FOLIA Amazónica
Revista del Instituto de Investigaciones de la Amazonía Peruana

PHYSICOCHEMICAL CHARACTERIZATION OF PEANUT OIL (*Arachis hypogaea* L.) CONSIDERING DIFFERENT GENETIC VARIETIES AND EXTRACTION METHODS

Juan Alejandro NEIRA MOSQUERA[1,2,3], Sungey Naynee SÁNCHEZ LLAGUNO[1] Marjorie MACAS MOREIRA[2], Jhonnatan Placido ALDAS-MOREJON[3,4], Karol Yannela REVILLA ESCOBAR[3,4]*, Ramona Cecilia PARRÁGA ÁLAVA[5]

[1] Universidad de las Fuerzas Armadas-ESPE, Departamento de Ciencias de la Vida y la Agricultura. Av. General Rumiñahui s/n Sangolquí, Ecuador, P.O.BOX: 171-5-231B.3.

[2] Facultad de Ciencias de la Industria y Producción, Universidad Técnica Estatal de Quevedo, Quevedo, Ecuador.

[3] Universidad Pública de Santo Domingo de los Tsáchilas - UPSDT, km 28, vía Quevedo, Santo Domingo, Ecuador.

[4] Facultad de Ciencias Aplicadas a la Industria, Universidad Nacional de Cuyo, San Rafael, M5600APG, Argentina

[5] Departamento de Procesos Agroindustriales, Universidad Técnica de Manabí, Chone, Ecuador.

* Correo electrónico: krevillaescobar@upsdt.edu.ec

ABSTRACT

This study compared the physicochemical characteristics of peanut oil considering different varieties and extraction methods. A factorial experimental design was used with factors A (peanut varieties: INIAP 380 Negra, INIAP 381 Rosa, and INIAP 382 Caramelo) and B (extraction methods: Soxhlet, hot pressing, and cold pressing). The Soxhlet method yielded the highest percentage (37.33%). The INIAP 380 (Negra) variety, extracted using Soxhlet, showed the best quality in terms of acidity (0.34%), ash (0.16–0.27%), impurities (0.01%), and peroxide value (3.00 meqO_2/kg). No significant differences were found in pH (3.58–4.55) or density (0.91–0.92 g/cm^3) among the study factors. Regarding chemical properties, cold and hot-pressing methods stood out in saponification value (190.61 and 190.27 mg KOH/g, respectively) and acid value (14.99 and 11.63 mg/g). The INIAP 381 (Pink) variety, obtained using Soxhlet extraction, presented the highest iodine value (114.28 cg/g) and a cyanide content of 0.76 ppm. In conclusion, the INIAP 380 (Black) variety, extracted using Soxhlet extraction, showed the best yield and oil quality, while the pressing methods favored higher saponification values, demonstrating the influence of the variety and extraction method on the physicochemical properties of peanut oil.

KEYWORDS: Lipid profile, groundnut, genotype, mechanical extraction, hydrocyanic compounds.

CARACTERIZACIÓN FISICOQUÍMICA DEL ACEITE DE MANÍ (*Arachis hypogaea* L.) CONSIDERANDO DISTINTAS VARIEDADES GENÉTICAS Y MÉTODOS DE EXTRACCIÓN

RESUMEN

Este estudio comparó las características fisicoquímicas del aceite de maní considerando distintas variedades y métodos de extracción. Se utilizó un diseño experimental factorial con los factores A (variedades de maní: INIAP 380 Negra, INIAP 381 Rosa e INIAP 382 Caramelo) y B (métodos de extracción: Soxhlet, prensado en caliente y prensado en frío). El método Soxhlet obtuvo el mayor rendimiento (37,33 %). La variedad INIAP 380 (Negra) con extracción Soxhlet mostró la mejor calidad en términos de acidez (0,34 %), cenizas (0,16–0,27 %), impurezas (0,01 %) e índice de peróxidos (3,00 meqO_2/kg). No se encontraron diferencias significativas en el pH (3,58–4,55) ni en la densidad (0,91–0,92 g/cm^3) entre los factores de estudio. En cuanto a las propiedades químicas, el prensado en frío y en caliente sobresalió en índice de saponificación (190,61 y 190,27 mg KOH/g, respectivamente) e índice de acidez (14,99 y 11,63 mg/g). La variedad INIAP 381 (Rosa) obtenida mediante Soxhlet presentó el mayor índice de yodo (114,28 cg/g) y un contenido de cianuro de 0,76 ppm. En conclusión, la variedad INIAP 380 (Negra) extraída mediante Soxhlet presentó el mejor rendimiento y calidad del aceite, mientras que los métodos de prensado favorecieron mayores índices de saponificación, evidenciando la influencia de la variedad y del método de extracción sobre las propiedades fisicoquímicas del aceite de maní.

PALABRAS CLAVE: Perfil lipídico, cacahuete, genotipo, extracción mecánica, compuestos cianhídricos.

INTRODUCTION

The global production and consumption of major edible oils have shown continuous annual growth (Taha *et al.*, 2019). Among these, palm, soybean, and canola oils remain the three most consumed oils worldwide. Currently, global production of edible vegetable oils reaches approximately 200 million tons and is projected to increase by more than 40 million tons by 2025 (Siddeegc & Xia, 2015).

Peanut (*Arachis hypogaea* L.), also known as groundnut and a member of the Leguminosae family, is cultivated in various tropical and subtropical regions including South America, Africa, and Asia (Wang *et al.*, 2022). Its importance has grown considerably due to its nutritional value and its contribution to the vegetable oil industry (Lakhlifi *et al.*, 2022). Peanuts are a notable source of oil (approximately 50%), protein (25%), and dietary fiber (9%) (Chouaibi *et al.*, 2019; Codex Alimentarius Commission, 2019). They also contain high levels of oleic acid, a monounsaturated fat beneficial for cardiovascular health, which enhances the oil's oxidative stability and shelf life (Lafont *et al.*, 2011).

Globally, peanuts rank as the fourth most important oilseed crop, with an annual production of around 43.98 million tons (Kruatian *et al.*, 2013). About one-third of this output is used for oil extraction, while the rest is processed for food applications (Bravo *et al.*, 2018). The rising demand for peanut oil, estimated between 100 and 500 tons annually, has heightened interest in its processing and quality evaluation (European Food Safety Authority, 2019). To ensure product quality and shelf life, physical-chemical parameters such as acidity and peroxide value are routinely assessed (Tahir *et al.*, 2024).

In Ecuador, peanut cultivation is mainly concentrated in the provinces of Manabí, El Oro, Loja, and Guayas, covering between 10,000 and 15,000 hectares and yielding an average of 800 kg per hectare. However, this production is insufficient to meet domestic demand, impacting industries such as edible oils, confectionery, and vegetable fats (Waszkowiak *et al.*, 2015). The growing popularity of peanut oil in the country is driven by its nutritional benefits, positioning it as a healthy alternative to palm and olive oils (Gómez *et al.*, 2015; Tabio *et al.*, 2021).

Peanut oil is valued for its pale yellow color, distinctive aroma, and characteristic flavor, making it recognizable in the market. In consuming countries, it is primarily used for cooking and frying (Ferrer *et al.*, 2020). Various extraction methods influence the oil's quality, including solvent extraction, cold and hot pressing, and modern techniques such as microwave or ultrasound-assisted extraction (Montero, 2020). Each method affects the oil's nutritional and sensory attributes as well as its stability. Cold pressing better preserves heat-sensitive compounds and quality, while hot pressing may increase yield but potentially degrade some beneficial components (Gómez *et al.*, 2016; Fajardo *et al.*, 2022).

Therefore, the objective of this study was to comparatively analyze the physicochemical characteristics of peanut (*Arachis hypogaea* L.) oil, considering both genetic varieties and extraction methods. This analysis aimed to identify the optimal extraction method for maximizing oil quality and to provide valuable insights for producers and the food industry.

MATERIALS AND METHODS

RAW MATERIAL

The raw material consisted of cultivating peanut seeds from the varieties INIAP 380 (Black), INIAP 381 (Pink), and INIAP 382 (Caramel) in an area of 200 m^2. The process included all agronomic activities from planting to harvest, such as soil preparation, planting, fertilizer application, pest and disease control, weed management, and harvesting. Both the cultivation and the corresponding analyzes were conducted at the University of the Armed Forces "ESPE," Santo Domingo campus, located at geographic coordinates latitude 00° 24' 36" and longitude 79° 18' 43", at an altitude of 270 meters above sea level.

SAMPLE PREPARATION

The samples were visually inspected to eliminate those in poor condition and to remove any impurities.

EXTRACTION USING THE SOXHLET METHOD

The oil extraction was performed by placing 3 grams of dried, ground samples into the Soxhlet extractor. The system's liquid solvent recirculation allowed for the separation of solid and liquid phases, using petroleum ether (250 ml) at a temperature of 50°C (Zurita-Santillan *et al.*, 2021).

EXTRACTION BY HOT PRESSING

The dried seeds were subjected to a water bath until reaching a temperature of 80°C. Subsequently, a cloth was used, and with the help of a hydraulic press, the oil contained in the peanut seeds was extracted (Carrasco-Calvo 1995).

EXTRACTION BY COLD PRESSING

The samples were stored at -15 °C for 24 hours. After this period, a hydraulic press was used with a pressure of 246–250 bar, applying a temperature of 45 °C for 45 minutes. The oil from the seeds was collected in stainless steel trays and finally filtered through a sieve (Prestes *et al.*, 2023).

PEANUT OIL YIELD

The amount of oil extracted was evaluated in milliliters per kilogram of peanut seed. To determine the yield, the formula used by Salvador-Badui (1997) was applied:

$$R = mOil/mSeed*100$$

Where:
R= Yield
m Oil= Quantity of oil obtained (g)
m Seed= Quantity of seed fed (g).

EVALUATION OF PHYSICAL AND CHEMICAL CHARACTERISTICS

The parameters of acidity, density, ash, moisture, pH, peroxide value, and impurities were determined according to the procedures established in various Ecuadorian Technical Standards NTE INEN. Acidity was determined by titration (Ecuadorian Institute of Standardization [INEN], 1978), density using a pycnometer (Ecuadorian Institute of Standardization [INEN], 2012), moisture content by the loss on drying method, pH using a potentiometer (Cruz & Melendez-Zepeda, 2004), and ash based on AOAC 923.03/ Gravimetry method. The peroxide value was measured by weighing 5 g of sample in a stoppered Erlenmeyer flask (250 cm^3) (Ecuadorian Institute of Standardization [INEN], 1978). Impurities were assessed using a centrifuge; 5 ml of samples were placed in a centrifuge and centrifuged for 5 minutes at 3000 rpm (Ecuadorian Institute of Standardization [INEN], 2002).

DETERMINATION OF CHEMICAL PROPERTIES

To determine the Saponification Index, 4-5 g of oil were subjected to a 0.5 N alcoholic potassium hydroxide solution in a water bath. For the Iodine Index, 15 g of oil were used (Ecuadorian Institute of Standardization [INEN], 2013). The cyanide test was carried out according to the method established by Nava *et al.*, (2007). Finally, for the Acidity Index, 50 g of oil were dissolved in 100 ml of alcohol, as described in reference (Ecuadorian Institute of Standardization [INEN], 1878).

STATISTICAL ANALYSIS

For this study, a completely randomized block design with an A*B factorial arrangement was used, where factor A = peanut varieties (INIAP 380 Black; INIAP 382 Pink; INIAP 382 Caramel) and factor B = extraction methods (Soxhlet method; Hot pressing; Cold pressing). This resulted in 9treatments with 3 replicates of 1 kg each. Statistical differences were measured using the Tukey test (P<0.05) with InfoStat software. Treatment combinations are summarized in Table 1.

RESULTS AND DISCUSSION

YIELD OF PEANUT OIL (*Arachis hypogaea* L)

Figure 1 illustrates that the Soxhlet extraction method resulted in a higher oil yield across the three peanut varieties, with the INIAP 382 (Caramelo) variety achieving the highest yield at 37.33 %. In contrast, the hot-pressing method produced lower yields, with the INIAP 382 (Caramelo) variety showing the lowest yield at 20,58 %. These findings confirm the efficiency of the Soxhlet method for oil extraction, aligning with previous studies that reported a 36.19 % yield for peanut oil using this technique (Valdiviezo *et al.*, 2019). Furthermore, research by Pereira-Braga *et al.* (2024) has shown that in other oilseed species, such as Citrullus lanatus, the cold-pressing method achieved a higher oil yield.

PHYSICOCHEMICAL CHARACTERISTICS OF PEANUT OIL

Table 2 presents the results of the physicochemical analysis of peanut oils extracted from different varieties and by various methods. Statistically significant differences (p<0.05) were observed in acidity, moisture content, and density. In contrast, the pH, ash content, impurities, and peroxide values showed no significant variation across the tested varieties or extraction methods.

The highest acidity level (6.03 %) was found in the oil extracted by cold pressing from the INIAP 381 (Negro) variety, suggesting substantial oil

Table 1. Treatments to compare in the peanut oil extraction study considering three varieties and three extraction methods.

Treatment	Description
T1	INIAP 380 (Negro) + Soxhlet
T2	INIAP 380 (Negro) + Hot pressing
T3	INIAP 380 (Negro) + Cold pressed
T4	INIAP 381 (ROsita) + Soxhlet
T5	INIAP 381 (Rosita) + Hot pressing
T6	INIAP 381 (Rosita) + Cold pressed
T7	INIAP 382 (Caramelo) + Soxhlet
T8	INIAP 382 (Rosita) + Hot pressing
T9	INIAP 382 (Caramelo) + Cold pressed

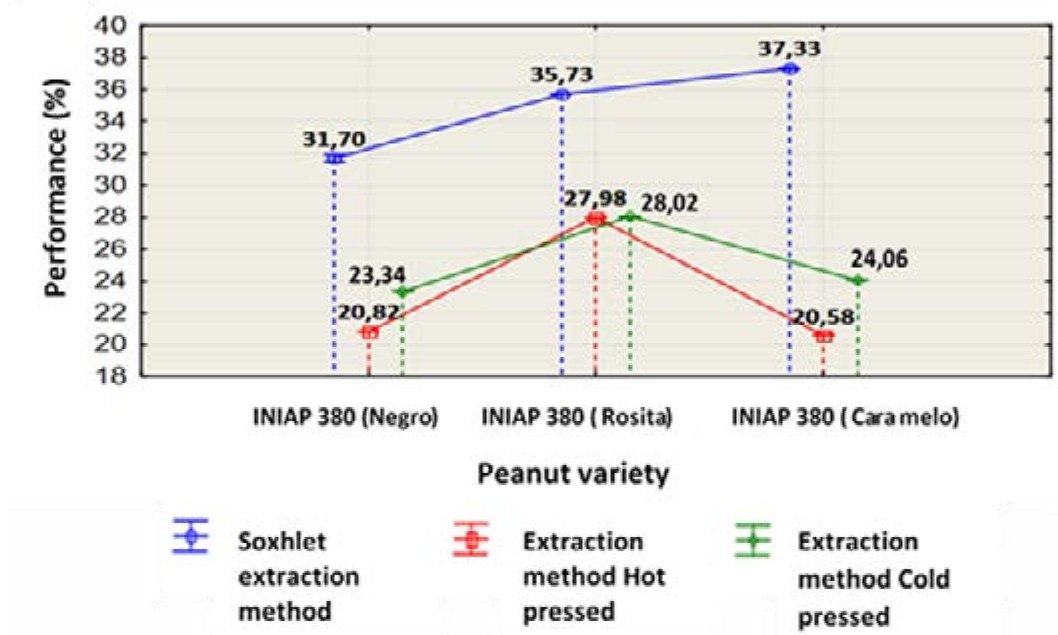

Figure 1. Yield of Arachis hypogaea L. oil considering different varieties and extraction methods.

degradation during processing. Conversely, the lowest acidity (0.34 %) was observed in the Soxhlet-extracted oil from the INIAP 380 (Negro) variety, indicating a lower level of hydrolysis. These findings align with prior studies suggesting that cold and hot pressing can elevate titratable acidity due to exposure to high temperatures and mechanical stress, while Soxhlet extraction typically yields oils with lower acidity (Reboredo-Rodríguez *et al.*, 2016; León-Mendoza *et al.*, 2021). Since acidity is a key indicator of oil degradation, lower values reflect greater oxidative and hydrolytic stability (Martínez *et al.*, 2023).

Regarding moisture content, the oil obtained by hot pressing from the INIAP 382 (Caramelo) variety exhibited the highest moisture level (0.21 %), while the cold-pressed oil from the same variety presented the lowest value (0.08 %). These results suggest that hot pressing may allow slightly more moisture retention, potentially affecting shelf life and susceptibility to rancidity. For comparison, Bonku and Yu (2020) reported a moisture content of 0.17 % in cold-pressed cashew oil, which falls between the values found in this study. Elevated moisture levels are associated with an increased risk of hydrolytic rancidity and reduced oil stability (Pereira-Braga *et al.*, 2024).

The pH values of the analyzed oils ranged from 3.58 to 4.55, showing no significant influence from either the extraction method or peanut variety. These values fall within the acceptable range for edible oils and indicate adequate stability. Similar pH levels have been reported in previous studies, such as cashew oil with a pH of 5.50 (Mingrou *et al.*, 2022) and peanut oil with a pH range of 4.9–5.3 (Ibáñez-Jácome *et al.*, 2018), although these were slightly higher than those observed in the present study.

The oil density varied only slightly, between 0.91 and 0.92 g/cm^3, indicating high consistency between treatments. These variations can be attributed to differences in non-lipid components, such as volatile compounds or residual matter. These results are consistent with previously reported values for peanut oil, which have determined values of 0.91 g/cm^3 (Pons,

Table 2. Physicochemical properties of peanut oils obtained from different peanut varieties and extraction methods.

Treatments	Acidity (%)	Moisture (%)	pH	Density (gr/cm³)	Ash (%)	Impurity (%)	peroxide index (meqO_2/Kg)
INIAP 380 (Negro) + Soxhlet	0.34 A	0.15 BCD	4.55 A	0.92 B	0.27 A	0.02 A	3.00 A
INIAP 380 (Negro) + Hot pressing	1.71 E	0.13 ABC	4.19 A	0.92 AB	0.37 AB	0.08 A	15.33 A
INIAP 380 (Negro) + Cold pressed	1.29 C	0.13 ABC	4.02 A	0.91 AB	0.43 AB	0.11 A	12.00 A
INIAP 381 (Rosita) + Soxhlet	1.71 E	0.13 ABC	4.19 A	0.92 AB	0.37 AB	0.08 A	15.33 A
INIAP 381 (Rosita) + Hot pressing	1.39 CD	0.10 AB	3.58 A	0.91 A	0.16 A	0.01 A	9.40 A
INIAP 381 (Rosita) + Cold pressed	6.03 G	0.16 BCD	3.85 A	0.91 AB	0.67 B	0.07 A	8.00 A
INIAP 382 (Caramelo) + Soxhlet	0.71 B	0.18 CD	4.28 A	0.91 AB	0.20 A	0.01 A	9.20 A
INIAP 382 (Rosita) + Hot pressing	5.84 F	0.21 D	3.88 A	0.92 AB	0.20 A	0.10 A	16.00 A
INIAP 382 (Caramelo) + Cold pressed	1.85 E	0.08 A	4.02 A	0.91 AB	0.34 AB	0.04 A	4.00 A
INIAP 380 (Negro) + Soxhlet	1.50 D	0.13 ABC	3.98 A	0.91 AB	0.23 A	0.09 A	4.13 A

A-G statistically significant using Tukey's test ($p<0.05$).

2015) and 0.95 g/cm^3 in edible oils (Siddeegc & Xia, 2015). This supports the idea that the extraction method has a minimal influence on this parameter.

The ash content, which reflects the mineral composition of the oils, was highest in the cold-pressed oil of the INIAP 381 (Rosita) variety, at 0.67%, and lowest in the hot-pressed oil of the same variety, at 0.16 %. These results suggest that cold pressing may retain a higher proportion of minerals. However, all ash content values were lower than those reported for Plukenetia volubilis oil (2.90 %), as noted by Bai *et al.* (2021). Pereira-Braga *et al.* (2024) also observed that mineral content in oils is particularly sensitive to the extraction method, with cold-pressed oils typically presenting higher levels.

Impurities, which affect oil purity and quality, ranged from 0.01 % to 0,11 %. The cleanest samples were those of hot-pressed and Soxhlet-pressed oils from INIAP 381 (Rosita) and INIAP 382 (Caramelo) varieties (0.01 %), while the highest level of impurities (0.11 %) was observed in the cold-pressed oil of INIAP 380 (Negro). The high level of impurities in cold-pressed oils could be due to less effective mechanical filtration. Even so, all impurity levels remained within acceptable limits and were lower than those previously reported for cold-pressed *Annona crassiflora* oils, which determined a value of 0.79 % (Pasupuleti *et al.*, 2013; Pereira-Braga *et al.*, 2024).

The peroxide index, which measures the degree of primary oxidation, ranged widely across treatments. The highest value (16.00 meq O_2/kg) was found in the hot-pressed oil from the INIAP 382 (Rosita) variety, while the lowest (3.00 meq O_2/kg) occurred in the Soxhlet-extracted oil from INIAP 380 (Negro). These results indicate greater oxidative stability in oils extracted via Soxhlet, consistent with the reduced exposure to oxygen and heat during this method. Peroxide values below 5 meq O_2/kg are generally indicative of fresh oil (León-Sánchez *et al.*, 2022), while values above this threshold may reflect early-stage oxidation. Crude peanut oils obtained through cold pressing typically show peroxide values ranging from 0.35 to 1,99 meq O_2/kg, further emphasizing the stability benefits of Soxhlet extraction (Oubannin *et al.*, 2024).

CHEMICAL PROPERTIES OF PEANUT OIL (*Arachis hypogaea* l.) CONSIDERING THREE VARIETIES AND THREE EXTRACTION METHODS

Figure 2A shows the saponification index of oils extracted from different peanut varieties using various methods. The results reveal that pressing, both hot (INIAP 381: 190.27 mg KOH/g) and cold (INIAP 382: 190.61 mg KOH/g), yields oils with a higher saponification index compared to the Soxhlet method (INIAP 380: 79.40 mg KOH/g). This suggests that pressing techniques extract a greater proportion of free fatty acids, resulting in oils with increased saponification capacity. However, no statistically significant differences were observed among the peanut varieties analyzed. These findings are consistent with those reported by Rivera *et al.* (2022), who investigated the impact of extraction methods on the quality of *Brassica napus* and *Linum usitatissimum* oils, noting saponification indices of 194.25–199.98 mg/g for pressing and lower values (173.21–178.60 mg/g) for Soxhlet extraction. Additionally, the typical saponification index range for peanut oil, as reported by Variath and Janila (2017) and Jácome-Calie *et al.* (2023), is between 186.20 and 187.80 mg KOH/g.

Figure 2B presents the acidity index values, showing that the highest acidity was found in oil from the INIAP 380 (Negro) variety obtained through hot pressing (14.99 mg KOH/g). In contrast, oils extracted via Soxhlet exhibited significantly lower acidity values, specifically 0.68 mg KOH/g for INIAP 380 (Negro) and 1.42 mg KOH/g for INIAP 382 (Caramelo). These results indicate that hot pressing substantially increases the acidity index, regardless of variety. This increase is attributed to the elevated temperatures and prolonged extraction times applied to the seeds (Reboredo-Rodríguez *et al.*, 2016). Similarly, Valdiviezo *et al.* (2019) reported that hot pressing of Virginia and Valencia peanut varieties resulted in significantly higher acidity values (11.81 and 14.80 mg KOH/g, respectively) compared to Soxhlet extraction (0.81 and 0.80 mg KOH/g). Nonetheless, despite the elevated acidity in oils obtained through pressing, all samples from INIAP 380 (Negro), INIAP 382 (Rosita), and INIAP 382 (Caramelo) remained within the Codex Alimentarius limit of 4 mg KOH/g for virgin vegetable oils (Hussain *et al.*, 2015).

Figure 2C displays the iodine index values, indicating that both peanut variety and extraction method significantly affect this parameter. The Soxhlet method yielded the highest iodine index, with a peak value of 114.28 cg/g for the INIAP 381 (Rosita) variety. In contrast, oils extracted via hot and cold pressing showed lower values, ranging from 76.53 to 82.10 cg/g for hot pressing, and from 77.67 to 111.24 cg/g for cold pressing. The elevated iodine values associated with Soxhlet extraction may be due to the more efficient recovery of unsaturated fatty acids (Delgado *et al.*, 2010). Despite these variations, all values for oils obtained via pressing fell within the Codex Alimentarius acceptable range of 86 to 107 cg/g (Hussain *et al.*, 2015). Comparable iodine indices between 97.22 and 99.50 cg/g have also been reported in other peanut varieties (Martínez *et al.*, 2023). According to standard classifications, oils can be categorized as drying (140 to 210 cg/g), semi-drying (100 to 140 cg/g), or non-drying (less than 100 cg/g), which informs their suitability for specific applications in the agro-food industry (Bonku and Yu, 2020).

Figure 2D summarizes the cyanide content, highlighting a significant effect of the extraction method ($p < 0.05$). The Soxhlet method produced the highest cyanide levels, with a maximum

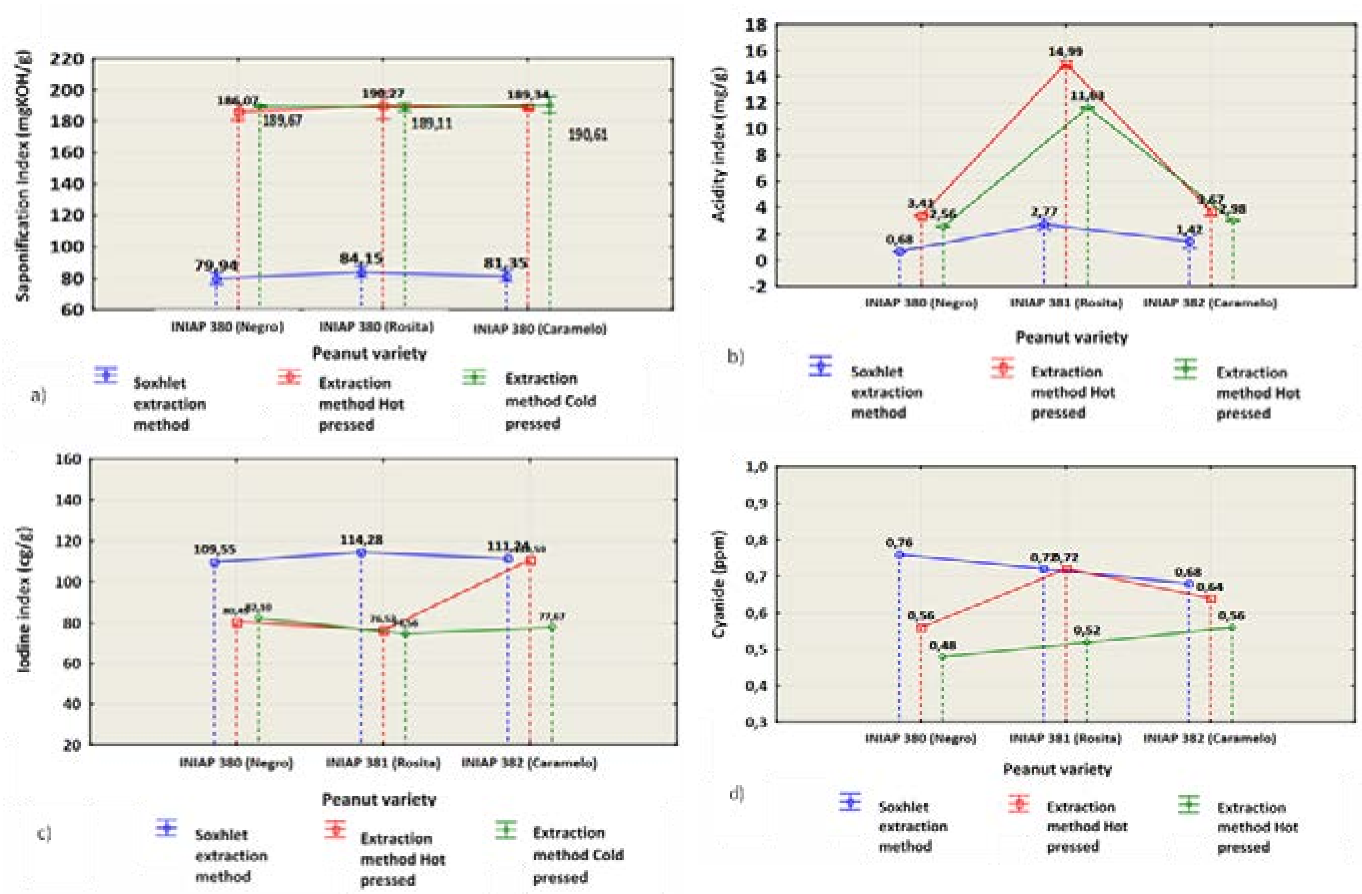

Figure 2. Chemical parameters of *Arachis hypogaea* L. oil considering different varieties and extraction methods. a) Saponification Index (mg KOH/g), b): Acidity Index (mg/g), c): Iodine Index (cg/g), and d): Cyanide (ppm).

of 0.76 ppm for the INIAP 381 (Rosita) variety. In contrast, hot and cold pressing yielded slightly lower cyanide concentrations, ranging from 0.48 to 0.56 ppm and from 0.52 to 0.72 ppm, respectively. The influence of the extraction method on cyanide content has been documented in Linum usitatissimum, where aqueous extraction reduced cyanogenic glycosides by 96 percent, resulting in 0.56 to 0.62 mmol/g, while ethanol-based methods produced much higher levels (71 to 89 mmol/g) (Adesipe-Olugbemi *et al.*, 2019). Moreover, pre-extraction seed conditioning, such as grinding, has been shown to further reduce cyanide levels (Abedinzadeh *et al.*, 2024). It is also important to consider regulatory limits; according to EU Regulation 2022/1364, human exposure to cyanide below the acute reference dose of 20 micrograms per kilogram of body weight is not considered to pose an acute health risk (Martínez-Sánchez, 2015).

CONCLUSIONS

The results obtained show that the physicochemical characteristics of peanut oil (Arachis hypogaea L.) are significantly influenced by the extraction method and, to a lesser extent, by the variety used. Statistically significant differences ($p<0.05$) were observed in oil acidity, moisture and density, while parameters such as pH, ash content, impurities and peroxide index did not show significant variations between treatments.

The oils extracted by Soxhlet showed the lowest values of acidity and peroxides, indicating greater stability against oxidation and hydrolysis. On the other hand, cold pressing generated oils with higher levels of acidity and impurities, especially in the INIAP 381 (Rosita) variety. In terms of chemical parameters, the saponification indexes were higher in the oils obtained by pressing, while the highest values of iodine and cyanide index were found in the oils extracted by Soxhlet. These findings show that the choice of extraction method has a direct impact on the quality and chemical composition of peanut oil, which is decisive for its stability, shelf life and possible industrial or food applications.

REFERENCES

Abedinzadeh, S.; Torbati, M.; Azadmard-Damirchi, S.; Hashempour-Baltork, F. 2024. Changes in the quality of oil extracted by hot pressing from black cumin (Nigella sativa) seeds and by solvent from the obtained cake during refining. *Food Science & Nutrition*, 12(5), 3563–3573. DOI: https://doi.org/10.1002/fsn3.4025

Adesipe-Olugbemi, I.T.; Makanjuola-Olakunle, M. 2019. Physico-chemical properties of oil obtained from groundnut seeds (Arachis hypogaea L.) using. different extraction methods. *International Journal of Food Science and Nutrition*, 4(4), 160–164.

Bai, Y.; Zhai, Y.; Ji, C.; Zhang, T.; Chen, W.; Shen, X.; Hong, J. 2021. Environmental sustainability challenges of China's edible vegetable oil industry: From farm to factory. *Resources, Conservation & Recycling*, 170, 105606. DOI: https://doi.org/10.1016/j.resconrec.2021.105606

Bonku, R.; Yu, J. 2020. Health aspects of peanuts as an outcome of its chemical composition. *Food Science & Human Wellness*, 9(1), 21–30. DOI: https://doi.org/10.1016/j.fshw.2019.12.005

Bravo, A.; Navarro, E.; Rincon, C.; Soriano, M. 2018. Physico-chemical characteristics and fatty acid profile of two peanut cultivars of the. *Revista de Ciencias Naturales y Agropecuarias,* 5(15): 9-18.

Carrasco-Calvo, J.L. 1995. Extraction of palm kernel oil: processes. *Palmas*, 16. Recuperado a partir de https://publicaciones.fedepalma.org/index.php/palmas/article/view/505

Chouaibi, M.; Rezig, L.; Hamdi, S.; Ferrari, G. 2019. Chemical characteristics and compositions of red pepper seed oils extracted by different methods. *Industrial Crops and Products*, 128, 363–370. DOI: https://doi.org/10.1016/j.indcrop.2018.11.030

Codex Alimentarius Commission. 2019. *Report of the 26th Session of the Codex Alimentarius Committee on Fats and Oils*. FAO. 63pp.

Cruz, R.; Melendez-Zepeda, C. 2004. *Extraction, refining, and characterization of Passiflora edulis flavicarpa seed oil.* Tesis de pregrado. Universidad de El Salvador. Facultad de Química y Farmacia. 78pp.

Delgado, M.; Modroño-Alonso, M.; Mujica, V.; Ramírez, M.; Rodríguez, M.; Yamal, E.; Velásquez, I. 2010. Evaluation of the pilot scale cashew (Anacardium occidentale L.) oil extraction process at the Chemical Engineering Laboratory, University of Carabobo. *Revista Técnica de Ingeniería de la Universidad del Zulia*, 33(1).

Ecuadorian Institute of Standardization [INEN]. 1978. *Ecuadorian Technical Standard NTE INEN 0038. Edible fats and oils - Determination of acidity*. 9pp.

Ecuadorian Institute of Standardization [INEN]. 2012. *Ecuadorian Technical Standard NTE INEN 0391. Vegetable preserves. Fruit juices - Determination of relative density*. 10pp

Ecuadorian Institute of Standardization [INEN]. 2013. Ecuadorian Technical Standard

NTE INEN 3961. *Vegetable oils and fats. Determination of iodine value (IV)*. 10pp.

Ecuadorian Institute of Standardization [INEN]. 1978. Ecuadorian Technical Standard NTE INEN 0277. *Fats and oils. Determination of peroxide value*. Quito. 10pp.

Ecuadorian Institute of Standardization [INEN]. 2002. Ecuadorian Technical Standard NTE INEN 240. *Animal and vegetable fats and oils. Determination of insoluble impurities content*. Quito. 9pp.

Ecuadorian Institute of Standardization [INEN]. 2013. Ecuadorian Technical Standard NTE INEN 3657. *Animal and vegetable fats and oils. Determination of saponification value (SV)*. Quito. 10pp.

Ecuadorian Institute of Standardization [INEN]. 2013. Ecuadorian Technical Standard NTE INEN 662. *Animal and vegetable fats and oils. Determination of moisture and volatile matter content (VM).* Quito. 9pp.

European Food Safety Authority. 2019. Evaluation of the health risks related to the presence of cyanogenic glycosides in foods other than raw apricot kernels. *EFSA Journal*, 17(4), 1–78. DOI: https://doi.org/10.2903/j.efsa.2019.5662

Fajardo, J.; Sánchez, F.; Dueñas, J.; Dueñas, A. 2022. Ultrasound-assisted extraction and its application in obtaining vegetable oils. *Centro Azúcar,* 49(4), 125–143.

Ferrer, C.; Zumalacárregui, B.; Mazorra, M. 2020. Physicochemical characterization of Moringa oleifera seed oil. *Revista Centro Azúcar*, 47(4): 1-11.

Gómez, B.; Martínez, B.; Cardona, L. 2015. Fatty acid composition in some fried foods and frying oils and related factors, in a university sector of Medellín - Colombia. *Revista de Investigación Administrativa e Ingeniería*, 16(2), 16. DOI: https://doi.org/10.17533/udea.penh.v16n2a04

Gómez, D.; Pita, V.; Zumalacárregui, B. 2016. Characterization of Moringa oleifera seed oils from extraction by different methods. *Revista Colombiana de Biotecnología*, 18(2), 99–111. DOI: https://doi.org/10.15446/rev.colomb.biote.v18n2.54324

Hussain, R.; Hussain, A.; Asadullah; Sattar, S.; Zeb, M.; Hussain, A.; Nafees, M. 2015. Physico-chemical properties and assessment of edible oil potential of peanuts grown in Kurram Agency, Parachinar. *Pakistan Journal of Analytical & Environmental Chemistry,* 16(1), 45–51.

Ibáñez-Jácome, S.; Alcívar-Soria, E.; Cedeño-Alcívar, L.; Caicedo-Aldaz, J. 2018. Evaluation of agronomic behavior of 15 Valencia peanut (Arachis hypogaea L.) lines. *Ciencia Digital,* 2(1), 263–281. DOI: https://doi.org/10.33262/cienciadigital.v2i1.18

Jácome-Calie, M.D.; Castro-Holguín, K.V.; Zambrano-Muñoz, D.M.; Revilla-Escobar, K.; Aldas-Morejón, J.; Zambrano-Muñoz, R.M.; Argüello-Cedeño, J.A. 2023. Physicochemical characterization of watermelon (Citrullus lanatus) and melon (Cucumis melo) seed oils considering different extraction methods. *Revista Innovaciencia*, 11(1), 1–13. DOI: https://doi.org/10.15649/2346075X.3518

Kruatian, T.; Jitmanee, K. 2013. Simple spectrophotometric method for determination of iodine value of vegetable oils. *Chiang Mai Journal of Science,* 40(3), 419–426.

Lafont, J.; Páez, N.; Portacio, A.A. 2011. Extraction and physicochemical characterization of cashew nut (Anacardium occidentale L.) oil. *Información Tecnológica,* 22(1), 51–58. DOI: https://doi.org/10.4067/S0718-07642011000100007

Lakhlifi El Idrissi, Z.; El Moudden, H.; Mghazli, N.; Bouyahya, A.; El Guezzane, C.; Merae-Alshahrani, M.; Al Awadh, A.; Goh, K.; Ming, L.; Harhar, H.; Tabyaoui, M. 2022. Effects of extraction methods on the bioactivities and nutritional value of Virginia and Valencia-type peanut oil. *Molecules*, 27(22). DOI: https://doi.org/10.3390/molecules27227709

León-Mendoza, L.; Casanova-Pavel, D.; González-Cabeza, J. 2021. Stability of the sensory quality of extra virgin olive oils (Olea europaea) from varietal and monovarietal sources. *Arnaldoa*, 28(3), 613–624. DOI: https://doi.org/10.22497/arnaldoa.283.28308

León-Sánchez, G.; Monteagudo-Borges, R.; Rodríguez-Jiménez, E. 2022. Characterization of the procedure for obtaining Moringa oleifera oil in relation to the type of seeds. *Chemical Technology,* 42(1): 1-16.

Martínez, M.L.; Bodoira, R.M.; Grasso, F.V.; Penci-Ma, C.; Cittadini-Ma, C.; Mestri, D.M. 2023. Press extraction of peanut oil: Influence of material characteristics and processing conditions on yield and quality parameters of the oils. *Revista Volanta*, 2.

Martínez-Sánchez, J. 2015. Physicochemical evaluation of the oil from criollo varieties of Arachis hypogaea L. *Revista Agroproductividad*, 8(4).

Mingrou, L.; Guo, S.; Ho, C.T.; Bai, N. 2022. Review on chemical compositions and biological activities of peanut (Arachis hypogaea L.). *Journal of Food Biochemistry*, 46(14119). DOI: https://doi.org/10.1111/jfbc.14119

Montero, J. 2020. Nutritional and economic importance of peanut (Arachis hypogaea L.). *Revista de Investigación e Innovación Agropecuaria y de Recursos Naturales*, 7(2), 112–125.

Nava, F.; Elorza, E.; Uribe, A.; Pérez, R. 2007. Chemical analysis of cyanide in the cyanidation process: Review of the main methods. *Revista de Metalurgia*, 43(1): 20-28.

Oubannin, S.; Bijla, L.; Ahmed, M.; Ibourki, M.; El Kharrassi, Y.; Devkota, K. 2024. Recent advances in the extraction of bioactive compounds from plant matrices and their use as potential antioxidants for vegetable oils enrichment. *Journal of Food Composition and Analysis*, 128. DOI: https://doi.org/10.1016/j.jfca.2024.105995

Pasupuleti, J.; Nigam, S.N.; Pandey, M.K.; Nagesh, P.; Varshney, R.K. 2013. Groundnut improvement: Use of genetic and genomic tools. *Frontiers in Plant Science*, 4(23). DOI: https://doi.org/10.3389/fpls.2013.00023

Pereira-Braga, L.; Alvez-Amorim, K.; Soares-Goulart, G.A.; Ramirez-Asquieri, E.; Damiani, C. 2024. Effect of different extraction methods on yield and quality of araticum (Annona crassiflora Mart.) seed oil. *Food Science and Technology,* 44: e00176. DOI: https://doi.org/10.5327/fst.00176

Pons, G. 2015. *Vegetable oils, towards sustainable production. El Hombre de la Máquina*. 12pp.

Prestes, A.A.; Canella, M.H.; Helm, C.; Gomes-Da Cruz, A.; Prudencio, E.S. 2023. The use of cold pressing technique associated with emerging nonthermal technologies in the preservation of bioactive compounds in tropical fruit juices: An overview. *Current Opinion in Food Science*, 51: 100275. DOI: https://doi.org/10.1016/j.cofs.2023.101005

Reboredo-Rodríguez, P.; González-Barreiro, C.; Cancho-Grande, B.; Valli, E.; Bendini, A.; Gallina Toschi, T.; Simal-Gandara, J. 2016. Characterization of virgin olive oils produced with autochthonous Galician varieties. *Food Chemistry*, 212: 162-171. DOI: https://doi.org/10.1016/j.foodchem.2016.05.135

Rivera, M.; Ramos, M.; Silva, M.; Briceño, J.; Álvarez, M. 2022. Effect of temperature prior to extraction on the yield and fatty acid profile of morete oil (Mauritia flexuosa L.f.). *The Farm*, 35(1), 98–111. DOI: https://doi.org/10.17163/lgr.n35.2022.08

Salvador-Badui, D. 1997. *Food Chemistry (4th ed.)*. Pearson Addison Wesley. 738pp.

Siddeeg, A.; Xia, W. 2015. Oxidative stability, chemical composition and organoleptic properties of seinat (Cucumis melo var. tibish) seed oil blends with peanut oil from China. *Journal of Food Science and Technology*, 52(2), 8172–8179. DOI: https://doi.org/10.1007/s13197-015-1889-x

Tabio, D.; Díaz, Y.; Rondón, M.; Fernández, E.; Piloto, R. 2017. *Extraction of vegetable oils*. Universidad Tecnológica de La Habana "José Antonio Echeverría". 28pp.

Taha, M.; Yousef, H.; El-Behery, S.; Mostafa, H. 2019. Fatty acids and chemical composition of peanut (Arachis hypogaea L.). *Al-Azhar Journal of Agricultural Research*, 44(1), 119–127. DOI: https://doi.org/10.21608/ajar.2019.59735

Tahir, F.; Ali, E.; Hassan, S.; Bhat, Z.; Walayat, N.; Nawaz, A.; Mousavi-Khaneghah, A.; Phimolsiripol, Y.; Khan, M.; Aadil, R. 2024. Cyanogenic glucosides in plant-based foods: Occurrence, detection methods, and detoxification strategies – A comprehensive review. *Microchemical Journal,* 199: 11065. DOI: https://doi.org/10.1016/j.microc.2024.110065

Valdiviezo, C.J.; Romero-Hidalgo, L.E.; Bonilla-Bermeo, S.M. 2019. Characterization of Sacha Inchi (Plukenetia volubilis) seed oil from the San Vicente Canton, Manabí, Ecuador, obtained through non-thermal extrusion processes. *La Granja*, 30(2): 77-87. DOI: https://doi.org/10.17163/lgr.n30.2019.07

Variath, M.; Janila, P. 2017. *Economic and academic importance of peanut.* En: Vashney, R.K.; Pandey, M.K.; Puppala, N. (Eds). Springer International Publishing AG. 169pp.

Wang, S.; Wang, J.; Dong, G.; Chen, X.; Wang, S.; Lei, F.; Su, X.; Bai, Q. 2022. Effect of different extraction methods on quality characteristics of rapeseed and flaxseed oils. *Journal of Food Quality,* 1(3): 1-12. DOI: https://doi.org/10.1155/2022/8296212

Waszkowiak, K.; Gliszczyńska-Świgło, A.; Barthet, V.; Skręty, J. 2015. Effect of extraction method on the phenolic and cyanogenic glucoside profile of flaxseed extracts and their antioxidant capacity. *Journal of the American Oil Chemists' Society*, 19(2), 1609–1619. DOI: https://doi.org/10.1007/s11746-015-2729-x

Zurita-Santillán, A.; Koller-Claure, A.; Zabala-Dávila, R. 2021. Extraction of amaranth oil using Soxhlet and ultrasound-assisted extraction techniques. *Acta Nova*, 10(2): 246-255.

Recibido: 28 de mayo de 2025 **Aceptado para publicación:** 09 de febrero de 2026