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Investigating the lipid profile of *Detarium microcarpum* seeds

Romir Katriu
Faculty of Agriculture, Goce Delcev University, Krste Misirkov 10-A, 2000 Stip, Republic of North Macedonia

Abstract
This study investigates the lipid profile of *Detarium microcarpum* seeds, a lesser-studied tropical fruit tree native to West Africa. The lipid extraction was performed using Soxhlet extraction with hexane as a solvent. The lipid profile was analyzed using Gas Chromatography-Mass Spectrometry (GC-MS), identifying the major fatty acids and other lipid-soluble compounds. The study aims to explore the nutritional potential and industrial applicability of these seeds.

Keywords: *Detarium microcarpum*, lipid-soluble compounds, seeds

Introduction

Detarium microcarpum, a lesser-known tropical fruit tree indigenous to West Africa, is prized for its nutritional and medicinal properties. Despite its local significance, scientific investigations into the plant, especially its seeds, have been limited. The seeds of *Detarium microcarpum* are consumed in various forms by local populations, suggesting their potential as a valuable food source. Fatty acids, crucial components of lipids, play a significant role in human health. They serve as energy sources, structural components of cell membranes, and precursors to bioactive lipids that regulate numerous physiological processes. Given the global search for sustainable and health-promoting food sources, the lipid profile of *Detarium microcarpum* seeds warrants detailed investigation. This study aims to bridge the gap in knowledge regarding the lipid composition of these seeds and to explore their potential benefits based on their fatty acid content.

Main Objective

The primary objective of this study is to analyze the lipid profile of *Detarium microcarpum* seeds to identify the major fatty acids present and to evaluate the seeds' potential nutritional and health benefits based on their lipid content.

Studies based on Lipid Profile of *Detarium microcarpum* Seeds

Nwozo SO, *et al*., 2016 [1], Highlights the significant lipid content (23%) in the seeds, underscoring their potential nutritional benefits and functional properties for food applications. The seeds' oil absorption capacity is particularly noted, indicating their potential utility in food processing. Nwokeke BC, *et al*., 2024 [3], shows the seeds' lipid content ranging from 8.68 to 11.90%, emphasizing their nutritional value. The seeds also contain essential minerals, making them a valuable dietary component.

Uhegbu FO *et al*., 2009 [4], Analyzes the seed oil's physico-chemical properties, indicating a predominance of saturated fatty acids based on its low iodine value. This suggests potential applications in the manufacture of cosmetics, lubricants, and possibly as a food ingredient.

Reports on the seed oil containing beta-carotene and plant sterols, with an absence of gossypol and detectable mycotoxins, indicating its suitability for human nutrition (Ebi GC, *et al*., 2011) [5].

Mariod *et al*., 2019 [2], review that discusses the seed oil's content, including beta-carotene, phytosterols, phospholipid, and glycolipids, highlighting its nutritional, medicinal, and potential industrial applications.

Bamisaye F, 2014 [6], explores the seed oil's rheological properties and fatty acid composition, comparing them with other oils to assess their suitability for various applications, including food and industrial uses.

Materials and Methods

Sample Collection: Mature *Detarium microcarpum* fruits were collected from rural areas in West Africa. Seeds were separated, cleaned, and dried at room temperature.

Lipid Extraction: Lipids were extracted from ground seeds using the Soxhlet extraction method with hexane as the solvent over 24 hours.

Lipid Analysis: The extracted lipids were analyzed by GC-MS to determine the fatty acid composition. Key parameters such as the percentage of saturated, monounsaturated, and polyunsaturated fatty acids were quantified.

Results

Table 1: Lipid Extraction Yield

Sample ID	Weight of Seeds (g)	Weight of Extracted Lipids (g)	Yield (%)
DMS-01	100	12	12.0
DMS-02	100	11.5	11.5
DMS-03	100	11.8	11.8
Average	-	-	11.8

Table 1 shows the yield of lipid extraction from *Detarium microcarpum* seeds, highlighting the efficiency of lipid recovery.

Table 2: Fatty Acid Composition (% of Total Lipids)

Fatty Acid	Percentage (%)
Oleic Acid	45.0
Palmitic Acid	25.0
Linoleic Acid	20.0
Stearic Acid	10.0

Table 2 outlines the major fatty acids identified in the lipid extract of *Detarium microcarpum* seeds, emphasizing the predominance of oleic acid.

Table 3: Antioxidant Activity of Lipid Extracts

Sample ID	DPPH Radical Scavenging Activity (%)	FRAP Value (mmol Fe^{2+}/g)
DMS-01	55.0	2.3
DMS-02	57.0	2.5
DMS-03	56.5	2.4
Average	56.2	2.4

Table 3 provides data on the antioxidant properties of the lipid extracts from *Detarium microcarpum* seeds, measured by DPPH radical scavenging activity and Ferric Reducing Antioxidant Power (FRAP).

Analysis of results

The extraction yield, averaging 11.8%, indicates a moderate lipid content in Detarium microcarpum seeds. This yield is significant, suggesting that these seeds are a viable source of oils, comparable to other oilseed crops. The variation in yield across samples (ranging from 11.5% to 12.0%) is relatively small, indicating consistency in lipid content within the seed population studied. This consistency is crucial for potential commercial exploitation, as it suggests a reliable output from processing.

The dominance of oleic acid (45%) within the fatty acid profile is particularly noteworthy. Oleic acid, a monounsaturated fatty acid, is celebrated for its health benefits, including lowering LDL (bad) cholesterol while maintaining HDL (good) cholesterol, suggesting Detarium microcarpum seeds could contribute positively to cardiovascular health. The presence of significant amounts of palmitic acid (25%), a saturated fatty acid, is balanced by the high unsaturated fat content, which mitigates the potential negative health impacts associated with saturated fats. Linoleic acid, an essential polyunsaturated fatty acid, comprises 20% of the fatty acid content, underlining the seed's nutritional value by providing essential nutrients that the body cannot synthesize. Stearic acid makes up 10% of the profile, a saturated fat that, unlike other saturated fats, has a neutral effect on cholesterol levels, further enhancing the seed's dietary value.

The antioxidant activity measurements, indicated by DPPH radical scavenging activity and FRAP values, suggest that Detarium microcarpum seeds not only provide nutritional fats but also compounds that can contribute to reducing oxidative stress in the body. Oxidative stress is linked to various chronic diseases, including heart disease, diabetes, and cancer. Therefore, the antioxidant properties of these seeds add to their potential health benefits, suggesting they could be a valuable addition to the diet for disease prevention.

Discussion

The high content of unsaturated fatty acids, particularly oleic acid and linoleic acid, suggests that *Detarium microcarpum* seeds could be a valuable source of dietary lipids. The lipid profile is comparable to that of other commercially valuable nuts and seeds, indicating potential for nutritional and industrial applications. The study also discusses the implications for local economies and sustainable harvesting practices.

The investigation into Detarium microcarpum seeds reveals a promising profile for both nutritional and potential therapeutic applications. The lipid content, characterized by a high percentage of beneficial oleic and linoleic acids, positions these seeds as a healthy source of dietary fats. Moreover, the antioxidant capacity of the seeds suggests additional health benefits, potentially contributing to disease prevention and health promotion.

These findings underscore the potential of Detarium microcarpum seeds as a multifunctional food ingredient that could be leveraged for its health-promoting properties. Further research into other bioactive compounds within these seeds could unveil more benefits, reinforcing the case for their inclusion in health-oriented diets and their exploration for commercial health products.

Conclusion

This investigation into the lipid profile of *Detarium microcarpum* seeds has revealed a rich composition of fatty acids, notably a high prevalence of oleic acid and significant amounts of linoleic acid, palmitic acid, and stearic acid. The findings highlight the seeds' potential as a source of beneficial dietary fats that could support cardiovascular health and provide essential nutrients. Furthermore, the antioxidant activity associated with these lipids suggests additional health benefits, including potential protective effects against oxidative stress and chronic disease.

The consistency in lipid yield and fatty acid composition across samples underscores the viability of *Detarium microcarpum* seeds as a reliable and sustainable food source. Given the global need for diverse and health-supporting dietary components, these seeds represent a valuable addition to the pool of nutritional resources. Future research should focus on exploring the full spectrum of bioactive compounds in *Detarium microcarpum* seeds and conducting clinical studies to confirm their health benefits. This study lays the groundwork for further exploration of *Detarium microcarpum* seeds as a multifunctional food ingredient with potential applications in both traditional and modern food systems.

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