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AN ATTEMPT TO PRODUCE AN ACCEPTABLE QUALITY GHEE LIKE PRODUCT WITH INCREASED DEGREE OF UNSATURATION

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ABSTRACT: Trials had been made to produce acceptable quality ghee like product with high degree of unsaturation, using blends of butter or coconut and soy oils. Preliminary examinations showed that blends containing butter oil/soy oil (40:60 or 30:70) or coconut oil/soy oil (30:70 or 20:80) had an acceptable colour and texture but oily flavour was detected in all blends. Boiling the different blends with ghee residue induced ghee like flavour in them. This treatment was more effective in butter oil/soy oil blends (40:60 or 30:70) and coconut oil/soy oil blend 30:70. Although ghee residue was an effective flavouring agent, it did not enhance the oxidative stability of the blends. Addition of certain natural antioxidants namely propolis, wheat germ oil or black cumin oil to butter or coconut oil /soy oil blends with simulated ghee flavour retarded the rate of oxidative changes particularly in blends containing the less amount of soy oil and those with added propolis or black cumin oil. The different blends with the addition of antioxidants showed an acceptable flavour during incubation at 60 ±1°C except in case of coconut oil/ soy oil blend (20:80), whereas a slight oxidized flavour was detected at the end of incubation. In conclusion, butter oil/soy oil blends (40:60 or 30:70) and coconut oil/ soy oil blend (30:70) could be treated with ghee residue followed by the addition of propolis (500 ppm) or black cumin oil (400 ppm) to prepare ghee like product with high degree of unsaturation, acceptable flavour and good oxidative stability during storage.

Key words: Ghee flavour, simulation, natural antioxidants, vegetable oils.

INTRODUCTION

Milk fat has been considered to be hyperchloestrolemic because it contains cholesterol and generous proportions of long chain saturated fatty acids (Ney 1991). As healthy problems such as obesity, heart diseases and diabetes increase in many developed and developing countries, a considerable interest has been directed to improve the nutritional quality of dairy food. Particular attention has focused on the health problems associated with saturated fats and on the potential health benefits of increasing monounsaturated and polyunsaturated fats in foods (Williams 2006). The use of vegetable oils instead of milk fat in the manufacture of certain dairy products has been attempted (Abdel Kheir 1996, During *et al.*, 2000a&b, Shehata, 2005). Such substitution could be advantageous because the vegetable oils are cholesterol free, usually cheaper and less subject to seasonal variations (Strugnell 1993 and Hansen 1994). The major problem related to the introduction of unsaturated fats into dairy products is the possible alteration of their propertics (During *et al.*, 2000 b and Shehata, 2005). Meanwhile the high sensitivity of unsaturated fats to autoxidation could lead to the formation of undesirable compounds that may reduce both flavour quality and shelf life of the products ((During *et al.*, 2000 b and Ibrahim, 2003).

Galborta and Wadhwa (1991 a, b) showed that ghee residue is a potential rich source of ghee flavour components such as free fatty acids, carbonyls and lactones. These basic components make use of ghee residue as a very effective source of ghee flavour for flavouring bland products such as butter oil and vegetable oils.

Wadhwa *et al.* (1991) showed that boiling butter oil with ghee residue for 3 min. with constant stirring and filtration induced good ghee flavour and enhanced the shelf life of the product. Meanwhile Wadhwa and Bindal (1995) used ghee residue to stimulate ghee flavour in hydrogenated edible oils. The treatment was found to enhance both flavour quality and storage stability of the product.

Attention has been paid to the use of more safe natural antioxidants to retard fat autoxidation .The essential oils of many herbs such as black cumin,

celery, cardamom, parsley and rosemary were recommended to be added to edible oils to increase their stability against oxidation rancidity (El-Laban 1998).

El-Abassy (2001) showed that the methanol extract of certain herbs e.g. rosemary, cardamom and black cumin were effective with respect to retardation of autoxidation in ghee during storage. Tocopherol and carotene were also used to enhance oxidative stability of fats and oils (Ibrahim, 2003 and Shehata, 2005). Meanwhile, several investigators reported on the antioxidative activity of propolis (Hemeida and Abdel Fattah, 1993, Abdel-Fattah *et al.*, 1993, Isla *et al.*, 2005). Abdel-Fattah and Abou Dawood (2004) recommended the use of propolis extract as a natural antioxidant for butter. The stability of butter treated with propolis increased from 2.5 to 6 times than control depending on the concentration of added propolis.

The present work was carried out as an attempt to produce acceptable quality ghee like product with a high degree of unsaturation. Improving the flavour and storage stability of the product was taken into consideration.

MATERIALS AND METHODS

Materials

Butter

Butter was obtained from Dairy Technology Unit., Food Sci. Dept., Faculty of Agric. Zagazig Univ.,

Ghee and Ghee Residue

Ghee and ghee residue were obtained after converting butter into ghee by boiling off.

Soy Oil

Soy oil was obtained from Misr Company for oils and soaps, Zagazig, Egypt.

Coconut Oil

Coconut oil was obtained from local market

Antioxidants

Wheat germ oil and black cumin oil were obtained from Mebaco Arabic Comp. Anshase, Egypt. Propolis was obtained from local market of honey bee products. Propolis extract was prepared for use as an antioxidant as described by Abou Dawood and Abdel Fattah (2004).Tertiary butyl hydroquinone (TBHQ) as synthetic antioxidant was obtained from Nova international, India.

Methods

Preparation of Butter Oils

Butter was melted at 55 °C, the clear butter oil layer was carefully decanted as described by Abdel Kheir (1996).

Butter Oil/ Soy Oil and Coconut Oil / Soy Oil Blends

The following blends were prepared for use in the preparation of acceptable quality ghee like product with high degree of unsaturation

- A blend of 40 % butter oil and 60 % soy oil
- A blend of 30 % butter oil and 70 % soy oil
- A blend of 30 % coconut oil and 70 % soy oil
- A blend of 20 % coconut oil and 80 % soy oil

The above mentioned blending ratios were chosen on the basis of preliminary trials which showed that these chosen blending ratios gave blends with acceptable colour and texture as compared with pure ghee.

Simulation of Ghee Like Flavour in the Prepared Blends

Ghee residue was used as a flavouring agent to induce ghee like flavour in the different blends. Each blend was treated with ghee residue at a level of 5 % then boiled for 3 minutes with continuous stirring, cooled and filtered Wadhwa *et al.* (1991)

Addition of Antioxidants to Various Blends with Simulated Ghee Flavour

Each blend with simulated ghee flavour was divided into 7 equal parts. The first and the second parts were treated with propolis (300 and 500 ppm), the third and the fourth parts were treated with wheat germ oil (300 and 500 ppm), and the fifth and sixth parts were treated with black cumin oil (200 and 400 ppm). The seventh part was left without additives as a control. Meanwhile, an additional part of butter oil / soy oil blend was treated with TBHQ (200 ppm) as synthetic antioxidant for comparison.

Indices Used to Determine Oxidative Stability

All blends with simulated ghee like flavour either untreated or treated with natural antioxidants were incubated at 60 ±1 ° C to accelerate the rate of fat oxidation and examined at the beginning and after 7,14 and 21 days for flavour (Abdel Kheir 1996),

peroxide, and iodine values (A.O.A.C., 1980).

Statistical Analysis

Results were statistically analysed by a split point ANOVA to determine the effect of the different treatments according to Bulmer (1967).

RESULTS AND DISSCUSION

Degree of Unsaturation

Iodine value was taken as an index for the degree of unsaturation of blends with simulated ghee flavour (Table 1). Iodine values of blends with simulated ghee flavour were: 76.0, 80.47, 94.0, and 101.80 for blends containing butter oil, soy oil 40:60, butter oil / soy oil 30:70, coconut oil / soy oil 30:70 and coconut oil / soy oil 20:80 respectively. The corresponding iodine value for ghee was 39.00.

These results clearly indicated that the blends had higher degree of unsaturation due to the use of liquid vegetable oil which has a considerable concentration of mono- and poly unsaturated fatty acids (Ibrahim, 2003).

Effect of Treating Blends with Ghee Residue on their Quality

The colour and texture of all blends before treating with ghee residue were acceptable. However oily flavour was detected in all blends without treatment with ghee residue. The oily flavour was more detectable in blends containing the higher levels of soy oils (butter oil/ soy oil 30/70 and coconut/soy oil 20:80).

Boiling the different blends with ghee residue resulted in the simulation of ghee like flavour in all blends. The efficiency of this treatment was found to be more observable in butter oil / soy oil blend (40:60 or 30: 70) and coconut/soy oil (30:70) (Table 2).

These observations could be attributed to the transfer of ghee flavour contributors such as fatty acids, carbonyls and lactones from ghee residue to the fat phase during processing (Galborta and Wahwa 1991a&b, Wadhwa and Bindahl 1995).

Table 1. Iodine value of freshly prepared butter oil or coconut oil / soy oils with simulated ghee flavour

Blends	Blending ratio	Iodine value
Butter oil/ soy oil	40:60	76.00
	30:70	80.47
Coconut oil / soy oil	30:70	94.00
	20:80	101.80
Control (Ghee)	--	39.00

Table 2. Colour, texture and flavour of butter oil or coconut oil / soy oil blends as affected by treatment with ghee residue

Blends	Blending ratio	Treatments	Colour	Texture	Ghee like flavour
Butter oil / soy oil	40:60	A	++	++	-
		B	++	++	++
	30:70	A	++	++	-
		B	++	++	++
Coconut oil / soy oil	30:70	A	++	++	-
		B	++	++	++
	20:80	A	++	+	-
		B	+	+	+

++ Good acceptable
+ Satisfactory
- Oily flavour

A: Untreated
B: Treated with ghee residue

Oxidative Stability of Butter Oil/Soy Oil Blends before and after Treatment with Ghee Residue

Preliminary determination of peroxide values in a blend containing butter oil / soy oil (40:60) before and after treatment with ghee residue and without the addition of any antioxidant showed that the trend of increase in peroxide values was relatively similar in both cases of untreated or treated with ghee residue only (Table 3).

This indicated that ghee residue is considered to be a potent flavouring agent but it has no considerable effect on the stability of blends.

This observation could be due to the high level of unsaturated fatty acids in the blend with consequent high sensitivity to autoxidation. In the light of this evidence, it was found desirable to enhance the oxidative stability of the blends with stimulated ghee flavour using some natural antioxidants.

Table 3. Changes in peroxide values of butter oil / soy oil blend (40:60) during incubation at 60 ± 1 °C as affected with ghee residue

Incubation periods at 60± 1 °C (days)	Peroxide value(mequivalent peroxides/1 kg fat)	
	Untreated blend	Ghee residue treated blend
0	1.8	1.8
3	2.1	2.2
6	2.8	2.8
9	3.2	3.2
15	9.2	9.0
21	15.5	15.8
27	20.0	20.0

Oxidative Stability of Blends with Simulated Ghee Flavour as Affected by Certain Natural Antioxidants

Peroxide and iodine values were taken as indices to evaluate the oxidative changes occurring in the different blends during incubation at 60 ±1 °C

Butter oil / soy oils blends with simulated ghee flavour

From the results presented in Tables 4 and 5 it could be seen that peroxide values were increased gradually during the whole period of incubation, while iodine values decreased. The rates of changes in the above mentioned indices started slowly at the beginning and developed faster towards the termination of incubation period. The changes in the oxidation indices took place in blends containing propolis, wheat germ oil and black cumin at a relatively lower rate compared with blends without added antioxidants. Also, propolis and black cumin oil showed more observable antioxidant activity compared with wheat germ oil. The antioxidant activity of all natural antioxidants was more remarkable in the blend containing butter oil/ soy oil 40:60 and blends with the higher concentration of added antioxidant. Meanwhile the natural antioxidant showed an antioxidant activity compared with TBHQ.

Coconut oil / soy oil blends

Peroxide and iodine values Tables 6 and 7 of blends containing coconut oil /soy oil 30:70 or 20:80 followed similar trend of changes as mentioned in butter oil/soy oil blends. However, the oxidative changes took place in coconut oil/soy oil blends at a higher rate compared with butter oil/ soy oil blends and this was more observed in coconut oil/soy oil 20:80. This could be explained on the basis that coconut oil/soy oil blends have more degree of unsaturation compared with other blends. Higher degree of unsaturation of a fat is generally associated with more rate of fat oxidation (During et al b, 2000).

The antioxidant activity of propolis could be attributed to the presence of polar components mainly phenols, i.e. flavonoids, phenolic acid and their esters. Propolis flavonoids are considered to be free radical scavengers and they can scavenge single oxygen and terminated peroxidation (Pincemall and Goutier 1985, Ushkalova and Murykhnich 1978 and Isla *et al.* 2005).

Table 4. Changes in peroxide value of butter oil / soy oil blends with simulated ghee flavour as affected by certain antioxidant (mequivalent peroxides/1 kg fat)

Blending ratios	Incubation period at 60 ± 1 °C (days)	Added antioxidants (ppm)								L.S.D.
		Without antioxidant	Propolis		Wheat germ oil		Black cumin oil		TBHQ 200	
			300	500	300	500	200	400		
40 :60	Fresh	2.27^{b}	2.53^{a}	2.47^{ab}	2.43^{ab}	2.40^{ab}	2.33^{ab}	2.40^{ab}	2.35^{ab}	0.20
	7	4.6^{a}	3.27^{bc}	3.13^{c}	4.53^{a}	3.33^{bc}	3.93^{ab}	3.60^{bc}	3.30^{bc}	0.71
	14	11.67^{a}	3.93^{e}	3.57^{e}	6.80^{b}	5.60^{c}	4.40^{d}	3.80^{e}	3.55^{e}	0.40
	21	17.00^{a}	5.93^{e}	5.67^{ef}	9.17^{b}	8.53^{bc}	7.47^{cd}	6.73^{de}	4.60^{f}	1.08
30 :70	Fresh	2.17^{c}	2.53^{a}	2.47^{ab}	2.43^{ab}	2.40^{ab}	2.40^{ab}	2.33^{b}	2.40^{ab}	0.15
	7	4.87^{a}	3.70^{cd}	3.47^{d}	4.87^{a}	3.87^{c}	4.17^{b}	3.73^{cd}	3.45^{d}	0.27
	14	14.13^{a}	4.43^{e}	3.97^{f}	7.93^{b}	6.73^{c}	5.80^{d}	4.80^{e}	4.00^{f}	0.41
	21	18.67^{a}	7.30^{d}	6.33^{e}	9.97^{b}	8.93^{c}	8.67^{c}	7.57^{d}	5.00^{f}	0.58

- Average of three trials
- Mean having different letters in the same row significantly differ.

Table 5. Changes in iodine value of butter oil/soy oil blends with simulated ghee flavour as affected by certain antioxidants

Blending ratios	Incubation period at 60 ± 1 °C (days)	Added antioxidants (ppm)								L.S.D.
		Without antioxidant	Propolis		Wheat germ oil		Black cumin oil		TBHQ	
			300	500	300	500	200	400		
40 :60	Fresh	76.00^{a}	76.63^{a}	76.63^{a}	76.77^{a}	75.97^{a}	76.10^{a}	76.33^{a}	76.00^{a}	1.36
	7	73.03^{d}	75.20^{a}	75.60^{a}	73.37^{d}	73.43^{d}	74.13^{c}	74.70^{bc}	75.25^{ab}	0.64
	14	70.10^{e}	74.17^{bc}	74.70^{a}	72.37^{d}	73.33^{d}	73.40^{d}	73.80^{cd}	74.80^{a}	0.60
	21	64.40^{d}	72.83^{b}	73.60^{a}	70.67^{c}	71.73^{c}	71.60^{c}	72.63^{b}	73.50^{a}	0.64
30 :70	Fresh	80.47^{a}	81.03^{a}	81.37^{a}	80.47^{a}	80.80^{a}	80.87^{a}	81.03^{a}	81.50^{a}	2.16
	7	79.50^{d}	81.07^{b}	81.77^{a}	79.53^{d}	78.60^{e}	80.10^{c}	80.97^{b}	80.90^{b}	0.34
	14	76.23^{e}	79.00^{b}	80.00^{a}	76.37^{e}	77.17^{d}	78.23^{c}	79.27^{b}	79.70^{a}	0.33
	21	69.33^{f}	78.20^{b}	79.00^{a}	75.47^{e}	76.30^{d}	77.70^{c}	77.77^{c}	79.00^{a}	0.47

- Average of three trials
- Mean having different letters in the same row significantly differ.

Table 6. Changes in peroxide value of coconut oil/ soy oil blends with simulated ghee flavour as affected by certain antioxidant (mequivalent peroxides/1 kg fat)

Blending ratios	Incubation period at 60 ± 1 °C (days)	Added antioxidants (ppm)							L.S.D.
		Without antioxidant	Propolis		Wheat germ oil		Black cumin oil		
			300	500	300	500	200	400	
30 :70	Fresh	2.67[a]	2.63[a]	2.60[a]	2.63[a]	2.60[a]	2.60[a]	2.63[a]	0.16
	7	4.67[a]	4.07[b]	3.90[b]	4.87[a]	4.07[b]	4.63[a]	4.03[b]	0.32
	14	14.00[a]	5.87[d]	4.63[e]	7.67[b]	6.70[c]	6.43[c]	5.83[d]	0.35
	21	20.13[a]	8.03[d]	7.07[e]	11.20[b]	9.77[c]	9.73[c]	8.00[d]	0.18
20 :80	Fresh	2.67[a]	2.60[b]	2.67[a]	2.60[b]	2.57[c]	2.57[c]	2.53[c]	0.19
	7	6.50[a]	5.60[b]	4.87[c]	5.60[b]	4.87[c]	4.87[c]	4.73[c]	0.30
	14	15.13[a]	8.40[b]	5.87[e]	8.40[b]	7.03[c]	7.13[c]	6.10[d]	0.16
	21	21.67[a]	12.00[b]	7.70[e]	12.00[b]	11.00[b]	10.03[c]	9.20[d]	0.73

- Average of three trials
- Mean having different letters in the same row significantly differ.

Table 7. Changes in iodine value of coconut oil/ soy oil blends with simulated ghee flavour as affected by certain antioxidant

Blending ratios	Incubation period at 60 ± 1 °C (days)	Added antioxidants(ppm)							L.S.D.
		Without antioxidant	Propolis		Wheat germ oil		Black cumin oil		
			300	500	300	500	200	400	
30 :70	Fresh	94.00^{c}	94.60^{b}	94.63^{ab}	94.37^{b}	94.60^{b}	94.87^{a}	94.87^{a}	0.26
	7	91.50^{e}	93.10^{b}	93.67^{a}	92.03^{d}	92.53^{c}	92.87^{b}	93.10^{b}	0.29
	14	89.27^{d}	92.40^{ab}	92.90^{a}	91.30^{c}	90.00^{b}	91.80^{bc}	92.00^{b}	0.69
	21	83.23^{f}	91.53^{bc}	92.43^{a}	88.20^{e}	89.00^{d}	90.70^{b}	91.00^{c}	0.60
20 :80	Fresh	101.83^{c}	102.40^{b}	102.43^{b}	102.57^{ab}	102.60^{ab}	102.87^{a}	102.87^{a}	0.38
	7	99.17^{e}	101.17^{ab}	101.53^{a}	99.70^{d}	100.20^{cd}	100.80^{bc}	100.93^{ab}	0.72
	14	94.07^{d}	100.17^{a}	101.00^{a}	98.60^{c}	98.70^{c}	99.07^{c}	100.00^{b}	0.49
	21	91.23^{e}	99.47^{b}	100.23^{a}	97.30^{d}	97.87^{c}	99.07^{d}	99.80^{a}	0.47

- Average of three trials
- Mean having different letters in the same row significantly differ.

Wheat germ oil contains high content of tocopherol. Tocopherol serves as antioxidant agent by physically taking away the force of O2, chemically reaction with O_2, univalently reducing free radicals to break chain reaction (Gottstein and Grosch 1990).

Black cumin oil was found to contain 74 components, out of them 21 components were identified. The major components were limonene (27.4 %), triphen-4-ol (2.79 %) and p-cymene (1.25 %). They act as effective antioxidants and have an effective role in retarding lipid oxidation (El-Laban, 1998).

Flavour Development

Butter oil/soy oil blend

Blends containing butter oil/ soy oil (40:60 or 30:70) treated with ghee residue and the addition of propolis, wheat germ oil or black cumin oil as natural antioxidants showed acceptable flavour without any detectable off flavour when fresh and during the whole period of incubation, while blends without antioxidants showed oxidized off flavour starting from the second week of incubation (Table 8).

Flavour stability indices of blends treated with propolis or black cumin was more acceptable compared with that of blends treated with wheat germ oil (Table 4&5).

Coconut oil/soy oil blends

Coconut oil / soy oil blends (30:70) with simulated ghee flavour and added antioxidants had an acceptable flavour during incubation at 60±1 ° C, while a slight oxidized flavour began to appear in coconut oil/ soy oil blends (20:80) at the end of incubation. Also, an oxidized off flavour was developed in blends without antioxidants at the early stage of incubation (Table 9).

In conclusion, ghee like product could be prepared from blends containing butter/ soy oils (40:60 or 30:70) and coconut/ soy oil (30:70). The blends should be treated with ghee residue followed by the addition of propolis or black cumin oil as natural antioxidants at concentration of 500 or 400 ppm respectively. The resultant product was found to be characterized with high unsaturation degree, acceptable flavour and good stability against oxidative rancidity.

Table 8. Flavour acceptability of butter oil / soy oil blend with simulated ghee flavour and added antioxidant during incubation at 60 ± 1 °C

Blending ratio	Incubation periods (days)	Without antioxidants	Added antioxidants (ppm)					
			Propolis		Wheat germ oil		Black cumin oil	
			300	500	300	500	200	400
40:60	0	+	+	+	+	+	+	+
	7	+	+	+	+	+	+	+
	14	-	+	+	+	+	+	+
	21	-	+	+	+	+	+	+
30:70	0	+	+	+	+	+	+	+
	7	+	+	+	+	+	+	+
	14	-	+	+	+	+	+	+
	21	-	+	+	+	+	+	+

+ Accepted ± Slight oxidised flavour - Oxidised flavour

Table 9. Flavour acceptability of coconut/ soy oil with simulated ghee flavour and added antioxidant during incubation at 60 ± 1 °C

Blending ratio	Incubation periods (days)	Without antioxidants	Added antioxidants (ppm)					
			Propolis		Wheat germ oil		Black cumin oil	
			300	500	300	500	200	400
30:70	0	+	+	+	+	+	+	+
	7	+	+	+	+	+	+	+
	14	-	+	+	+	+	+	+
	21	-	+	+	+	+	+	+
20: 80	0	+	+	+	+	+	+	+
	7	±	+	+	+	+	+	+
	14	-	+	+	±	±	+	+
	21	-	±	±	±	±	±	±

+ Accepted flavour ± Slight oxidised flavour - Oxidised flavour

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محاولة لإنتاج منتج شبيه بالسمن ذو جوده مقبولة و درجة مرتفعه من عدم التشبع

وفاء زكريا زغلول –عطيه عبد المعطى عبد الباقى–عبد الحميد محمد ربيع
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تهدف هذه الدراسة إلى إنتاج منتج شبيه بالسمن ذو خواص جودة مقبولة ومحتوى مرتفع من الدهون الغير مشبعة باستخدام مخاليط من زيت الزبد أو زيت جوز الهند مع زيت الصويا. وقد أشارت التجارب الأولية أن خلط زيت الزبد مع زيت الصويا بنسب خلط ٤٠:٦٠ ، ٣٠ :٧٠ وخلط زيت جوز الهند مع زيت الصويا بنسب ٣٠ : ٧٠ ، ٢٠ : ٨٠ على الترتيب قد أعطت مخاليط تتميز بلون وقوام مقبولين إلا أن نكهة الزيت كانت واضحة فى جميع المخاليط خاصة ذات المحتوى الأعلى من زيت الصويا وقد أدى غلى مخاليط الزيوت مع المورتة إلى تكوين رائحة شبيهه برائحة السمن فى المخاليط المختلفة وكان آثر هذه المعاملة أكثر وضوحا مع المخاليط المكونة من زيت الزبد وزيت الصويا (٤٠ : ٦٠ ، ٣٠ :٧٠) ومخلوط زيت جوز الهند مع زيت الصويا (٣٠: ٧٠). وعلى الرغم من أن المعاملة بالمورتة كان لها آثر فعال على تحسين نكهة مخاليط الزيوت إلا أنها لم يكن لها آثر ملحوظ فى تحسين الثبات ضد الأكسدة فى هذه المخاليط ذات المحتوى المرتفع من الدهون غير المشبعة. وقد أدت معاملة مخاليط الزيوت المختلفة بالبروبليز (٣٠٠ ، ٥٠٠ جزء فى المليون) وزيت جنين القمح (٣٠٠ ،٥٠٠ جزء فى المليون) وزيت حبة البركة (٢٠٠ ، ٤٠٠ جزء فى المليون) الى خفض معدل حدوث الأكسدة الذاتية للدهن خلال التحضين على درجة ٦٠ ± ١ درجة م لمدة ٢١ يوم وكان هذا الاثر أكثر وضوحا فى المخاليط التى تحتوى زيت الزبد و زيت الصويا (٤٠: ٦٠ ، ٣٠ :٧٠) ومخلوط زيت جوز الهند وزيت الصويا (٣٠:٧٠).وقد ظلت نكهه المخاليط المختلفه مقبوله فيما عدا مخلوط زيت جوز الهند وزيت الصويا (٢٠:٨٠)حيث بدأت النكهة المؤكسدة تظهر فى نهاية فترة التحضين. وتوصى هذه الدراسة بأنه يمكن إنتاج منتج شبيه بالسمن من مخاليط زيت الزبد وزيت الصويا (٤٠ : ٦٠ ، ٣٠ : ٧٠) وزيت جوز الهند مع زيت الصويا (٣٠ : ٧٠) مع معاملة هذه المخاليط بالمورته لتحسين النكهة وإضافة البروبليز أو زيت حبة البركة بتركيز ٥٠٠ ، ٤٠٠ جزء فى المليون على الترتيب لتحسين الثبات ضد الأكسدة خلال التخزين .