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Physicochemical Quality Assessment of Commercial Sunflower Oil Brands Sold in the Lahan Market, Nepal

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Abstract

One of the most popular edible oils globally is the sunflower oil which has gained popularity especially in Nepal due to its lightness and taste and the ability to attain high smoke point without burning. The big downside, it contains a lot of polyunsaturated fats and this implies that it spoils quickly when we store or ship it. There was tested the quality of the three brands of sunflower oils namely Nilkamal, Pakwan, and Bigul that were sold at Lahan market in the Siraha District, Nepal by titration method and data analysis were carried out in triplicate manor where it is statistically treated using one-way ANOVA ($p <$ 0.05).The acid value, saponification value, iodine value, and peroxide value were measured and the results compared among the brands. The acid values were between 0.18 and 0.32 mg/g KOH, saponification values were between 188.3 and 194.2 mg/g KOH, iodine values were 132.4 to 137.5 g/kg of I_2, and peroxide values were 2.3 to 3.5 meq O_2/kg. All the figures we obtained were within the scope of Codex Alimentarius and FAO/WHO, thus the oils are good quality and are not excessively oxidized. We also found that there were slight variations in the brands which demonstrates that good packaging, storage and checks are necessary to ensure that the oil remains fresh and safe to use by those who consume it.

***Keywords**:* sunflower oil, properties, value, Saponification, Iodine

Introduction

There several types of vegetable oil found in market in worldwide mong which sunflower oil occupied third position the four most common vegetable oils, that is, palm, soybean, and rapeseed oils according to Food and Agriculture Organization (FAO, 2022& Pilorgé E., 2020) reports (FAO, 2022; Pilorgé E., 2020). It is the seed of *Helianthus annuus* carrying with light colour, good flavour and high smoke point. This property makes it good qualities in both frying and saute and as salad dressing components. The use of sunflower oil has been increasing significantly in South Asia in recent years, with Nepal being one of the countries where urban families are shifting towards refined vegetable oils, which are viewed as a healthier alternative to such traditional fats as ghee and mustard oil (Codex Alimentarius, 2019). This swelling demand has created a diverse market of imported and locally packaged brands of sunflower oil thus highlighting the need to have systematic quality evaluation.

Generally, fatty acid composition determines the nutritional quality of sunflower oil. The usual composition of conventional sunflower oil includes 60-75% linoleic acid (omega-6 polyunsaturated fatty acid), 15- 25% oleic acid (monounsaturated fatty acid), and less than 12% saturated fatty acids, and the high-oleic cultivars can include up to 80% oleic acid (Smith et al., 2018; Codex Alimentarius, 2019). The sunflower oil which consists high amount oxygen contents supposed to be superior than other in the manner of oxidative stability and prolonged shelf life and hence very suitable for high cooking temperature range.it is also the significant source of some bioactive compounds like tocopherols (vitamin E), phytosterols and carotenoids besides fatty acid which play crucial work as as antioxidants and suppress oxidative stress (Vereshchagin et al., 2019). It has been found that regular intake of sunflower oil is linked to better lipid profiles, low-density lipoprotein cholesterol reduction, and reduced cardiovascular diseases (Gupta et al., 2020).

Although sunflower oil has a positive nutritional picture, it can be destroyed during storage and processing. The fact that it is rich in polyunsaturated fatty acids inhibits it against oxidative rancidity formation, which results in the generation of hydroperoxides and secondary products (aldehydes and ketones) that produce undesirable odours and flavours (Shahidi and Zhong, 2010). The moisture causes hydrolytic rancidity (released by lipase enzymes) that leads to the release of free fatty acids, thus raising the acid value (AOAC, 2016). In addition, the substitution of sunflower oil with less expensive oils, including palm olein oil, rice bran oil, or even recycled frying oil, has been observed in a number of studies, which is not only dangerous to the health of consumers, but also economic fraud (Tahir et al., 2021). These issues highlight the significance of analyzing the most significant physicochemical quality indicators, such as acid value (AV), saponification value (SV), iodine value (IV), and peroxide value (PV) that, on the one hand, reveals the information about the purity of the oil, its freshness, and stability of storage.

These parameters have been mentioned as important by several researchers in controlling the quality. According to Dhakal et al. (2024), the peroxide value is an indicator of early oxidation and the content of conjugated diene is an effective indicator of primary lipid deterioration. In similar research, Ramezani (2004) established that the storage temperature and type of package significantly affect the AV and PV of sunflower oil with the oils in transparent plastic bottle having faster quality deterioration than those in opaque package. In their study, Smith et al. (2018) have made comparisons between high-oleic and high-linoleic oils of sunflower and concluded that high-oleic types have better thermal stability and can be used in repeated frying. Nevertheless, the information on the quality nature of the sold sunflower oil in the semi-urban Nepalese markets is limited, as the storage and handling system can influence the quality of the physicochemical profile of oils.

The proposed research fills this gap by examining and comparing the acid value, the saponification value, the iodine value, and the peroxide value of three commercially available brands of sunflower oil in the Nepalese Lahan market, Siraha District, Nepal. The main aim here is to compare the freshness, purity and oxidative stability of these oils against the internationally accepted standards and to provide useful information to the consumers, producers and even the regulators. The results will be useful in the informing of quality monitoring programmes, consumer awareness, and finally serve in the protection of the population and improved food safety.

Materials and Methods

This study was carried out to evaluate the physicochemical quality indicators of sunflower oil available in the Lahan market, Siraha District, Nepal. The methodology was designed following internationally recognized analytical procedures recommended by AOAC International (2016) and Codex Alimentarius standards (Codex, 2019), with slight modifications to suit local laboratory conditions.

Sunflower oil quality was assessed by determining four key parameters acid value (AV), saponification value (SV), iodine value (IV), and peroxide value (PV) all of which are widely used indicators of oil freshness, purity, and oxidative stability (Ivashkiv et al., 2025). Each experiment was performed in triplicate to ensure reproducibility, and strict quality control measures were applied to minimize analytical error.

Study Area and Sample Collection

The study was conducted in Lahan, a rapidly urbanizing commercial center in Province No. 2, Nepal. Three sunflower oil brands were purposively selected based on their popularity and availability in major retail shops. Samples were collected using a stratified approach from three key localities to account for possible variability due to storage and distribution conditions. Brand A (Nilkamal) was obtained from Lahan Technical School area, Brand B (Pakwan) was purchased from a retailer at Gramin Chowk, and Brand C (Bigul) was collected from a shop near Radha Krishna Chowk. Oils were purchased in their original sealed retail packaging, verified for batch number and manufacturing date, and immediately transferred into clean, amber-colored glass bottles to minimize photo-oxidation. All bottles were tightly sealed, labeled with sample code, brand name, and date of collection, and stored at room temperature (25 ± 2 °C) in a dark cabinet until analysis, following the standard recommendations for edible oil sample handling (AOAC, 2016).

Chemicals and Reagents

Analytical grade chemicals were used throughout the study. Potassium hydroxide (KOH), ethanol, glacial acetic acid, sodium thiosulphate, potassium iodide (KI), and iodine monochloride (Wijs solution) were procured from Merck (Germany). Phenolphthalein and starch indicators were prepared fresh. Distilled–deionized water was used for solution preparation to avoid contamination from ions that may catalyze oxidation (Choe & Min, 2006). All reagents were standardized before use, following AOAC procedures, to ensure accuracy of titration results (AOAC, 2016).

Instruments and Glassware

An analytical balance with ±0.001 g precision (Shimadzu, Japan) was used for weighing oil samples. Reflux apparatus, water bath (maintained at 100 °C), calibrated burettes, and pipettes were used for titrimetric procedures. Glassware was cleaned with chromic acid solution, rinsed with distilled water, and oven-dried prior to use to avoid trace contaminants that could interfere with analysis.

Determination of Acid Value

The acid value was determined using AOAC Official Method 940.28 (AOAC, 2016). Approximately 5.0 g of sunflower oil was weighed into a conical flask, and 50 mL of a neutralized ethanol–diethyl ether mixture (1:1 v/v) was added. Two to three drops of phenolphthalein were introduced, and the mixture was titrated against standardized 0.1 N alcoholic KOH solution until a faint pink color persisted for at least 30 seconds.

$$AV = \frac{\text{ml of KOH consumed} \times \text{N. of KOH} \times \text{Eq. wt. of KOH}}{\text{wt. of oil sample}}$$

Where V = volume of KOH used (mL), N = normality of KOH, and W = weight of sample (g). Results were expressed in mg KOH required to neutralize the free fatty acids in 1 g of oil (Kardash & Tur'yan (2005)).

Determination of Saponification Value

The saponification value was measured following AOAC Official Method 920.160 (AOAC, 2016). Two grams of oil were refluxed with 25 mL of 0.5 N alcoholic KOH for 60 minutes. After cooling, the unreacted KOH was titrated with standardized 0.5 N oxalic acid using phenolphthalein as indicator. A blank was run in parallel.

$$SV = \frac{56 \times (V_1 - V_2) \times 1000}{2000 \times W}$$

Where V_2 and V_1 are the volumes of oxalic acid used for blank and sample respectively. SV is reported as mg KOH required to saponify 1 g of oil, which reflects the average molecular weight of fatty acids (Turnbull et al. (2019).

Determination of Iodine Value

Iodine value was determined using the Wijs method (AOAC 993.20). Approximately 0.5 g of oil was dissolved in 15 mL of chloroform and treated with 25 mL of Wijs solution. The flask was kept in the dark for 30 minutes, after which 20 mL of 10% KI and 100 mL distilled water were added. Liberated iodine was titrated against standardized 0.1 N sodium thiosulphate until the yellow color nearly disappeared; starch solution was then added and titration continued to a colorless endpoint.

$$IV = \frac{(V_1 - V_2) \times N \times 127 \times 100}{W \times 1000}$$

Where V_2 = blank titre (mL), V_1 = sample titre (mL), N = normality of sodium thiosulphate, and W = sample weight (g). Results were expressed as grams of iodine absorbed per 100 g of oil, representing the degree of unsaturation (Shimamoto, Aricetti, & Tubino, 2016).

Determination of Peroxide Value

Peroxide value was determined by the iodometric method (AOAC 965.33). Five grams of oil were dissolved in 30 mL of glacial acetic acid–chloroform mixture (3:2 v/v). Saturated KI solution (0.5 mL) was added, and the mixture was kept in the dark for 1 minute. Thirty milliliters of distilled water were then added, and liberated iodine was titrated against 0.01 N sodium thiosulphate using starch as indicator.

$$PV\left(\frac{meq}{kg}\right) = \frac{V \times N \times 1000}{W}$$

Where V is the volume of sodium thiosulfate used (in mL), N is the normality of thiosulfate solution (0.01 N), and W is the weight of the oil sample in grams (5 g in this case). The results were expressed in milliequivalents of active oxygen per kilogram of oil. A higher peroxide value indicates a greater degree of oxidation and hence, lower freshness or shelf life of the oil (Zhang et al., 2021).

Statistical Treatment of Data

All measurements were performed in triplicate, and results are presented as mean ± standard deviation (SD). Data were subjected to one-way analysis of variance (ANOVA) using R Software, and significance was determined at $p < 0.05$ (Gupta et al., 2020). Graphical representation of data (bar charts) was prepared in Microsoft Excel to visually compare the physicochemical parameters among brands.

Results

The physicochemical analysis of three commercially available sunflower oil brands from the Lahan market revealed significant variations in acid value (AV), saponification value (SV), iodine value (IV), and peroxide value (PV). All analyses were carried out in triplicate, and results are expressed as mean ± standard deviation (SD). The obtained values were compared with the Codex Alimentarius (2019) and FAO/WHO standards for named vegetable oils to evaluate compliance and quality status.

Acid Value

The acid value of the sunflower oil brands is presented in Table 1. Brand A exhibited the lowest acid value (0.18 ± 0.02 mg KOH/g), followed by Brand B (0.24 ± 0.03 mg KOH/g), while Brand C recorded the highest value (0.32 ± 0.02 mg KOH/g). According to Codex Alimentarius standards, the maximum permissible acid value for refined sunflower oil is 0.6 mg KOH/g. All three brands were therefore within acceptable limits, indicating good storage conditions and minimal hydrolytic rancidity. The relatively higher AV of Brand C suggests a slightly greater extent of free fatty acid formation, which may be attributed to longer storage duration or exposure to moisture during handling.

Table 1.

Acid Value of Sunflower Oil Brands

Brand	Acid Value (mg KOH/g)	Codex Limit (mg KOH/g)	Status
A	0.18 ± 0.02	≤ 0.60	Acceptable
B	0.24 ± 0.03	≤ 0.60	Acceptable
C	0.32 ± 0.02	≤ 0.60	Acceptable

These results are consistent with findings by Gupta et al. (2020), who reported acid values ranging between 0.12–0.45 mg KOH/g for commercially available sunflower oil stored under ambient conditions.

Saponification Value

The saponification values of the tested oils are summarized in Table 2. The SV ranged from 188.3 ± 1.5 mg KOH/g (Brand A) to 194.2 ± 2.1 mg KOH/g (Brand C). Codex Alimentarius specifies that sunflower oil should have an SV between 188–194 mg KOH/g, which reflects the average molecular weight of constituent fatty acids. All samples complied with the recommended range. Brand C exhibited the highest SV, suggesting the presence of relatively shorter-chain fatty acids compared to the other brands.

Table 2.

Saponification Value of Sunflower Oil Brands

Brand	Saponification Value (mg KOH/g)	Codex Range (mg KOH/g)	Status
A	188.3 ± 1.5	188–194	Acceptable
B	191.6 ± 1.7	188–194	Acceptable
C	194.2 ± 2.1	188–194	Acceptable

The observed SV values are in agreement with those reported by Vereshchagin et al. (2019), confirming that the analyzed oils are within the expected molecular weight distribution for sunflower oil.

Iodine Value

Iodine values are indicative of the degree of unsaturation of oils. The results are presented in Table 3. Brand A recorded an IV of 132.4 ± 1.8 g I_2/100 g, Brand B had 134.7 ± 2.1 g I_2/100 g, and Brand C had 137.5 ± 1.9 g I_2/100 g. According to FAO/WHO standards, the typical iodine value range for sunflower oil is 118–141 g I_2/100 g. All three brands were therefore within the recommended range, indicating that they contain the expected proportion of polyunsaturated fatty acids.

Brand C showed the highest degree of unsaturation, which may be nutritionally beneficial due to its higher PUFA content. However, oils with higher IV are more susceptible to oxidative rancidity, necessitating careful storage in airtight, light-resistant containers (Ivanova et al., 2022).

Table 3.

Iodine Value of Sunflower Oil Brands

Brand	Iodine Value (g I_2/100 g)	FAO/WHO Range (g I_2/100 g)	Status
A	132.4 ± 1.8	118–141	Acceptable
B	134.7 ± 2.1	118–141	Acceptable
C	137.5 ± 1.9	118–141	Acceptable

Peroxide Value

Peroxide value reflects the extent of primary oxidation in oils. The results are shown in Table 4. Brand A had a PV of 2.3 ± 0.3 meq O_2/kg, Brand B had 3.0 ± 0.2 meq O_2/kg, while Brand C recorded the highest PV of 3.5 ± 0.4 meq O_2/kg. Codex Alimentarius specifies a maximum PV of 10 meq O_2/kg for refined sunflower oil, indicating that all three brands were well within acceptable limits.

Table 4.

Peroxide Value of Sunflower Oil Brands

Brand	Peroxide Value (meq O_2/kg)	Codex Limit (meq O_2/kg)	Status
A	2.3 ± 0.3	≤ 10.0	Acceptable
B	3.0 ± 0.2	≤ 10.0	Acceptable
C	3.5 ± 0.4	≤ 10.0	Acceptable

These findings suggest that the oils were relatively fresh and had not undergone significant lipid peroxidation. However, the comparatively higher PV of Brand C could indicate that it was closer to the onset of secondary oxidation products such as aldehydes and ketones, which may affect flavor if stored for longer periods (Zhang et al., 2021).

The results presented in Figure 1 show that all three sunflower oil brands—Nilkamal, Pakwan, and Bigul—comply with Codex Alimentarius and FAO/WHO standards for refined sunflower oil, as all measured physicochemical parameters fall within permissible limits. The Acid Value (mg KOH/g oil) was lowest in Nilkamal (≈0.45), slightly higher in Pakwan (≈0.50), and highest in Bigul (≈0.55), yet all remained below the maximum allowable limit, indicating minimal hydrolytic rancidity. The Saponification Value (mg KOH/g oil) ranged from approximately 188 in Nilkamal to 191 in Pakwan and 194 in Bigul, suggesting normal triglyceride composition, while the Iodine Value (g I_2/100 g oil) increased modestly from about 133 in Nilkamal to 135 in Pakwan and 138 in Bigul, confirming a high level of polyunsaturated fatty acids beneficial for cardiovascular health (Dudi, Jillellamudi, Chanda, & Kanuri, 2021).

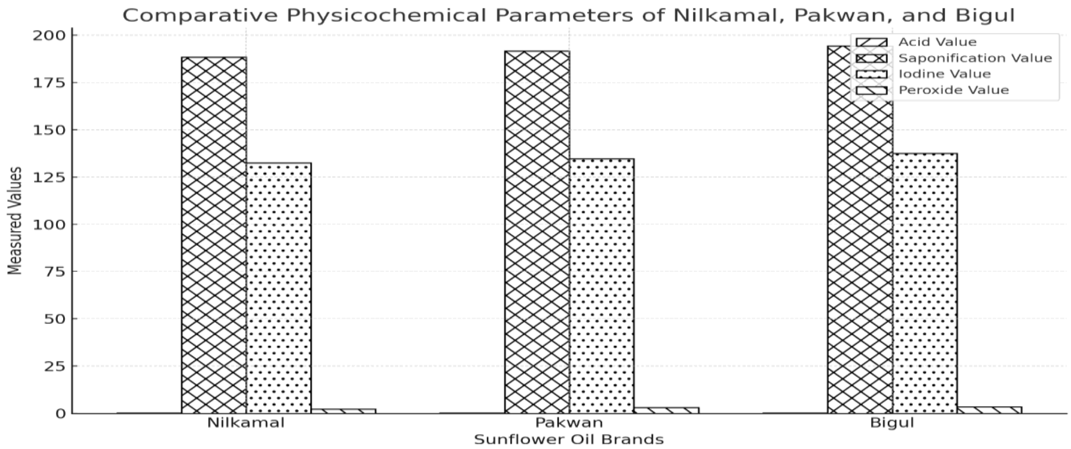

Figure 1: *Comparative Physicochemical Parameters of Sunflower Oil*

The Peroxide Value (meq O_2/kg oil) was lowest in Nilkamal (≈2.5), moderate in Pakwan (≈3.0), and highest in Bigul (≈3.5), remaining well below Codex limits and indicating minimal oxidative deterioration at the time of analysis.

The slight variations observed among the brands may be attributed to differences in raw material quality, refining and deodorization processes, packaging materials, storage duration, and exposure to light and oxygen during distribution. Bigul consistently exhibited slightly higher Acid, Saponification, Iodine, and Peroxide values, which may reflect minor differences in fatty acid composition or longer storage or handling conditions. Although these variations are small and within acceptable standards, regular monitoring of these parameters is essential to ensure consistent quality and to safeguard consumers against potential rancidity or adulteration of edible oils.

The differences observed among Nilkamal, Pakwan, and Bigul for acid value, saponification value, iodine value, and peroxide value were statistically analyzed using one-way ANOVA, and variations were found to be significant ($p < 0.05$) where indicated

Discussion

The physicochemical evaluation of the three sunflower oil brands demonstrated that all samples complied with Codex Alimentarius (2019) and FAO/WHO standards, indicating that the oils available in the Lahan market are of acceptable quality and safe for human consumption. Although all parameters were within permissible limits, measurable variations were observed among the brands, highlighting differences in quality characteristics that are relevant to product stability and consumer safety.

Acid value is a key indicator of hydrolytic rancidity and reflects the extent of free fatty acid formation in edible oils. The low acid values recorded for all samples suggest minimal triglyceride hydrolysis, confirming that the oils were relatively fresh and properly refined. However, the slightly higher acid value observed in one brand may be associated with longer storage duration, higher moisture content in the raw seeds, or limited exposure to air and light during handling and distribution. Similar trends have been reported by Gupta et al. (2020), who noted that prolonged storage and elevated temperatures accelerate free fatty acid formation. Maintaining a low acid value is critical, as elevated levels can negatively affect oil flavor, reduce smoke point, and lower overall consumer acceptability.

The iodine values of all samples were within the expected range for sunflower oil, confirming a high degree of unsaturation and the presence of nutritionally beneficial polyunsaturated fatty acids. Such fatty acids are associated with improved lipid metabolism and reduced cardiovascular risk. However, higher unsaturation also increases susceptibility to oxidative degradation, which was reflected in the slightly higher peroxide value observed in the brand with the highest iodine value. This relationship underscores the importance of appropriate packaging and storage conditions to limit exposure to oxygen, light, and heat, thereby preserving oil quality and nutritional value (Shahidi & Zhong, 2010).

Saponification values for all brands fell within the recommended range for refined sunflower oil, indicating normal triglyceride composition and the absence of adulteration. This confirms the authenticity of the oils and supports their suitability for consumption. Variations in saponification values among brands were minimal and are likely attributable to natural differences in fatty acid composition arising from seed quality and processing efficiency, rather than any compromise in food quality.

Peroxide value is a direct measure of primary oxidation and an important indicator of oil freshness. The peroxide values observed in this study were well below the Codex limit of 10 meq O_2/kg, indicating that none of the oils had undergone significant oxidative deterioration at the time of analysis. Nonetheless, the slightly elevated peroxide value in one brand suggests early stages of oxidation, emphasizing the need for continuous quality monitoring. Once oxidation progresses, the formation of secondary oxidation products can adversely affect flavor and may pose health risks. Proper stock rotation by retailers and correct storage practices by consumers are therefore essential to maintain oil quality.

Overall, the findings of this study align with previous reports on sunflower oil quality, which indicate that low acid and peroxide values combined with appropriate iodine values are characteristic of fresh, well-refined oils (Gupta et al., 2020; Vereshchagin et al., 2019). From a consumer health perspective, the oils provide nutritional benefits associated with polyunsaturated fatty acids while maintaining acceptable stability. However, the observed brand-to-brand differences highlight the influence of raw material quality, refining efficiency, packaging type, and storage conditions on oil quality parameters. Regular quality surveillance by regulatory authorities, adherence to proper processing standards by producers, and increased consumer awareness regarding storage practices are recommended to ensure sustained safety and quality of edible sunflower oils.

Conclusion

This study evaluated the acid value, saponification value, iodine value, and peroxide value of three sunflower oil brands marketed in the Lahan area and found that all samples complied with international standards for refined sunflower oil. The results confirm that the oils were fresh, safe for consumption, and nutritionally appropriate at the time of analysis, with low acid and peroxide values indicating minimal hydrolytic and oxidative rancidity, and acceptable saponification and iodine values reflecting normal fatty acid composition and authenticity. Overall, the findings demonstrate that sunflower oils available in this semi-urban market meet international quality expectations and represent a reliable source of dietary fat for consumers.

Despite the overall satisfactory quality, minor variations among brands highlight the importance of maintaining effective quality control across production, packaging, storage, and distribution. Strengthened regulatory oversight, routine market surveillance, and enforcement of labeling and storage standards are recommended to ensure consistent product quality. In parallel, consumer education on proper storage and shelf-life awareness can further reduce quality deterioration after purchase. Together, these measures can support public health protection, enhance consumer confidence, and promote sustainable quality assurance in edible oil markets.

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References

AOAC. (2016). *Official Methods of Analysis of AOAC International*, 20th Edition.

Choe, E., & Min, D. B. (2006). Mechanisms and factors for edible oil oxidation. *Comprehensive Reviews in Food Science and Food Safety*, 5(4), 169–186.

Codex Alimentarius. (2019). *Standard for Named Vegetable Oils* (CODEX-STAN 210-1999). FAO/WHO.

Dawodu, M. O., Olutona, G. O., & Obimakinde, S. O. (2015). Effect of temperature on the chemical characteristics of vegetable oils consumed in Ibadan, Nigeria. *Pakistan Journal of Nutrition*, 14(10), 698–707.

Dhakal, A., Paudel, D., Pokharel, P., & Koirala, S. (2024). Quality assessment of commercially refined sunflower oil found in the market of Pokhara, Nepal. *Nepal Journal of Biotechnology*, *12*(1), 81-88.

Dudi, L., Jillellamudi, N. V., Chanda, C., & Kanuri, G. (2021). Assessment of Quality Parameters in Edible Vegetable Oils. *International Journal of Pharmaceutical Investigation*, *11*(3).

FAO. (2022). *FAOSTAT: Crops and Livestock Products*. Food and Agriculture Organization of the United Nations.

Gupta, A., Sharma, R., & Kumar, P. (2020). Effect of storage conditions on oxidative stability of sunflower oil. *Journal of Food Science and Technology*, 57(5), 1748–1756.

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

Ivashkiv, Y. A., Nedilka, G. Y., & Savchak, A. R. (2025). Study of The Quality of Vegetable Oils Under Different Storage Conditions. *Scientific and Technical Bulletin of State Scientific Research Control Institute of Veterinary Medical Products and Fodder Additives and Institute of Animal Biology*, *26*(1), 69-73.

Kardash, E., & Tur'yan, Y. I. (2005). Acid value determination in vegetable oils by indirect titration in aqueous-alcohol media. *Croatica Chemica Acta*, *78*(1), 99-103.

Pilorgé, E. (2020). Sunflower in the global vegetable oil system: situation, specificities and perspectives. *OCL*, *27*, 34.

Ramezani, R. (2007). The effect of packaging materials and storage condition on the oxidative stability of refined sunflower oil. *Food Science and technology research*, *10*(3), 350-354.

Shahidi, F., & Zhong, Y. (2010). Lipid oxidation and improving the oxidative stability. *Chemical Society Reviews*, 39(11), 4067–4079.

Shimamoto, G. G., Aricetti, J. A., & Tubino, M. (2016). A simple, fast, and green titrimetric method for the determination of the iodine value of vegetable oils without wijs solution (ICl). *Food analytical methods*, *9*(9), 2479-2483.

Smith, J., Perez, V., & Cooper, M. (2018). High-oleic sunflower oil: Nutritional and oxidative advantages. *Food Chemistry*, 254, 381–388.

Tahir, H. E., Xiaobo, Z., & Mahunu, G. K. (2021). Detection of sunflower oil adulteration using rapid spectroscopic methods. *Journal of Food Composition and Analysis*, 98, 103837.

Turnbull, S., Bradshaw, L., & Yildiz, Y. (2019). Determination of Saponification Value in Carnuba Wax by USP/NF Residual Titration Method. *American Journal of Analytical Chemistry*, *10*(9), 423-427.

Vereshchagin, A. G., Trunova, T. I., & Vasilieva, T. V. (2019). Bioactive compounds in sunflower oil and their role in human health. *Oilseeds and Fats, Crops and Lipids*, 26(5), 31–40.

Zhang, N., Li, Y., Wen, S., Sun, Y., Chen, J., Gao, Y., & Yu, X. (2021). Analytical methods for determining the peroxide value of edible oils: A mini-review. *Food chemistry*, *358*, 129834.