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MODIFIED LECITHINS AS A SUBSTITUTED CONSITUENT OF EGG YOLK IN LOW CALORIE- FREE CHOLESTEROL MAYONNAISE

[15]

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ABSTRACT

Extracted lecithins from different oil sources (soybean, sunflower and corn germ) as well as their modified forms (alcohol soluble and lecithin-soy protein isolate complex) at levels of 0.2 and 0.4 % were used as replacer of egg yolk in manufacturing low calorie-free cholesterol mayonnaise. Rheological measurements, stability rate and sensory evaluation of prepared mayonnaise were studied. Obtained data showed that samples prepared using raw lecithins proved the highest dynamic viscosity values at all shear rates than mayonnaise samples prepared using the modified lecithins. On the other hand, using lecithin forms at 0.4 % improved the rheological properties of studied low calorie-free cholesterol mayonnaise and they were greatly stable over all the storage period compared to the control sample. The pH values of all samples slightly increased on the storage and reached their maximum at the end of the storage periods. The mean score values of panelists on the quality attributes of studied mayonnaise samples showed no significant differences between all treated samples compared with the control one.

Key words: Lecithins, Oilseeds, Rheology, Sensory evaluation, Quality attributes, Low calorie mayonnaise

INTRODUCTION

There are many foods containing oil together with water, it is necessary for the taste and texture of these foods to make oil and water stable emulsions. Commercial lecithin is a natural occurring mixture of phospholipids (PL) obtained during the refining of crude vegetable oils (**Smiles *et al* 1988**). Improved emulsifing properties could be obtained by modification of crud lecithin. Fractionation crude lecithin into phosphatidyl choline (PC) and phosphatidyl ethanolamine (PE) rich portion could be achieved by alcohol treatment. Products with a PC/PE ratio 5:1 were obtained with 90 % ethanol (**Van Nieuwenhuyzen, 1976**). PC enriched lecithin had better O/W emulsifying properties than lecithin mixture, and it functioned in wide pH range. PC had also therapeutic effects on verious metabolic disorders such as lowering cholesterol levels, treating neurological disorders etc. (**Sosada *et al* 1994 and Temelli & Dunford, 1995**).

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Mizutani and Nakamura (1988) prepared lecithin-protein complex by sonicating each of wheat or blood globulin solution with soy lecithin suspension. The emulsifying activity was much improved in the neutral pH by complex formation of lecithin with each protein.

Mayonnaise is an oil-in-water emulsion, droplets of oil are dispersed in a continuous aqueous phase. The rigidity of the emulsion depends partly on the size of the oil droplets and how tightly they are packed. Several investigator covered the mayonnaise preparation and manufacturing **(Gladwell *et al* 1985 and Yao *et al* 1990)**

Many factors affect the oil-in-water emulsion stability of mayonnaise including the amount and stability of oil, amount of egg yolk, relative volume of oil phase to aqueous phase, types and amounts of emulsifiers, method of mixing, water quality, and temperature **Stefanow (1989), Daugaard (1993) and Meyer (1996). Pons *et al* (1994)** studied the influence of different oil contents on the flow characteristics for standard mayonnaise and light mayonnaise. However, **Puppo *et al* (2000)** prepared mayonnaise samples with modified soy protein isolate (SPI). Yet's there are no available data about the production of low calorie-free cholesterol mayonnaise. Therefore, the objectives of this investigation were carried out to utilize lecithins and their modified forms as an replacer of egg yolk in low calorie-free cholesterol mayonnaise.

MATERIAL AND METHODS

MATERIAL

Soybean and sunflower wet gums used in preparation of lecithins were obtained from Misr Gulf Oil Processing Company (MIGOP) Suez city, Egypt, however, corn germ oil and its wet gum were obtained from Arma Food Industry company 10^{th} of Ramadan city, Egypt. Ingredients used in manufacturing low calorie mayonnaise were purchased from the local market, Cairo, Egypt. Defatted soy flour was obtained from Agriculture Research Center, Ministry of Agriculture, Giza, Egypt. All materials used in this investegation were obtained from different sources in April, 1998.

METHODS

Technological processing

Degumming process was carried out according to **Smiles *et al* (1988)**. Extraction of lecithin was carried out according to Sosada *et al* **(1994)**. Soy protein isolate was prepared according to the method described by **Hirotsuka *et al* (1984b)**.

Lecithin modifications

The procedure of **Hollo *et al* (1993)** was used for the preparation of ethyl alcohol soluble fraction of lecithins. Lecithin-soy protein isolate complexes was prepared according to the method described by **Hirotsuka *et al* (1984a)**. Treatment of the complexes with ethanol alcohol was carried out using the procedure outlined by **Hirotsuka *et al* (1984a)**.

Processing of low calorie-free cholesterol mayonnaise

Low calorie mayonnaise sample containing 40 % corn oil was prepared using whole egg as a control with the addition of blanched potato tissues. The suggested formula was as below:

Ingredients	%
Corn oil	40.00
Blanched Potato	29.00
Whole egg	22.37
Lemon juice	2.21
Vinegar	0.95
Mustard	2.21
Mustard flour	0.31
Salt	1.73
Sugar	0.63
White pepper	0.31
Potassium sorbate	0.28

Potato tissues. salt, sugar, mustard, white pepper and potassium sorbate were first mixed with whole egg, vinegar, lemon juice using electric mixer on liquefying velocity for 5 sec. The oil was then slowly added to the system on puree velocity and more rapidly after the mass began to thicken, with raising gradually the velocity from puree to liquefying during 50 sec. All the ingredients were then mixed on liquefying velocity for 20 sec.

Low calorie-free cholesterol mayonnaise samples were prepared using each of the studied lecithins and their modified types at levels of 0 2 and 0.4 %, with the addition of another proportion of blanched potato tissues (more than in recipe) to replace egg yolk. While the white egg was added so that its per cent' was 14.54 %.

The prepared low calorie mayonnaise and low calorie-free cholesterol mayonnaise were packed in 100 g size glass jars with screw cap. Jars were stored at ambient temperature (20°C ± 5). Samples were then taken at the next day and after one month intervals in three replications till 6 months for measuring stability rate, pH, rheological measurements and organolyptic evaluations.

The pH values of mayonnaise samples were measured according to the procedure of **Zaika *et al* (1976)**.

Rheological measurement of mayonnaise

Viscoelasticity of mayonnaise samples was measured as described by **Gladwell *et al* (1985)** at 25°C by the rotation type RV (rotational viscometer rheo-test). The tested material was introduced into the "S" cylinder of the viscometer. In such a case, shear stress developed at shear ranging from 0.1 to 43.74 / sec. The dynamic viscosity was calculated according to the following formula:

$$(\eta) = \sigma / \gamma$$

Where:

η = Dynamic viscosity in p. σ = Shear stress dyne / cm^2 . γ = Shear rate sec^{-1}

(σ) was calculated from the obtained torque value (α) in SKT and the cylinder constant Z (dyne / cm^2 SKT) according to the following equation:

$$\sigma = Z \cdot \alpha$$

The power low parameters consistency index (K) and flow behavior index (n) were calculated from the regression coefficients of log shear rate and log shear stress data **Paredes *et al* (1988)**. The power law equation is as follow:

$$\sigma = K \cdot \gamma^n$$

Stability rate of mayonnaise

The stability rate (SR) of mayonnaise was determined according to **Sheng and**

Cotteril (1989) and was calculated as follows:

$$SR = F_1/F_0 \times 100$$

Where:

F_1 = Separated fat content. F_0 = initial fat content.

Sensory evaluation of mayonnaise

Mayonnaise samples made using different types of lecithin under the previous experiments were asked for their quality attributes by ten members preference taste panel, from staff of the Department of Food Science, Faculty of Agriculture, Ain Shams University. The panelists were asked to score appearance, color, consistency, mouth feel, taste, flavor, overall acceptability by giving a degree up ten using the report sheet according to **Raganna (1977)**. The data obtained were exposed to proper statistical analysis according to Statistical Analysis System User's Guide, (SAS 1988). Duncan multiple range at 5 % level of significance was used according to Duncan (1955) to compare between means.

RESULTS AND DISCUSSION

As shown in Figure (1), mayonnaise samples prepared using raw lecithins showed the highest dynamic viscosity values at shear rates of 0.1 to 43.74 than mayonnaise samples prepared using whole egg and modified lecithins. While, mayonnaise samples prepared using whole egg had the lowest viscosity values at all shear rates. The viscosity was 1806.0 poise at shear rate 0.1 which gradually decreased to reach 11.0 poise at shear rate 43.74 sec^{-1}.

The viscosity of mayonnaise samples prepared using ethanol soluble lecithins fraction and lecithins-SPI complex treated with ethyl alcohol of each of soy, sunflower and corn germ at 0.2 and 0.4 % ranging between 2709.0 to 1204.0 poise at the beginning of shear rate 0.1 sec^{-1}. With increasing the shear rate, the viscosity values of mayonnaise samples gradually declined till reached their minimal values at shear rate 43.74 sec^{-1} for different mayonnaise samples.

From the obtained data in the same figure it was possible to connect between the decrease in emulsion activity of the used lecithin and the increase in dynamic viscosity of the product. Also, it was clearly noticed that the concentration of the used lecithin greatly affected the dynamic viscosity of mayonnaise samples. The reduction of lecithin concentration from 0.4 to 0.2 % was accompanied by an increase in viscosity. Therefore, mayonnaise samples prepared using modified lecithins at concentration of 0.4 % was preferred than those prepared using 0.2% modified lecithin or the raw lecithins at both concentrations. The differences between the viscosity values for the first concentration in the control samples were negligible. While, the second concentration gave relatively higher viscosity values at all treatments. The reduction of emulsifier concentration from 0.4 to 0.2% affected in viscosity of mayonnaise samples prepared using modified lecthins. Decreases the amounts of emulsifier were accompanied by increased of viscosity **Gladwell *et al* (1985)**.

Following the preparation of O/W emulsion the oil drops flocculated and formed three-dimensional network structures that exhibited viscoelastic behavior. The distance of separating the drops depended on the van der Waals' attraction and the electrostatic and steric repulsion potentials. Decrease of an emulsion

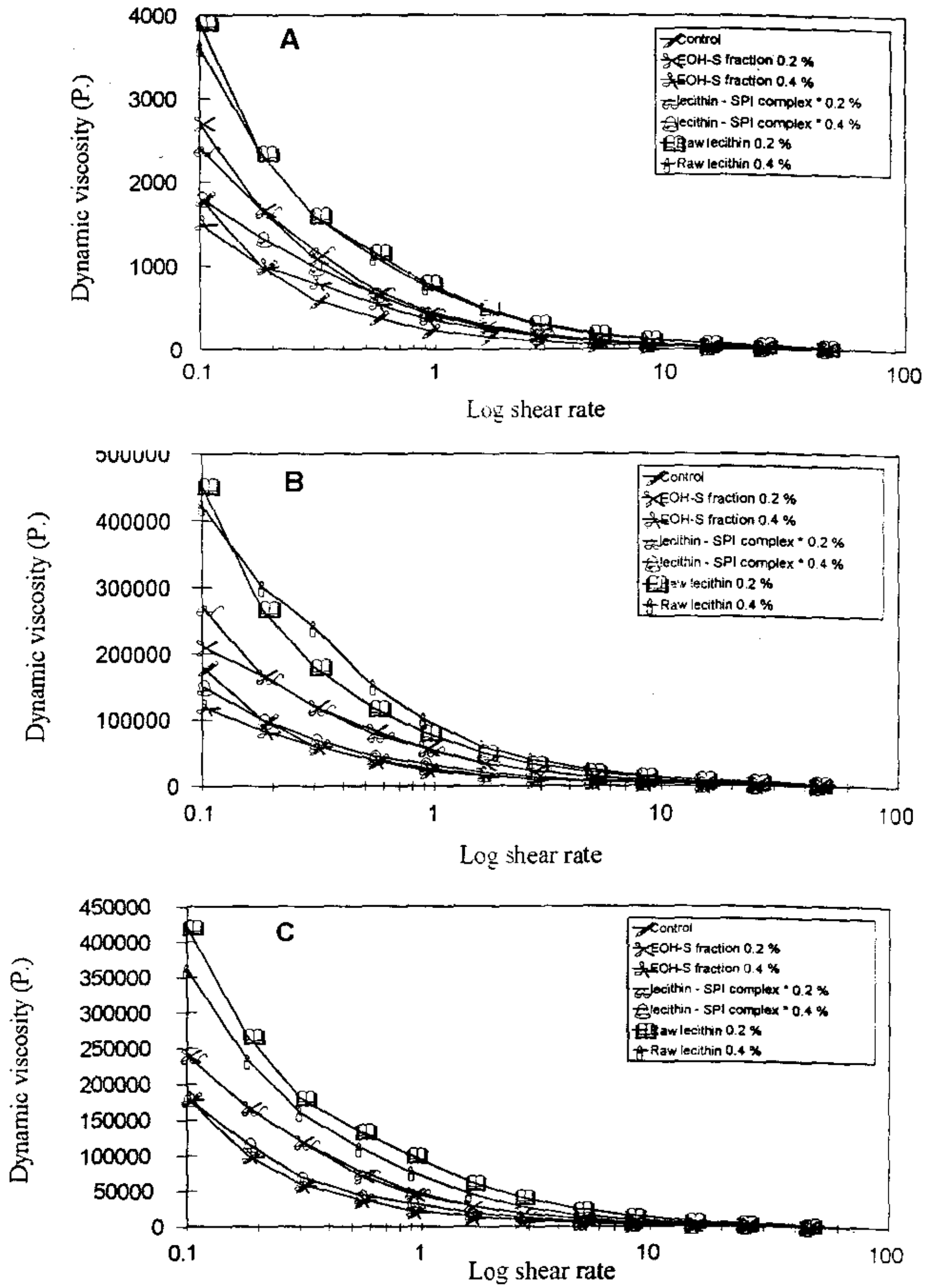

Figure 1. Shear rate and dynamic viscosity (P.) of mayonnaise prepared from modified soybean (A), sunflower (B) and corn germ (C) lecithins.

activity of emulsifier lessened the corporated water with the emulsifier, accordingly the potato tissues absorbed the water. Thus, the use of raw lecithins that had lower emulsion activity at 0.2, 0.4 % and decreasing the amount of the modified lecithins to 0.2 % gave higher viscose emulsions than other free cholesterol and control samples. These obtained facts agree with **Kiosseoglou & Sherman (1983), and Gladwell (1985)**. The flow behavior indexes (n) of the different tested samples were less than 1.0 indicating their pseudoplastic nature. However, mayonnaise samples prepared using modified lecithins had lower n values than mayonnaise samples prepared using raw lecithins as shown in Table (1) and Figure (2).

Concerning the consistency coefficient (K values) of the mayonnaise samples prepared using soy, sunflower, and corn ethanol soluble fractions and lecithin–SPI complexes treated with ethanol at the concentration of 0.2 % were in the second order. While, the control whole egg mayonnaise showed the lowest K value. K values for mayonnaise samples prepared using ethanol soluble lecithin fractions and lecithin–SPI complexes treated with ethyl alcohol at the concentration of 0.4 % were approximately equal to that of mayonnaise control samples being 301.34, 222.58, 228.37 and 351.16, 281.05, 283.07, respectively. It could be concluded that using modified lecithins at the concentration of 0.4 % was preferred to make a high quality of low calorie-free cholesterol mayonnaise.

The data presented in Table (2) indicated clearly that low calorie free cholesterol mayonnaise samples manufactured using modified soy, sunflower and corn lecithins at the concentration of 0.4% were greatly stable over all the storage period compared to the other samples. However, when alcohol soluble fraction lecithins; soy, sunflower and / or corn lecithin-SPI complexs treated with ethyl alcohol were used at 0.2 % in mayonnaise manufacture, the stability rates of the emulsions were markedly decreased and the emulsions were separated after four and three months, respectively. While, mayonnaise samples made from raw lecithins at either 0.2 or 0.4 %, the emulsions were unstable for a large extent and separated after only one month during storage.

The differences in stability of prepared mayonnaise samples were due to the difference in concentration and the type of the emulsifiers used. Increasing the concentration of lecithin decreased droplet size and improved the emulsification and dispersion of oil in the aqueous phase. Mayonnaise samples prepared from ethanol soluble fraction lecithins showed higher stability due to the higher phosphatidylcholine per cent that improved the emulsification activity. These above observations agree with **Zlatanov (1994), Polic and Panin (1997).**

The presented data in Table (3) showed slight differences in pH values between the studied mayonnaise samples before storage. The pH values ranged between 3.7 and 3.9. As storage period stepped up, the pH values of all studied samples were gradually and markedly increased till reached their maximal values at the end of storage period, ranging from 4.3 and 4.4. These increases might be due to the excess of deterioration occurred in egg protein and the liberation of ammonia and other volatile basis which caused frequent increases in pH during storage (**Tunaley *et al* 1985).**

Table 1. Flow behavior constants of the mayonnaise samples prepared from modified soybean, sunflower and corn germ lecithins

Treatments	Lecithins concentration %	Soybean			Sunflower			Corn germ		
		n	k	R^2	n	k	R^2	n	k	R^2
Control	0.0	0.1698	234.54	0.9677	0.1698	234.54	0.9677	0.1698	234.54	0.9677
EOH-S fraction	0.2	0.1671	402.84	0.9941	0.2080	450.79	0.9154	0.1675	411.15	0.9604
	0.4	0.2072	301.34	0.9044	0.2096	222.58	0.9712	0.1607	228.37	0.9317
lecithin--SPI complex *	0.2	0.1711	413.69	0.9676	0.2219	478.97	0.9739	0.1606	418.31	0.9366
	0.4	0.1782	351.16	0.9042	0.2321	281.05	0.9724	0.1773	283.07	0.9734
Raw lecithin	0.2	0.2020	662.09	0.9641	0.1835	822.79	0.8975	0.2042	780.37	0.8901
	0.4	0.1979	633.69	0.9669	0.2139	723.24	0.9936	0.1577	605.89	0.9066

SPI = Soy protein isolate. n = Flow behavior index * = Treated with ethyl alcohol. k = Consistency index EOH-S = Ethanol soluble.

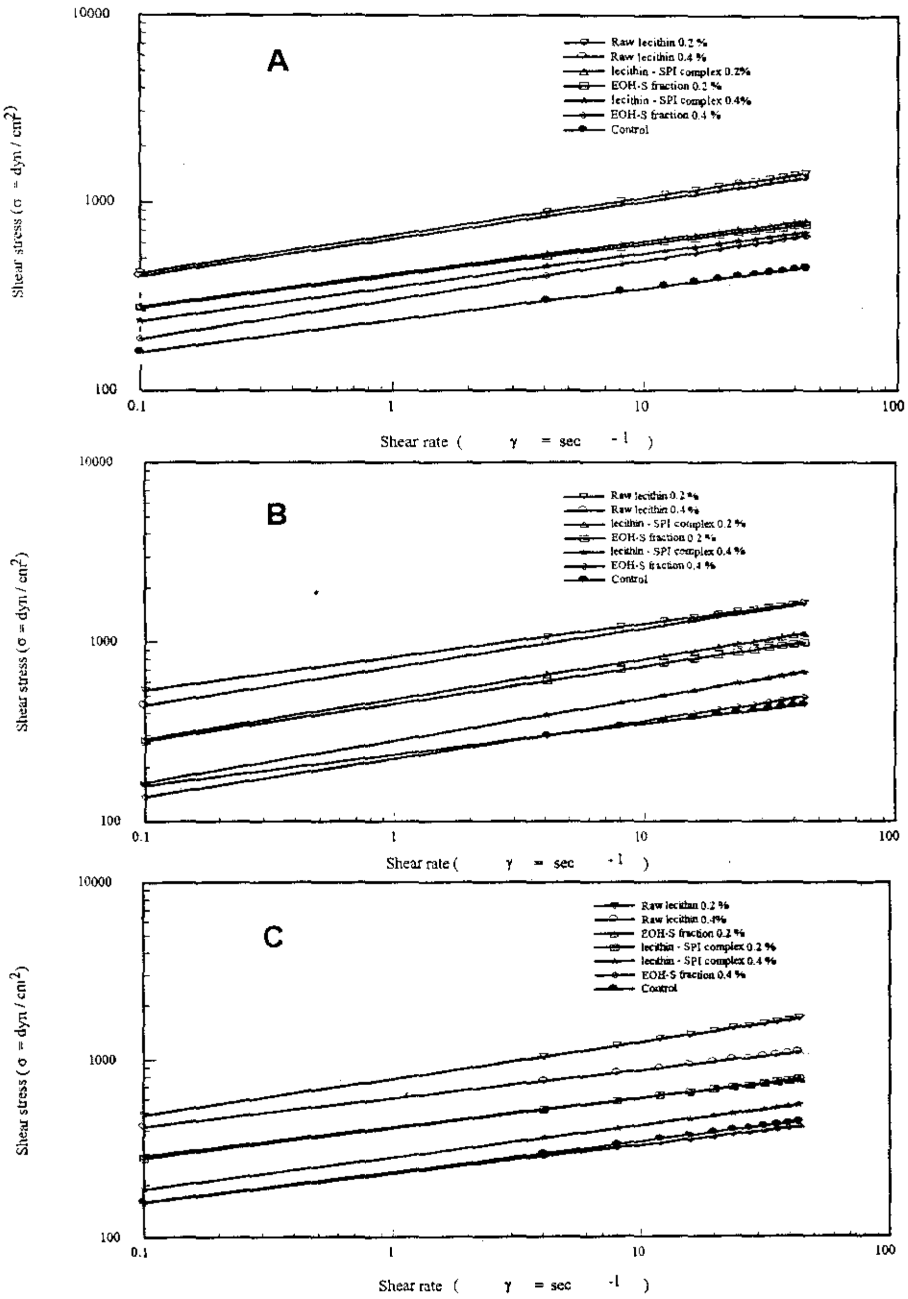

Fig. 2. Shear rate and shear stress of mayonnaise samples prepared from modified soybean (A), sunflower (B) and corn germ lecithins.

Table 2. Stability rate of mayonnaise emulsions prepared using modified soybean, sunflower and corn germ lecithins at different concentrations and stored at room temperature

Storage period (month)	Control	Soybean					
		EOH-S fraction		Lecithin-SPI complex *		Raw lecithin	
		0.2 %	0.4 %	0.2 %	0.4 %	0.2 %	0.4 %
0	97.50	91.66	99.17	92.00	98.67	85.66	86.67
1	96.83	82.83	98.83	83.33	98.33	72.00	74.83
2	93.83	77.50	98.16	75.50	98.33	---	---
3	90.16	75.33	96.83	73.00	97.50	---	---
4	87.33	72.60	95.50	---	96.66	---	---
5	83.50	---	94.67	---	96.00	---	---
6	83.00	---	93.33	---	94.50	---	---
		Sunflower					
0	97.50	89.16	98.33	89.50	98.50	82.33	83.83
1	96.83	77.16	97.83	79.33	98.16	67.83	68.50
2	93.83	74.83	96.83	75.50	97.50	---	---
3	90.16	73.33	94.66	74.67	95.33	---	---
4	87.33	71.33	92.33	---	93.16	---	---
5	83.50	---	91.33	---	92.00	---	---
6	83.00	---	89.50	---	90.67	---	---
		Corn germ					
0	97.50	90.50	98.50	91.33	98.83	83.30	85.00
1	96.83	80.16	98.33	82.16	98.50	70.16	71.33
2	93.83	76.33	97.17	78.16	98.00	---	---
3	90.16	73.50	95.67	74.17	96.00	---	---
4	87.33	72.16	93.50	---	93.83	---	---
5	83.50	---	92.67	---	93.33	---	---
6	83.00	---	91.50	---	92.00	---	---

SPI = Soy protein isolate. * = Treated with ethyl alcohol. EOH-S = Ethanol soluble.
-- = Separation

Table 3. pH values of mayonnaise emulsions prepared using modified soybean, sunflower and corn germ lecithins at different concentrations and stored at room temperature

Storage period (month)	Control	Soybean					
		EOH-S fraction		Lecithin-SPI complex *		Raw lecithin	
		0.2 %	0.4 %	0.2 %	0.4 %	0.2 %	0.4 %
0	3.7	3.8	3.8	3.9	3.7	3.7	3.7
1	3.7	3.8	3.8	3.8	3.7	3.7	3.7
2	3.7	3.8	3.8	3.8	3.7	---	---
3	3.9	3.9	3.9	3.9	3.9	---	---
4	4.2	4.0	4.0	---	4.1	---	---
5	4.4	---	4.2	---	4.3	---	---
6	4.4	---	4.3	---	4.3	---	---
		Sunflower					
0	3.7	3.7	3.7	3.7	3.7	3.7	3.7
1	3.7	3.7	3.7	3.7	3.7	3.7	3.7
2	3.7	3.8	3.8	3.8	3.8	---	---
3	3.9	3.9	3.9	3.9	3.9	---	---
4	4.2	4.0	4.1	---	4.2	---	---
5	4.4	---	4.3	---	4.2	---	---
6	4.4	---	4.3	---	4.3	---	---
		Corn germ					
0	3.7	3.8	3.7	3.7	3.7	3.8	3.7
1	3.7	3.8	3.7	3.7	3.7	3.8	3.7
2	3.7	3.8	3.7	3.7	3.7	---	---
3	3.9	3.9	3.8	3.8	3.9	---	---
4	4.2	4.0	4.0	---	4.1	---	---
5	4.4	---	4.2	---	4.3	---	---
6	4.4	---	4.3	---	4.4	---	---

SPI = Soy protein isolate. * = Treated with ethyl alcohol. EOH-S = Ethanol soluble.
- = Separation

The mean values of sensory evaluation scores of mayonnaise samples are shown in Table (4). It could be noticed that the mean score values of appearance were significantly higher for all samples prepared using modified lecithins at levels of 0.2 and 0.4 % compared to mayonnaise prepared using raw lecithins. On the other hand, the mean score values of samples prepared using modified lecithins and that prepared using whole egg were statistically the same.

The average data shown in the same Table indicated that the received color scores of mayonnaise prepared using raw soy and sunflower lecithins were insignificantly higher as compared to mayonnaise samples prepared using raw corn lecithin at 0.2 % and 0.4 %. While, it was obviously clear that using either whole egg or modified lecithins at the previous concentrations in manufactured mayonnaise samples showed the same color score. From the obtained data it was cleared that the color of studied mayonnaise samples was not affected by using different types of raw and modified lecithins.

Consistency is an important quality attribute of mayonnaise, which related to its physical properties. The data indicated no significant differences in consistency of mayonnaise samples prepared using whole egg and all modified lecithins at 0.2 and 0.4 %. Their means were higher than those prepared using raw lecithins. The noticing deleterious in mayonnaise consistency manufactured using raw lecithins was contributed to their changes in physical properties. The consistency of mayonnaise emulsions transformed to a dried and rigid texture. These findings were keeping close to mayonnaise stability rates and viscosity.

The mouthfeel of studied mayonnaise samples followed the same trend of consistency. The mean values among samples prepared using either modified lecithins or whole egg were higher and statistically the same, while there was significant different between these samples and those prepared using raw lecithins at 5 % level of probability.

Mayonnaise contained a balancing proportions of salt, sugar, vinegar and spicing that contributed, its taste. Because the relatively high content of vinegar, mayonnaise characterized by sour taste. The received mean score values of panel members on taste of all mayonnaise samples were statistically the same ranging between 7.6 and 9.0, indicating that the use of either modified lecithins or raw ones were not affected in the taste of prepared samples compared with the whole egg control one.

The means of panelist score values on overall acceptability of mayonnaise samples reflected all the previously judged quality attributes, it followed approximately a similar pattern.

From the obtained data it could be concluded that the quality and quantity of lecithin played a major role in quality attributes and the stability of mayonnaise. In general, both ethanol soluble lecithin fraction and lecithin-SPI complex treated with ethyl alcohol gave high quality mayonnaise samples not differed to the control one. Therefore, the modified forms were preferred than raw lecithins under all studied conditions. These two modified lecithins, when used in low calorie free cholesterol mayonnaise showed no oiling-off and had negligible effect on sensory characteristics.

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Table 4. Mean values of sensory evaluation of mayonnaise emulsions prepared using modified soybean, sunflower and corn germ lecithins at different concentrations

Quality attributes	Control	Soybean					
		EOH-S fraction		Lecithin-SPI complex*		Raw lecithin	
		0.2 %	0.4 %	0.2 %	0.4 %	0.2 %	0.4 %
Appearance	9 [a]	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	6.6 [b]	6.6 [b]
Color	9 [a]	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	9.0 [a]	9.0 [a]
Consistency	9 [a]	9 [a]	8.6 [a]	8.6 [a]	8.6 [a]	5.0 [b]	5.0 [b]
Mouthfeel	9 [a]	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	7.0 [b]	7.0 [b]
Taste	9 [a]	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	8.6 [a]	8.6 [a]
Flavor	9 [a]	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	8.6 [a]	8.6 [a]
Overall acceptability	9 [a]	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	5.3 [b]	5.3 [b]
		Sunflower					
Appearance	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	6.3 [b]	6.3 [b]
Color	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	9.0 [a]	9.0 [a]
Consistency	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	5.0 [b]	5.0 [b]
Mouthfeel	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	7.3 [b]	7.3 [b]
Taste	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	8.6 [a]	8.6 [a]
Flavor	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	8.6 [a]	8.6 [a]
Overall acceptability	9 [a]	9 [a]	9 [a]	9 [a]	9 [a]	5.3 [b]	5.3 [b]
		Corn germ					
Appearance	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	9.0 [a]	7.6 [ab]	6.3 [b]
Color	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	9.0 [a]	7.6 [a]	8.0 [a]
Consistency	9 [a]	8.3 [a]	8.3 [a]	8.6 [a]	8.6 [a]	5.0 [b]	5.3 [b]
Mouthfeel	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	8.6 [ab]	7.0 [b]	7.0 [b]
Taste	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	8.6 [a]	7.6 [a]	7.6 [a]
Flavor	9 [a]	9.0 [a]	9.0 [a]	9.0 [a]	8.6 [a]	7.6 [a]	7.6 [a]
Overall acceptability	9 [a]	9.0 [a]	8.3 [a]	9.0 [a]	8.6 [a]	5.3 [b]	5.3 [b]

SPI = Soy protein isolate * = Treated with ethyl alcohol. EOH-S = Ethanol soluble.

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الليسيثين المعدل كبديل لصفار البيض فى المايونيز المنخفض السعرات والخالى من الكولستيرول

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أجرى هذا البحث بغرض تقييم استخدام الليسيثين المستخلص من مصادر زيتية مختلفة (فول الصويا - عباد الشمس - جنين الذرة) وكذلك صوره المعدلة(الجزء الذائب من الليسيثين فى الكحول- معقد الليسيثين مع بروتين فول الصويا المعزول والمعامل بالكحول) بتركيزات ٠,٢ و ٠,٤ % كبديل لصفار البيض فى انتاج المايونيز المنخفض السعرات والخالى من الكولستيرول. وقد تم اختبار العينات المصنعة من حيث الخواص الريولوجية، الثبات الأستحلابى وكذلك الصفات الحسية.

أظهرت النتائج المتحصل عليها ان عينات المايونيز المحضرة باستخدام الليسيثين الخام كانت لها قيم لزوجه مرتفعه بالمقارنه بتلك المصنعه باستخدام البيض الكامل والليسيثين المعدل. كما أدى استخدام الليسيثين المعدل بتركيز ٠,٤ %إلى تحسين الخواص الريولوجيه لعينات المايونيز المنخفض السعرات والخالى من الكولستيرول وكانت له أعلى قيم ثبات للمستحلب خلال فترات التخزين المختلفة بالمقارنة بعينة الكنترول كما حدثت زيادة بسيطة فى رقم الحموضة لعينات المايونيز خلال التخزين ووصلت الزيادة لأقصاها فى نهاية مدة التخزين. دلت نتائج التقييم الحسى على ان العينات المصنعه من الليسيثين المعدل كانت عاليه الجودة وأفضل من تلك

المستنعه من الليسيثين الخام ولا يوجد فروق معنويه بينها وبين عينـــه الكنـــترول. وقـــد أشارت نتائج هذة الدراســـه الـــى امكانيـــة استخدام كل من جزئ الليسيثين الذائب فـــي الكحول وكذلك معقد الليسيثين مع بروتيـــن فول الصويا المعزول فـــى انتـــاج مـــايونيز منخفض السعرات وخالى من الكولســـتيرول يتميز بثبات عالى وجوده حسيه مرتفعه.

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