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STUDY ON THE PRODUCTION OF LOW CHOLESTEROL CREAM-LIKE.

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ABSTRACT

The mixed cream with coconut and palm seed oils may affects their properties, as fat constants and fatty acids composition. Among the vegetable oils, these fats proved to be the most suitable source of fatty products and to provide nutritional value. Therefore, these study was planned to investigate the possibility and the effect of adding these oils to the natural cream, From the obtained results, one can conclude the following:The addition of 25% and 50% of coconut oil to the cream resulted to a good quality cream, and decreased cholesterol from 210 to 162 and 115 mg/100g, respectively, with no effect on fat constant or the fatty acids composition. The addition of coconut and date palm oils to cream in the level of 75%, failed to produce cream of good quality. The addition of coconut and date palm oils to cream at the levels 25 and 50% gained the highest score points among the examined treatments. The addition 25% and 50% of date palm oil to the cream resulted in a good quality cream and decreased cholesterol from 210 to 157 and 97 mg/100g respectively, with no effect on fat constant or the fatty acids composition.

INTRODUCTION

There is more than one source for the world consumption of fats and oils which are animal and plant sources, the preference to consume one of them than the other depends on many factors. The healthy and economical factors are the most important ones, the milk fats is decreased in production, besides the high price due to the increment of the production cost. So, the consumers aimed to use the vegetable oils as a substitute of milk fats. Since the fats and oils are the concentrate source of energy compared with protein or starch substances, and one gram of protein or starch produces only four calories, while one gram of fats or oils produces nine calories, the fats and oils are even in their calories produced. Besides, the lockage of proteins sources in societies suffering from nutrition shortage, so, it is recommended to use the oils as an alternative source of energy. Consuming the animal fats comprising milk fat may cause a healthy problems due to the cholesterol content of these fats, while the vegetable oils contains the phytosterols (Bindal *et al.*, 1973). On the other hand, the triglycerides of vegetable oils containing unsaturated fatty acids, gave the oils its chemical character is ties characteristics concerning the oxidation. It was reported that the unsaturated fatty acids increase the high density cholesterol of blood, while decrease the low density cholesterol in blood, which causes the healthy problems. Mixing of vegetable oils with animal fats may partially led to reduce the costs of the produced admixture, besides the reducing of cholesterol content consequently may avoid the healthy problems occurred due to the high content of cholesterol in food (Katan *et al.*, 1984, Pantulu *et al.*, 1975 and Younes *et al.*, 1986).

The aim of this work was to produce a cream-like product, which have the same chemical and physical properties of the cream, but, did not contain the high cholesterol content. Furthermore, the products have the same energy of natural milkfat, besides the low price compared with milkfat price.

MATERIALS AND METHODS

Milk:

Buffaloe's milk was obtained from the experimental farm belonged to the Faculty of Agriculture, Al-Azhar University , Mostorod, Egypt.

Cream:

Buffaloes Cream (30% fat) was separated from milk by the separator.

Edible oils:

Coconut oil. was purchased from the market.

Palm oil was purchased from the market.

Stabilizer:

UniCream stabilizer was purchased from the market.

Preparation of samples:

The fresh cream separated from buffaloe's milk was standardized to 30% fat and divided into two parts.

PART 1: Cream plus oil.

The added oil to the cream was estimated to substitute 25, 50 and 75% of the actual W/W of the produced cream. The fresh buffaloe's milk cream was mixed proper by with the other mentioned oils at 45^{o}C, then 0.2% stabilizer was added and solidified in a refrigerator to 12^{o}C .

PAR II: Cream:

The fresh buffaloe's milk cream was solidified in a refrigerator at 12^{o}C and served as control. Both fat and oil were warmed to 45^{o}C and proper by mixed, and then the samples were directly taken for analysis.

Chemical analysis:

Fat content was detected by Extraction with ether was carried out by using separation funnel which is widely used for oil extraction (A.O.A.C., 1970). Moisture content were estimated as mentioned by Ling (1963). While the pH value was measured using a glass electrode pH meter (PYE).

Analysis of mixed samples.

Fat constants.

The official Hanus method was used to determine the iodine value according to the procedure given by A.O.A.C. (1975). Specification number was estimated by the method outlined by Bird (1964). Reichert-Meissl and Polenske number was detected according to the A.O.A.C. (1975)

Finally, the procedure described by Shahin (1977) was used to converte sample's fatty acids to the corresponding methyl esters using methanol, zinc chloride and zinc dust as a catalyst.

Chromatographic analysis:

The determination of the result ant resultant fatty acids methyl esters was carried out using a gas chromatograph type Hewlett-Packard 5840 A, with double flame ionization detector and with multilevel temperature programmer provided with a HP-5840A terminal. Column used was a 6 feet

stainless steel internal diameter 1/8 inch packed with 3% ov.17 chromasorb w. (60-80 mesh).

Carrier gas used was nitrogen. The conditions were as follows:

Length of column, 6 feet, with internal diameter 1/8 in. programming temperature 140-300°C, injection port temperature 230 °C. Carrier gas flow rate (N2) 30 ml/min. Hydrogen flow rate 30 ml/min. Airflow rate 300 ml/min.

Determination of total cholesterol:

This estimation of total cholesterol was carried out as described by Pantulu *et al.* (1975).

Sensory evaluation:

The fresh cream sample and those samples of mixed oil were scored organoleptically by ten panel dairy experts from Dairy Departments, Faculty of Agriculture, Al-Azhar University.

RESULTS AND DISCUSSION

A) Effect of using some milkfat substitutes on the fat constants and cholesterol content of buffaloe's Cream.

Reichert-Meissl number (RM), Polenske number (PN) process is based on the fact that cream fat is unique in containing glycerides into whose composition short chain fatty acids enter. Caproic acid account for nearly the whole of the Reichert value of cream fat. The Polenske value is governed chiefly by the presence of glycerides containing caprylic, capric and louric, even myrestic and palmitic acids (Zehren and Jackson, 1956). While iodine (IV) and saponification values (SN) depend on the long chain fatty acids, saturated and unsaturated fatty acids.

Table (1), show the RM, PN, IV and SN of cream and mixes of Coconut oil in the ratios of 25%, 50% and 75%. It was observed that the control cream had constants values of 27, 3, 37.9 and 230 for RM, PN, IV and SN, respectively, while the coconut oil had 0.5, 3.23, 45.23 and 198.80, in the same respect. The addition of 25% coconut oil to the cream, slightly decreased the RM and IV, and slightly increased the PN and SN of the produced cream (Williams 1950a).

Bergman and Joost, 1953 and Helal *et al.* (1976) stated that the addition of 50% and 75% of coconut oil depressed the RM and IV, while PN and SN were increased. From these results, it appears that the constants of cream substituted with 25% coconut oil are still within the normal range of natural cream (Williams, 1950b), except the RM which varied from that range as well as the 50% and 75% added coconut oil get the RM, PN and IV out of normal range, while SN was within the normal range of natural cream fat. These results are expected, due to the lower values of RM and IV of the coconut oil added, and the higher values of PN and SN (Ortin and Sanchez-Algaba, 1990).

From the same table, it could be seen the cholesterol content of cream and buffaloe's cream mixed with coconut oil. It was observed that the addition of 25% of coconut oil, decreased the cholesterol content of the produced cream to 162 mg/100 g. The cholesterol content of the control cream was 210 mg/100 g (Bindal and Jain, 1973), while the cholesterol content of the cream produced from the cream mixed with 50% coconut oil was 115 mg/100 g.

Furthermore, the addition of 75% coconut oil to the cream, reduced the cholesterol content of the produced cream to be 67 mg/100 g (Katan *et al.*, 1984).

Table (1): Fat constants and cholesterol content of buffaloe's Cream mixed with 25, 50 and 75% Coconut oil:

Fatty acids	Cholesterol	RM	PN	IV	SN
Cream	210	27	3	37.9	230
25% Coconut oil	162	22	6.38	30.6	236.8
50% Coconut oil	115	17	9.75	23.45	243.5
75% Coconut oil	67	12	13.13	16.23	250.3

RM = Reichert-Meissl number **PN = Polenske number**
IV = Iodine value **SN = Saponification number**

Table (2), reports the results of adding palm seed oil to buffaloes' cream and its effect on some constants of produced cream. From these data, the use of palm seed oil as a milkfat substitute reduced the RM and IV, while such addition increased the values of SN and PN of the produced cream. These results may be attributed to the lower RM and IV and higher PN and SN in the substitute oil. However, the addition of 25% palm seed oil led to obtain a cream with normal values of RM, PN, IV and SN similar to those in the natural butter (Williams, 1950b and Bailey, 1964).

Table (2): Fat constants and cholesterol content of buffaloe's Cream mixed with 25, 50 and 75% Palm seed oil:

Fatty acids	Cholesterol	RM	PN	IV	SN
Cream	210	27	3	37.9	230
25% Palm oil	154	21.75	2.44	33.18	235
50% Palm oil	97	16.5	1.88	28.45	240
75% Palm oil	52	11.25	1.31	23.73	245

RM =Reichert-Meissl number, **PN = Polenske number**
IV = Iodine value, **SN = Saponification number**

On the other hand, it was also reported that the 50% and 75% added palm seed oil did not keep the RM and PN within the normal range.

From the same table it was reported that the addition of palm seed oil to the cream at the ratios 25%, 50% and 75% led to a decrease in the cholesterol content of the produced cream. The addition of 25% palm seed oil decreased the cholesterol content to 154 mg/100 g, 50% to 97 mg/100 g and 75% to 52 mg/100 g (Sebastian and Rao, 1974).

From the above results, it could be concluded that the effect of coconut oil addition to the cholesterol content was less than the palm seed oils, due to the unsaturated fatty acids content of the coconut oil which was higher than the unsaturated fatty acids content of the palm seed oil (Younes and Soliman, 1987).

It could also be concluded that the best treatment concerning the cream constants using coconut oil at the rate of 25% and 50% substitution, except the RM value with 50% substitution was failed, while the use of palm seed oil in the substitution of cream in the ratios 50% and 75%, failed in

keeping the RM and IV within the normal range of the natural cream SN value in spite of the decreasing of the cholesterol content significantly. Also. the addition of 75% resulted in lower RN value than the minimum limit of the natural cream.

B) Effect of add coconut oil on the fatty acid composition of buffaloes' cream:

Fatty acid composition of vegetable oils plays a great role in the fat characteristics is ties and its properties.

The vegetable oil characterized with the high content of short chain fatty acids, which the other fats are missing these components (Hilditch, 1949). The use of vegetable oil such as coconut oil as a milkfat substitute is reported in (Table 3). Coconut oil was mixed with buffaloes' cream. The ratios of added coconut oil were 25%, 50% and 75%. As shown in the table, coconut oil contains high short chain fatty acids C4-C12, while it is characterized with a low prportion of C16, C18 and C18:1. The latter acid was the predominant among the saturated and unsaturated fatty acids. The total unsaturated fatty acids of the coconut oil accounted 8.35% of the total fat. On the other hand, the fatty acid composition of the buffaloes' cream is characterized with the short chain acids which represented 12.32%, of total fat, and the unsaturated acids were 31.02% which means that coconut oil was softer than the milkfat (Gulyaev-Zaitsev and Tverdokhleb, 1965).

Howevér, the addition of coconut oil in the previous percentages to the buffaloes' cream led to an increase in the short chain fatty acids C4-C12 which was 24.71%, 37.67% and 50.75%, respectively, (Bailey, 1964), while the total short chain of the control cream was 12.32%.

Furthermore, the saturated fatty acid C14 increased from 9.60% in the control to 14.88% when 75% of coconut oil was added. The saturated fatty acids C16 and C18 slightly decreased. The total saturated fatty acids was gradually increased when 25%, 50% and 75% coconut oil were added. On the other hand, the unsaturated fatty acid C18:1, decreased as the added coconut oil increased (Echizen and Deki, 1975). The other unsaturated fatty acids C14:1, C14:2, C16:1 and C18:2 decreased in their values. Gnerally, according to the fatty acid content of the produced cream, specially the saturated acids, it was observed that the addition of coconut oil improved the quality of cream concerning the saturated/unsaturated fatty acids ratio (Younes and Soliman, 1986).

The treatment with palm seed oil was reported in Table (4). The buffaloe's cream was mixed with palm seed oil in the ratios of 25%, 50% and 75%. The effect of adding palm seed oil to the cream on the fatty acid composition of the cream admixture is illustrated in the same table. From these data, it was found that the fatty acid composition of palm seed oil greatly differs from the fatty acid composition of the buffaloe's cream. The short chain fatty acids of palm seed oil accounted 57.25% of the total fat (Inada, 1976). While the total unsaturated fatty acids was 16%. The addition of palm seed oil at the ratios 25%, 50% and 75% led to an increase in the total short chain fatty acids of the produced cream to 23.13%, 33.73% and 44.88%,respectively. These values of the short chain fatty acids was an

indication of the addition of substitute fat has a very high content of short chain, fatty acids, specially the latter values, (Carisano and Riva,1976).

Table (3): Fatty acid composition of Cream and mixed cream with 25, 50% and 75% coconut oil:

No. of C. atoms	Cream	C oil	25% C oil	50% C oil	75% C oil
4	3.5	-	2.45	1.52	0.88
6	1.5	0.5	1.15	0.9	0.75
8	1	7	2.23	4	5.5
10	3	8	4.25	5.5	6.75
12	3.5	48	14.63	25.75	36.88
14	11.5	16	12.63	13.75	14.88
16	27.5	9.5	23.38	18.35	14
18	11.5	2.4	9.23	6.95	4.68
20	2	0.2	1.8	1.3	0.80
10:01	-	-	-	-	0
12:01	-	-	-	-	0
14:01	2	-	1.7	1.2	0.6
16:01	3	0.5	2.38	1.9	1.13
18:01	27	6.5	21.88	16.55	11.43
18:02	2	1.25	1.81	1.63	1.44
18:03	1	0.1	0.78	0.55	0.33
Short chain	12.5	63.5	24.71	37.67	50.75
Total USA	35	8.35	28.34	21.68	15.01
Sat : Unsat	1.86	10.97	2.52	3.61	5.66

C oil = Coconut oil

Furthermore, the value of the saturated fatty acids C16 and C18 acids were greatly affected by increasing the palm seed oil ratio. They decreased gradually, while C14 acid was slightly affected. However, the total unsaturated acids decreased, being 30.25%, 25.50% and 20.75% regarding the 25%, 50% and 75% added palm seed oil (Soliman *et al.*, 1979). The results indicated that the adding of sunflower oil in the ratios 25% led to an improvement in the consistency of the produced cream, due to the high percentages of C12 when compared to the control cream, while the addition of 50% and 75% palm seed oil led to a production of cream expected to be softer than the control butter due to the high content of short chain fatty acids in spite of the improvement of the cream consistency, the fatty acid profile of the produced cream indicated a great evidence of the vegetable oil existence.

Furthermore the saturated:unsaturated acids of the produced cream by adding 25%, 50% and 75% palm seed oil was greatly changed than the saturated:unsaturated acids of the control cream, which empharize the treatment with a vegetable oil (Hewela *et al.*, 1978). So, it must refer to such addition when such product deals with the market.

Table (4): Fatty acid composition of cream and mixed cream with 25, 50 and 75% Palm seed oil:

No. of C. atoms	Cream	P oil	25% P oil	50% P oil	75% P oil
4	3.5	-	2.33	1.71	0.85
6	1.5	0.75	1.24	1	0.93
8	1	3	1.41	2	2.5
10	3	4	3.25	3.21	3.75
12	3.5	49.5	14.9	25.8	38
14	11.5	16.5	12.6	14	15.25
16	27.5	8	23	18	12.68
18	11.5	3	9.58	7.35	5.13
20	2	-	1.3	1.1	0.7
10:01	-	-	-	-	-
12:01	-	-	-	-	-
14:01	2	-	1.7	0.80	0.5
16:01	3	-	2.05	1.5	0.75
18:01	27	14	23.75	20.5	17.25
18:02	2	2	1.95	2.1	1.9
18:03	1	-	0.8	0.6	0.35
Short chain	12.50	57.25	23.13	33.73	44.88
Total USA	35	16	30.25	25.5	20.75
Sat : Unsat	1.86	5.30	2.30	2.9	3.79

C) Effect of addition of coconut and palm seed oils on the organoleptic properties of buffaloes' cream:

For the completion of the present study organoleptic tests were undertaken to determine the real and final acceptability of the product by consumer. Results of most food researches lie in the human palate and from these the decision on success or failure is determined. The organoleptic tests were thought of almost importance to clear the final decision. Judging and scoring were carried out by a group of eminent dairy technology who examined with great care all the different organoleptic characteristics namely appearance, body & texture and Flavour of the resultant cream.

Table (5): Organoleptic properties of buffaloe's Cream mixed with Coconut and Palm seed oils:

Properties	Control	25% C oil	25% P oil	50% C oil	50% P oil	75% C oil	75% P oil
Appearance (15)	14	13	12	12	10	9	7
Body & texture 30)	28	26	25	24	22	20	15
Flavour (55)	53	50	48	45	43	40	35
Total (100)	95	89	85	81	75	69	57

C oil = Coconut oil, P oil = Palm seed oil

The organoleptic properties of the examined cream were presented in Table (5). It could be observed that the addition of coconut oil to cream at the levels 25 and 50% (W/W) gained the highest score points (after the control score points) namely 89 and 81, respectively. The corresponding score points

of cream mad from cream mixed with palm seed oil were 85 and 75 at the same two the added levels respectively. When the addition coconut and palm seed oil to cream at the level 75% (W/W) were 69 and 57, respectively.

In conclusion, cream could be successfully produced by mixing coconut and palm seed oils with traditional cream at levels 25 and 50%.

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دراسة على إنتاج قشدة منخفضة الكولسترول

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تتميز الزيوت النباتية مثل زيت جوز الهند وزيت نوى النخيل بخلوها من الكولسترول وارتفاع محتواها من الأحماض الدهنية قصيرة السلسلة الكربونية مما يساعد عند خلطها بالقشدة الطبيعية الجاموسي في إنتاج قشدة منخفضة الكولسترول .

وقد اعتمدت هذه الدراسة على استبدال دهن القشدة بنسب مختلفة من نوعي الزيت ودراسة تأثيرها على ثوابت دهن اللبن وكذلك تركيب الأحماض الدهنية للقشدة ونسبة الكولسترول في القشدة الناتجة. حيث كانت نسب الإستبدال ٢٥ ، ٥٠ و٧٥% وزن لوزن وكانت النتائج كما يلي:

نجحت إضافة نوعي الزيت بنسبة ٢٥ و ٥٠% في خفض محتوى القشدة من الكولسترول من ٢١٠مجم/١٠٠جم إلى ١٦٢ و ١١٥ مجم/١٠٠جم على التوالي بالنسبة للقشدة الناتجة من خلط زيت جوز الهند بينما انخفضت إلى ١٥٤ و ٩٧ لنسبتي خلط زيت نوى النخيل. دون التأثير على ثوابت دهن اللبن أو محتواه من الأحماض الدهنية.

أما عند الاستبدال بنسبة ٧٥% فقد أدى إلى خفض الكولسترول إلى ٦٧ مجم/١٠٠جم عند إضافة زيت جوز الهند والى ٥٢مجم في حالة زيت نوى النخيل ولكن كان هناك تأثير واضح على ثوابت دهن اللبن والمحتوى من الأحماض الدهنية.

وأظهرت درجات التحكيم أن أقرب العينات إلى الكونترول كانت نسبة استبدال ٢٥% من زيت جوز الهند تليها نفس النسبة لزيت نوى النخيل ثم نسبة ٥٠% وبنفس الترتيب لنوعي الزيت بينما انخفضت درجات التحكيم لنسبة استبدال ٧٥%.