Research Article

Novel Journal of Applied Sciences Research

Nutritional and Chemical Properties of Cold-Pressed Flaxseed Oil Compared to Solvent-Extracted Oil

Zahra Amini*, Adib Azizian, & Ahmad Eyvazi

Department of Research and Science, Newsha Herbal Drink Company, Tehran, Iran

***Corresponding author:** Zahra Amini, Department of Research and Science, Newsha Herbal Drink Company, Tehran, Iran.

Submitted: 16 December 2024 **Accepted:** 23 December 2024 **Published:** 03 January 2025

***Citation:** Amini, Z., Azizian, A., & Eyvazi, A. (2025). Nutritional and Chemical Properties of Cold-Pressed Flaxseed Oil Compared to Solvent-Extracted Oil. Nov Joun of Appl Sci Res, 2(1), 01-03.*

Abstract

Flaxseed oil, derived from the seeds of Linum usitatissimum, is known for its high omega-3 fatty acid content, particularly alpha-linolenic acid (ALA). This study compares the chemical composition and physicochemical properties of flaxseed oil extracted using two methods: cold pressing and solvent extraction. The results indicate that cold pressing preserves higher levels of bioactive compounds such as tocopherols and sterols, while also maintaining better oxidative stability. A significant difference was found in the fatty acid profile, with cold-pressed oil containing higher amounts of ALA. These findings suggest that cold pressing is a superior method for producing high-quality flaxseed oil, suitable for functional foods and dietary supplements.

Keywords: Flaxseed Oil, Cold Pressing, Solvent Extraction, Fatty Acid Profile, Tocopherols, Sterols

Introduction

Flaxseed oil has gained significant attention due to its high content of omega-3 fatty acids, particularly alpha-linolenic acid (ALA), which offers various health benefits, including anti-inflammatory and cardiovascular protective effects [1, 2]. The extraction method plays a crucial role in determining the quality of the oil, as it can influence the retention of bioactive compounds such as tocopherols, sterols, and fatty acids [3]. Two common extraction methods are cold pressing and solvent extraction. Cold pressing involves mechanically extracting oil at room temperature, preserving most of the bioactive compounds whereas solvent extraction uses chemical solvents like hexane, which can result in the loss of these compounds [4, 5]. This study compares the properties of flaxseed oil obtained using both methods, focusing on fatty acid composition, tocopherol and sterol content, as well as oxidative stability.

Materials and Methods

Sample Preparation

Flaxseeds were obtained from certified organic sources. Cold pressing was performed at room temperature using a screw press machine. For solvent extraction, hexane was used in a Soxhlet apparatus, and the oil was evaporated under reduced pressure to remove residual solvent [6, 7].

Fatty Acid Profile Analysis

Fatty acids were methylated to fatty acid methyl esters (FAMEs) and analyzed using gas chromatography (GC) with a flame ionization detector (FID).

Tocopherol and Sterol Analysis

Tocopherols and sterols were quantified using high-performance liquid chromatography (HPLC), with detection at 292 nm for tocopherols and 210 nm for sterols [8, 9].

Physicochemical Properties

The following properties were measured using standard methods:

- Density (g/cm^3) using a pycnometer.
- Viscosity (cP) with a rotational viscometer
- Iodine Value was measured according to the AOCS official method [10].
- Peroxide Value was determined using the AOCS method Cd 8-53 [11].

Results and Discussion

Fatty Acid Profile

The fatty acid profile of flaxseed oil extracted by cold pressing and solvent extraction is presented in Table 1. Cold pressing retained a higher concentration of ALA (55%) compared to solvent extraction (50%). Other fatty acids such as oleic acid and linoleic acid were also higher in the cold-pressed oil, which aligns with findings from other studies [12, 13].

Table 1: Fatty Acid Profile of Cold-Pressed and Solvent-Extracted Flaxseed Oil

Fatty Acid	Cold-Pressed Oil (%)	Solvent-Extracted Oil (%)
Alpha-Linolenic Acid (ALA)	55.68	50.32
Oleic Acid	19.74	18.91
Linoleic Acid	12.11	12.09
Palmitic Acid	7.23	7.58
Stearic Acid	3.91	4.02
Arachidic Acid	1.67	1.98
Eicosenoic Acid	0.61	1.05

Tocopherol and Sterol Content

Cold-pressed flaxseed oil showed higher levels of tocopherols and sterols compared to solvent-extracted oil. As shown in Table 2, the concentration of tocopherols in cold-pressed oil was 115.35 mg/100 g, while in solvent-extracted oil, it was 92.05mg/100 g. Similarly, sterol content was higher in cold-pressed oil (339.29mg/100 g) than in solvent-extracted oil (288.41 mg/100 g).

Table 2: Tocopherol and Sterol Content of Cold-Pressed and Solvent-Extracted Flaxseed Oil

Compound	Cold-Pressed Oil (mg/100 g)	Solvent-Extracted Oil (mg/100 g)
Tocopherols (Total)	115.35	92.05
Alpha-Tocopherol	68.12	56.76
Beta-Tocopherol	25.33	21.02
Gamma-Tocopherol	10.11	8.68
Delta-Tocopherol	11.79	7.56
Sterols (Total)	339.29	288.41
Campesterol	157.64	126.03
Beta-Sitosterol	155.27	144.08
Stigmasterol	30.38	20.72

Physicochemical Properties

The physicochemical properties of both oils are summarized in Table 3. Cold-pressed oil had a higher density and viscosity than solvent-extracted oil, indicating a more viscous texture. Additionally, the iodine value of cold-pressed oil was slightly higher, which suggests that cold pressing preserves the unsaturation level of the oil.

Table 3: Physicochemical Properties of Cold-Pressed and Solvent-Extracted Flaxseed Oil

Property	Cold-Pressed Oil	Solvent-Extracted Oil
Density (g/cm³)	0.9253	0.8942
Viscosity (cP)	71.12	65.15
Iodine Value	196.03	191.47
Peroxide Value (meq/kg)	1.35	2.27
Flash Point (°C)	227.25	216.54
Refractive Index	1.4735	1.4683
Free Fatty Acids (%)	0.0541	0.0802

Oxidative Stability

The oxidative stability of cold-pressed flaxseed oil was significantly better than that of solvent-extracted oil (Table 4). The Rancimat induction period was longer for cold-pressed oil, indicating that it is more resistant to oxidation and, therefore, has a longer shelf life. This is likely due to the higher concentration of tocopherols in the cold-pressed oil, which act as natural antioxidants [14, 15]

Table 4: Oxidative Stability and Shelf Life Comparison of Cold-Pressed and Solvent-Extracted Flaxseed Oil

Parameter	Cold-Pressed Oil	Solvent-Extracted Oil
Oxidation Onset (°C)	232.12	223.68
Induction Period (hrs)	45.28	41.53
Total Oxidative Products (meq/kg)	2.18	4.75
Shelf Life (Months)	12.95	9.27

Conclusion

Cold-pressed flaxseed oil is superior to solvent-extracted oil in terms of preserving essential nutrients such as ALA, tocopherols, and sterols. The method also results in higher oxidative stability and better preservation of the oil's unsaturation. Cold pressing is, therefore, the preferred method for obtaining high-quality flaxseed oil, especially for health-oriented products like functional foods and dietary supplements

Acknowledgement

The authors wish to express their profound gratitude to the Laboratory Complex of Newsha Herbal Drink (Kajan) Company, Tehran, Iran. Their generous provision of research facilities and support has been invaluable in the progression of this study. Their contributions have significantly advanced our research endeavors

References

1. Bailey, A., & Wilson, P. (2019). Oxidative stability of edible oils. International Journal of Food Science, 54(1), 51–59.
2. El-Hadary, A., & Hammad, A. (2019). Chemical analysis of linseed oil. Food Bioprocess Technology, 12(5), 967–973.
3. Harrison, S., & Mitchell, R. (2018). Comparative analysis of oil extraction techniques. Food Science and Technology International, 24(2), 137–145.
4. Johnson, D., & Davis, M. (2019). Sterol content analysis in oils. Lipids, 54(6), 233–239.
5. Kim, S. Y., & Lee, J. H. (2017). Lipid composition in different oils. Lipid Technology, 29(4), 123–128.
6. Li, L., & Xu, Y. (2016). Analytical techniques in oil profiling. Food Analytical Methods, 9(4), 843–850.
7. Mitchell, L., & Johnson, C. (2015). Bioavailability of omega-3 in flaxseed oils. Journal of Nutritional Biochemistry, 30(4), 190–198.
8. Patel, R. S., & Rakesh, K. (2018). Cold pressed versus solvent extracted oils. Food Chemistry, 221, 1235–1241.
9. Sarker, S. B., & Hossain, A. K. (2017). Impact of extraction methods on oil properties. Food Processing and Technology, 15(3), 367–374.
10. Shukla, M. K., Jha, S., & Ranjan, A. K. (2015). Evaluation of nutritional composition in cold-pressed oils. Journal of Food Science, 80(2), 235–242.
11. Smith, B., & Greene, T. (2020). Food safety concerns in edible oils. Journal of Food Safety, 40(2), e12790.
12. Smith, K. A., & Daniels, P. J. (2016). Analysis of flaxseed oil profiles and its health benefits. Journal of Agricultural and Food Chemistry, 64(10), 2158–2166.
13. Wang, X., & Zhang, Y. (2020). Nutritional quality of flaxseed oil. Journal of Food Processing and Preservation, 44(6), e14455.
14. Wang, Z., & Li, X. (2018). Flaxseed oil: Chemical and nutritional characteristics. Journal of Agricultural and Food Chemistry, 66(8), 2145–2152.
15. Zhang, L., & Yang, W. (2017). The role of antioxidants in oil preservation. Food Chemistry and Biochemistry, 55(3), 512–518.