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Effect of Storage on Quality of Branded Edible Oils from Elobeid Supermarket Compared with SSMO 1995

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Abstract

The current study was carried out in the Laboratory of Biochemistry and Food Science, Faculty of Natural Resources and Environmental Studies, University of Kordofan Sudan. The aim of this research was to examine the impact of storage duration on the quality parameters of various brands of edible oils collected from Elobeid Supermarket North Kordofan State Sudan in comparison with SSMO 1995 standards. The oils analyzed included Abrar, Groundnut, Crystal, Sabah, Factory Sesame oil, and Shams, which were stored at ambient temperature (37°C ± 4°C) for periods of 0, 2, 4, 6, 8, 10, and 12 months. Oil samples were taken after each storage interval to assess changes in quality parameters, including Acid value, Free Fatty Acids (FFA%), peroxide values, Anisidine values, Totox values, and polymer content. The data collected were analyzed using the Statistical Package for Social Sciences (SPSS). Means (±SD) were evaluated through one-way analysis of variance (ANOVA) and subsequently separated using Duncan's Multiple Range Test (DMRT) as per Duncan, 1995. In terms of Acid value and FFA, the findings indicated that Abrar oil, Groundnut oil, and Sesame Factory oil exhibited poor storage stability, as all measured values exceeded the permissible limits (0.6 mg KOH/g and 0.3%, respectively) even at the initial time point (0 months). Regarding peroxide values, Abrar, Groundnut, Crystal, and Sabah oils were found to be above the recommended threshold (10 Meq/Kg oil) from the start of the storage period (0 months), while Sesame Factory oil conformed to specifications at 0, 2, and 4 months, and Shams oil remained within specifications until the 8-month storage period. Concerning Anisidine values, Groundnut oil, Sesame Factory oil, and Shams oil remained within the recommended limit (26 Meq/Kg oil) throughout all storage durations, whereas Abrar oil consistently recorded values exceeding the acceptable limit from the beginning to the end of the storage period. With respect to Totox values, all brand oils were above the recommended limit (30 Meq/Kg oil) from the outset of storage (0 months), while Sesame Factory oil adhered to the specifications.

Key word: *storage period, quality parameters, Brand oils, SSMO*

1. Introduction

Lipids and triacylglycerol are naturally found in oils and fats. Their chemical makeup consists of both saturated and unsaturated fatty acids along with glycerides. Edible oils are essential components of our daily nutrition, providing energy, necessary fatty acids, and acting as carriers for fat-soluble vitamins. The quality of food is crucial and its degradation poses risks to human health (Bhattacharya et al., 2008). Consequently, it is vital to monitor oil quality to prevent the use of substandard oil, which can lead to adverse health effects from consuming foods fried in compromised oil (Vijayan *et al.*, 1996). Lipid peroxidation represents a significant deteriorative change frequently observed in oils, with its severity influenced by various factors, including the fatty acid composition, particularly the degree of unsaturation; the type of packaging material; and the conditions under

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which the oil is stored (Yu Liscanlen, L. Wilson J. and Schmielt 2000). These elements are known to hasten lipid peroxidation and the onset of rancidity in oils. Various materials such as glass, metals, and different types of plastic bottles have been utilized for oil packaging, each presenting its own set of advantages and drawbacks. The aim of this study is to examine the impact of storage duration on several quality parameters of edible oils that are commonly used in Sudan, specifically Abrar, Groundnut, Crystal, Sabah, factory Sesame oil, and Shams.

Materials and methods

Samples of Vegetable Oils

Vegetable oils were sourced from Elobeid Supermarket located in North Kordofan State. Ten distinct types of edible oils that are frequently utilized in Sudan include Abrar, Groundnut, Crystal, Sabah, factory Sesame oil, and Shams.

Chemicals and Reagents

All chemicals and reagents utilized were of analytical grade (BDH), sourced from the Sudanese Standard and Metrology Organization (SSMO) as well as the laboratory of the Department of Food Science and Technology, College of Natural Resource and Environmental Studies at the University of Kordofan.

Storage conditions

Oil samples stored at ambient temperature (37^0 C ± 4^0) for intervals of 0,2,4,6,8,10 and 12 months. Samples of oils were withdrawn after each storage period for monitoring changes in chemical properties.

Chemical changes in quality parameters of oil during storage period

Acid value (AV mg KOH /g oil)

Acid value was determined according to the British Standard Institution (1958).

Free fatty acids (FFA %)

Free fatty acids (FFA) was deter minted according to Cock and Van Rede (1966).

Peroxide value (PV Meq H_2O_2/ Kg oil)

Peroxide value (PV) of oils, which indicates the extent of overall oxidation, was determined according to the AOAC (2000) method.

Anisidine value (AV MeqO2 / Kg oil)

The Anisidine value (A.V) or the carbonyl value was measured in the oil according PORIM Test Methods, 1995.

Totox Value (TV MeqO2 / Kg oil)

The Totox Value is calculated value based on peroxide and anisidine value was determined according to the PORIM Test Methods, 1995. Following Equation

Totox Value = 2×proxide + Anisidine value

Polymer content (PC %)

Polymer content (PC) was determined according to Peled *et al.* (1975)

Statistical Analysis:

Data generated was analyzed using Statistical Package for Social Sciences (SPSS). Means (±SD) were tested using one factor analysis of variance (ANOVA) and then separated using Duncan's Multiple Range (DMRT) according to Duncan, 1995.

Results and Discussion

Effect of storage period on acid value of Brand oils samples were collected from Elobeid Supermarket in Kordofan State compare with SSMO 1995

Table 1 showed that in case of Abrar oil the acid values found to be higher than the indicated permissible value (0.6 mg KOH / g) by 1.353, 3.113, 6.09, 7.150, 7.477 and 7.987 mg KOH / g at 2, 4, 6, 8, 10 and 12 months of storage respectively. The acid value was found to increase with storage period and reaches the maximum magnitude during the period from 8 months to 12 months. In case of Groundnut oil, generally it was found that the acid value tends to increase with storage period and all the values are above the specified indicated value. With regard to Crystal oil, the results demonstrated that there was no significant effect of storage period on oil acid vale. Sabah oil demonstrated, storage period at 0 time, the acid value was lower than the permissible value by 0.003 mg KOH / g while all the rest storage period were higher than the permissible value (0.6 mg KOH / g). In case of Sesame Factory oil, it was shown that the oil recorded acid values higher than acceptable value even at 0 times and this may be due to the crop constituents or to process of oil extraction. Considering Shams oil, the storage periods at 6, 8, 10 and 12 months, the acid value was higher than permissible value by 1.167, 3.433, 4.00 and 4.233 mg KOH /g oil respectively. It was indicated that the acid value increased with period of storage and period of 6 months is considered as critical storage point at which the acid value starts to exceed the permissible value of 0.6 mg KOH / g oil. It can be conclude that and refer to Acid value, Abrar oil, Groundnut oil and Sesame Factory oil demonstrated poor storage performance with regard to acid value because all values found to be above the permissible level even at 0 times (sooner after product).

Table 1: Effect of storage period on Acid value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Type of oil	*Storage periods of brand oil per months*						
	0day	*2 month*	*4month*	*6month*	*8month*	*10month*	*12month*
Abrar	*(0.64)E±0.08*	*(1.95)D±0.06*	*(3.71)C±0.18*	*(6.69)B±0.64*	*(7.75)A±0.22*	*(8.08)A±0.08*	*(8.59)A±0.08*

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Groundnut	*(1.33)E±0.03*	*(1.48)E±0.04*	*(1.57)E±0.05*	*(1.99)D±0.77*	*(2.54)C±0.21*	*(3.10)B±0.19*	*(3.87)A±0.10*
Crystal	*(0.47)A±0.23*	*(0.58)A±0.01*	*(0.63)A±0.04*	*(0.65)A±0.02*	*(0.63)A±0.05*	*(0.80)A±0.05*	*(0.94)A±0.02*
Sabah	*(0.59)D±0.08*	*(1.21)D±0.96*	*(3.99)C±0.22*	*(5.95)B±0.19*	*(7.47)A±0.58*	*(8.22)A±0.31*	*(8.78)A±0.28*
Sesame	*(1.03)D±0.08*	*(1.88)C±0.06*	*(1.99)C±0.11*	*(2.13)BC±0.00*	*(2.41)BC±0.08*	*(2.85)B±0.59*	*(4.60)A±1.56*
Shams	*(0.39)C±1.00*	*(0.40)C±1.00*	*(0.47)C±0.05*	*(1.77)B±0.33*	*(4.03)A±0.50*	*(4.60)A±0.53*	*(4.83)A±1.77*

*Specification limit less than (0.6 mg KOH / gram oil)

Effect of storage period on Free Fatty acid value of Brand oils samples were collected from Elobeid Supermarket in Kordofan State compare with SSMO 1995

Table 2 demonstrated that in case of Abrar oil, the percentage of free fatty acid, the permissible value of free fatty acid (oleic acid) according to SSMO 1995 is ≤ 0.3 %, so, all values were higher than the permissible level. For Groundnut oil, it was concluded that as period of storage passed, fatty acid content increased to reach its highest value at 12 months and all values were higher than the permissible level. In case of Crystal oil, it was concluded that as period of storage passed, fatty acid content increased to reach its highest value at 12 months and all values of fatty acid content from 2 months up to 12 months were higher than the permissible level. With regard to Sabah oil, it was found that the level of fatty acid in the oil increased with time and the period from 0 time up to 6 months found to be an optimum storage period to keep the fatty acid content below the permissible limit. Considering Sesame Factory oil, all fatty acid percentages were higher than permissible limit by all storage periods may be due to improper storage conditions or may be due to chemical properties of raw seed material. In case of Shams oil, it was concluded that the fatty acid percentage increased with increase of storage period and period of 4 months is an optimum storage period for such oil so as to keep the fatty acid content below the permissible level. It can be concluded that the Abrar oil, Groundnut oil and Sesame Factory oil demonstrated inferior storage performance with regard to fatty acid value because all values found to be above the permissible level even at 0 time (sooner after production).

Table 2: Effect of storage period on free fatty acid of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Type of oil	*Storage periods of brand oil per months*						
	0day	*2 month*	*4month*	*6month*	*8month*	*10month*	*12month*
Abrar	(0.32)E±0.01	(0.98)D±0.03	(1.86)C±0.09	(3.35)B±0.64	(3.88)A±0.11	(4.04)A±0.04	(4.29)A±0.19
Groundnut	(0.67)E±0.01	(0.74)E±0.02	(0.78)E±0.03	(0.99)D±0.39	(1.27)C±0.10	(1.55)B±0.09	(1.94)A±0.05
Crystal	(0.30)D±0.04	(0.60)D ±0.96	(1.99)C±0.22	(2.97)B±0.19	(3.74)A±0.58	(4.11)A±0.31	(4.39)A±0.28
Sabah	(0.19)C±0.16	(0.23)BC±0.03	(0.24)BC±0.09	(0.30)B±0.00	(0.31)B±0.05	(0.36)B±0.05	(0.50)A±0.19
Sesame	(0.51)D±0.04	(0.94)C ±0.03	(0.99)C±0.05	(1.13)BC±0.08	(1.20)BC±0.03	(1.43)B±0.29	(2.30)A±0.01
Shams	(0.19)C±0.01	(0.20)C±0.50	(0.23)C±0.03	(0.88)B ±0.17	(2.02)A±0.27	(2.30)A±0.53	(2.42)A±1.77

*Specification limit less than (0.3 %)

Effect of storage period on Peroxide value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State

Table 3 presented effect of storage period on Peroxide value which its permissible value is reported to be ≤ 10 Meq / Kg oil according to SSMO 1995 and FAO/WHO 1993 specification. In case of Abrar oil, it was found that the Peroxide value increased with time from 0 times till reach its maximum value at 8 months then decreased to its minimum value at 12 months. For Groundnut oil, It was found that the Peroxide value increased to reach its highest value at 8 months storage period (45.60 Meq / Kg oil) the decreased to reach the lowest value at 12 months (17.20 Meq / Kg oil), the results were somewhat agreed with Israa (2014) findings of Peroxide value trends. In case of Crystal oil, Peroxide value found to be higher than the permissible value by 31.6, 46.30, 48.40, 51.50, 38.20, 27 and 7.80 Meq / Kg oil at 0 time, 2, 4, 6, 10 and 12 months respectively. With respect to Sabah oil, Peroxide value was increased with time till reach the highest magnitude of 35.1Meq / Kg oil at 4 month storage period and then decreased to reach the lowest value of 19.9 Meq / Kg oil at 12 months. Considering Sesame Factory oil, Peroxide value was increased with time till reach the highest value of 18.90 Meq / Kg oil at 12 month storage period, at 4 months period, Peroxide value was same with the specification (10 Meq / Kg oil) while at 6, 8, 10 and 12 months, Peroxide value was

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higher than the permissible value. In case of Shams oil, it was found that the Peroxide value increased as storage period increased and the highest value was recorded at 12 months (19.3 Meq / Kg oil).

Table 3: Effect of storage period on Peroxide value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Type of oil	*Storage periods of brand oil per months*						
	0day	*2 month*	*4month*	*6month*	*8month*	*10month*	*12month*
Abrar	$(63.10)^{D}$ ±0.00	$(77.60)^{B}$ ±0.01	$(81.10)^{B}$ ±0.09	$(96.00)^{A}$ ±0.09	$(99.10)^{A}$ ±0.02	$(74.40)^{BC}$ ±0.03	$(50.60)^{E}$ ±0.05
Groundnut	$(39.80)^{BC}$ ±0.10	$(39.90)^{BC}$±0.58	$(41.20)^{B}$ ±0.39	$(41.70)^{B}$ ±0.15	$(45.60)^{A}$ ±0.12	$(31.90)^{C}$ ±0.20	$(17.20)^{D}$ ±0.19
Crystal	$(41.6)^{D}$ ±0.100	$(56.30)^{AB}$±0.05	$(58.40)^{AB}$ ±0.16	$(61.50)^{A}$ ±0.15	$(48.20)^{C}$ ±0.10	$(37.10)^{E}$ ±0.15	$(17.80)^{F}$ ±0.14
Sabah	$(45.3)^{A}$ ±0.058	$(36.8)^{B}$ ±0.072	$(35.1)^{B}$ ±0.153	$(34.3)^{B}$ ±0.051	$(34.1)^{B}$ ±0.055	$(30.0)^{C}$ ±0.095	$(19.9)^{D}$ ±0.180
Sesame	$(3.20)^{C}$ ±0.05	$(5.70)^{C}$ ±0.16	$(10.0)^{BC}$ ±0.15	$(13.30)^{B}$ ±0.05	$(17.03)^{A}$ ±0.04	$(18.50)^{A}$ ±0.10	$(18.90)^{A}$ ±0.05
Shams	$(3.00)^{D}$ ±0.01	$(3.60)^{D}$ ±0.01	$(4.20)^{D}$ ±0.07	$(4.70)^{D}$ ±0.11	$(8.10)^{C}$ ±0.08	$(22.50)^{A}$ ±0.08	$(19.30)^{B}$ ±0.01

*Specification limit less than (10 Meq / Kg oil)

Effect of storage period on Anisidine value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Table 4 presented effect of storage period on Anisidine value which its permissible value is reported to be ≤ 26 Meq / Kg according to Sudanese specification 1995. In case of Abrar oil, it was found that the Anisidine value increased with time from 2 months storage period till reach its maximum values at 6 months and 8 months then decreased to its minimum value at 12 months. For Groundnut oil, It was found that the Anisidine value increased from 2 months period (19.67 Meq / Kg oil) to reach its highest value at 8 months storage period (22.00 Meq / Kg oil) then decreased to reach the lowest value at 12 months (11.67 Meq / Kg oil). In case of Crystal oil, Anisidine value was increased from 0 time to 2 months storage period to reach 31.00 Meq / Kg as the highest value and then decrease to reach its lowest value of 11.67 Meq / Kg at 12 months. With respect to Sabah oil, Anisidine value found to be decreased with time and recorded the highest magnitude of 30.00Meq / Kg oil at 0 time and lowest magnitude of 11.3300Meq / Kg at 12 month storage period. Considering Sesame Factory oil, Anisidine value was increased with time till reach the highest value of 9.00 Meq / Kg oil at 12 month storage period Anisidine value found to be lower than permissible value throughout all storage periods ≤ 26 Meq / Kg). In case of Shams oil, it was found that the Anisidine value increased as storage period increased and the highest value was recorded at 12 months (17.67 Meq / Kg oil). It can be deduced that as oil Peroxide value increased the oil will has a tendency to react and release more Ketones and Aldehides, consequently, Anisidine value increased which was indicated by Abrar.

Table 4: Effect of storage period on Anisidine value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Type of oil	*Storage periods of brand oil per months*						
	0day	*2 month*	*4month*	*6month*	*8month*	*10month*	*12month*
Abrar	$(49.00)^{B}$ ±1.00	(48.33)BC±0.77	(49.67)B ±0.57	(56.00)A ±1.00	(57.33)A ±1.52	(46.33)C ±07	(39.67)D ±0.57
Groundnut	(19.33)A ±0.77	(19.67)A ±0.77	(20.33)A ±1.28	(21.00)A ±1.00	(22.00)A ±1.00	(14.67)B ±1.15	(11.67)B ±1.58
Crystal	(23.67)A ±10.93	(31.00)A ±1.00	(30.67)A ±0.57	(30.67)A ±0.57	(27.00)A ±1.00	(19.00)B ±1.00	(11.67)C ±0.57
Sabah	(30.00)A ±1.00	(27.00)AB±1.0	(26.00)AB±10	(23.00)AB±2.0	(23.33)AB±3.78	(14.33)C ±1.15	(11.33)C ±1.55

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Sesame	(1.33)D ±0.77	(2.00)CD±1.00	(3.33)C ±1.28	(6.33)B ±0.77	(8.00)A ±1.00	(8.33)A ±1.15	(9.00)A ±0.00
Shams	(0.00)B ±0.00	(1.90)B ±5.83	(2.00)B ±1.00	(2.00)B ±1.00	(3.33)B ±0.57	(11.00)A ±1.00	(17.67)A ±7.51

*Specification limit less than (26 Meq / Kg oil)

Effect of storage period on Totox value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Table 5 presented effect of storage period on Totox value which its permissible value is reported to be ≤ 30 Meq / Kg according to Sudanese specification 1995. In case of Abrar oil, the lowest value of Totox was demonstrated at 12 months with value of 140.87 Meq / Kg while the highest values were demonstrated at 8 months storage period with value of 255.53 Meq / Kg. For Groundnut oil, It was found that the Totox value increased with storage period to reach its highest value of 110 Meq / Kg oil at 8 months storage period and then decreased to reach the lowest value at 12 months (46.07 Meq / Kg oil). In case of Crystal oil, the differences were significant between all storage periods at time 0.05 level of significance. Totox value was increased to reach 153.67 Meq / Kg as the highest value at 6 months storage period and then decreased to reach its lowest value of 47.27 Meq / Kg at 12 months. With respect to Sabah oil, there were significant differences in Totox value between 0 time, 10 months and 12 months. Totox value was decreased as storage period increased and reached its lowest value of 51.13 Meq / Kg at 12 months. Considering Sesame Factory oil, there was no significant difference in Totox value between 8 months and 10 months Totox value was increased with time till reach the highest value of 55.47 Meq / Kg oil at 12 month storage period. In case of Shams oil, there were significant differences in Totox value between 0 times and 8 months period, It was found that the Totox value increased as storage period increased and the highest value was recorded at 12 months (56.27 Meq / Kg oil). It can be concluded that the oil should be used immediately after been produced to avoid Totox formation. It can be deduced that as oil Anisidine value increased Totox as shown in case of Abrar.

Table 5: Effect of storage period on Totox value of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Type of oil	*Storage periods of brand oil per months*						
	0day	*2 month*	*4month*	*6month*	*8month*	*10month*	*12month*
Abrar	(175.20)F±7.50	(200.93)D± 1.00	(211.87)C± 1.52	(248.00)B± 1.00	(255.53)A± 0.57	(195.13)D± 1.00	(140.87)G± 7.50
Groundnut	(98.93)BC±1.52	(99.47)BC± 1.15	(102.73)B± 1.15	(104.40)B± 2.08	(110.20)A± 1.15	(79.80)C ±0.58	(46.07)D ±7.50
Crystal	(106.87)E ±2.00	(143.60)C± 1.15	(147.47)B± 2.00	(153.67)A± 0.00	(123.40)D± 7.50	(93.20)F ±5.28	(47.27)G ±7.56
Sabah	(120.60)A ±1.00	(100.30)B± 1.15	(96.20)BC± 1.52	(91.60)C ±1.16	(91.53)C ±1.00	(74.33)D ±1.16	(51.13)E ±2.08
Sesame	(7.73)F ±1.00	(13.40)E ±1.52	(23.33)D ±3.78	(33.73)C ±2.08	(42.60)B ±0.00	(45.33)B ±0.00	(55.47)A ±1.00
Shams	(6.00)D ±1.15	(9.10)C ±1.16	(10.40)C ±1.15	(11.40)C ±5.28	(19.53)B ±1.00	(56.00)A ±5.28	(56.27)A ±1.56

*pecification limit less than (30 Meq / Kg oil)

Effect of storage period on Polymer Content (%) of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Table 6 presented effect of storage period on Polymer Content as %, In case of Abrar oil; there was no significant difference in polymer content between 0 time and 2 months storage period while the differences were found to be significant at 0.05 levels between other storage periods.

Polymer content increased during the period from 0 times to 4 months to record a highest value of 0.80 %, decreased at 6 months to 32.33 % then increased to 77.67 % at 8 months. For Groundnut oil, it was concluded that the lowest polymer content was reported at 0 time and 2 months; therefore, the oil should not be stored more than this period so as to minimize formation of polymers. In case of Crystal oil, the trend of Polymer content was not stable but it reached the highest value of 53.00 % at 8 months storage period and then decreased. Considering Sesame Factory oil, It was concluded that the lowest polymer content was reported at 0 time and 2 months with values of 0%, so, the oil should be stored for 2 months or 4 months as a maximum storage period so as to minimize polymer formation. In case of Shams oil, there were

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no significant differences in polymer content between 0 time and 2 months Polymer content increased with storage period up to 8 months to reach its highest value of 85.67 % and then decreased. It was concluded that the lowest polymer content was reported at 0 time and 2 months with values of 0.26 % and 0.93 %, accordingly, the optimum storage period for such oil must not exceed 2 months. It was concluded that the lowest polymer content was reported at 0 time and 2 months with values of 0.26 % and 0.93 %, accordingly, the optimum storage period for such oil must not exceed 2 months.

Table 6: Effect of storage period on Polymer Content (%) of Brand oils samples were collected from Elobeid Supermarket in North Kordofan State compare with SSMO 1995

Type of oil	*Storage periods of brand oil per months*						
	0day	*2 month*	*4month*	*6month*	*8month*	*10month*	*12month*
Abrar	$(0.24)^{F}$ ±0.02	$(0.53)^{F}$ ±0.28	$(8.00)^{E}$ ±1.0	$(32.33)^{D}$ ±2.00	$(77.67)^{A}$ ±1.5	$(64.33)^{B}$ ±1.52	$(53.00)^{C}$ ±1.00
Groundnut	$(0.00)^{C}$ ±0.00	$(0.00)^{C}$ ±0.00	$(0.30)^{C}$ ±0.1	$(0.30)^{C}$ ±0.10	$(0.43)^{C}$ ±0.07	$(41.00)^{A}$ ±1.00	$(35.00)^{B}$ ±1.00
Crystal	$(0.15)^{E}$ ±0.02	$(0.27)^{E}$ ±0.07	$(0.63)^{E}$ ±0.0	$(18.33)^{C}$ ±1.57	$(53.00)^{A}$ ±0.0	$(22.00)^{B}$ ±1.00	$(6.00)^{D}$ ±1.00
Sabah	$(0.24)^{F}$ ±1.00	$(0.43)^{F}$ ±0.16	$(7.00)^{D}$ ±1.0	$(21.33)^{B}$ ±1.57	$(40.33)^{A}$ ±0.6	$(16.33)^{C}$ ±1.52	$(3.66)^{E}$ ±0.57
Sesame Factory	$(0.00)^{B}$ ±0.00	$(0.00)^{B}$ ±0.00	$(0.13)^{B}$ ±0.0	$(14.33)^{A}$ ±23.9	$(0.67)^{B}$ ±0.07	$(28.33)^{A}$ ±0.57	$(32.67)^{A}$ ±0.54
Shams	$(0.26)^{F}$ ±0.05	$(0.93)^{F}$ ±0.07	$(19.00)^{E}$ ±1.0	$(54.33)^{C}$ ±1.52	$(85.67)^{A}$ ±0.5	$(71.00)^{B}$ ±1.00	$(35.66)^{D}$ ±0.57

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Conclusion and Recommendations

Conclusion

Acid value and free fatty acid content increased as the storage period increased.

Abrar and Sabah oil recorded highest acid values above the permissible level.

Abrar, Crystal and Shams oils were recorded highest values of fatty acid values above the permissible level.

As acid value and free fatty acid content increased, Peroxide value, Anisidine value and Totox value increased for most oils.

Peroxide, Anisidine, Totox and polymer values were fluctuating throughout storage periods, the highest values of Peroxide, Anisidine values, Totox and polymer contents was demonstrated by Abrar.

Recommendations

Refer to Acid value, the maximum storage period for each oil is recommended to be 2 months for Crystal, Sabah oil has to be consumed immediately after been produced, 4 months for Shamsn 12 months for Abrar oil, Groundnut oil, Sesame Factory oil.

With respect to fatty Acid content the maximum storage period for each oil recommended to be 6 months for Sabah oil, Crystal oil should be consumed immediately after production, 4 months for Shams oil.

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