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EFFECT OF BLENDING PROCESS ON PHYSICO-CHEMICAL PROPERTIES OF LOCAL AND IMPORTED COW BUTTER FATS WITH PALM OIL AND PALM STEARIN BLENDS

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ABSTRACT

This research aims to study the effect of blending animal fats (local or imported cow butter fats) with vegetable oils (palm oil or palm stearin) in different percents (at various ratios from 10 to 90%) on the physical and chemical properties of different blends produced. This study includes the determination of physico-chemical characteristics such as refractive index, melting point, slip point, acid value, peroxide value, iodine value, oxidative stability by rancimat at 120°C, conjugated diene and triene fatty acids, reichart-meissl value, polenske value and the solid fats content. The obtained results indicated that the blending of 10 to 90 % of palm stearin with either local or imported cow butter fats led to clear a progressively increase in both melting point and slip point. However, the same behavior was also observed concerning the oxidative stability (induction period hr). The reichert- meissl and polenske value were higher as 35 and 18.0 times in local or imported cow butter fats more than that found in palm oil or palm stearin, respectively. Reichert-meissel and polenske values were significantly decreased as the blending ratio increase from 10 to 90 % of both palm oil and palm stearin with either local or imported cow butter fats. In addition, the solid fat content of both palm oil and palm stearin was found to be higher than that found in either local or imported cow butter fats, especially at 30 and 40°C. The same behavior was also observed concerning to the solid fat content of all binary mixtures. It could be concluded that the type of

fats and oils of any blend produced having unknown animal fat or vegetable oils on its label information having no label information data regarding the percents animal fat or vegetable oil used in the produced blend, and useful to detect adulteration in milk fat.

Key words: Blending, cow butter fat, palm oil, palm stearin, solid fat content, physico-chemical prosperities.

INTRODUCTION

Blending has been long used to modify oils and fats into functional products. It modifies the physical properties of oils by rearranging the distribution of fatty acids on the glycerol without changing their chemical composition. Blending has become more popular for the preparation of zero trans functional blended fats (Norizzah *et al*., 2004).

Milk fat is composed of 98 % triacylglycerols which are triesters of fatty acids and glycerol. More than 400 fatty acids and 200 triacylglycerols have been identified (Lopez *et al*., 2006). Undoubtedly, it is one of the most complex fats found in nature. Milk fat is characterized by short – chain (C_4 – C_8: 8.3 %), medium chain (C_{10} –C_{12}: 6.6%) and long chain (C_{14} – C_{18} 81.9 %) length fatty acids (Jensen and Newburg, 1995). Moreover, milk fat is a relatively high saturated fat: about 65% saturated fatty acids (mainly $C_{16:0}$, $C_{18:0}$, $C_{14:0}$). The chemical composition of milk fat varies greatly with the season breed, stage of lactation and the type of feed (Walstra and Jenness, 1984).

Palm oil and palm stearin have a high content of palmitic acid (saturated fatty acids), but they are free of cholesterol (May et al, 2005 and Piska et al, 2005).

The blending of milk fat with vegetable oils has been used to increase the cow butter fat flavor of vegetable oils and also to change the physical and chemical properties of milk fat, for example, milk fat alone does not have the appropriate plasticity and hardness for use in pastries (Dimick *et al*., 1996), but blending milk fat with vegetable oils results in a significant alteration of the physical and chemical properties of milk fat, so that the produced fat blends can be used in the processing of confectionary, pastry, baking and other applications (Shen *et al*., 2001 and Hashem *et al*., 2007).

The aim of the present study can be summarized as follows:

1- To produce new products with different fats and oil contents ranging from 10% up to 90%, which can meet all requirements and wishes of the consumers.
2- To study the effect of blending animal fats with vegetable fats in different percentages on the physical and chemical of different blends produced.
3- To determine the type of fats and oils of any blend produced having unknown animal fat or vegetable oils on its label information having no label information data regarding the percentage animal fat or vegetable oil used in the produced blend.

MATERIALS AND METHODS

Materials:

Palm oil and palm stearin: Refined, bleached and deodorized palm oil and palm stearin used in the present study were obtained from the Extracted Oils and Derivatives Company, Arma Company.10th of Ramadan City Egypt. The fats and oils were immediately analyzed and stored under frozen conditions at - 18˚C till to use.

Imported *cow butter fat:* imported cow butter fat used in the present study was obtained from Greenland. Company. 10th of Ramadan City Egypt. Final product of cow butter fat samples obtained were immediately analyzed and stored under frozen condition at - 18 ˚C till use.

Local *cow butter fat:* Cow milk fat was obtained from local butter cream by removal practically all the water and solids not fat content. Anhydrous milk fat was processed according to Walstra et al., (2006). Butter milk fat samples obtained were immediately analyzed and stored under frozen condition at - 18˚C till analysis.

Chemical: Hexane, chloroform, ethyl alcohols and acetic acid glacial were analytical grade were purchased from. Nasr Company Cairo, Egypt. The chemical were distilled before use.

***Blending process*:** Animal fats **(**local or imported cow butter fats) and vegetable oils (palm oil or palm stearin) were melted at 60 ˚C in a water bath prior to use. The liquefied fats and oils used were mixed in proportions ranging from 90 % to 10 % (w/w). Blended in different

ratios of fats and oil as indicated in Table 1, 2. All fats and oils used were individually melted, filtered before blending treatments.

Table (1) Blending of both local and imported cow butter fats with palm oil used.

Fat and oil blends produced					
Type. of blended samples	**Imported cow butter fat and palm oil blends**		**NO. of blended samples**	**Local cow butter fat and palm oil blends**	
	Imported cow butter fat (%)	**Palm oil (%)**		**Local cow butter fat (%)**	**Palm oil (%)**
A1*	100.00	00.00	B1*	100.00	00.00
A2**	00.00	100.00	B2**	00.00	100.00
A3	90.00	10.00	B3	90.00	10.00
A4	80.00	20.00	B4	80.00	20.00
A5	70.00	30.00	B5	70.00	30.00
A6	60.00	40.00	B6	60.00	40.00
A7	50.00	50.00	B7	50.00	50.00
A8	40.00	60.00	B8	40.00	60.00
A9	30.00	70.00	B9	30.00	70.00
A10	20.00	80.00	B10	20.00	80.00
A11	10.00	90.00	B11	10.00	90.00

A1* pure Imported cow butter fat, B1* pure Local cow butter fat, A2** and B2** pure palm oil

Table (2) Blending of both local and imported cow butter fats with palm stearin used.

Fat and oil blends produced					
Type . of blended samples	Imported cow butter fat and palm stearin blends		NO. of blended sample	Local cow butter fat and palm stearin blends	
	Imported cow butter fat (%)	Palm stearin (%)		Local cow butter fat (%)	Palm stearin (%)
C1*	100.00	00.00	D1*	100.00	00.00
C2**	00.00	100.00	D2**	00.00	100.00
C3	90.00	10.00	D3	90.00	10.00
C4	80.00	20.00	D4	80.00	20.00
C5	70.00	30.00	D5	70.00	30.00
C6	60.00	40.00	D6	60.00	40.00
C7	50.00	50.00	D7	50.00	50.00
C8	40.00	60.00	D8	40.00	60.00
C9	30.00	70.00	D9	30.00	70.00
C10	20.00	80.00	D10	20.00	80.00
C11	10.00	90.00	D11	10.00	90.00

C1*pure Imported cow butter fat, D1* pure Local cow butter fat, C2** and D2** pure palm stearin

Analytical methods:

Determination of physico – chemical characteristics of fats and oils used and their blends.

1- Physical properties:

Refractive index was determined by using a carlzeiss refractometer at 40˚C for imported and local cow butter fats, palm oil and 60˚C for palm stearin specific gravity was determined at 40˚C for imported and local cow butter fats, palm oil and 60˚C for palm stearin

by using a pycnometer 20 ml, melting and slip point were determined by using capillary tubes. And colour was determined by a Lovibond tintometer using three colour scals (yellow, red and blue) in 5.25 inch cell. These analytical methods were carried out according to the methods described by A.O.A.C (2005).

2- Chemical properties:

a- Free fatty acid (F.F.A) (as % Oleic acid); Peroxide value (meq. active O_2/kg); Iodine value (measured according to the procedure of Hannus method) ; TBA value (as mg malonaldehyde/kg) and unsabonfable matter (%) were determined according to the procedure of A.O.A.C (2005).

b- Reichert-meissel and polenske number:

Reichert-meissel, it is the number of milliliters of 0.1 N KOH required to neutralise the soluble volatile fatty acids derived from 5 grams of fat. Polenske number it is the number of milliliters of 0.1 N KOH required to neutralise the in soluble volatile fatty acids derived from 5 grams of fat.

The reichrt-meissel and polenske number measures the quantity of short chain fatty acids in the fat molecule, according to the method described by firestone (2005 n).

c- Determination of conjugated dienoic and trienoic fatty acids:

The conjugated dienoic and trienoic fatty acids were the tested samples were measured at 232 and 268 nm for dienoic and trienoic fatty acid, respectively. The obtained results were calculated as the procedure in A.O.A.C (2005).

d- Solid fat content:

The solid fat content (SFC) of the tested samples was determined by Nuclear Magnetic Resonance (NMR) using a Bruker Minispec Analyzer (Model NO.120, Rheirs tetten, Germany) according to the A.O.A.C (2005). The tested samples were measured at 10, 20, 30 and 40˚C.

e- Determination of minerals content:

Iron (Fe), Copper (CU), Lead (Pb), and Magnesium (Mg) were determined according to the method of A.O.A.C (2005), using Atomic Absorption spectrophotometer (Perkin Elmer, Model 3300, Germany).

F- Measurement of induction period by Rancimat (stability test):

The Rancimat induction period measurements are carried out on fats and oils in order to provide a quick indication of the trends in resistance to the oxidative rancidity as well as of the shelf-life of oils. The induction periods, as the oxidative stability index, of the tested samples were measured by an automated Rancimat (Metrohm Ltd. CH-9100 Herisau, Switzeland, model 679), comprises of the control unit and the wet section containing 6 reaction vessels, according to the method described by Mendez et al, (1996).

Three replicates of all analysis were performed for each sample.

Statistical analysis:

Statistical analysis involved used the statistical analysis systems (SAS, 1985) software package. Analysis of variance performed by ANOVA procedures. Significant differences between means were determined using Duncan s multiple rang testes (SAS, 1985).

RESULTS AND DISCUSSION

- Physico-chemical properties of cow butter fat, cow milk fat, palm oil and palm stearin

1- Physical properties

There are many physical characteristics of the edible fats and oils such as specific gravity, refractive index, melting point, slip point and colour, which are played an important role in assessing their quality and palatability, as well as the consumer acceptability of these products. The physical characteristics of fat or oil are dependent on the degree of unsaturation, the carbon chain length, the isomeric fatty acid forms, and molecular configuration (Zaidul *et al.,* 2007).

The physical quality characteristics of local and imported cow butter fats were determined, in comparison with the corresponding characteristics of palm oil and palm stearin, as shown in Table (3). From the obtained data, it could be observed that the specific gravity at 40-60 ℃ of both imported cow butter fat and local cow butter fat were found to be as 0.8411 and 0.8511, respectively, which were relatively higher than those found in both palm oil and palm stearin which were found to be as 0.8010 and 0.8231 respectively. These results are in agreement with the data obtained by (Bora *et al.,* 2002).

Regarding the refractive index at 40-60 ℃ for imported cow butter fat and local cow butter fat, it was 1.4591 and 1.4578, versus 1.4556 and 1.4599 for palm oil and palm stearin, respectively these results found to be agreement with those found by (Hui, 1996)

On the other hand, melting point and slip point in palm stearin were more higher as1.5 (53.5 and 52) respectively than that found in both imported cow butter fat and local cow butter fat, which recorded a values of 33.5 and 32.0 and 35.2 and 33.7 ˚C respectively in palm oil. The melting point and slip point of palm oil, palm stearin and imported and local cow butter fats were also investigated by Reshma *et al.,* (2007), Soares *et al.,* (2009) and Berger (1996). Their results were relatively comparable with the present data.

Concerning the colour intensity, lower red unit value (2.0) was recorded in palm oil while its value ranged between 3.0 to 3.2 in the other investigated samples (imported and local cow butter fats) in the red lovibond scale. In all tested samples, the yellow scale is fixed at 35.

2- Chemical properties

The chemical characteristics of edible fats and oils are play an important role in assessing their quality assurance, palatability and consumer acceptability, as well as they are related with the healthy safe quality criteria of these fats and oils by using them. Thereupon, the chemical quality assurance criteria, including the acidity (free fatty acid %), peroxide value, thiobarbituric acid (TBA) value, iodine value, unsaponifable matter %, oxidative stability (Induction period by Rancemat), conjugated diene and triene fatty acid, reichart-meissel and polenske values for imported cow butter fat, local cow butter fat, palm oil and palm stearin were determined.

As illustrated in the obtained results of Table (3), it could be indicated that the free fatty acid % (as oleic acid), peroxide value (meq. active O2/Kg oil) and thiobarbituric acid (TBA) value (mg malonaldehyde/ Kg oil) were found in the range 0.059 to 1.40 %, 0.05 to 1.06 (meq/Kg) and 0.011 to 0.022 (mg/Kg) in all tested samples, respectively. The present results are found to be much greatly lower than the maximum values (with in the permissible values) for human consumption as reported by the Egyptain Standard specifications (2005) for edible fats and oils.

Iodine value is useful determining degree of hardness, since high iodine value indicate high content of unsaturated fatty acid

components which contribute to the softness in butter fat. (Chaiseri and Dimick, 1989).

Concerning the iodine value, palm oil had higher value being which was found to be as 48.7 than those obtained from the other tested samples.

Reichert meissl and polenske value: The reichert meissl value is a measure of the amount of soluble volatile fatty acid and is a classical way to detect adulteration in milk fat. The polenske value is a measure of the amount of insoluble volatile fatty acid and is useful to detect coconut and related oils with intermediate chain fatty acids. While, the reichert-meissel and polenske value can be used to detect vegetable oil adulteration of milk products (Sheppard *et al.,* 1985).

From the same table, it could be also observed that the reichert-meissl and polenske value were higher as 35 and 18.0 times in imported cow butter fat and local cow butter fat more than that found in palm oil and palm stearin respectively. These results are in agreement with the data oblained by (Murthy and Dastur, 1955) they reported that the imported and local cow butter fats contains high proportions of volatile fatty acids, whereas vegetable oils and other animal fats contain very little or no volatile fatty acids.

The induction period (IP) measured by Rancimat at 120°C, as a measure for the oxidative stability of fats and oils is also illustrated in the obtained results of the former table, it could be noticed that IP of palm stearin was obvious higher than those obtained from the other tested samples, which was found to be as 21 hours.

These results may be due to the sum of saturated fatty acids in palm stearin which were be found higher than that found in the other investigated samples.

Table (3): Physical and chemical properties of fats and oils used.

Physical and chemical properties	Pure fats and oils used				
	Imported cow butter fat	**Local cow butter fat**	**Palm oil**	**Palm stearin**	**LSD value at p ≥ 0.05**
1-physical properties Refractive index at 40 - 60 ℃	1.4591	1.4578	1.4566	1.4599	0.002
Specific gravity 40 - 60 ℃	0.801	0.8231	0.8511	0.8411	0.01
Melting point ℃	33.50	35.20	38.00	53.50	0.30
Slip point ℃	32.00	33.70	36.5	52.00	0.30
Colour Yellow	35.00	35.00	35.00	35.00	0.50
Red	3.20	3.00	2.00	2.50	
Blue	0.00	0.00	0.00	0.00	
2-chemical properties F.F.A (%as oleic acid)	0.50	1.40	0.059	0.086	0.07
Peroxide value(meq/kg)	0.98	0.05	0.90	1.06	0.10
Iodne value	38.50	32.10	48.70	32.40	1.00
TBA at 530 nm	0.001	0.001	0.001	0.001	0.001
Induction period (hr)	10.50	7.10	13.50	21.00	1.50
Conjugated diene at232nm	0.075	0.023	0.091	0.088	0.01
Conjugated triene at268nm	0.072	0.016	0.041	0.032	0.01
Unsponifiable matter (%)	0.70	0.62	0.48	0.20	1.00
Reichert-meissel number	31.27	28.49	0.80	0.90	1.00
polenske number	3.79	2.53	0.15	0.20	0.5

LSD determination to least significant differences test.

The Effect of Blending imported and local cow butter fats with Palm Oil and Palm Stearin on their Pysico- chemical Properties of their produced Blends.

The effect of blending imported cow butter fat and local cow butter fat individually with palm oil and palm stearin in ratio of from 10,20,30,40,50,60,70,80 and 90% on the physical and chemical properties of their blends (A,B,C and D) were evaluated.

Physical and chemical properties of binary mixtures (A, B, C, and D) are presented in Tables (4, 5, 6 and 7). From the obtained data, it could be observed that blending of palm oil with either imported cow butter fat or local cow butter fat at ratio ranging from 10 to 90 % caused slight a gradual decrease in refractive index. In contrast, by increasing the blend levels from 10 to 90 % of palm stearin with either imported cow butter fat or local cow butter fat, the refractive index was gradual increased slightly.

From the same results it could be seen that the colour index was found to be decrease by increasing the blend levels of either palm oil or palm stearin from 10 to 90 % with either imported cow butter fat or local cow butter fat in the red lovibond scale for all blends. It could be also noticed that the blending of 10 to 90 % of palm stearin with either imported cow butter fat or local cow butter fat led to clear a progressively increase in both melting point and slip point. However the same behavior was also observed concerning the oxidative stability (induction period hr), it was increased by increasing the level of palm stearin from 10 to 90 % with either imported cow butter fat or local cow butter fat.

As also illustrated in the obtained results of Tables (4, 5, 6 and 7), it could be conduced that Reichert-meissel and polenske values were significantly decreased as the blending ratio increase from 10 to 90 % of both palm oil or palm stearin with either imported cow butter fat or local cow butter fat. These results may be due to the vegetable oils containing a very small amount or no of short chain fatty acids (volatile fatty acids). Reichert-meissel value of vegetable oils is so very low compared to the butter fat, it would seem that it should be simple enough to detect their presence in butter fat, even is small amounts. (Sheppard *et al.,* 1985).

Table (4): Physical and chemical properties of different blends of (Imported cow butter fat blended with palm oil).

Type .of blended sample / Analyses	A1*	A2**	A3	A4	A5	A6	A7	A8	A9	A10	A11	LSD value at $p \geq 0.05$
Refractive index at 40 - 60 (°c)	1.4591	1.4566	1.4588	1.4586	1.4583	1.4581	1.4578	1.4575	1.4572	1.4570	1.4567	0.002
Melting point°c)	33.50	38.00	34.90	35.40	35.80	36.30	36.70	37.30	37.60	37.65	37.80	0.30
Slip point (°c)	32.00	36.50	33.40	33.90	34.30	34.80	35.20	35.70	36.00	36.15	36.10	0.30
Colour yello	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	0.50
Red	3.20	2.00	3.08	2.96	2.84	2.72	2.60	2.48	2.36	2.24	2.12	
Blue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
F.F.A (as oleic acid)	0.50	0.059	0.31	0.28	0.27	0.25	0.24	0.19	0.15	0.13	0.12	0.07
Peroxide value(meq.active O2 /Kg)	0.98	0.90	0.97	0.96	0.94	0.93	0.90	0.89	0.87	0.85	0.84	0.10
Iodine value (Hanus)	38.5	48.70	39.04	40.26	41.48	42.70	43.92	45.14	45.47	46.36	47.69	1.00
Induction period (hr)	10.50	13.50	10.60	11.00	11.40	11.70	12.00	12.40	12.60	12.90	13.20	1.50
Conjugated diene at 232nm	0.075	0.091	0.076	0.078	0.079	0.081	0.083	0.084	0.086	0.087	0.089	0.01
Conjugated trine at 268nm	0.072	0.041	0.068	0.065	0.062	0.059	0.056	0.053	0.050	0.047	0.044	0.01
Unsponifiable matter %	0.70	0.48	0.67	0.65	0.63	0.61	0.58	0.55	0.52	0.49	0.45	1.00
Reichert-meisel	31.27	0.80	3.09	5.98	9.27	12.30	15.51	17.98	21.63	24.11	26.95	2.00
polenske	3.79	0.15	0.32	0.70	0.94	1.23	1.65	2.00	2.24	2.51	2.82	1.10

LSD determinations to least significant differences test
A1* Pure imported cow butter fat, A2** pure palm oil, A3 till all Blends investigated

Table (5): Physical and chemical properties of different blends of (local cow butter fat blended with palm oil).

Type .of blended sample / Analyses	B1*	B2 **	B3	B4	B5	B6	B7	B8	B9	B10	B11	LSD value at $p \geq 0.05$
Refractive index at 40 - 60 (°c)	1.4578	1.4566	1.4576	1.4575	1.4574	1.4573	1.4572	1.4570	1.4569	1.4568	1.4567	0.002
Melting point°c)	35.20	38.00	35.48	35.76	36.05	36.30	36.60	36.88	37.16	37.44	37.72	0.30
Slip point(°c)	33.70	36.50	34.00	34.26	34.55	34.80	35.10	35.40	35.65	35.95	36.20	0.30
Colour yello	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	0.50
Red	3.00	2.00	2.91	2.80	2.64	2.55	2.44	2.35	2.26	2.15	2.04	
Blue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
F.F.A (as oleic acid)	1.40	0.059	0.54	0.54	0.49	0.45	0.36	0.25	0.19	0.14	0.13	0.07
Peroxide value(meq.active O2 /Kg)	0.05	0.90	0.13	0.22	0.30	0.39	0.47	0.55	0.64	0.72	0.81	0.10
Iodine value (Hanus)	32.10	48.70	33.95	34.38	37.13	38.81	40.60	42.39	43.49	45.93	47.59	1.00
Induction period (hr)	7.10	13.50	7.75	8.40	9.00	9.65	10.50	11.00	11.60	12.30	12.85	1.50
Conjugated diene at 232nm	0.023	0.091	0.029	0.036	0.043	0.050	0.057	0.063	0.070	0.077	0.084	0.01
Conjugated trine at 268nm	0.016	0.041	0.018	0.021	0.023	0.026	0.028	0.031	0.034	0.035	0.038	0.01
Unsponifiable matter %	0.62	0.48	0.60	0.59	0.57	0.56	0.54	0.53	0.51	0.50	0.47	1.00
Reichert-meisel	28.49	0.80	25.52	22.79	19.84	17.00	14.36	11.88	7.65	5.71	2.79	2.00
polenske	2.53	0.15	2.27	2.04	1.59	1.37	1.12	0.99	0.75	0.50	0.24	1.10

LSD determinations to least significant differences test
B1* Pure local cow butter fat, B2** Pure palm oil, B3 till all Blends investigated

Table (6): Physical and chemical properties of different blends of (Imported cow butter fat blended with palm stearin).

Type .of blended sample / Analyses	C1*	C2**	C3	C4	C5	C6	C7	C8	C9	C10	C11	LSD value at p ≥ 0.05
Refractive index at 40 - 60 (°c)	1.4591	1.4599	1.4592	1.4593	1.4594	1.4595	1.4595	1.4596	1.4596	1.4597	1.4598	0.002
Melting point(°c)	33.50	53.50	35.50	37.40	39.35	41.30	43.25	45.20	47.15	49.10	51.00	0.30
Slip point (°c)	32.00	52.00	34.00	35.30	37.50	39.30	41.25	43.20	45.15	47.10	49.00	0.30
Colour yello	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	0.50
Red	3.20	2.50	3.13	3.04	2.94	2.85	2.74	2.66	2.57	2.48	2.40	
Blue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
F.F.A (as oleic acid)	0.50	0.086	0.45	0.41	0.37	0.33	0.29	0.25	0.21	0.16	0.12	0.07
Peroxide value(meq.active O2 /Kg)	0.98	1.06	0.90	0.93	0.95	0.95	0.98	1.00	1.02	1.04	1.05	0.10
Iodine value (Hanus)	38.50	32.40	37.82	37.13	36.60	36.07	35.58	34.16	33.95	33.55	32.94	1.00
Induction period (hr)	10.50	21.00	11.55	12.60	13.65	14.70	15.75	16.80	17.85	18.90	19.95	1.50
Conjugated diene at 232nm	0.075	0.088	0.076	0.077	0.078	0.080	0.081	0.083	0.084	0.085	0.086	0.01
Conjugated trine at 268nm	0.072	0.032	0.068	0.064	0.061	0.056	0.052	0.047	0.044	0.040	0.036	0.01
Unsponifiable matter %	0.70	0.20	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	1.00
Reichert-meisel	31.27	0.90	26.89	24.80	12.21	18.70	15.38	11.94	9.35	6.02	3.10	2.00
polenske	3.79	0.20	3.19	2.91	2.48	2.11	1.65	1.36	1.02	0.71	0.35	1.10

LSD determinations to least significant differences test
C1* Pure imported butter fat, C2** Pure palm stearin, C3 till all Blends investigated

Table (7): Physical and chemical properties of different blends of (local cow butter fat blended with palm stearin).

Type .of blended sample / Analyses	D1*	D2 **	D3	D4	D5	D6	D7	D8	D9	D10	D11	LSD value at $p \geq 0.05$
Refractive index at 40 - 60 (°c)	1.4578	1.4599	1.4580	1.4582	1.4584	1.4586	1.4588	1.4590	1.4592	1.4594	1.4596	0.002
Melting point°c)	35.20	53.50	37.00	38.80	40.65	42.50	44.40	46.10	48.00	49.80	51.65	0.30
Slip point(°c)	33.70	52.00	35.50	37.30	39.00	41.00	42.90	44.60	36.50	48.30	50.00	0.30
Colour yello	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	0.50
Red	3.00	2.50	2.93	2.86	2.80	2.72	2.65	2.58	2.51	2.45	2.37	
Blue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
F.F.A (as oleic acid)	1.40	0.086	1.26	1.12	0.98	0.84	0.71	0.55	0.42	0.29	0.15	0.07
Peroxide value(meq.active O2 /Kg)	0.05	1.06	0.18	0.25	0.34	0.46	0.55	0.68	0.75	0.85	0.98	0.10
Iodine value (Hanus)	32.1	32.49	32.13	32.17	32.21	32.25	32.30	32.34	32.38	32.42	32.45	1.00
Induction period (hr)	7.10	21.00	8.50	9.90	11.30	12.56	14.00	15.50	16.85	18.30	19.60	1.50
Conjugated diene at 232nm	0.023	0.088	0.029	0.036	0.043	0.051	0.058	0.065	0.072	0.080	0.085	0.01
Conjugated trine at 268nm	0.016	0.032	0.017	0.019	0.020	0.022	0.024	0.025	0.027	0.028	0.030	0.01
Unsponifiable matter %	0.62	0.20	0.57	0.53	0.49	0.44	0.39	0.35	0.32	0.27	0.24	1.00
Reichert-meisel	28.49	0.90	25.64	22.86	20.02	16.99	14.24	11.43	8.58	5.69	2.88	2.00
polenske	2.53	0.20	2.29	2.02	1.87	1.56	1.29	1.05	0.87	0.52	0.26	1.10

LSD determinations to least significant differences test
D1* Pure local cow butter fat, D2** Pure palm stearin, D3 till all Blends investigated

3-Minerals content of fats and oils used

Minerals content of imported cow butter fat, local cow butter fat, palm oil, palm stearin and their blends are tabulated in Table (8), namely Fe, Cu, Pb and Mg. It could be concluded that all tested samples were found to be as the limits required by the Egyptian standard specification (2005) for edible fats and oils. These results are conformity within the permissible level reported by ESS, which indicating the authenticity of fats and oils and their blendes and its suitability for consumption.

4-Solid fat contents of fats and oils used and their produced blendes at 20, 30, and 40°C.

Functional properties of fats are largely determined by their solid fat content at a specific temperature or series temperatures. A major portion of the structure of the food may depend on the solids contributed by the fat (Rodrigues et al., 2005).

Solid fat content, the quantity of fat crystals in a fat or fat blend, has a great influence on the suitability of the fat or fat blend for a particular application. The solid fat content is responsible for many product characteristics in margarines, shortenings and fat spreads, including their general appearance, ease of packing, spread ability, oil oxidation and organoleptic properties (Dian *et al.*, 2007).

Regarding to the solid fat content at 20, 30, and 40 °C in the fats and oils and their blends under investigation, Table (9). shows that solid fat content of both palm oil or palm stearin was found to be higher than that found in either imported cow butter fat or local cow butter fat, especially at 30 and 40°C. The same behavior was also observed concerning to the solid fat content of binary mixtures (A, B, C, and D), it was increased by increasing the rate of blending from 10 to 90 % of either palm oil and palm stearin with either imported cow butter fat or local cow butter fat, especially at 30 and 40 °C. this increase in the solid fat content was mainly due to the higher content of long chain saturated fatty acid in palm oil and palm stearin as compared to imported cow butter fat or local cow butter fat according to (Hui, 1996), (Ho and Chow 2000).

Table (8): Minerals content (ppm) of fats and oils used and their produced blends.

Type .of blended samples	Imported cow butter fat and palm oil blends				Type .of blended samples	Local cow butter fat and palm oil blends				Type.of blended samples	Imported cow butter fat and palm stearin blends				Type .of blended samples	Local cow butter fat and palm stearin blends			
	Fe	Cu	Pb	Mg		Fe	Cu	Pb	Mg		Fe	Cu	Pb	Mg		Fe	Cu	Pb	Mg
A1*	1.49	0.72	0.01	0.52	B1*	0.93	0.02	0.01	0.52	C1*	1.49	0.72	0.01	0.52	D1*	0.93	0.02	0.01	0.52
A2**	1.30	0.95	0.01	0.78	B2**	1.30	0.95	0.01	0.78	C2**	1.29	0.05	0.01	0.96	D2**	1.29	0.05	0.01	0.96
A3	1.47	0.74	0.01	0.54	B3	0.96	0.11	0.01	0.54	C3	1.47	0.63	0.01	0.55	D3	1.96	0.021	0.01	0.54
A4	1.45	0.76	0.01	0.57	B4	1.00	0.21	0.01	0.57	C4	1.45	0.58	0.01	0.60	D4	1.01	0.022	0.01	0.60
A5	1.45	0.79	0.01	0.59	B5	1.04	0.29	0.01	0.59	C5	1.43	0.51	0.01	0.65	D5	1.05	0.029	0.01	0.65
A6	1.43	0.81	0.01	0.62	B6	1.07	0.37	0.01	0.62	C6	1.41	0.44	0.01	0.69	D6	1.09	0.032	0.01	0.68
A7	1.42	0.84	0.01	0.65	B7	1.11	0.45	0.01	0.66	C7	1.40	0.37	0.01	0.74	D7	1.12	0.035	0.01	0.74
A8	1.40	0.86	0.01	0.67	B8	1.15	0.54	0.01	0.67	C8	1.37	0.31	0.01	0.78	D8	1.19	0.038	0.01	0.78
A9	1.38	0.89	0.01	0.69	B9	1.19	0.66	0.01	0.70	C9	1.35	0.25	0.01	0.82	D9	1.22	0.041	0.01	0.82
A10	1.35	0.90	0.01	0.72	B10	1.22	0.73	0.01	0.72	C10	1.33	0.18	0.01	0.87	D10	1.25	0.043	0.01	0.88
A11	1.31	0.92	0.01	0.76	B11	1.26	0.85	0.01	0.75	C11	1.31	0.11	0.01	0.91	D11	1.28	0.045	0.01	0.91
LSD value at $p \geq 0.05$	0.1	0.02	0.001	0.1	LSD value at $p \geq 0.05$	0.1	0.02	0.001	0.1	LSD value at $p \geq 0.05$	0.1	0.02	0.001	0.1	LSD value at $p \geq 0.05$	0.1	0.02	0.001	0.1

LSD determinations to least significant differences test

A1* and C1* Pure imported cow butter fat, B1* and D1* Pure local cow butter fat, A2** and B2** Pure palm oil, C2** and D2** Pure palm stearin

Table (9): Solid fat content of fats and oils used and their produced blends at 20, 30, and 40C°.

Type .of blended samples	Imported cow butter fat and palm oil blends			Type .of blended samples	Local cow butter fat and palm oil blends			Type .of blended samples	Imported cow butter fat and palm stearin blends			Type .of blended samples	Local cow butter fat and palm stearin blends		
	20C°	30C°	40C°		20C°	30C°	40C°		20C°	30C°	40C°		20C°	30C°	40C°
A1*	25.85	11.10	0.52	B1*	23.20	8.19	0.83	C1*	25.85	11.10	0.52	D1*	23.20	8.19	0.83
A2**	26.40	19.14	3.89	B2**	26.40	19.14	3.89	C2**	27.50	20.05	3.60	D2**	27.50	20.05	3.60
A3	22.36	11.90	0.85	B3	23.52	9.28	1.13	C3	25.34	11.97	0.80	D3	23.63	9.37	1.10
A4	22.98	12.70	1.19	B4	23.86	10.37	1.44	C4	25.79	12.89	1.15	D4	23.20	10.62	1.38
A5	24.00	13.51	1.52	B5	24.12	11.46	1.78	C5	26.00	13.79	1.44	D5	24.49	11.38	1.65
A6	25.02	14.31	1.86	B6	24.46	12.55	2.06	C6	26.21	14.68	1.75	D6	24.92	12.92	2.00
A7	25.65	15.12	2.20	B7	24.85	13.64	2.35	C7	26.62	15.54	2.00	D7	25.35	14.11	2.25
A8	25.82	15.92	2.53	B8	25.10	14.73	2.63	C8	26.74	16.47	2.36	D8	25.79	15.30	2.53
A9	26.00	16.72	2.88	B9	25.54	15.82	2.99	C9	26.89	17.36	2.67	D9	26.23	16.48	2.79
A10	26.20	17.53	3.21	B10	25.85	16.91	3.27	C10	27.10	18.26	2.98	D10	26.59	17.65	3.06
A11	26.25	18.33	3.55	B11	26.19	18.00	3.60	C11	27.29	19.15	3.29	D11	27.07	18.84	3.35
LSD value at $p \geq 0.05$	1.15	1.00	0.20	LSD value at $p \geq 0.05$	1.13	0.80	0.30	LSD value at $p \geq 0.05$	1.10	0.95	0.32	LSD value at $p \geq 0.05$	1.12	0.75	0.33

LSD determinations to least significant differences test

A1* and C1* Pure imported cow butter fat, B1* and D1* Pure local cow butter fat, A2** and B2** Pure palm oil, C2** and D2** Pure palm stearin

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تأثير عملية الخلط على الخواص الطبيعية والكيماوية لمخاليط دهن الزبد البقرى المحلى والمستورد مع زيت النخيل وإستيارين النخيل

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يهدف هذا البحث إلى دراسة تأثير عملية الخلط للدهون الحيوانية كدهن الزبد البقرى المحلى والمستورد مع الزيوت النباتية كزيت النخيل وإستيارين النخيل بنسب مختلفة تتراوح من 10 إلى 90 % على الخواص الفيزيقية والكيميائية للمخاليط المختلفة المنتجة. وتشتمل الدراسة على تقدير الخواص الفيزيو-كيميائية لتلك المخاليط مثل معامل الأنكسار، نقطتى الأنصهار والإنزلاق، رقم الحموضة، رقم البيروكسيد، الرقم اليودى، الأحماض الدهنية متبادلة الروابط الزوجية الثنائية والثلاثية، رقمى ريخارت ميثيل وبولنسكى وكذلك محتوى الدهون الصلبة. وقد أشارت النتائج المتحصل عليها أن خلط إستيارين النخيل بنسب تتراوح من 10 إلى 90 % مع أى من دهن الزبد البقرى المحلى أوالمستورد أدى إلى زيادة تدريجية واضحة فى كلا" من درجتى الأنصهار والإنزلاق، كما لوحظ نفس السلوك أيضا" مع الثباتية لعملية الأكسدة (الرانسيمات). كما أشارت النتائج إلى أن قيم كلا"من رقمى ريخارت ميثيل وبولنسكى كانت فى أى من دهن الزبد البقرى المحلى أوالمستورد أكثر من 18 إلى 35 مرة عن القيم المسجلة فى كلا" من زيت النخيل وإستيارين النخيل، على التوالى، وبالتالى فقد إنخفضت قيم كلا"من رقمى ريخارت ميثيل وبولنسكى بدرجة واضحة عند زيادة نسب الخلط من هذه الزيوت تدريجيا" من 10 إلى 90 % فى المخاليط المختلفة. بالإضافة إلى ذلك، فقد كان محتوى الدهون الصلبة سواء فى زيت النخيل أو إستيارين النخيل أعلى من تلك القيم الموجودة فى كلا" من دهن الزبد البقرى المحلى والمستورد، وقد كانت هذه القيم أكثر وضوحا" على درجات حرارة30°م و 40°م، كما لوحظ نفس السلوك عند زيادة نسب الخلط من كلا" من زيت النخيل وإستيارين النخيل فى الخلطات المنتجة تدريجيا خاصة عند درجات حرارة30°م و 40°م.

ونستنتج من هذه الدراسة أن أى خلط بين الدهون الحيوانية و الزيوت النباتية غير معروف نسبتة أو غير موضح على بطاقة البيانات للمنتج يمكن الوقوف عليها وتحديد النسب المئوية للخلط وتحديد أى نوع من أنواع الغش التجارى.