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Comparative Analysis of Mechanically Extracted Oils from Underutilized Seeds: Yield, Physicochemical Properties, and Antioxidant Potential for Industrial Applications

Musa Runde[1], Neksumi Musa[2], Uzairu M. Sada[1] and Amina Ibrahim[1]

[1]Department of Chemistry, National Open University of Nigeria
[2]Department of Science Laboratory Technology, Adamawa State Polytechnic, Yola

***Corresponding author's email:**

rmusa@noun.edu.ng

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The global demand for plant-based oils continues to rise, yet many underutilized seeds remain unexplored despite their nutritional and industrial potential. This study conducted a comparative evaluation of oils mechanically extracted from five underutilized seeds; black seed (*Nigella sativa*), flax seed (*Linum usitatissimum*), mustard seed (*Brassica juncea*), sweet melon seed (*Cucumis melo*), and castor seed (*Ricinus communis*). Using a standardized screw-press method and AOAC analytical protocols, the oils were assessed for yield, key physicochemical properties (iodine value and saponification value), and antioxidant potential (total phenolic contents and DPPH radical scavenging activity) to determine their industrial suitability. Castor seed yielded the highest oil contents (30.55%), while flaxseed oil exhibited the greatest unsaturation (iodine value: 153.21 g I_2/100 g). Sweet melon seed oil recorded the highest total phenolic contents (0.75 mg GAE/g), and all the oils demonstrated moderate but significant DPPH radical scavenging activity (50%). The saponification values (176.9–188.4 mg KOH/g) are within the acceptable range for soap and cosmetic formulations. The results highlight the unique compositional profiles of each oil: Black seed and mustard oils are valuable for nutraceutical and cosmeceutical applications due to their antioxidant capacity; and castor oil remains suitable for specialized industrial and pharmaceutical uses. The study provides a scientific basis for the valorization of underutilized seeds, supporting their integration into value-added products while promoting economic diversification and sustainable practices.

Keywords: Antioxidant, Base-oils, Oil-yield, Phenolics, and scavenging.

1. Introduction

The global demand for plant-based oils continues to rise, fueled by their extensive applications across the food, pharmaceutical, cosmetic, and biofuel industries (Nguyen et al., 2025). While conventional oilseeds maintain market dominance, there is increasing interest in underutilized seeds as sustainable and novel sources of oil with unique physicochemical and bioactive properties. Seeds such as black seed (*Nigella sativa*), flaxseed (*Linum usitatissimum*), Mustard seed (*Brassica juncea*), sweet melon seed (*Cucumis melo*), and castor seed (*Ricinus communis*) remain largely overlooked despite their high oil contents and potential health benefits (Karimi *et al*., 2025; Shang *et al*., 2025; Wang *et al*., 2025;Hassan *et al*., 2025; Singh *et al*., 2015),. Mechanical extraction methods, especially cold pressing, are preferred for obtaining these oils, so as to avoid chemical solvents and high temperatures, thereby preserving heat-sensitive bioactive compounds and ensuring a cleaner, more environmentally friendly product (Sannino *et al*., 2025).

Despite this potential, many indigenous oil-bearing seeds are not fully exploited due to lack of comprehensive scientific data on their oil characteristics (Runde *et al*., 2025). The variability in oil yield, fatty acid composition, and antioxidant profiles among these seeds has not been well-documented. This knowledge gap impedes their commercial valorization and integration into specific industrial applications. Without a detailed comparative analysis of their physicochemical and functional attributes, it remains difficult to assess their suitability for targeted end-uses in nutraceuticals, cosmeceuticals, or industrial formulations.

This study aimed to conduct a comparative evaluation of oils mechanically extracted from selected underutilized seeds (black seed (*Nigella sativa*), flaxseed (*Linum usitatissimum*), mustard seed (*Brassica juncea*), sweet melon seed (*Cucumis melo*), and castor seed (*Ricinus communis*)) to determine their potential for industrial and nutraceutical applications. Specifically, it sought to determine the percentage oil yield from each seed, analyze key physicochemical properties including iodine value and saponification value, and evaluate antioxidant potential through total phenolic content and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity.

2. Material and Methods

2.1 Plant Materials and Sample Preparation

This study utilized five underutilized oil-bearing seeds (Plate 1), black seed (*Nigella sativa*), flaxseed (*Linum usitatissimum*), mustard seed (*Brassica juncea*), sweet melon seed (*Cucumis melo*), and castor seed (*Ricinus communis*) The seeds were sourced locally from the Abuja central Mosque shops and were identified by a taxonomist at the Biological Sciences National Open University of Nigeria, cleaned to remove dirt and impurities, and air-dried at ambient temperature. Where applicable, seeds were manually dehulled to obtain the kernels. The prepared samples were stored in airtight containers at room temperature before oil extraction.

Plate 1. Representative samples of the five underutilized oil-bearing seeds

2.2 Equipment and Reagents

Oil extraction was performed using mechanical screw press. The subsequent physicochemical analyses utilized standard laboratory equipment, including an analytical balance, reflux apparatus, water bath, and glassware. Reagents used were of analytical grade and included potassium hydroxide, hydrochloric acid, phenolphthalein, Wij's solution (or equivalent for iodine value), chloroform, potassium iodide, sodium thiosulfate, Folin-Ciocalteu reagent, gallic acid, and the stable radical compound, DPPH (2,2-diphenyl-1-picrylhydrazyl).

2.3 Oil Extraction Process

The method as described by Wu *et al.*, (2022) was adopted. Oil was extracted from the prepared seeds using a mechanical expeller at a controlled temperature to prevent thermal degradation. The extracted crude oil was then subjected to centrifugation to remove suspended impurities and mucilaginous matter, yielding a clear, purified oil. The oil yield was calculated gravimetrically as a percentage of the initial weight of the dried seed material. The color and clarity of each purified oil were recorded.

2.4 Physicochemical Analyses

Key physicochemical properties were determined according to the standard association of Official Analytical Chemists (AOAC) methods (Townshend, 1987). The saponification value (SV) was determined by refluxing a known weight of oil with an excess of alcoholic potassium hydroxide. The unreacted alkali was then titrated with standard hydrochloric acid using phenolphthalein as an indicator. The iodine value (IV), which indicates the degree of unsaturation, was assessed using Wij's reagent method. The oil sample was treated with an excess of Wij's solution, after which the liberated iodine was titrated with standard sodium thiosulfate solution. The refractive index of each oil was measured at a standardized temperature (typically 40 °C) using an Abbe refractometer.

2.5 Analysis of Antioxidant Activity

The total phenolic contents (TPC) was determined using the Folin-Ciocalteu assay as described by Molole *et al*, 2022. Briefly, a diluted oil sample was mixed with the Folin-Ciocalteu reagent and sodium carbonate solution. After incubation, the absorbance of the resulting blue complex was measured spectrophotometrically at 765 nm. The TPC was calculated from a standard curve prepared with gallic acid and expressed as milligrams of Gallic Acid Equivalents (GAE) per gram of oil (mg GAE/g).

The free radical scavenging activity was evaluated using the DPPH assay as described by Runde *et al,* (2015), A methanolic solution of DPPH radical was mixed with various concentrations of the oil samples. After a period of incubation in the dark, the reduction in absorbance was measured at 517 nm. The antioxidant activity was calculated as the percentage of DPPH radical scavenged.

2.6 Statistical Analysis

The results for oil yield, saponification value, iodine value, total phenolic contents, and DPPH scavenging activity are presented as Mean ± Standard deviation (SD) of triplicate values.

3. Results and Discussion

3.1 Oil Yield and Physical Characteristics

Castor seed (Ricinus communis) exhibited the highest oil yield (30.55%), followed by mustard seed (Brassica juncea) (28.75%), flaxseed (Linum usitatissimum) (27.80%), black seed (Nigella sativa) (26.45%), and sweet melon seed (Cucumis melo) with the lowest yield (24.40%), as shown in Table 1 and Figure 1. This variation is directly attributable to the inherent genetic makeup of each seed, which influences the size and density of oil bodies within the endosperm or cotyledons (Song, *et al*, 2017).

Comparable results have been reported in previous studies. For instance, Rao and Ravishankar (2020) observed oil yields of 31.2% for Ricinus communis and 28.4% for Brassica juncea, aligning closely with the present findings. Similarly, Abayeh *et al.* (2019) reported flaxseed oil yields ranging between 27–29%, corroborating the current data. Variations in oil yield among seed species have been linked not only to genetic diversity but also to factors such as seed maturity, environmental conditions, and extraction method (Kumar *et al.*, 2021).

The relatively higher yield of castor and mustard seeds suggests that these species possess more efficient lipid biosynthetic pathways and denser oil bodies, resulting in greater extractable oil content (Manaf et al., 2018). In contrast, the lower oil yield observed in sweet melon seeds could be attributed to lower triacylglycerol accumulation and a higher proportion of non-lipid cellular structures (El Khaleefa *et al.*, 2020).

The variation in oil yield among these seeds has important industrial and nutritional implications. Seeds with higher oil yield, such as castor and mustard, are economically advantageous for large-scale oil production and can be targeted for biofuel, lubricant, and cosmetic applications. On the other hand, seeds with moderate yields but rich in polyunsaturated fatty acids (like flaxseed and black seed) are valuable for nutraceutical and therapeutic formulations, despite their relatively lower yield. Furthermore, understanding the genetic basis of oil-body development and density can guide breeding programs aimed at improving oil content and quality in seed crops (Song et al., 2017; Kumar *et al.*, 2021).

Table 1: Percentage yield and extraction parameters of the oils

Local name	Weight (g)	Wt. of oil (g)	Yield %	Centrifuge (sample holder)	Time (min)
Black seed	500	125.60	25.12	15	20
Flaxseed	500	136.50	27.30	15	20
Mustard seed	500	140.60	28.12	15	20
Sweet melon seed	500	122.00	24.40	15	20
Castor seed	500	152.75	30.55	15	20

The physical appearance of the extracted oils showed distinct colors and clarity. Flaxseed oil possessed a characteristic golden-yellow hue, while black seed oil was a darker amber. Mustard seed oil was a deep yellow, castor oil was pale yellow, and sweet melon seed oil appeared light yellow. These visual differences are indicative of the unique pigment profiles, such as carotenoids and chlorophyll, present in each seed source (Borello *et al*, 2021.).

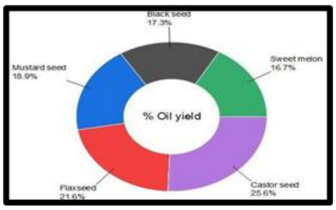

Figure 1: Physical appearance and the Percentage yield.

3.2 Physicochemical Properties

The chemical quality and potential applications of the oils were evaluated through key indices.

3.2.1 Iodine Value (IV)

The iodine values, presented in Table 2, revealed significant differences in the degree of unsaturation. Flaxseed oil had the highest IV (153.21 g I_2/100g), confirming its status as a rich source of polyunsaturated fatty acids (PUFAs), particularly alpha-linolenic acid (ALA). This was followed by mustard seed oil (125.44 g I_2/100g) and black seed oil (118.92 g I_2/100g), both also known for their high unsaturated fat content. Sweet melon seed oil (105.36 g I_2/100g) and castor oil (92.53 g I_2/100g) showed lower degree of unsaturation. The exceptionally low IV of castor oil is a hallmark of its unique fatty acid profile, dominated by ricinoleic acid, a monounsaturated fatty acid with a hydroxyl group that does not contribute to the iodine value in the same way as standard double bonds (Imran *et al.*, 2025).

Table 2: Iodine Value of the Oils

Sample Oil	Weight (g)	Iodine Value (g I_2/100g oil)
Black seed	3	105.30
Flaxseed	3	194.20
Mustard seed	3	106.60
Sweet melon seed	3	100.70
Castor seed	3	88.80
Blank	3	0.00
Control	3	0.02

3.2.2 Saponification Value (SV)

The saponification values (Table 3) ranged from 176.9 to 188.4 mg KOH/g oil, consistent with values reported for vegetable oils in previous studies. The SV is inversely related to the average molecular weight of the fatty acids, with higher values indicating shorter chain lengths. Castor oil exhibited the highest SV (188.4 mg KOH/g), suggesting a relatively higher proportion of medium-chain fatty acids, a feature that contributes to its well-known solubility in alcohol and its emollient properties in cosmetic formulations. The black seed, flaxseed, mustard, and sweet melon seed oil, showed SVs clustered between 176.9 and 182.6 mg KOH/g, reflecting the predominance of long-chain fatty acids, particularly C18 fatty acids, which are typical of edible seed oils (Ivanova *et al*, 2022).

These results indicate that all the oils are within the recommended saponification value range for industrial and domestic applications, especially in soap and cosmetic production. The relatively high SV of castor oil further underscores its unique functional versatility, while the uniformity of SVs in the other oils suggests their suitability as substitutes or blends in conventional formulations (Jiang *et al*., 2024).

Table 3. Saponification value of the oils.

Sample	Weight (g)	Saponification Value (mg KOH/g oil)
Black seed	2	176.9
Flaxseed	2	182.5
Mustard seed	2	179.8
Sweet melon	2	177.4
Castor seed	2	188.4
Blank	2	–

3.3 Antioxidant Properties

The antioxidant capacity of the oils, a critical factor for oxidative stability and nutraceutical value, was assessed through two primary methods.

3.3.1 Total Phenolic Contents (TPC)

The total phenolic contents (TPC) of the oils, presented in Table 4, ranged from 0.32 to 0.75 mg GAE/g. Sweet melon seed oil had the highest phenolic compounds level (0.75 mg GAE/g), followed closely by mustard seed (0.72 mg GAE/g) and flaxseed (0.69 mg GAE/g). Black seed oil showed a moderate value (0.49 mg GAE/g), while castor seed oil (0.32 mg GAE/g) had the lowest phenolic concentration among the oils tested.

Although the values are lower than the control standard (gallic acid, 0.95 mg GAE/g), the presence of measurable phenolic compounds confirms the contribution of these underutilized seed oils to antioxidant capacity. The relatively higher TPC in sweet melon, mustard, and flaxseed oils suggests that these may be particularly promising for nutraceutical and functional food applications (Do Espírito Santo De Jesus *et al.*, 2023). The lower levels observed in black seed and castor oil may reflect differences in seed composition, extraction efficiency, or phenolic solubility in the oil matrix (Do Espírito Santo De Jesus *et al.,* 2023).

Table 4. Total phenolic contents of the oils

Sample	Total Phenolic Content (mg GAE/g oil)
Black seed (1)	0.49
Flaxseed (2)	0.69
Mustard seed (3)	0.72
Sweet melon seed (4)	0.75
Castor seed (5)	0.32
Blank	0.00
Control (Gallic acid)	0.95

3.3.2 DPPH Radical Scavenging Activity

The results of the DPPH assay, which evaluates the free radical scavenging activity of the oils, is presented in Table 5. All the seed oils demonstrated moderate antioxidant activity, with values clustering closely between 50.0% and 51.4%. Among them, flaxseed oil exhibited the highest scavenging ability (51.4%), followed by sweet melon (50.3%), castor seed (50.2%), and both black seed and mustard seed (50.0%). Although the differences among the samples were relatively small, the results indicate that the oils contain bioactive compounds capable of donating hydrogen atoms or electrons to neutralize free radicals (Lobo *et al*, 2010).

The activity of the oils was slightly lower than that of the standard antioxidant, ascorbic acid (52.1%), but markedly higher than the blank (2.23%). This suggests that while the phenolic contents in these oils contributes to radical scavenging, their efficacy is moderate compared to pure antioxidant standards. The results confirm their potential role as natural antioxidants in nutraceutical and cosmetic formulations (Kumar *et al.*, 2024).

Table 5. DPPH radical scavenging activity of the oils

Sample	DPPH Radical Scavenging Activity (%)
Black seed	50.0
Flaxseed	51.4
Mustard seed	50.0
Sweet melon	50.3
Castor seed	50.2
Control (Ascorbic acid)	52.1
Blank	2.23

3.4 Comparative Analysis and Industrial Implications

Figure 2 provides a chart for a direct visual comparison of the key parameters (Yield, IV, SV, TPC, DPPH) across all the five oils, highlighting their unique compositional profiles. The high unsaturation (IV) of flaxseed and mustard oils makes them excellent drying oils, suitable for use in paints, varnishes, and linoleum. However, this also makes them more susceptible to oxidative rancidity, necessitating the use of antioxidants if used in food products (Zhou *et al.*, 2025). The high phenolic contents and radical scavenging activity of black seed and mustard oils confer significant oxidative stability, making them valuable for cosmeceutical and nutraceutical applications where shelf-life and bioactivity are paramount. Castor oil's unique properties, indicated by its high SV and low IV, make it irreplaceable in specialized industrial applications like lubricants, coatings, and pharmaceuticals. These results clearly demonstrate that mechanical extraction provides oils of distinct quality from these underutilized seeds. Each oil possesses a unique combination of properties that dictates its optimal application, ranging from industrial uses to high-value functional food and cosmetic ingredients. This study validates the potential of these indigenous seeds and provides a scientific basis for their valorization.

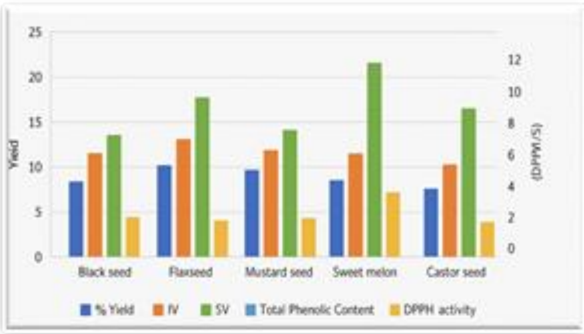

Figure 2: Comparative analysis of the yield, iodine value, saponification value, phenolic contents, and DPPH activity of selected seed oils.

4. Conclusion

This study conclusively demonstrates that mechanically extracted oils from black seed, flaxseed, mustard seed, sweet melon seed, and castor seed possess distinct and valuable profiles, making them promising resources for various industries. The analysis revealed significant differences in yield, with castor seed providing the highest output, and in composition, evidenced by flaxseed oil's high unsaturation and black seed oil's superior antioxidant capacity, which was confirmed by its exceptional phenolic content and DPPH radical scavenging activity. The physicochemical properties further indicate that all oils are suitable for applications in soap and cosmetic formulations. Based on these findings. It is recommended that industries leverage these unique properties; for instance, the potent antioxidants in black seed and mustard oils should be explored for nutraceutical and cosmeceutical products, while flaxseed oil's drying potential makes it ideal for industrial uses like paints and coatings. Future work should focus on optimizing extraction techniques to maximize yield and preserve bioactivity, conducting detailed compositional analyses including fatty acid and tocopherol profiles, and performing necessary toxicological and efficacy studies to ensure safe consumption and topical use.

Finally, agricultural policymakers are encouraged to promote the cultivation of these underutilized crops to enhance economic diversity, improve food security, and establish a sustainable supply chain for emerging bio-based markets.

Conflict of Interest

The authors declare no conflict of interest.

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References

Do Espírito Santo De Jesus, F., De Jesus Freitas, T., Bispo, A. M., De Matos Santos, L., Braga Alves, A. S., Aparecida Souza Machado, B., & Ferreira Ribeiro, C. D. (2023). Edible oils and development of new products: Sensory, microbiological, and cytotoxic aspects. *Current Organic Chemistry, 27*(22), 1917–1945. https://doi.org/10.2174/0113852728267166231123111707

Hassan, S. A., Khalid, S., Javaid, H., Zafar, S., Abdi, G., & Aadil, R. M. (2025). Unlocking the

potential of muskmelon seeds as sustainable ingredients for the food industry. *Food Chemistry Advances, 7,* 101008. https://doi.org/10.1016/j.focha.2025.101008

Imran, M., Huangying, S., Hongshuo, Z., Xiaoyun, P., Zhou, R., Guanming, C., & Xianhai, Z.

(2025). Genetic and metabolic engineering of oleic acid synthesis pathways in oil palm: Challenges and future prospects. *Plant Physiology and Biochemistry, 228,* 110288. https://doi.org/10.1016/j.plaphy.2025.110288

Jiang, Y., An, J., Zhai, S., Gao, X., & Song, J. (2024). Research progress on biomass-based

materials for oil/water separation: Designing strategy and efficiency mechanism. *International Journal of Biological Macromolecules, 283,* 137646. https://doi.org/10.1016/j.ijbiomac.2024.137646

Karimi, M., Pirzad, S., Pourfaraji, S. M. A., Sedgi, F. M., Darouei, B., Amani-Beni, R., Kazemi,

K., & Rabiee, R. (2025). Effects of black seed (*Nigella sativa L.*) on cardiometabolic indices in type 2 diabetic patients: A systematic review and meta-analysis of RCTs. *Complementary Therapies in Medicine, 90,* 103174. https://doi.org/10.1016/j.ctim.2025.103174

Kumar, R., Shikha, D., and Sinha, S. K. (2024). DPPH radical scavenging assay: A tool for

evaluating antioxidant activity in 3% cobalt–doped hydroxyapatite for orthopaedic implants. *Ceramics International, 50*(8), 13967–13973. https://doi.org/10.1016/j.ceramint.2024.01.314

Nguyen, D., Sae-Eaw, A., Chompreeda, P., Siripatrawan, U., & Suppakul, P. (2025). Optimal

synergistic formulation of essential oils: Antimicrobial and physical-mechanical properties of cinnamon-oregano oils-incorporated cassava starch films for fresh Vietnamese bread preservation. *Journal of Agriculture and Food Research, 21,* 101897. https://doi.org/10.1016/j.jafr.2025.101897

Runde, M., Sada, U. M., & Musa, N. (2025). Physicochemical, antioxidant, and antimicrobial

evaluation of a multifunctional natural base oil. *Caliphate Journal of Science and Technology, 7*(2), 272–281. https://doi.org/10.4314/cajost.v7i2.10

Sannino, M., Piccolella, S., Maresca, G., Siano, F., Picariello, G., Pacifico, S., & Faugno, S.

(2025). Cooling-assisted cold-pressing: A sustainable approach to high-quality hemp seed oil extraction. *Future Foods, 12,* 100714. https://doi.org/10.1016/j.fufo.2025.100714

Shang, J., Zhang, X., Zhang, J., Huang, D., Chu, B., Gao, Y., Li, Q., Wang, X., & Yu, X. (2025).

Enhancement of bioactive compounds in flaxseed (*Linum usitatissimum L.*) oil through germination during roasting. *Grain & Oil Science and Technology.* https://doi.org/10.1016/j.gaost.2025.08.002

Singh, A. S., Kumari, S., Modi, A. R., Gajera, B. B., Narayanan, S., & Kumar, N. (2015). Role

of conventional and biotechnological approaches in genetic improvement of castor (*Ricinus communis L.*). *Industrial Crops and Products, 74,* 55–62. https://doi.org/10.1016/j.indcrop.2015.05.001

Townshend, A. (1987). Official methods of analysis of the association of official analytical

chemists, 14th edn. *Analytica Chimica Acta, 193,* 400–401. https://doi.org/10.1016/S0003-2670(00)86185-1

Wang, T., Van Dijk, A. D. J., Cai, X., Wu, J., Bonnema, G., & Wang, X. (2025). *Brassica*

diversity through the lens of polyploidy: Genomic evolution, introgression, and homoeologous exchange. *Horticultural Plant Journal, 11*(5), 1777–1790. https://doi.org/10.1016/j.hpj.2025.08.002

Wu, L., Zhao, J., Wu, L., Zhang, Y., & Li, J. (2022). Simultaneous determination of squalene,

tocopherols and phytosterols in edible vegetable oil by SPE combined with saponification and GC-MS. *LWT, 169,* 114026. https://doi.org/10.1016/j.lwt.2022.114026

Zhou, J., Yan, F., Bi, Y., & Li, J. (2025). Nuts: An overview on oxidation, affecting factors,

inhibiting measures, and prospects. *Journal of Food Composition and Analysis, 139,* 107134. https://doi.org/10.1016/j.jfca.2024.107134

Runde M., Kubmarawa D. and Maina H.M. (2015). Compositional Analysis and Anti-Oxidant

Assesment of Essential Oil of some Aromatic Plants Obtained from North-Eastern Nigeria. Research Journal of Chemical Sciences. 5(10), 7-12

Molole, G.J., Gure, A. and Abdissa, N. (2022). Determination of total phenolic content and

antioxidant activity of *Commiphora mollis* (Oliv.) Engl. resin. *BMC Chemistry* **16**, 48. https://doi.org/10.1186/s13065-022-00841-x

Borello, E., Roncucci, D., and Domenici, V. (2021). *Study of the evolution of pigments from freshly*

pressed to 'on-the-shelf' extra-virgin olive oils by means of near-UV visible spectroscopy. Foods, 10 (8), 1891. https://doi.org/10.3390/foods1008189

Ivanova, M., Hanganu, A., Dumitriu, R., Tociu, M., Ivanov, G., Stavarache, C., Popescu, L.,

Ghendov-Mosanu, A., Sturza, R., Deleanu, C., and Chira, N.-A. (2022). *Saponification value of fats and oils as determined from ¹H-NMR data: The case of dairy fats.* Foods, 11(10), 1466. https://doi.org/10.3390/foods11101466

Song, Y., Wang, X.-D., and Rose, R. J. (2017). Oil body biogenesis and

biotechnology in legume seeds. *Plant Cell Reports, 36*(10), 1519-1532. https://doi.org/10.1007/s00299-017-2201-5

Lobo, V., Patil, A., Phatak, A., & Chandra, N. (2010). Free radicals, antioxidants and

functional foods: Impact on human health. *Pharmacognosy Reviews, 4*(8), 118-126. https://doi.org/10.4103/0973-7847.70902

Abayeh, O. J., Aina, E. A., and Okounghae, C. O. (2019). Comparative analysis of oil

yield and physicochemical properties of selected seed oils. *Journal of Applied Sciences and Environmental Management, 23*(5), 935–940.

El Khaleefa, A. H., Babiker, E. E., and Ahmed, A. E. (2020). Extraction and

characterization of oil from melon (*Cucumis melo*) seeds: Yield and physicochemical properties. *International Journal of Food Science, 2020*, 1–7. https://doi.org/10.1155/2020/6584731

Manaf, S. M., Rahim, H. A., and Isa, M. I. N. (2018). Characterization of seed oil yield

and composition in selected tropical oil-bearing plants. *Industrial Crops and Products, 118*, 154–161. https://doi.org/10.1016/j.indcrop.2018.03.067

Rao, R. S., and Ravishankar, G. A. (2020). Influence of seed composition and

extraction method on the oil yield of selected oilseeds. *Journal of Food Biochemistry, 44*(10), e13388. https://doi.org/10.1111/jfbc.13388

