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Evaluation of the Oxidative Stability of a Blend of Soybean Oil, Palm Olein, and Extra Virgin Olive Oil Using an Accelerated Test

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ABSTRACT

Mixing vegetable oils improves their quality, increases bioactive compounds and antioxidants, and consequently enhances their oxidative stability. In this study, various ratios of soybean oil, palm olein, and extra virgin olive oil were first mixed together. Using a thermal test (heating at 170 °C for 12 hours), the best ratios in terms of thermal stability were determined, and their oxidative stability was then evaluated using an accelerated test (heating at 65 °C for 16 days). Afterwards, UV absorption at 233 and 270 nm (to determine conjugated dienes and trienes), total polyphenols, and acid value were assessed. The results showed that the best ratio in terms of thermal and oxidative stability was 35:30:35 of soybean oil, palm olein, and extra virgin olive oil, because this ratio exhibited lower acid value and lower levels of conjugated dienes and trienes at the end of the accelerated process, and also contained the highest number of phenolic compounds.

1-Introduction

The most significant changes occurring in edible oils and fats during processing and storage are due to oxidation. This phenomenon is recognized as one of the main factors responsible for the reduction of oil quality and stability, leading to undesirable alterations in their chemical, sensory, and nutritional properties. During the oxidation of unsaturated fatty acids, particularly linoleic and linolenic acids, compounds such as conjugated dienes (CD) and conjugated trienes (CT) are formed, which serve as key indicators of the primary and secondary stages of oxidation. The increase in the concentration of these compounds reflects the deterioration of oil quality and stability; therefore, UV absorbance measurements at wavelengths of 233 and 270 nm are commonly employed as a standard method for evaluating oxidation levels and determining the rancidity of oils.

During the heating of frying oils at temperatures ranging from 150–190°C (deep frying), in the presence of atmospheric oxygen and moisture, the oils undergo substantial physical and chemical changes. These alterations result from auto-oxidation, thermal oxidation, pyrolysis, and polymerization reactions, producing a wide range of undesirable degradation products in frying oils. The type, formation pathway, and concentration of these degradation products depend on the processing conditions during frying. The key parameters affecting the frying process include: the type of frying oil, processing temperature, frying time, fryer design, and moisture content of the food materials. Among these parameters, the nature and type of the frying oil as the heat transfer medium plays a particularly critical role in determining the quality of fried foods [2].

Oils such as soybean and canola, despite their high content of unsaturated compounds and nutritional value, exhibit relatively low thermal stability. For instance, soybean oil contains high levels of tocopherols and essential fatty acids, making it nutritionally valuable; however, its oxidative stability is limited due to the large proportion of polyunsaturated fatty acids (particularly linolenic acid with three double bonds) [3,4]. Crude soybean oil is obtained through solvent extraction and typically contains 5–9% linolenic acid, making it susceptible to oxidation and flavor reversion. This reaction and the resulting odor in refined and deodorized oil are primarily attributed to linolenate compounds (salts of linolenic acid). Nowadays, the stability of this oil has been significantly improved by adding antioxidant compounds or performing partial hydrogenation, which reduces the linolenic acid content to below 3% [5].

Palm oil is among the oils resistant to oxidation because of its considerable content of saturated fatty acids (around 39% palmitic acid) and monounsaturated fatty acids (around 42% oleic acid). Consequently, it does not present the smoke formation problem associated with short-chain fatty acids [6]. At present, palm oil and its derived products are extensively used in various food applications, such as margarine, vegetable fats, cooking oils, spreads, confectionery, and bakery fats [7].

The diversity of palm oil for different food applications depends on several factors. The first and most important is its fatty acid composition, which typically consists of 39% palmitic acid, 5% stearic acid, 42% oleic acid, and 10% linoleic acid [8]. The ratio of saturated to unsaturated fatty acids in palm oil is approximately 1, which makes it semi-solid at ambient temperature and provides desirable plasticity [9]. Palm oil, with its high smoke point and strong resistance to thermal oxidation, is widely used either in pure form or blends as a frying or cooking oil. Palm olein, the more liquid fraction obtained by fractionation of

palm oil, contains a higher proportion of unsaturated fatty acids especially oleic acid and possesses a lower melting point while maintaining satisfactory oxidative stability. These characteristics make palm olein particularly suitable for use in various food products and for blending with other vegetable oils [7].

Olive oil, due to its unique fatty acid composition particularly its high oleic acid content and low levels of polyunsaturated fatty acids exhibits high thermal and oxidative stability and is therefore used as a frying oil in some countries. This fatty acid profile enables olive oil to better resist oxidation at high frying temperatures [10]. Extra virgin olive oil, in particular obtained from the first mechanical extraction of olives without the use of heat or chemical solvents contains substantial amounts of natural antioxidants such as polyphenols and tocopherols. These compounds not only enhance its nutritional properties but also ensure its high oxidative stability [11].

Various methods exist to increase the oxidative stability of oils, including hydrogenation, interesterification, genetic modification techniques, and oil blending**.** One approach in oil blending is the combination of oxidation-susceptible oils with oils possessing high antioxidant activity, such as sesame oil, olive oil, and rice bran oil, which are widely used for this purpose [12]. Another strategy includes blending such oils with oils containing lower levels of unsaturated fatty acids, such as palm oil. A blend containing 0.1% wild pistachio oil (Beneh oil)**,** which is rich in antioxidant compounds, mixed with canola oil resulted in an increase in natural antioxidant content, modification of the fatty acid profile, and improved stability of the oil at 170°C [13].

Blends of Moringa oleifera oil (40–60–80–20% w/w) with soybean and sunflower oils were investigated to evaluate changes in fatty acid composition and thermal stability. An increase in oleic acid content and a reduction in linoleic acid were observed. The storage stability test (180 days at ambient temperature) showed a significant improvement in oxidative stability with increasing proportions of Moringa oleifera oil. Moreover, in the thermal stability test (180°C for 48 hours, with 6 hours of heating per day), the highest stability was observed in the blend containing 20:80 (w/w) Moringa oleifera oil to sunflower oil [14].

In another study, blends of lentisk oil**,** sesame oil, and almond oil with soybean oil were evaluated for thermal stability. Lentisk oil (from the fruits of *Pistacia lentiscus L.*), rich in unsaturated fatty acids—particularly oleic and linoleic acids—and containing natural antioxidant components, contributes to enhanced oxidative stability. Results indicated that the blend containing 70% soybean oil with 17.7% lentisk oil and 12.3% sesame oil was identified as the optimal formulation, exhibiting the greatest improvement in thermal stability compared to pure soybean oil. It was also shown that essential fatty acids, particularly linoleic and linolenic acids, were better preserved after heating in the optimized blends compared to soybean oil alone. This enhanced thermal stability was attributed to significant improvements in physicochemical properties, antioxidant activity, and the fatty acid profile—especially the linoleic-to-linolenic acid ratio [15].

Blending palm olein and cottonseed oil (at ratios of 1:0, 3:2, 1:1, 2:3, and 0:1 w/w) demonstrated that increasing the proportion of palm olein in cottonseed oil reduced the levels of polyunsaturated fatty acids while increasing saturated fatty acid content [2]. Another study showed that blending grape seed oil with Kilka fish oil markedly improved the quality indices, sensory attributes, and oxidation time of the oil, achieving results comparable to those

obtained by adding synthetic antioxidants to fish oil [16].

Most synthetic antioxidants are unstable at high temperatures; they decompose and lose their effectiveness during thermal processing. Furthermore, due to their potential adverse effects on human health, the use of synthetic antioxidants has become increasingly restricted. In contrast, oil blending modifies the fatty acid ratios and physicochemical properties of oils without any chemical or biological treatment, thereby enhancing their stability. Blending vegetable oils increases the levels of bioactive lipids and antioxidants within the mixture and consequently improves oil quality [17]. It has been reported that blending vegetable oils enhances their nutritional properties, physical characteristics, and oxidative stability [18].

The most critical factors influencing the effects of thermal treatment on oils are their intrinsic structure, as well as the time and temperature of heating [19]. Therefore, in this study, the oxidative stability of blends composed of soybean oil, palm olein, and extra virgin olive oil was evaluated based on the parameters of heating time and blend composition.

2- Materials and Methods

2.1 Procurement of Raw Materials

Antioxidant-free soybean oil and palm olein were obtained from Ghancheh Co. (Sari, Iran), and extra virgin olive oil was purchased from Mission Co. (Gorgan, Iran). The samples were stored at −18°C until analysis. Prior to the experiments, the initial physicochemical properties of the oils were determined. The peroxide values were 1.5 meq O_2/kg for soybean oil, 0.8 meq O_2/kg for palm olein, and 4 meq O_2/kg for extra virgin olive oil. The acid values were 0.15 mg KOH/g for soybean oil, 0.10 mg KOH/g for palm olein, and 0.35 mg KOH/g for extra virgin olive oil. Moreover, oxidative stability (Rancimat test at 110°C) was found to be 5.2 h for soybean oil, 13.5 h for palm olein, and 8.7 h for extra virgin olive oil [20–24].

2.2 Oil Blending Procedure

The oils were blended by continuous stirring of each oil mixture at 50°C for 10 minutes.

3.2 Thermal Stability Test

Based on previous studies and standard evaluations, five blending ratios were selected (Table 1). The oil mixtures were subjected to thermal processing for two consecutive days, six hours per day, in an electric deep fryer equipped with a thermocontrol unit (Model DF-280, Moulinex, France) at 170°C. Every two hours, 20 grams of oil were sampled, and various analyses including UV absorbance measurement, acid value determination, and assessment of total polyphenolic compounds were performed.

According to studies by Parsaei et al. (2016) [22] and Tourani et al. (2011) [23], along with preliminary testing, five different ratios of soybean oil, palm olein, and extra virgin olive oil were selected. Following thermal exposure at 170°C for 12 hours over two days (6 hours per day), UV absorbance (as an indicator of secondary oxidation products) and acid value were measured.

Table 1- Oil Blending Ratios

Samples	Blending Ratio
Sample 1	45:10:45
Sample 2	30:20:50
Sample 3	40:20:40

Sample 4	25:30:45
Sample 5	35:30:35

2.4 Accelerated Test

After conducting the thermal stability test and identifying the oil sample with the highest thermal stability, two samples (each weighing 200 grams) from this stable oil and a soybean oil sample (as control) were subjected to an accelerated oxidation condition. They were stored in an oven at 65°C for 16 days, and every four days, 3 grams of each sample were taken for analysis.

5.2 Chemical Analyses

1-5.2 UV Absorbance Measurement

Initially, between 0.01 and 0.03 grams of oil sample was weighed into a 25 mL volumetric flask and then dissolved in isooctane solvent. After complete dissolution, the increase in UV absorbance of the solution relative to the isooctane blank was measured at wavelengths of 233 nm and 270 nm. These readings serve as indicators of primary oxidation products (peroxide compounds) and secondary oxidation products (conjugated dienes and trienes), respectively, following the method outlined by the International Union of Pure and Applied Chemistry (IUPAC) [24].

Measurements were performed using a UV-Vis Spectrophotometer (Model: LAMBDA 35, PerkinElmer, USA). The concentrations of conjugated dienes and trienes were subsequently calculated using the following equations:

$$E_{1cm}^{1\%} = \frac{A}{C_{\mathcal{L}} * L}$$

In this formula: E is the specific absorbance index, A is the absorbance at wavelengths of 233 or 270 nm, $C_{\mathcal{L}}$ is the fat solution concentration in grams per hundred milliliters (g/100mL), and L is the cuvette length in centimeters (cm).

2-5-2 Acid Value Determination

The acid value, expressed in terms of oleic acid equivalent, was determined according to reference method [25] using 0.1 N sodium hydroxide solution as the titrant. It was calculated using the following relationship:

$$\text{Acid Value (mg KOH/g oil)} = \frac{V \times N \times 56.1}{W}$$

Where: V is the volume of sodium hydroxide solution consumed in the titration (mL), N is the normality of the sodium hydroxide solution, and W is the weight of the oil sample (grams). The number 56.1 is the equivalent weight of potassium hydroxide (mg/mmol).

2-5-3 Polyphenol Determination

To extract polyphenols from the oil, 10 grams of oil were dissolved in 50 mL of hexane and transferred to a separatory funnel. Then, 60 mL of 30% aqueous methanol was prepared and added to the separatory funnel in three consecutive portions (20 mL each). In each step, the contents of the separatory funnel were shaken thoroughly for 20 minutes. After the separatory funnel settled and the phases separated, the methanolic phase containing polyphenols and the hexane phase containing oil were collected.

To determine the polyphenol concentration, the Folin-Ciocalteu reagent was used. 0.3 mL of the extracted alcoholic extract was poured into a 10 mL volumetric flask. Then, 5 mL of distilled water and 0.5 mL of Folin-

Ciocalteu reagent were added. After 3 minutes, 1 mL of saturated sodium carbonate solution was added to each flask. After mixing, the volume was brought up to 10 mL with distilled water. The absorbance of the samples was measured after one hour at a wavelength of 725 nm against the blank (distilled water) [26]. The concentration of phenolic compounds in the samples was calculated using the standard curve of gallic acid based on the equation $Y = 0.1073x - 0.0006$with a correction coefficient $R^2 = 0.9823$.

6-2 Statistical Analysis

The different stages of the research were designed using factorial experiments in a completely randomized design (CRD) framework. The results were statistically analyzed using SAS software, and Duncan's multiple range test was employed for mean comparisons.

3-1 Thermal Stability Test

According to Table 2, the lowest values for conjugated diene and triene compounds, as well as the acid value, were related to the oil ratios of 35:30:35 and 25:30:45 (soybean, palm olein, and extra virgin olive oils, respectively). The highest values were observed for soybean oil (control sample), which had lower stability compared to other samples due to its high content of unsaturated fatty acids. Based on this data, these two ratios were selected as the most stable because of the higher stability of the oil, the lower the production of conjugated diene and triene compounds (which are secondary oxidation products), and the slow rate of increase in its acid value during the process. An accelerated stability test was performed based on the two ratios (35:30:35 and 25:30:45) of soybean, palm olein, and extra virgin olive oils.

3- Results and Discussion

Table 2: Values of Conjugated Diene, Conjugated Triene, and Acid Value for Different Oil Blends

Ratios	Conjugated Diene (DN)	Conjugated Triene (TN)	Acid Value (AV) (mg KOH/ g oil)
Soybean Oil (Control)	29.94 ± 1.50 a	6.69 ± 0.34 a	0.282 ± 0.014 a
45:10:45 (Sample 1)	21.36 ± 1.07 b	4.23 ± 0.21 b	0.395 ± 0.020 b
30:20:50 (Sample 2)	19.23 ± 0.96 b	4.17 ± 0.21 b	0.282 ± 0.014 b
40:20:40 (Sample 3)	18.44 ± 0.92 b	4.15 ± 0.21 b	0.451 ± 0.023 b
25:30:45 (Sample 4)	17.62 ± 0.88 c	4.09 ± 0.20 c	0.282 ± 0.014 c
35:30:35 (Sample 5)	15.36 ± 0.77 c	3.85 ± 0.19 c	0.338 ± 0.017 c

Non-homonymous lower case letters indicate a significant difference between treatments ($p<0.05$).
Values are presented as mean ± SD (approx. 5% of mean) to indicate experimental variability.

7-3 Determination of Secondary Oxidation Compounds

7-3-1 Conjugated Diene Compounds

During frying or cooking processes, the fatty acids in edible oils undergo oxidation, which leads to a decline in their quality. Lipid oxidation results in the formation of some toxic products, initially comprising primary oxidation products (alkoxyl, peroxyl radicals, and hydroperoxides) and subsequently secondary compounds (aldehydes, ketones, and carbonyl components). These secondary compounds can often have adverse effects on oil quality [27]. Monohydroperoxides can lead to the formation of compounds such as pentane, hexane, octanal, pentanal, and others, which are recognized as secondary

oxidation products [28]. The conjugated diene and triene compounds are products resulting from the oxidation of polyunsaturated fatty acids [29].

Based on the obtained data, the effects of treatment time and type of mixture on the conjugated diene value were statistically significant (Figure 1). The results indicated that with increasing time under accelerated conditions, the amount of conjugated diene compounds increased. This reflects oxygen absorption by the oil during accelerated oxidation, leading to the formation of hydroperoxides in the early stages of oxidation [30]. Comparing the behavior of these two ratios with the control sample (soybean oil), it is observed that mixing the oils altered the fatty acid profile, with increased saturated and monounsaturated fatty acids (oleic acid) relative to polyunsaturated fatty acids. This shift enhances oil stability because, for the formation of conjugated dienes, at least two double bonds in the fatty acid structure must be present [31]. Conversely, olive oil contains many antioxidant compounds which, by scavenging radical species, prevent the formation of primary oxidation products (hydroperoxides).

The effect of the mixture type on the amount of conjugated diene compounds was also significant. As shown, the highest conjugated diene value was related to soybean oil, likely due to its high content of polyunsaturated fatty acids, which react rapidly with oxygen and oxidize to form hydroperoxides. No significant difference was observed between the two mixtures with the highest thermal stability, although both differed significantly from the control (soybean oil) in terms of conjugated diene content.

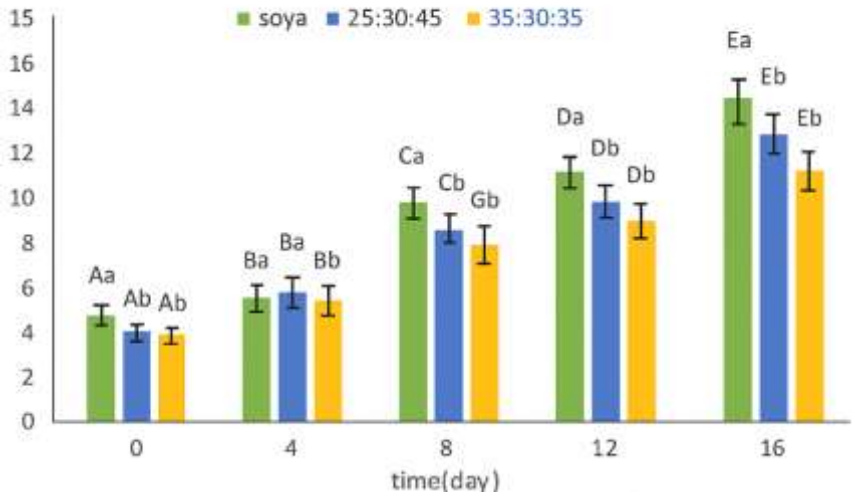

Figure 1: Changes in conjugated diene value during heat treatment under accelerated conditions for the control (soybean) and the 25:30:45 and 35:30:35 blends of soybean, palm olein, and extra virgin olive oil. Uppercase letters indicate statistically significant differences ($p < 0.05$) among heat treatment times under accelerated conditions, and lowercase letters indicate statistically significant differences ($p < 0.05$) among the selected oil blends.

2-2-3 Amount of Tri-Unsaturated Compounds

Trienes are also considered secondary products of oxidation, formed through the breakdown of hydroperoxides and their reaction with oxygen. Based on the obtained data, the effects of treatment time and mixture type on the trienes value were statistically significant; however, these two factors did not show a significant interactive effect.

As shown in Figure 2, soybean oil exhibited the highest triene content. Mixing the oils with palm olein and extra virgin olive oil reduced the formation of trienes. However, no significant difference was observed in the amount of trienes between the two ratios (35:30:35 and 45:30:25 of soybean, palm olein, and olive oil) after the same duration. The changes in triene content in the 45:30:35 ratio was significant after four days compared to the initial sample, but from day 4 to day 16, no significant differences in triene levels were observed. In the 35:30:35 ratio, no significant difference was seen in the triene amount between the unheated sample and the heat-treated samples over 16 days.

Torbani and colleagues [23] found that during heating, the amounts of conjugated dienes and triene increased in mixtures of soybean, palm olein, and corn oil, as well as in soybean oil without antioxidant (control). The highest levels were recorded in soybean oil, indicating that the mixture of soybean, palm olein, and corn oil enhances the stability of soybean oil.

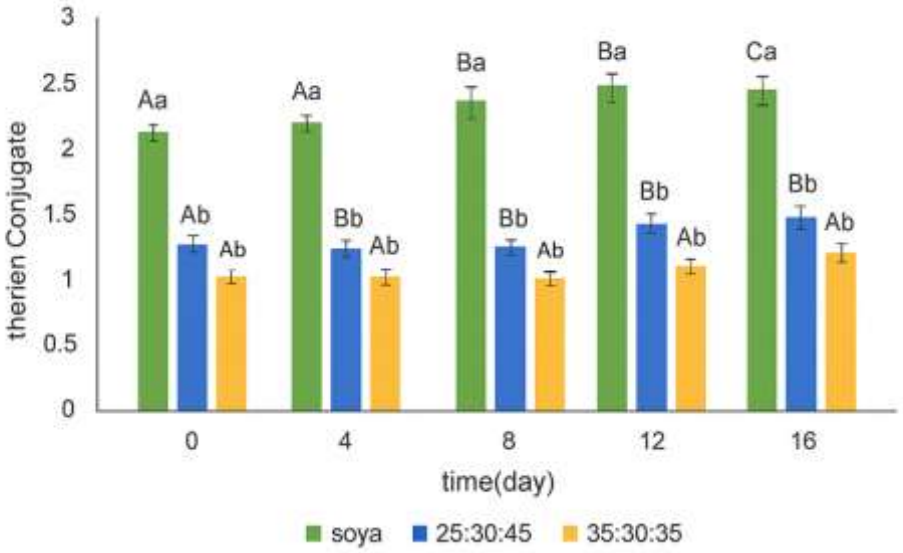

Figure 2 Changes in conjugated triene value during heat treatment under accelerated conditions for the control (soybean oil) and the 25:30:45 and 35:30:35 blends of soybean, palm olein, and extra virgin olive oil. Values are presented as mean ± SD from three independent replicates. Different lowercase letters indicate significant differences between oil blends, and different uppercase letters indicate significant differences across heating times ($p < 0.05$, Duncan's multiple range test).

3-3 Total Phenolic Compounds Content During the Accelerated Process

Phenols are simple organic compounds formed by the attachment of a hydroxyl group to a benzene ring. One of their key characteristics is their antioxidant property, which is linked to their regenerative ability. These compounds can act as hydrogen donors and iron chelators [32].

The data showed that the effects of treatment time, mixture type, and their interaction on the total phenolic compounds were statistically significant. The effect of heat treatment time under accelerated conditions on phenolic content was significant, with a notable decrease in phenolic compounds as the heating duration increased (Figure 3). Silva and colleagues [33] reported in 2010 that phenolic compounds and antioxidants decrease during the heat treatment process to protect the oil from oxidative reactions.

Furthermore, the effect of the oil ratio in the mixture on phenolic content was also significant. The data demonstrated that

increasing the proportion of olive oil in the mixtures led to higher levels of phenolic compounds. Since the 35:30:35 ratio contained more olive oil compared to the 25:30:45 ratio of olive oil, palm olein, and soybean oil, the phenolic content was higher in this mixture, and its reduction during the process was less significant. Carasco and colleagues [34] in 2007 reported that extra virgin olive oil exhibited considerable stability during the heat process, which is not only due to an appropriate fatty acid profile but also because of the presence of phenolic compounds. These phenolics aid in protecting the oil against oxidative reactions, although their levels significantly decrease during processing [33,34].

Based on these results, it can be inferred that the phenolic content in olive oil contributed to enhancing the oxidative stability of soybean oil, owing to the antioxidant properties of these compounds, which inhibit lipid oxidation.

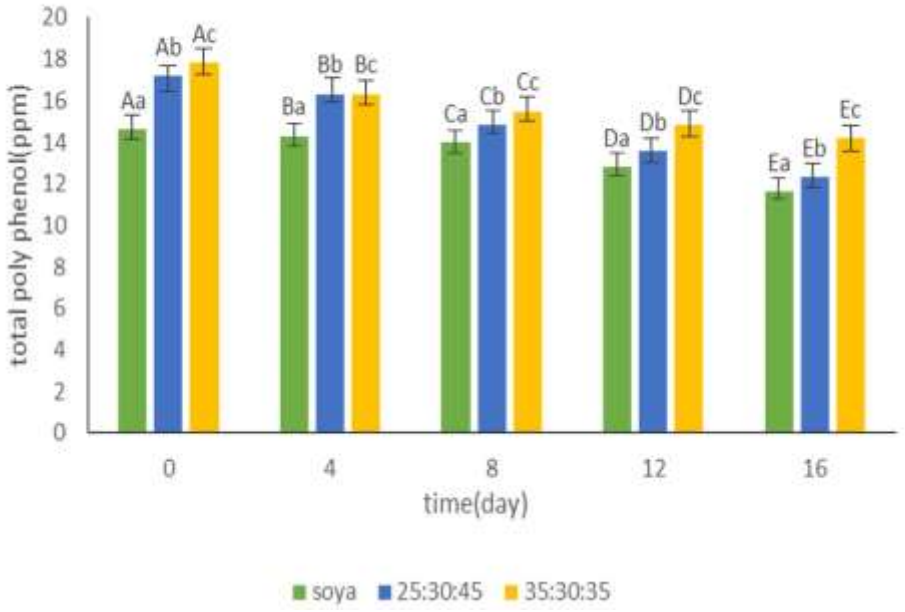

Figure 3: Changes in total polyphenol content during heat treatment under accelerated conditions for the control (soybean) and the 25:30:45 and 35:30:35 blends of soybean, palm olein, and extra virgin olive oil. Uppercase letters indicate statistically significant differences ($p < 0.05$) among heat treatment times under accelerated conditions, and lowercase letters indicate statistically significant differences ($p < 0.05$) among the selected oil blends.

4-3 Acid Value

The free fatty acid content in oil is the most commonly used test to assess oil quality during heat processing, as it is a good indicator of oil deterioration and can be measured simply and rapidly. The acid value increases due to the progression of hydrolytic reactions between the oil and moisture present in the food [35].

Considering the obtained data, the effects of heat treatment time under accelerated conditions, the ratio of oils in the mixtures, and their interaction on the acid value were statistically significant. With increasing heating time under accelerated conditions, the acid value increased, indicating hydrolysis of fatty acids during the process. As shown in Figure 4, soybean oil exhibited a higher acid value compared to other samples, likely due to its high content of unsaturated fatty acids and more intense hydrolytic reactions.

The ratio of oils in the mixture also had a significant effect on the acid value. Blending soybean oil with palm olein and olive oil resulted in a decrease in the production of free fatty acids. In a study on the thermal stability of canola oil with 5%, 10%, and 15% olive oil, it was observed that the acid value increased during heat treatment. The highest acid value was recorded in pure canola oil, while mixing it with various percentages of olive oil led to a smaller increase in acid value during the process [36].

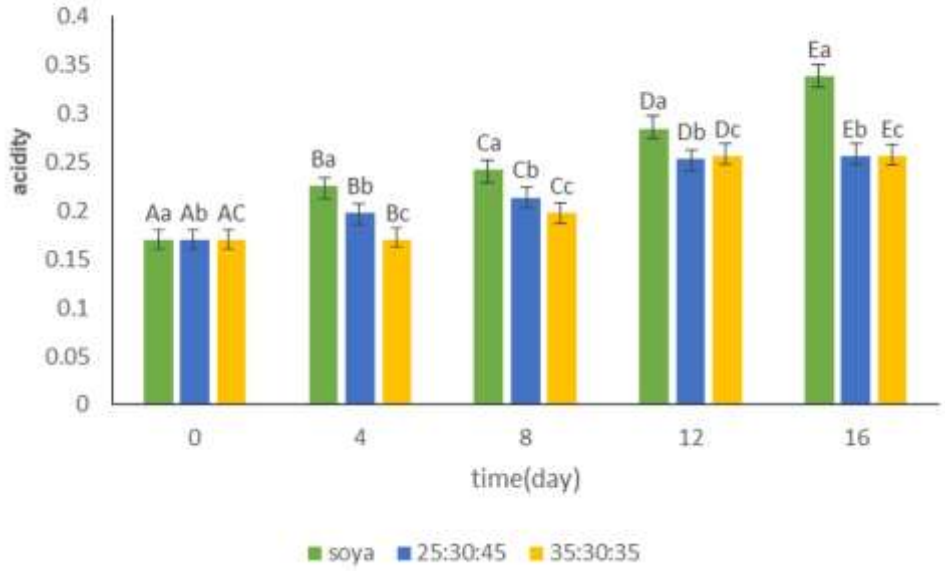

Figure 4: Changes in acid value over time for the control (soybean) and the 25:30:45 and 35:30:35 blends of soybean, palm olein, and extra virgin olive oil. Uppercase letters indicate statistically significant differences ($p < 0.05$) among heat treatment times under accelerated conditions, and lowercase letters indicate statistically significant differences ($p < 0.05$) among the selected oil blends.

4- General Conclusion

Based on the results of this research, the optimal ratio was determined to be 35:30:30 of soybean oil, palm olein, and extra virgin olive oil. This ratio exhibited the lowest acid value and conjugated diene and triene values during the accelerated process, while also maintaining the highest amount of phenolic compounds. Extra virgin olive oil can enhance the stability of oils with lower thermal stability, such as soybean oil, when combined with them, serving as a suitable alternative to synthetic antioxidants. Furthermore, it can increase the nutritional value and improve the fatty acid profiles of oils.

Conflict of Interest

There are none to declare.

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Author Contributions

All authors have contributed to the design, analysis, writing, and approval of the final manuscript in this manner

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بررسی پایداری اکسایشی اختلاط روغن سویا، پالم اولئین و زیتون فرابکر با آزمون تسریع یافته

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چکیده

مخلوط‌کردن روغن‌های گیاهی با یکدیگر موجب بهبود کیفیت، افزایش ترکیبات زیست‌فعال و آنتی‌اکسیدان‌ها و در نتیجه افزایش پایداری اکسایشی آن‌ها می‌شود. در این پژوهش ابتدا نسبت‌های مختلفی از روغن‌های سویا، پالم‌اولئین و زیتون‌فرابکر با هم مخلوط شد و با استفاده از آزمون حرارتی (حرارت‌دهی در دمای ۱۷۰درجه-سیلسیوس به مدت ۱۲ ساعت) بهترین نسبت‌ها از نظر پایداری حرارتی تعیین و با استفاده از آزمون تسریع‌یافته (حرارت‌دهی در دمای ٦٥ درجه‌سیلسیوس به مدت ۱٦ روز) پایداری اکسایشی آنها مورد بررسی قرار گرفت. سپس آزمون‌های جذب فرابنفش در ۲۳۳ و ۲۷۰ نانومتر (تعیین ترکیبات دی ان و تری ان مزدوج)، پلی‌فنول-تام، عدداسیدی مورد ارزیابی قرار گرفت. نتایج بدست آمده نشان داد که بهترین نسبت از نظر پایداری حرارتی و اکسایشی مربوط به نسبت ۳۵:۳۰:۳۵ از روغن سویا، پالم‌اولئین و زیتون فرابکر بود زیرا این نسبت عدداسیدی و ترکیبات دی‌ان و تری-ان‌مزدوج کم‌تری را در پایان فرایند تسریع‌یافته نشان داد و همچنین دارای بیشترین مقدار ترکیبات‌فنولی بود.