American Journal of Food Technology

ISSN 1557-4571

Academic Journals Inc.

www.academicjournals.com

American Journal of Food Technology 10 (3): 118-126, 2015
ISSN 1557-4571 / DOI: 10.3923/ajft.2015.118.126

Utilization of High Quality Extracted Olive Oil in Manufacture of Modified Butter Blends

[1]Fatma A.M. Hassan, [1]Hayam M. Abbas, [1]Jihan M. Kassem, [2]Nagwa M. Rasmy, [2]M.H. El Kalyoubi and [1]M.F. Al-Okaby
[1]Department of Dairy, National Research Centre, 33-El-Bohos Str., Dokki, Cairo, Egypt
[2]Department of Food Sciences, Faculty Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt

Corresponding Author: Fatma M. Hassan, Department of Dairy, National Research Centre, 33-El-Bohos Str., Dokki, Cairo, Egypt

ABSTRACT

Olive oil (*Olea europaea* L.) which extracted by pressure system from Koroneiki olive fruit variety by using 2% NaCl during malaxation step was used in manufacture of modified butter blends. Different ratios (5, 10, 15 and 20% w/w) olive oil/butter oil were applied to serve 4 treatments (A, B, C and D). The resultant modified butter blends were stored at 5±1°C for 6 weeks and assayed for organoleptic, physical and chemical properties. Obtained results showed that Free Fatty Acids (FFA) contents were increased by increasing oil percent either fresh or during cold storage. Peroxide Value (PV) took the same trend of FFA. On the other hand, Iodine Value (IV) increased by increasing the percent of olive oil and decreased gradually during storage at 5±1°C. Refractive Index (RI) was proportionally decreased by increasing of addition level of olive oil. Oxidative stability was also gradually increased by increasing percentage of oil and decreased during storage. Melting point took the same trend of RI. On the other, obtained data revealed that the modified butter blend made with 10% olive oil was the best treatment and it was acceptable for appearance, consistency and flavor. It gained the highest degrees, when fresh and during cold storage (5±1°C). Statistical analysis showed significant differences between oil percentage and storage period at ($p \leq 0.05$). On the other side, fatty acid profile indicated that palmatic acid (C16:0) as saturated fatty acids and oleic acid (C18:1) as mono unsaturated fatty acids were the most abundant in control and all treatments. SO, it could be concluded that olive oil can be successfully used in preparing modified butter blend with good spreadability and satisfied properties.

Key words: Extracted olive oil, modified butter blends, fatty acids profile

INTRODUCTION

Olive (*Olea europea* L.) is an evergreen tree that has been traditionally cultivated for olive oil and table consumption. Olive tree is also mentioned in Quran. Although olive trees are distributed over all countries; 97% of the world production of olive oil is concentrated in Mediterranean basin countries (Doymaz *et al*., 2004). The increasing popularity of olive oil has been mainly attributed to its one of the natural sources of antioxidants such as vitamin E, carotenoids, aquiline and phenolic compounds, with a high unsaturated/saturated fatty acid ratio. It is claimed to have anti-oxidation and bioactive compounds that have health giving, physiological benefits and reduce the risk of chronic diseases. Dietary ingestion of olive oil has been also reported to have other physiological effects such as lowering serum cholesterol levels, suppressing certain types of cancer,

enhancing liver function and reducing the effects of aging or heart diseases. In addition, the consumption of olive oil is related to the full of LDL-cholesterol and blood pressure, which are associated with the reduction of coronary diseases and age effects (La Lastra *et al*., 2001; Carluccio *et al*., 2007; Chiacchierini *et al*., 2007; Aliakbarian *et al*., 2008). In Da Silva *et al*. (2010) added that the olive oil composition constitutes of 71 g/100 g of mono unsaturated fatty acids; which are beneficial to health and the main active components of olive oil are phenolic acids and mono unsaturated fatty acids. Blending and chemical inter esterification of fat have been used to modify physicochemical and nutritional properties of natural fats. Recently, the use of olive oil as an ingredient in specific products; has been expanding. Olive oil based products are promoted as part of the "Mediterranean diet, which is currently viewed as making a favorable dietary contribution (Ferro-Luzzi *et al*., 1994).

Olive oil and other vegetable oils such as palm oil, corn oil and soybean oil are commonly used in manufacture of some dairy products. Ahmed *et al.* (1979) prepared modified butter by using some vegetable oils. While olive oil was used in manufacture of Tallaga cheese as functional dairy foods (Moussa *et al*., 2008). El-Aziz *et al.* (2013) also investigated the impact of blending butter oil with refined palm oil on some physicochemical properties and oxidative stability of blends. While little work was done to utilize the olive oil in manufacture of butter blends. Fatma (1997) prepared modified butter blends by using different vegetable oils such as corn, sunflower and olive oils.

So, the aim of this work is to investigate the feasibility of utilizing the olive oil, which is laboratorial extracted from Koroneiki olive fruit variety (by using 2% NaCl during malaxation step) to obtain high quality oil and used it in manufacture of functional modified butter blend.

MATERIALS AND METHODS

Materials

- Variety of Koroneiki olive fruit (*Olea europaea* L.) was handpicked during the 2012-13 season in Khatatba, Sadat city, Minufiya Governorate, Egypt and transported in the same day to the laboratory
- Olive oil was extracted by pressure system by using 2% NaCl during malaxation step to obtain high quality olive oil (under publication)
- Skim Milk Powder (SMP), Butter Oil (BO) were obtained from the local market, Cairo, Egypt
- Sodium Carboxy Methyl Cellulose (CMC) as stabilizer was bought from BDH chemicals Ltd Poole, England
- A commercial emulsifier was bought from Pallaasgard 5923 DK-7130 Juelsminde, Denmark

Methods

Preparation of modified butter blend: The mixing process was adapted as described by Newstead *et al.* (1979) as follows:

Reconstituted Skim Milk (RSM) was prepared by adding 200 g skim milk powder slowly to the required quantity of distilled water at 45°C and dissolved to reach a complete hydration after 15 min. Salt and stabilizer was dissolved in a small portion of the RSM and then mixed with the rest. Butter oil was warmed to 40°C. Emulsifier was then added and stirred well. The resultant stirred milk fat was mixed with the salted stabilized RSM; the mixture was stirred again for 15-20 min at 42°C using the moderate rate of stirrer. Through that; the granules structure was

formed and could be visually observed. Moreover, no serum could separate from the resultant recombined butter. Thereafter; the final product was packed in aluminum foil containers and subjected analyses periodically during refrigerated storage (5±1°C) for 6 weeks. Three replicates were done from each treatment.

Composition of control is as follow: Moisture 16.0%, skim milk powder 2.0%, salt 1.5%, emulsifier 0.4%, stabilizer 0.1% and butter oil 80%.

Butter fat was substituted with different ratios of extracted olive oil (5, 10, 15 and 20% w/w butter oil) to serve four treatments A, B, C and D, respectively.

Organoleptic evaluation: Sensory evaluation was carried out using the five point's scale of the International Dairy Federation (IDF., 1987).

Chemical and physical properties evaluation: Free Fatty Acids contents (FFA) (as % oleic acid), Peroxide Value (PV) (meq O_2/kg oil), Refractive Index (RI) at 25°C, iodine value (IV) (g I_2/100 g oil) and Melting Point (MP) C were carried out according to the analytical methods described by AOAC. (2005).

Oxidative stability: The oxidative stability of the samples were estimated as induction period (h) according to the method described by Tsaknis *et al.* (1999) by using a Rancimat Metrohm instrument (Ud.CH-9100 Herisau, Switzeland, Model 679) at 100°C with air at flow rate of 20 L h^{-1}.

Fatty acid profile: Fatty acids methyl-ester of all treatment samples was determined according to AOAC. (2005).

Statistical analysis: Statistical analysis was performed using the GLM procedure with SAS. (2004) software. Analysis of Variance (ANOVA) and Duncan's multiple comparison procedure were used to compare the means. A probability of $p \leq 0.05$ was used to establish statistical significance.

RESULTS AND DISCUSSION

Table 1 reveled the organoleptic properties of modified butter blends with different ratios of olive oil; fresh and during 6 weeks of cold storage (5±1°C). It could be notice that modified butter blend with 10% olive oil was the best ratio and more acceptable for appearance, consistency, flavor and gained the highest degrees when fresh and during cold storage than control and other treatments. Also it could be noticed that, with progress storage; slight decrease for appearance, consistency and flavor in control and all treatments was observed until six weeks.

Statistical analysis of results indicated significant ($p \leq 0.05$) differences between oil percent and storage period for all organoleptic properties. These results are nearly similar to Fatma (1997), who found that 20% of olive oil which obtained from local market gave a compact body and good spreadability for modified butter blend. On the other hand, Ahmed *et al.* (1979) indicated that modified butter with 15% soy oil had a firm and smooth body.

Table 2 illustrates some chemical and physical properties of modified butter blends fresh and during cold storage at 5±1°C including.

Free fatty acids (as oleic acid %): From (Table 2); it was cleared that olive oil (which extracted from Koroneiki olive fruits var. by using 2% NaCl during malaxation step) had highest Free Fatty

Table 1: Organoleptic properties of modified butter blends when fresh and during storage at 5±1°C for 6 weeks

Treatments	Appearance (5)	Consistency (5)	Flavor (5)	Total scores (15)
Zero time				
Control	4.43±1.27^{b}	4.31±1.22^{b}	4.43±1.02^{b}	13.17
A	5.00±1.24^{a}	5.00±1.35^{a}	4.00±1.45^{c}	14.00
B	5.00±1.88^{a}	5.00±1.57^{a}	5.00±1.78^{a}	15.00
C	5.00±1.12^{a}	4.00±1.11^{c}	5.00±1.25^{a}	14.00
D	4.00±2.14^{c}	5.00±1.25^{a}	4.00±1.27^{c}	13.00
After two weeks				
Control	4.00±1.26^{c}	4.00±1.28^{c}	4.00±1.66^{c}	12.00
A	4.57±2.12^{b}	4.12±1.37^{b}	4.21±1.24^{b}	12.90
B	5.00±2.15^{a}	4.57±1.88^{a}	4.36±2.45^{a}	13.93
C	4.71±2.27^{b}	4.57±1.29^{a}	4.57±2.36^{a}	13.85
D	4.55±1.45^{b}	4.30±2.88^{b}	4.00±2.46^{a}	12.85
After four weeks				
Control	4.00±1.24^{c}	3.80±2.14^{b}	4.00±1.57^{b}	11.80
A	4.05±1.47^{c}	4.00±2.18^{a}	4.50±1.68^{a}	12.55
B	4.43±2.28^{b}	4.57±1.97^{a}	4.43±2.84^{a}	13.43
C	4.41±1.38^{a}	4.00±2.06^{a}	4.55±2.08^{a}	12.96
D	4.00±2.97^{c}	4.33±1.67^{b}	4.00±1.15^{b}	12.33
After six weeks				
Control	4.00±1.47^{c}	3.71±2.15^{d}	4.00±2.38^{b}	11.71
A	4.00±1.27^{c}	4.00±2.78^{c}	4.00±1.99^{c}	12.00
B	4.71±1.35^{a}	4.00±1.68^{c}	4.00±2.49^{b}	12.71
C	4.30±1.95^{b}	4.00±1.24^{b}	4.00±2.17^{b}	12.30
D	4.07±2.14^{c}	3.81±2.47^{b}	4.00±1.96^{b}	11.88

A: 5% olive oil, B: 10% olive oil, C: 15% olive oil and D: 20% olive oil. Means within a column followed by the same letter are not significantly different ($p \leq 0.05$)

Table 2: Chemical and physical properties of modified butter blends when fresh and during cold storage at 5±1°C for 6 weeks

Samples	FFA (as Oleic acid%)	PV (meq O_2/kg oil)	Iodine value (gI_2/100 g oil)	R.I (at 25°C)	Oxidative stability (h)	Melting point (°C)
Zero time						
Olive oil	0.66±0.02	9.48±0.09	80.77±1.21	1.4670±0.01	31.15±1.12	0.90±0.22
Butter oil	0.21±0.03	0.53±0.08	30.83±1.35	1.4612±0.02	16.30±1.20	34.90±0.12
Control	0.18±0.12^{a}	1.00±0.41^{a}	33.74±1.12^{a}	1.4616±0.04^{a}	16.16±1.04^{c}	35.10±0.09^{b}
A	0.20±0.14^{a}	1.62±0.16^{a}	35.51±0.85^{a}	1.4618±0.01^{a}	17.85±0.95^{b}	34.10±0.06^{b}
B	0.22±0.06^{a}	1.79±0.17^{a}	38.46±1.10^{a}	1.4621±0.08^{a}	18.98±1.12^{a}	33.20±0.14^{a}
C	0.25±0.08^{b}	2.42±0.12^{b}	40.98±1.47^{b}	1.4624±0.04^{b}	19.85±0.88^{a}	32.95±0.02^{a}
D	0.31±0.18^{c}	2.49±0.10^{b}	45.94±1.16^{b}	1.4630±0.09^{b}	20.23±1.21^{a}	32.60±0.08^{a}
After two weeks						
Control	0.20±0.06^{a}	1.25±0.52^{a}	33.12±1.40^{a}	1.4615±0.02^{a}	16.00±1.45^{c}	34.89±0.07^{b}
A	0.22±0.14^{a}	1.78±0.24^{a}	34.92±1.04^{a}	1.4617±0.06^{a}	17.21±1.50^{b}	33.90±0.14^{a}
B	0.26±0.12^{b}	1.85±0.72^{a}	37.85±1.07^{a}	1.4621±0.04^{a}	18.12±1.24^{b}	33.20±0.22^{a}
C	0.28±0.08^{b}	2.52±0.14^{b}	40.12±1.24^{b}	1.4623±0.06^{a}	19.15±1.35^{a}	32.90±0.24^{a}
D	0.32±0.16^{c}	2.68±0.54^{b}	45.65±0.99^{b}	1.4629±0.08^{b}	20.00±1.57^{a}	32.50±0.21^{a}
After four weeks						
Control	0.24±0.12^{a}	1.42±0.21^{a}	32.72±1.11^{a}	1.4614±0.06^{a}	15.89±1.14^{c}	34.90±0.21^{b}
A	0.25±0.09^{a}	2.12±0.22^{b}	33.26±1.06^{a}	1.4616±0.04^{a}	16.93±1.22^{b}	33.80±0.26^{b}
B	0.27±0.03^{b}	2.15±0.14^{b}	37.16±0.25^{b}	1.4620±0.08^{b}	17.78±1.18^{b}	33.10±0.18^{a}
C	0.30±0.06^{c}	2.69±0.18^{b}	39.65±1.52^{b}	1.4622±0.09^{b}	18.92±1.24^{a}	32.90±0.19^{a}
D	0.33±0.06^{c}	3.21±0.26^{c}	44.78±1.38^{c}	1.4628±0.06^{c}	19.10±1.58^{a}	32.45±0.18^{a}
After six weeks						
Control	0.27±0.09^{a}	1.57±0.12^{a}	32.15±1.24^{a}	1.4614±0.82^{a}	15.25±1.88^{c}	34.90±0.14^{c}
A	0.28±0.08^{a}	2.19±0.24^{b}	32.68±1.44^{a}	1.4615±0.05^{a}	16.74±1.27^{b}	33.60±0.18^{b}
B	0.28±0.05^{a}	2.31±0.24^{b}	36.70±1.27^{b}	1.4620±0.08^{b}	17.22±1.54^{b}	33.00±0.32^{a}
C	0.32±0.11^{b}	2.79±0.18^{b}	38.98±0.99^{b}	1.4622±0.18^{b}	18.26±1.26^{a}	32.85±0.09^{a}
D	0.35±0.08^{b}	3.71±0.42^{c}	43.95±1.28^{c}	1.4628±0.27^{c}	19.15±1.89^{a}	32.40±1.17^{a}

A: 5% olive oil, B: 10% olive oil, C: 15% olive oil and D: 20% olive oil. Means within a column followed by the same letter are not significantly different ($p \leq 0.05$)

Acids (FFA) than butter oil, control and other treatments. Control had lower FFA than other treatments. Whereas, FFA increased by increasing the olive oil percentage fresh and during cold

storage at 5±1°C until 6 weeks. Statistical analysis of results indicated significant difference between oil percent and storage period at ($p \leq 0.05$). Similar observations were reported by Shahin *et al*. (1988), Abd-El Gawad (1992) and Fatma (1997).

Peroxide value (meq O_2/kg oil): From the same Table 2; it could be seen that olive oil had higher PV than butter oil, control and other treatments. On the other hand, control had lower PV than other treatments. Increasing the percentage of oil led to increasing the PV fresh and during cold storage at 5±1°C until 6 weeks. Statistical analysis showed a significant difference between oil percent and storage period at ($p \leq 0.05$). These results are in agreement with Sayed *et al.* (1992), Fatma (1997) and El-Aziz *et al.* (2013).

Iodine value (gI_2/100 g oil): Iodine value is an important parameter for determining degree of hardness, since high iodine values indicate high content of unsaturation fatty acid components, which contribute to the softness in butter fat (Zaidul *et al*., 2007). From Table 2; it could be observed that olive oil had higher iodine value than butter oil or control and other treatments. Control had the lower iodine value than other treatments. It was increased by increasing the percentage of olive oil. With progress of storage, iodine value gradually decreased until six weeks in control and other treatments, this may be due to degree of unsaturation, which reduced to a minimal level and conversion of unsaturated fatty to saturated fatty acids occurred (Dhurvey *et al*., 2012). Statistical analysis indicated significant differences ($p \leq 0.05$) between oil percent and storage period. These results are in agreement with that obtained by El-Aziz *et al.* (2013).

Refractive index: From Table 2; it could be noticed that RI values of extracted olive oil was the highest compared to butter oil, control and other treatments. There were slightly decreases in their values in the treatments during storage at (5±1°C) until six weeks. The decrease of the refractive index was proportionally to the addition level of olive oil. The decrease in RI may be due to the hydrolysis of glyceroides to free fatty acids during storage at refrigerator (Swern, 1982). Statistical analysis showed no significant difference between oil percent and storage period at ($p \leq 0.05$). The refractive index of fats and oils may be correlated with fatty acids content, free fatty acids content, saturation degree and oxidative state (Fatouh *et al*., 2005). Several researches were made on the refractive index of butter oil blended with palm oil (Ozkanli and Kaya, 2007) and (Samet-Bali *et al*., 2009).

Oxidative stability (h): Table 2 reflected the oxidative stability (h) for olive oil, butter oil and all other treatments. It was cleared that olive oil had higher stability (h) than control and other treatments. Also, oxidative stability increased gradually by increasing percentage of oil whereas, the progress of storage led to decrease the oxidative stability (h). Statistical analysis showed significant differences between oil percent and storage period at ($p \leq 0.05$). Ramadan and Wahdan (2012) found that oxidative stability of blends (coriander or black cumin with corn oil) were better than corn oil. El-Aziz *et al.* (2013) reported that higher stability of Refined Palm Oil (RPO) than Butter Oil (BO) could be attributed to that RPO had high natural antioxidants, carotenoids, phenolic compounds and sterols which increased in BO with the addition of RPO.

Melting point (°C): Table 2 reflected the melting point (°C) of modified butter blends fresh and during cold storage. Control had higher melting point than butter oil and other treatments. Increasing the percentage of oil led to decrease melting point. On the other hand, melting point was

decreased with progress of storage until six weeks for control and all treatments. Statistical analysis indicated significant differences between oil percent and storage period for melting point (°C) at $p \leq 0.05$. El Hadad (2013) found that the increase of melting point of butter oil with palm oil could be attributed to the increase in solid fat content of palm oil as compared to butter oil. Soares *et al.* (2009) reported that melting point depends on the solid to liquid phase transition of triglycerols which are already present in greater amounts in palm oil.

Fatty acid profiles: Table 3 showed the fatty acids profile of fresh modified butter blends as well as butter oil and control. It was cleared that palmatic acid (C16:0) as saturated fatty acids and oleic acid (C18:1) as unsaturated fatty acids were the most abundant in control and all treatments. Control had the highest content of palmatic acid followed by treatment (A) finally treatment (D), C18:1 and C18:2 were the highest content in treatment (D) followed by treatment (C).

Also it could be noticed that the content of Linoleic acid (C18:2) was the lowest in control compared to other treatments. These results were in agreement with Ortiz *et al.* (2006), Samet-Bali *et al.* (2009), Abdul Aziz *et al.* (2011) and El-Aziz *et al.* (2013). From the same table it could be seen that addition of olive oil to prepared modified butter blend led to decrease the saturated fatty acids and increased the unsaturated fatty acids by a ratio related to the concentration of the added olive oil. El-Aziz *et al.* (2013) found that total saturated fatty acids decreased, while oleic acid and linoleic acid as unsaturated fatty acids increased by increasing the proportion of refined palm oil in butter oil.

Table 4 illustrated fatty acids profile of modified butter blends after storage at 5±1°C for 6 weeks. Palmatic acid (C16:0) was slightly decreased during storage when compared to fresh samples for control and other treatments. This may be due to the hydrolysis of fatty acids during storage. Also, it could be seen that control had the highest palmatic acid content compared to other treatments. Increasing the concentration or ratio of olive oil in the treatments led to decrease saturated fatty acids (C16:0, C18:0) and increase the unsaturated (C18:1, C18:2). These results are in agreement with El-Aziz *et al.* (2013). In Turkey Alpaslan and Karaali (1998) blended refined

Table 3: Fatty acids profile of fresh modified butter blends

			Treatments			
Fatty acids	Butter oil	Control	A	B	C	D
C6:0	0.164	0.02	0.04	1.31	1.05	0.09
C8:0	0.621	0.15	0.40	1.17	0.99	0.45
C10:0	2.470	1.48	2.97	3.38	3.12	2.02
C12:0	4.190	3.70	4.28	4.11	3.84	3.36
C14:0	11.860	12.03	11.59	10.72	9.99	9.11
C15:0	1.940	1.98	1.70	1.54	1.47	1.53
C15:1	1.320	1.36	1.26	1.15	1.08	1.00
C16:0	31.760	32.82	28.69	26.92	25.94	26.85
C16:1	3.002	2.87	2.72	2.52	2.41	2.39
C17:0	0.950	0.94	0.67	0.67	0.62	0.61
C17:1	0.380	0.38	0.38	0.36	0.36	0.30
C18:0	11.240	11.52	10.64	9.59	9.17	8.48
C18:1	24.530	25.35	29.00	30.54	33.56	36.57
C18:2	1.990	2.37	2.68	3.10	3.69	4.47
C18:3	2.820	2.23	2.16	2.05	1.91	1.89
C20:0	0.290	0.32	0.32	0.32	0.31	0.36
C20:1	0.340	0.30	0.27	0.27	0.27	0.36
C22:0	0.010	0.05	0.11	0.20	0.12	0.09
C24:0	0.100	0.09	0.09	0.08	0.07	0.07

A: 5% olive oil, B: 10% olive oil, C: 15% olive oil and D: 20% olive oil

Table 4: Fatty acids profile of modified butter blends after six weeks of storage at 5°C±1

		Treatments			
Fatty acids	Control	A	B	C	D
C6:0	0.01	0.32	0.94	0.84	0.06
C8:0	0.23	0.88	0.99	0.86	0.23
C10:0	1.79	3.40	3.11	2.78	1.36
C12:0	3.87	4.33	3.88	3.52	2.80
C14:0	11.85	11.41	10.47	9.59	8.56
C15:0	1.95	1.74	1.54	1.43	1.39
C15:1	1.33	1.22	1.16	1.07	0.96
C16:0	32.28	28.63	26.91	25.85	27.30
C16:1	2.85	2.89	2.55	2.46	1.89
C17:0	0.90	0.63	0.71	0.63	0.69
C17:1	0.36	0.37	0.38	0.36	0.28
C18:0	11.51	10.60	9.93	9.25	9.20
C18:1	25.18	27.90	31.48	34.38	37.14
C18:2	2.62	2.36	3.11	3.68	4.79
C18:3	2.26	2.12	2.11	2.05	1.95
C20:0	0.38	0.26	0.29	0.36	0.41
C20:1	0.41	0.23	0.30	0.32	0.40
C22:0	0.10	0.66	0.02	0.48	0.11
C24:0	0.10	0.00	0.08	0.08	0.07

A: 5% olive oil, B: 10% olive oil, C: 15% olive oil, D: 20% olive oil

olive oil with Partially Hydrogenated Palm Oil (PHPO) of varying proportions and were subjected to both chemical and enzymatic inter-esterification. They reported that the 30:70 olive oil-PHPO blend (after enzymatic inter-esterification) have similar properties to Turkish package margarine with the additional advantages of processing higher amounts of mono unsaturated fatty acids. On the other side; El-Aziz *et al.* (2012) mentioned that blending of butter oil with refined palm oil led to increase the levels of unsaturated fatty acids, bioactive lipids and natural antioxidant, which improve the nutritional quality and oxidative stability of the blends.

CONCLUSION

Modified butter blend could be prepared by using 10% of olive oil (which extracted from Koroneiki olive fruit variety by using 2% NaCl during malaxation step). The resultant modified butter had gained a higher score for appearance, consistency and flavor than other treatments. Blending butter oil with olive oil led to increase the level of unsaturated fatty acids and decreased saturated fatty acids. On the other hand, using olive oil in preparing of modified butter blend results in produced functional product with satisfied properties.

REFERENCES

AOAC., 2005. Official Method of Analysis. 18th Edn., Association of Official Analytical Chemists, Arlington, Virginia, USA.

Abd-El Gawad, M.A.M., 1992. Studies on production of recombined butter. M.Sc. Thesis, Ain Shams University, Egypt.

Abdul Aziz, A., Y. Mohamud, K. Roselina, H.C. Boo, L.C. Nyuk and Y.B.C. Man, 2011. Rheological, chemical and Dse thermal characteristics of different types of palm oil/palm stearin based shortening. Int. Food. Res. J., 18: 189-200.

Ahmed, N.S., F.R. Helal and A.A. EL-Nimr, 1979. Modified butter containing vegetable oils. Milchwissenschaft, 34: 218-219.

Aliakbarian, B., D. de Faveri, A. Converti and P. Perego, 2008. Optimisation of olive oil extraction by means of enzyme processing aids using response surface methodology. Biochem. Eng. J., 42: 34-40.

Alpaslan, M. and A. Karaali, 1998. The interesterification-induced changes in olive and palm oil blends. Food Chem., 61: 301-305.

Carluccio, M.A., M. Massaro, E. Scoditti and R. de Caterina, 2007. Vasculoprotective potential of olive oil components. Mol. Nutr. Food Res., 51: 1225-1234.

Chiacchierini, E., G. Mele, D. Restuccia and G. Vinci, 2007. Impact evaluation of innovative and sustainable extraction technologies on olive oil quality. Trends Food Sci. Technol., 18: 299-305.

Da Silva, R.C., D.F. Soares, M.B. Lourenco, F.A. Soares, K.G. Da Silva, M.I.A. Goncalves and L.A. Gioielli, 2010. Structured lipids obtained by chemical interesterification of olive oil and palm stearin. LWT-Food Sci. Technol., 43: 752-758.

Dhurvey, Y.R., P.S. Kawtikwar and D.M. Sakarkar, 2012. Evaluation of physicochemical properties of cow ghee before and after hydrogenation. Int. J. Chem. Technol. Res., 4: 185-189.

Doymaz, I., O. Gorel and N.A. Akgun, 2004. Drying characteristics of the solid by-product of olive oil extraction. Biosyst. Eng., 88: 213-219.

El Hadad, S.S.G., 2013. Comparative study between advanced and traditional methods for detection of milk fat deterioration and adulteration. M.Sc. Thesis, Ain Shams University, Egypt.

El-Aziz, M.A., S.M. Kholif and T.A. Morsy, 2012. Buffalo's milk composition and its fat properties as affected by feeding diet supplemented with flaxseed or fibrolytic enzymes in early lactation. J. Life Sci., 4: 19-25.

El-Aziz, M.A., G.A. Mahran, A.A. Asker, A.F. Sayed and S.S. El-Hadad, 2013. Blending of butter oil with refined palm oil: Impact on physicochemical properties and oxidative stability. Int.J. Dairy Sci., 8: 36-47.

Fatma, A.M.H., 1997. Modified butter blend. Ann. Agric. Sci. Moshtohor., 35: 311-323.

Fatouh, A.E., R.K. Singh, P.E. Koehler, G.A. Mahran and A.E. Metwally, 2005. Physical, chemical and stability properties of buffalo butter oil fractions obtained by multi-step dry fractionation. Food Chem., 89: 243-252.

Ferro-Luzzi, A., E. Cialfa, C. Leclercq and E. Toti, 1994. The Mediterranean diet revisited. Focus on fruit and vegetables. Int. J. Food Sci. Nutr., 45: 291-300.

IDF., 1987. International dairy federation. Sensory evaluation of dairy products, 99A.

La Lastra, C., M.D. Barranco, V. Motilva and J.M. Herrerias, 2001. Mediterrranean diet and health biological importance of olive oil. Curr. Pharm. Des., 7: 933-950.

Moussa, M.A.M., F.A. Abd EL-Malek, H.M.H. Hassaan and A.A. EL-Ghandour, 2008. Utilization of olive oil in making soft cheese as a functional dairy food. Egyptian J. Applied Sci., 23: 215-224.

Newstead, D.F., A. Goldmann and J.G. Zadow, 1979. In monograph on recombination of milk and milk products. Document No. 116, International Dairy Federation, Brussels, pp: 7-13.

Ortiz, C.L., M.P. Moya and V.B. Navarro, 2006. A rapid chromatographic method for simultaneous determination of ß-sitosterol and tocopherol homologues in vegetable oils. J. Food Compos. Anal., 19: 141-149.

Ozkanli, O. and A. Kaya, 2007. Storage stability of butter oils produced from sheep's non-pasteurized and pasteurized milk. Food Chem., 100: 1026-1031.

Ramadan, M.F. and K.M.M. Wahdan, 2012. Blending of corn oil with black cumin (*Nigella sativa*) and coriander (*Coriandrum sativum*) seed oils: Impact on functionality, stability and radical scavenging activity. Food Chem., 132: 873-879.

SAS., 2004. Statistical Analysis System. SAS Institute Inc., Cary NC., USA.

Samet-Bali, O., M.A. Ayadi and H. Attia, 2009. Traditional Tunisian butter: Physicochemical and microbial characteristics and storage stability of the oil fraction. LWT-Food Sci. Technol., 42: 899-905.

Sayed, A.F., N.S. Ahmed and A.E. Fayed, 1992. Production of aromatic recombined butter by using different milk solids not fat ingredients. Egypt. Food Sci., 20: 233-244.

Shahin, Y., M. Hofi and A.E. Fayed, 1988. Detection of Domiatic cheese adulteration with palm oil. Assiut. J. Agric. Sci., 19: 167-172.

Soares, F.A.S.D.M., R.C. da Silva, K.C.G. da Silva, M.B. Lourenco, D.F. Soares and L.A. Gioielli, 2009. Effects of chemical interesterification on physicochemical properties of blends of palm stearin and palm olein. Food Res. Int., 42: 1287-1294.

Swern, 1982. Bailey's Industrial Oil and Fat Products. 4th Edn., Vol. 11, John Willey & Sons Publisher, New York, USA., Pages: 456.

Tsaknis, J., S. Lalas, V. Gergis, V. Dourtoglou and V. Spiliotis, 1999. Characterization of *Moringa oleifera* variety mbololo seed oil of Kenya. J. Agric. Food Chem., 47: 4495-4499.

Zaidul, I.S.M., N.A.N. Norulaini, A.K.M. Omar and R.L. Smith Jr., 2007. Blending of supercritical carbon dioxide (SC-CO_2) extracted palm kernel oil fractions and palm oil to obtain cocoa butter replacers. J. Food Eng., 78: 1397-1409.