Oxidative stability, chemical composition and organoleptic properties of seinat (*Cucumis melo* var. *tibish*) seed oil blends with peanut oil from China

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Abstract Seinat seed oil was blended with peanut oil for the enhancement of stability and chemical characteristics of the blend. The physicochemical properties (relative density, refractive index, free fatty acids, saponification value, iodine value and peroxide value) of seinat seed and peanut oil blends in ratios 95:5, 85:15, 30:70 and 50:50 proportions were evaluated, as well as oxidative stability index, deferential scanning calorimetric (DSC) characteristics and tocopherols content. Results of oil blend showed that there was no negative effect by the addition of seinat seed oil to peanut oil and also had decreased percentages of all saturated fatty acids except stearic acid, conversely, increased the levels of unsaturated fatty acids. As for the sensory evaluation, the panelist results showed that seinat seed oil blends had no significant differences ($p < 0.05$) in all attributes except the purity. The results indicated that the blending of seinat seed oil with peanut oil had also increased the stability and tocopherols content. As Sudan is the first producer of seinat oil, blending of seinat seed oil with traditional oil like quality, and may decrease the consumption of other expensive edible oils.

Keywords Seinat seed · Peanut oil · Fatty acids · Tocopherols · Oxidative stability, Organoleptic properties

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Introduction

Vegetable oil is an important lipid source in our daily diet and widely used. Its demand is increasing day by day for food purposes and for the manufacture of a number of toiletry products. However, some vegetable oils are not up to standards to meet consumer satisfaction in terms of their physicochemical characteristics or for the texture and stability of the food products (Reyes-Hernandez et al. 2007). Seinat (*Cucumis melo* var. *tibish*) seed, a type of cucurbit seeds, contains 31 % crude oil and 28 % protein. It is an excellent source of edible oils comprises the main fatty acids linoleic acid (61.10 %), oleic acid (18.75 %), palmitic acid (10.37 %), and stearic acid (9.18 %) (Azhari et al. 2014). Cucurbit seeds are used widely in many countries for oil or protein production (Jacks et al. 1972). Oils are necessary in the diet as a source of fuel for the body and to give flavor to foods (Martin 1984). Fats and oils comprise one of the three major classes of foods, the others being carbohydrates and proteins. Chemically oils are defined as esters of the three-carbon trihydroxy alcohol, glycerol, with various monocarboxylic acids. Since glycerol is a trihydroxy alcohol, monoacid, diacid and triacid esters are known. Carelli et al. (2005) reported that the development of oxidative rancidity or autoxidation is the decisive factor affecting storage life and the use of edible oils and fats in food. Autoxidation of lipids is a natural process that occurs between molecular oxygen and unsaturated fatty acids through a free-radical chain mechanism that involves the formation of fat ‘free radicals’, peroxide ‘free radicals’ and hydro peroxides. The oxidative stability of oils and fats may be influenced by many factors, such as light, metal ions, oxygen, temperature and enzymes (Nawar 1985). The greater portion of the oil in cucurbit seeds is composed of unsaturated fatty acids. Due to its high content in unsaturated fatty acids, it has been suggested as a substitute for highly unsaturated oils in diets

(Azhari et al. 2014). The fatty acid composition indicates that cucurbit seeds are valuable sources of edible oil (Asenjo et al. 1951). There are some differences in the chemical composition of seinat seed oil and peanut oil (Table 1). Seinat seeds are available in many places in Sudan at a low price in all states of Sudan especially in autumn season. The conventional sources for vegetable oils in Sudan are limited to a few oilseeds such as sunflower, groundnut and sesame, and no longer meet the increasing demand for and industrial purposes (Mariod et al. 2009). Therefore, the need exists to look for new resources to meet this demand. The purpose of this study was to evaluate the influence of seinat seed oil blending with peanut oil on physico-chemical composition, fatty acids, oxidative stability index, differential scanning calorimetric and organoleptic characteristics.

Materials and methods

Dried seinat fruits were bought from a local farm in the Wad Medani City, Gezira State, Sudan, and transported to the Food Processing and Ingredients laboratory in Jiangnan University, Peoples Republic of China, while peanut seeds were purchased from a local market in Wuxi City, Jiangsu Province, People's Republic of China.

Oil extraction

Two hundred grams of seinat and peanut seeds were milled and mixed with 1 L of n-hexane in a shaker (IKA® RW 20 digital, UK-plug) at a rate of 440 rpm for 4 h. The mixture was then centrifuged for 20 min at a temperature of 4 °C. The supernatant was then filtered. The process of extraction was repeated. The oils were then recovered by evaporating off the solvent using rotary evaporator (Model N-1, Eyela; Tokyo Rikakikal, Japan) and the solvent was removed under a

laboratory fume hood for 30 min at 37 °C. Extracted seinat and peanut oil blend was drained under a nitrogen stream and were then stored in a refrigerator at 4 °C for analysis.

Chemical analysis of oil blends

Peroxide value was determined spectrophotometrically based on a method from the International Dairy Federation (IDF 1974). Approximately, 0.250 g of extracted oil blend was weighed into a glass tube and dissolved in 9.7 ml of a mixture of chloroform: methanol (4:1, v/v). Then, a drop of ammonium thiocyanate solution (30 %, w/v) and a drop of ferrous chloride solution (0.35 %, w/v) were added to the tube. After standing for 5 min, the absorbance of the mixture was read at 500 nm using a spectrophotometer. A calibration curve was also obtained using ferric chloride solutions containing 5–20 µg of Fe³⁺. American Oil Chemist's Society (AOCS 1997) methods were used for the determination of free fatty acids (method Ca 5a-4), peroxide value (method Cd 8-53), saponification value (method Cd 3-25), unsaponifiable matter (method Ca 6a-40), and specific gravity (using a 10 ml pycnometer at 25 °C). Refractive index was determined using Abbe refractometer at 25 °C. Iodine value was calculated by following Kyriakidis and Katsiloulis (2000).

Oxidative stability

Oxidative stability of seinat and peanut oil blends was measured by using the Rancimat method (743 Rancimat, Metrohm Co., Basel, Switzerland). Briefly, 3.6 g oil blend was weighed into the reaction vessel, which was placed into the heating block kept at 120 °C. Air flow was set at 20 L/h. Volatile compounds released during the degradation process were collected in a receiving flask filled with 60 mL distilled water. The conductivity of this solution was measured and recorded.

Table 1 Comparisons between some physiochemical characteristics of seinat seed crude oil and peanut crude oil

Properties	Seinat oil ^a	Peanut oil ^b
Physical state at room temperature	Liquid	Liquid
Color	28.31 Y + 1.21 R	Yellow
Melting point (°C)	−2.43	3.00
Relative density (25 °C)	0.91±0.02	0.913
Saponification value (mg KOH/g oil)	186.20±0.11	187.80
Iodine value	110.99	118.20
Peroxide value (meq O ₂ /kg oil)	2.50±0.20	2.09
Saponification value	186.20	190.33

^a Azhari et al. (2014)

^b Jamieson et al. (1921); Özcan and Seven (2003)

Table 2 Physicochemical properties of seinat seed oil and their blends with peanut oil

Parameters	Seinat oil: peanut oil			
	(5:95 %)	(15:85 %)	(30:70 %)	(50:50 %)
State at room temperature	Liquid	Liquid	Liquid	Liquid
Color	25.08Y + 1.84R	25.24Y + 1.73R	26.15Y + 1.29R	26.46Y + 1.38R
Melting point (°C)	1.76	0.97	−0.95	−1.36
Refractive index (25 °C)	1.471±0.01 ^a	1.470±0.01 ^a	1.463±0.02 ^a	1.451±0.02 ^a
Relative density (25 °C)	0.90±0.01 ^a	0.90±0.02 ^a	0.91±0.02 ^a	0.91±0.01 ^a
Free fatty acids (oleic acid %)	2.18±0.01 ^a	2.03±0.06 ^a	1.86±0.08 ^a	1.72±0.07 ^a
Saponification value (mg KOH/g oil)	188.44±1.82 ^a	186.74±1.72 ^a	185.11±0.34 ^a	184.53±0.21 ^a
Iodine value	99.12	100.00	101.83	103.82
Peroxide value (meq O ₂ /kg oil)	7.07±0.05 ^a	6.59±0.12 ^a	6.35±0.09 ^a	6.15±0.07 ^a

Values are mean of three replicate samples ($n=3$), mean±standard deviation. R Value on the red slide, Y value on the yellow slide. Iodine value was calculated following Kyriakidis and Katsiloulis (2000). The same superscripts in row are not significantly different (Tukey's test), significance at ($p<0.05$)

Determination of fatty acid composition

Fatty acids were converted to their methyl esters (FAME), following the method of He and Xia (2007) with a slight modification. In brief: 1 µL of FAME sample was injected in gas chromatograph (Series PEG30 M) equipped with a flame ionization detector; GC separation was conducted on a capillary column (PEG30M; 30 m×0.32 mm×0.50 µm). The carrier gas was nitrogen and the column flow rate was 0.8 mL/min. In the beginning, oven temperature was calibrated at 190 °C for 1 min, increased to 230 °C at a rate of 3 °C/min and then maintained at 230 °C for 10 min. The temperatures of the injection port and detector were 240 and 250 °C, respectively. The peaks were identified on chromatogram depending on retention data from analyzed standard. Finally, fatty acid contents were calculated as percentage (%).

Determination of tocopherol composition

The NY/T 1598-2008 method was used to determine tocopherol. A solution of 250 mg of oil blend, 25 mL of ethanol, 5 mL of 10 % ascorbic acid and 10 mL of 50 % KOH solution was saponified in a capped flask kept/mounted in a water bath at 90 °C for 1 h. After cooling, 100 mL of distilled water was added and mixed. The solution was extracted with 50 mL of diethyl ether. The upper layer was collected and washed with distilled water until a neutral pH was reached. The organic layer was then separated and dried over Na₂SO₄. After filtration of this solution, the solvent was evaporated to dryness under vacuum at 40 °C. The dry matter was dissolved in 2 mL of ethanol, and then centrifuged at 5000 rpm for 5 min. The upper layer (10 µL) was injected into the HPLC system (Waters, USA) with a Waters 2996 PAD detector and a

Spherisorb Silica column (250 mm×4.6 mm, 5 µm), operating at 30 °C. The separation of tocopherol was based on mobile phase methanol/ water (98:2, v/v) at a flow rate of 1.0 mL/min with detection at 290 nm. Tocopherols were calculated as mg/kg oil.

Differential scanning calorimeter (DSC)

The thermal parameter of seinat oil and their blends was measured by using a differential scanning calorimeter (DSC) [DSC-Q2000, V24.9, Instruments, Newcastle, USA]. Seinat oil and their blends were weighed directly into a DSC-pan. The oils were rapidly cooled to 40 °C with a speed of 10 °C/min, maintained for 10 min and heated to 120 °C with a heating speed of 15 °C/min. The heating process was repeated and the DSC thermographs were recorded during the second melting. An empty DSC-pan was used as a reference.

Table 3 Oxidative stability index (h) of seinat seed oil and their blends with peanut oil

Blends	Oxidative stability index (h)
Seinat oil	4.28±0.01 ^a
Peanut oil	2.78±0.07 ^d
Seinat oil: peanut oil (5:95 %)	2.83±0.06 ^{cd}
Seinat oil: peanut oil (15:85 %)	3.03±0.02 ^{bcd}
Seinat oil: peanut oil (30:70 %)	3.08±0.09 ^{bc}
Seinat oil: peanut oil (50:50 %)	3.11±0.21 ^b

Values are means±standard deviations of triplicate determinations. The same superscripts in column are not significantly different (Tukey's test), significance at ($p<0.05$)

Table 4 Fatty acid (%) composition of seinat seed oil, peanut oil and their blends

Fatty acid	Seinat oil	Peanut oil	Seinat oil: peanut oil			
			(5:95 %)	(15:85 %)	(30:70 %)	(50:50 %)
Myristic acid (C14:0)	0.05±0.01 ^b	0.04±0.01 ^b	0.13±0.01 ^a	0.05±0.01 ^b	0.04±0.01 ^b	0.03±0.01 ^b
Palmitic acid (C16:0)	10.37±0.02 ^c	11.17±0.02 ^a	10.87±0.01 ^b	10.83±0.02 ^b	10.85±0.03 ^b	10.80±0.05 ^b
Stearic acid (C18:0)	9.18±0.04 ^a	4.75±0.02 ^f	4.98±0.01 ^e	5.18±0.03 ^d	5.95±0.02 ^c	6.05±0.03 ^b
Arachidic acid (C20:0)	0.22±0.04 ^d	1.59±0.01 ^a	1.53±0.05 ^a	1.41±0.02 ^b	1.18±0.01 ^c	1.18±0.03 ^c
Docosanoic acid (C22:0)	ND	2.32±0.02 ^a	2.14±0.02 ^b	2.01±0.01 ^c	1.60±0.02 ^d	1.60±0.02 ^d
Palmitoleic acid (C16:1)	0.08±0.02 ^a	0.07±0.01 ^a	0.08±0.01 ^a	0.08±0.01 ^a	0.08±0.01 ^a	0.09±0.01 ^a
Oleic acid (C18:1)	18.75±0.1 ^f	43.54±0.02 ^a	42.65±0.05 ^b	41.13±0.5 ^c	37.04±0.04 ^d	36.77±0.03 ^e
Linoleic acid (C18:2)	61.10±0.08 ^a	35.90±0.02 ^f	37.15±0.03 ^c	38.70±0.02 ^d	42.72±0.02 ^c	42.93±0.01 ^b
Linolenic acid (C18:3)	0.16±0.03 ^b	0.04±0.01 ^c	0.06±0.01 ^c	0.07±0.01 ^c	0.08±0.01 ^c	0.82±0.01 ^a
Eicosenoic acid (C20:1)	0.09±0.02 ^c	0.57±0.01 ^a	0.52±0.02 ^{ab}	0.57±0.11 ^a	0.42±0.01 ^b	0.42±0.02 ^b
ΣSFA	19.82	19.87	19.65	19.50	19.64	19.77
ΣUFA	80.43	80.11	80.45	80.54	80.34	81.03
ΣMUFA	19.06	44.17	43.25	41.78	37.55	37.28
ΣPUFA	61.37	35.93	37.20	38.77	42.80	43.75

SFA saturated fatty acids, MUFA monounsaturated fatty acids, PUFA polyunsaturated fatty acids, UFA unsaturated fatty acids, ND not detected

All determinations were carried out in triplicate and mean value±standard deviation reported. The same superscripts in row are not significantly different (Tukey's test), significance at ($p<0.05$)

Sensory evaluation

Sensory evaluation was performed using a ten member panel (trained) to measure crust color, crumb color, crumb texture, flavor, taste and overall acceptability. A hedonic scale of 1 to 9 was used; 1: extremely bad, 2: very bad, 3: bad, 4: fairly bad, 5: satisfactory, 6: fairly good, 7: good, 8: very good, 9: excellent.

Statistical analysis

All experiments were conducted at least in triplicate and statistical analyses were performed using SPSS version 16.0 software for Windows (SPSS Inc., Chicago, IL, USA). One-way analysis of variance (ANOVA) was used to determine significant differences between means and Tukey's test was used to

perform multiple comparisons between means. The significance level was defined as $p<0.05$.

Results and discussions

Physiochemical analysis of oil blends

As illustrated in Table 2, the physical state at room temperature of the oil blends was liquid form with slight differences in color, refractive index and relative density. Addition of seinat seed oil to peanut oil decreased the melting point significantly from 1.76 °C at blend 5:95 to −1.36 °C at blend (50:50). A similar trend was observed in free fatty acids and saponification value from 2.51 to 1.63 % and from 189 to 186 mg KOH/g oil, respectively. According to Demian (1990), acid

Table 5 Total tocopherols (mg/kg oil) of seinat seed oil, peanut oil and their blends

Blend	Seinat oil	Peanut oil	Seinat oil: peanut oil			
			(5:95 %)	(15:85 %)	(30:70 %)	(50:50 %)
Total tocopherols	432.00	511.85	580.63	596.23	636.56	693.28
α-Tocopherol	27.00±0.17 ^a	24.44±0.02 ^b	18.63±0.73 ^d	23.25±0.03 ^{bc}	21.98±0.03 ^c	23.74±0.04 ^{bc}
β-Tocopherol	ND	ND	ND	ND	ND	ND
δ-Tocopherol	274.00±0.53 ^a	195.80±0.06 ^c	237.00±0.13 ^b	174.80±0.01 ^d	164.00±0.03 ^e	171.30±0.04 ^d
γ-Tocopherol	131.10±0.41 ^f	291.60±0.03 ^e	325.00±0.71 ^d	398.20±0.04 ^c	450.50±0.02 ^b	498.30±0.03 ^a

All determinations were carried out in triplicate and mean value±standard deviation reported. ND: not detected. The same superscripts in row are not significantly different (Tukey's test), significance at ($p<0.05$)

values are used to measure the extent to which glycerides in the oil has been decomposed by lipase and other physical factors such as light and heat. The higher the saponification numbers of the oil, the more soluble the soap that can be made from it (Alyas et al. 2006). The peroxide value is defined as the weight of active oxygen contained in one gram of oil (Pandurangan et al. 2014). Peroxide value was 7.07, 6.59, 6.35, and 6.15 meq O₂/kg oil for seinat seed oil blends with

peanut oil in 5:95, 15:85, 30:70 and 50:50 proportions respectively (Table 2). The peroxide values indicate that the oil started to degrade since it was identified as highly unsaturated oil (Azhari et al. 2014). According to Kyriakidis and Katsiloulis (2000) method, the iodine value of oil blends ranged from 99.12 to 103.82. The high iodine value is due to its high content of unsaturated fatty acids (80.18 mg/100 g oil); this indicates that the seed oil has

Fig. 1 Melting thermogram curve of seinat seed oil blends with peanut oil. **a** Seinat seed oil; **b** Peanut oil; Blends (Seinat oil: Peanut oil), **c** (5:95 %); **d** (15:85 %); **e** (30:70 %); **f** (50:50 %)

good edible and drying oil qualities (Eromosele et al. 1997). According to the results of the chemical composition of oil blends, there was no negative effect by the addition of seinat seed oil.

Oxidative stability of oil blends

Rancimat results are reported in Table 3. The stability of seinat seed oil and their blends expressed as the oxidation induction time (h). The oxidative stability index of seinat seed oil and peanut oil were 4.28, 2.78 (h), respectively and 2.83, 3.03, 3.08 and 3.11 (h) for blends. Therefore, addition of seinat seed oil to peanut oil had increased the stability of blends leading to a positive effect. The oxidative stability of seinat seed oil was found lower than that obtained by Mariod and Matthäus (2007) who reported an oxidation stability index of 5.7 to 5.9 h for *Cucumis. melo* var. *agrestis* seed oil under the same conditions. This value may be justified by the fact that the oil was crude. A linear regression based on the linoleic ratio and the contents of phenols and tocopherols in virgin olive oil, showed a good correlation with the oxidative stability measured by Rancimat (Aparicio et al. 1999).

Fatty acid composition

The fatty acid composition of seinat seed oil, peanut oil and their blends are shown in Table 4. There are 10 fatty acids including five unsaturated. Linoleic acid and oleic acid were the highest content (37.15 %, 38.70 %, 42.72 % and 42.93 %) and (42.65 %, 41.13 %, 37.04 % and 36.77 %) for seinat seed oil blends with peanut oil in 5:95, 15:85, 30:70 and 50:50 proportions respectively. The fatty acids of seinat seed oil are near to those reported by El-Adawy and Taha (2001), for watermelon seed oil. The fatty acids may have favorable nutritional implications and beneficial physiological effects in the prevention of diseases such as cancer and coronary heart disease (Oomah et al. 2000). The data in Table 4, also indicated that these blends were significantly enriched with MUFA and PUFA (from 43.25 to 37.28 % and 37.20 to 43.75 %, respectively). PUFA and MUFA incorporated in all the blends, therefore, these blends may help in reducing low-density lipoprotein cholesterol in the body (Wahida Karmally 2005). Σ SFA was found decreased with the increase of seinat oil percentage in the blend, while Σ UFA was found the highest in the blend 50 % seinat oil with 50 % peanut oil (81.03 %). Addition of seinat seed oil to peanut oil had decreased the percentages of all the saturated fatty acids except stearic acid, conversely, increased the levels of unsaturated fatty acids. Therefore, the effect of seinat seed oil addition to peanut oil on the content of fatty acids was positive and beneficial.

Table 6 Organoleptic properties of seinat seed oil and their blends with peanut oil

Parameters	Seinat oil: peanut oil			
	(5:95 %)	(15:85 %)	(30:70 %)	(50:50 %)
Yellow color	6.90 ^a	7.50 ^a	7.70 ^a	7.80 ^a
Flavor	7.80 ^a	7.60 ^a	7.90 ^a	7.90 ^a
Turbidity	6.70 ^a	7.20 ^{ab}	7.80 ^{ab}	8.10 ^b
Taste	7.90 ^a	7.70 ^a	7.20 ^a	7.70 ^a
Overall acceptability	7.10 ^a	7.50 ^a	7.70 ^a	7.60 ^a

The same superscript letters in row are not significantly different (Tukey's test), significance at ($p < 0.05$)

Tocopherols content

The tocopherol contents (γ , δ and α) of crude oil are shown in Table 5. The γ -tocopherol content was highest in all blends. It was 55.97 %, 66.79 %, 70.78 % and 71.87 % for the seinat seed oil blends with peanut oil in ratios 5:95, 15:85, 30:70 and 50:50 respectively, of total tocopherols, followed by δ -tocopherol (40.82 %, 29.31 %, 25.77 % and 24.71 %, respectively), while α -tocopherol was the lowest in the all oil blends. The total of tocopherol content in all blends (580–693 mg/kg) was found higher than that obtained by Bhatnagar et al. (2009) who reported that total tocopherols content of 20 % refined coconut oil with 80 % sesame oil 451 mg/kg. Also these results were found higher than that blends of 50 % coconut oil with 50 % rice bran oil, 50 % coconut oil with 50 % palm oil, 20 % refined coconut oil with 80 % sunflower oil and 80 % coconut oil with 20 % safflower oil (Bhatnagar et al. 2009). Alpha-tocopherol is good for human nutrition because it has a higher biological activity than other tocopherols (Fatnassi et al. 2009). Therefore, addition of seinat seed oil to peanut oil can be considered as a good attempt to improve the quality characteristics of oil, oxidative stability and anti-oxidant activity (Table 5).

Fig. 2 Seinat seed oil blends with peanut oil

DSC thermal characteristics of oil blends

Figure 1 shows the DSC of seinat seed oil and their blends with peanut. The oil samples exhibited four transitions when heated from -40 to 120 °C. The first and the last transition respectively occurred at -33.97 and 3.11 °C. The lowest first transition of seinat seed oil blends were found in the blends 5:95 (-33.78 °C) and 50:50 (-30.87 °C), followed by the blend 30:70 (-30.33 °C), while the blend 15:85 was at the highest temperature (-28.45 °C). Generally, the crude oil samples with high amount of saturated fatty acids illustrated differential scanning calorimetric melting profile at higher temperature zones compared to the oil sample with high amount of unsaturated fatty acids (Nyam et al. 2009). Such a feature may confirm the liquid state of the seed oil at room temperature (25 °C). It is noteworthy that the asymmetry of the recorded peak at -17.40 °C, -17.83 °C, -18.07 °C and -19.01 °C for the blends in ratios 5:95, 15:85, 30:70 and 50:50, respectively, can be regulated by two components of different weights. Similarly, the trend of two types of reduced fat spreads obtained by Lida and Ali (1998) showed endothermic heat flow over a wide range during scanning from -50 to 60 °C, indicating the presence of low-melting (<0 °C). The lowest first transition of seinat seed oil blends were found to be similar to that reported by Aguedo et al. (2009) who found the low-melting from the blend and mainly from rapeseed oil between -35 and -12.5 °C. Actually, the thermo gram seemed to correspond to a number of components higher than the visible ones suggested the presence of triglyceride fractions with melting points too near to be differentiated under the used conditions (Herrera and Añón 1991).

Sensory evaluation

The qualitative measurements of the various sensory characteristics for oil blends are presented in Table 6 and Fig. 2. All oil blends showed no significant difference in overall acceptability, color and flavor, while there is quite a significant difference in the purity. This difference due to the presence of waxes in peanut oil, which affected the purity of oil blend, but increased with increase of seinat seed oil percentage in the blend. Many studies may be carried out in order to encourage further studies of the utilization of cucurbit seed oil in other food products.

Conclusion

As the chemical composition of this seinat seed crude oil blends with peanut oil showed good results similar to other edible oils, it can be added to edible oils to prepare a blend for use as a source in the food and also in cosmetics and pharmaceuticals. The result of physicochemical properties further

confirmed the quality of the extracted oil for cooking and industrial purposes. Thus, blending is a good choice by which one can manufacture edible oils of good characteristics with assured quality. The advantages of using blends as a means of modifying oils is that it is easy and costs less. More importantly blending oils serves to improve the nutritional and functional qualities of the oils by combining the good attributes of the two oils into one, by this therefore, improving commercial viability. This study will help the oil industry to find the most economically viable oil blends for cooking purposes, with maximum nutrition as well as desirable physicochemical properties.

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