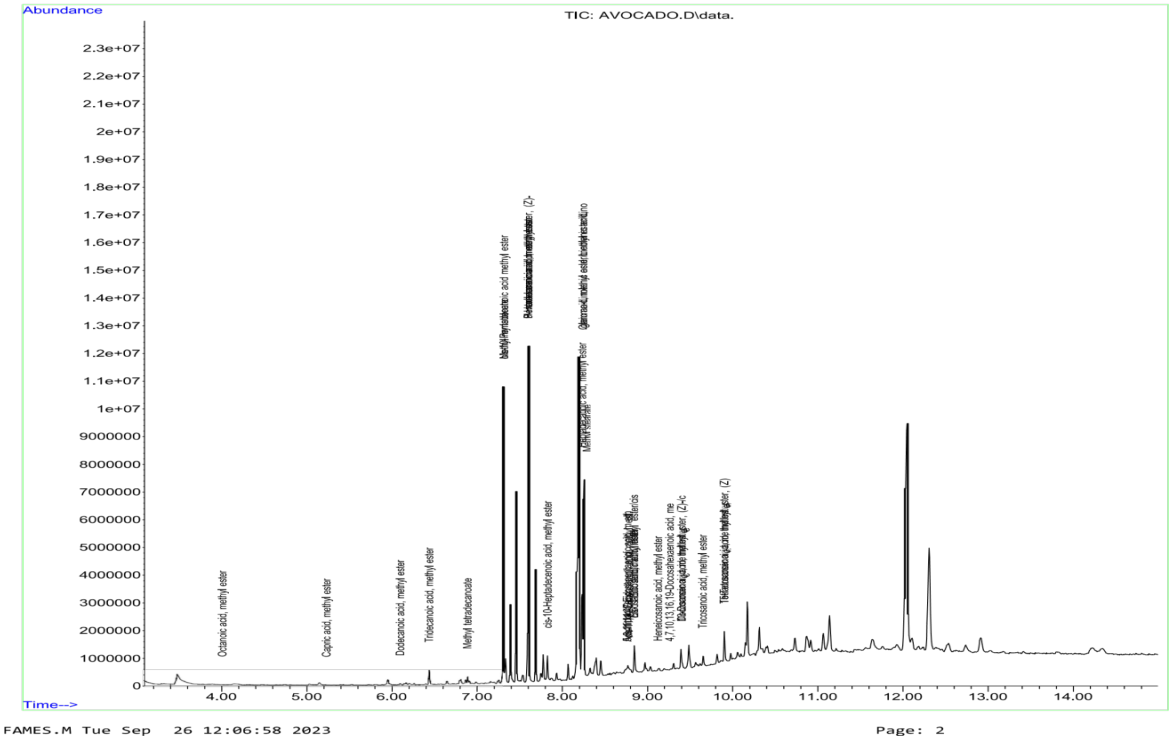

Figure 2. Fatty acid Gas Chromatogram of Avocado Seed Oil.