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CHEMICAL, MICROBIOLOGICAL AND SENSORY EVALUATION OF MAYONNAISE PREPARED FROM OSTRICH EGGS

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ABSTRACT

Ostrich eggs were evaluated for their chemical composition and mineral contents. Also, chemical, microbiological and sensory evaluation of mayonnaise made from ostrich eggs comparable to that made from chicken eggs were studied. Data indicated that ostrich eggs are a good source of protein (47.09 % d.b), total lipids (45.10 % d.b), carbohydrates (4.03 % d.b), calcium (206.5 mg/100g d.b), phosphorus (683.8 mg/100g d.b), potasslum (460 mg/100g d.b), sodium (408.7 mg/100g d.b) and zinc (5.2 mg/100g d.b). The chemical evaluation of unpasteurized and pasteurized mayonnaise indicated that mayonnaise made from ostrich eggs was relatively resistant to chemical spoilage due to auto-oxidation than that made from chicken eggs. In ostrich eggs mayonnaise, almost stored unpasteurized samples were associated with significantly ($P< 0.05$) greater titratable acidity (T.A). Conversely, T.A did not alter in stored pasteurized samples. However, in chicken eggs mayonnaise T.A did not affected in pasteurized or unpasteurized samples. The acid value (AV) and thiobarbituric acid (TBA) number of unpasteurized and pasteurized mayonnaise made from ostrich or chicken eggs were significantly ($P< 0.01$) increased as storage period increased. These increases in AV and TBA values were significantly ($P < 0.05$) decrease in pasteurized mayonnaise compared to unpasteurized one made from either ostrich or chicken eggs. Microbiological evaluation proved that ostrich eggs mayonnaise was relatively resistant to microbial spoilage due to decreasing in pH values. Sensory evaluation scores of taste, flavor, color, appearance and overall acceptability were significantly ($P< 0.05$) higher for ostrich eggs mayonnaise than those received for chicken eggs mayonnaise.

INTRODUCTION

Eggs have been called "nature's perfect food". This is because they are one of the few complete protein foods, i.e. they contain all the nine essential amino acids which can not be manufactured from the body but must be obtained from foods (Agriculture and Agri. Food Canada, 1999).

Eggs are probably one of the first multifunctional ingredients. They are well-known for their whipping, gelling and emulsification properties (Davis and Reeves, 2002). Eggs play an important role in food preparation. The three most acknowledged uses of eggs are: liquid egg will coagulate or solidify when heated (to produce cakes, ...etc.); aeration (whipping) creates lighter and airier products (e.g. meringues); and emulsification of egg yolk phosholipids and lipoproteins will produce salad dressing and sauces (Stadelman, 1999).

Mayonnaise is probably one of the most widely used sauces or condiments in the world today. It was first produced commercially in the early 1900, becoming popular in America from 1917 to 1927 (Harrison and Cunningham, 1985) and more recently in Japan where sales increased by 21

% in the year from 1987 to 1990 (Brabant, 1992). Because of its low pH and high fat content, mayonnaise is relatively resistant to microbial spoilage. Mayonnaise is an oil-in-water emulsion and is traditionally prepared from a mixture of egg yolk, vinegar, oil and spices (especially mustard); it may also include salt, sugar or sweeteners, and other optional ingredients (Depree and Savage, 2001). Pasteurization causes little or no damage to the functional properties and did not affect the formation of stable mayonnaise (Palmer *et al.*, 1969).

The aim of this investigation is to study the chemical composition of ostrich egg comparable to chicken egg. In addition, quality of both type of mayonnaise made from ostrich or chicken eggs were evaluated chemically and microbiologically as well as the sensory properties.

MATERIALS AND METHODS

A: Materials:

Ingredients used in this investigation were corn oil, white vinegar (6 % w/v acetic acid), salt and mustard purchased from a local supermarket. However, chicken fresh eggs were purchased from a local grocery store and ostrich eggs from the Egyptian company of ostrich breeding, Cairo, Egypt. Egg yolk was separated from the egg white and the yolk was rolled on a filter paper to remove adhering egg white fragments (Aluko and Mine, 1997). After puncturing of the yolk membrane, the liquid yolk was collected in a clean beaker and used in mayonnaise preparations.

B: Mayonnaise preparation:

Mayonnaise was prepared from ostrich and chicken eggs using the following formula: fresh egg yolk (15 %), white vinegar (12 %), corn oil (70 %), salt (2 %) and dry mustard (1 %). Mixing of ingredients was performed using electric mixer (Braun Combimax 700, Type 3202). The dry ingredients were mixed separately in a container using one-third of the total amount of vinegar until a smooth paste was obtained. The paste was added to the egg yolk and mixed for 5 min. Oil was added slowly under continuous mixing to form the emulsion; after all the oil has been added, mixing continued for 5 min. This was followed by addition of the remaining vinegar and mixing continued for additional 5 min (Depree and Savage 2001).

The prepared mayonnaise was divided into two portions. The first one was pasteurized at 70 °C for 15 min. and then cooled. The second portion was left without treatment (unpasteurized). Both two portions were transferred to sterile screw capped glass jars under aseptic conditions and stored at 4°C for 20 weeks. Samples for each treatment were taken at specified time intervals throughout storage for chemical, microbiological and sensory evaluations.

C: Chemical analysis:

Moisture, crude protein, total lipids, ash and acid value (AV) were determined in mayonnaise as the method described in AOAC (2000). The carbohydrates content was calculated by differences. Titratable acidity (T.A) was determined by titrations of 10 g mayonnaise to pH 8.1 with 0.1 N NaOH and results were converted to percentage of acetic acid according to the method of AOAC (2000). The pH values of mayonnaise samples were

measured using pH meter (model CyberScan 500) according to the procedure of Zaika *et al.* (1976), using 10 % dispersion of mayonnaise in distilled water. Thiobarbituric acid (TBA) number was determined as described by Okayama (1987). Mineral contents, i.e. calcium (Ca), phosphorus (P), iron (Fe), potassium (K), sodium (Na) and zinc (Zn) were determined according to the method of AOAC (2000) using atomic absorption spectrophotometer, Perkin-Elmr 2380.

D: Microbiological analysis:

Total bacterial counts (TBC), yeast, mold counts, E. Coli, Staphylococcus aureus (*S. aureus*) and *Salmonella spp. were determined* according to APHA, (1992).

E: Sensory evaluation:

Sensory evaluation of mayonnaise samples was conducted after preparation and during storage at 4 °C for 20 weeks. Sensory characteristics: taste, flavor, color, appearance and overall acceptability were evaluated by 25 panel on 10-point hedonic scale, 1= the least, the lowest; 10 = the most, *the highest according to Ranganna (1977).*

F: Statistical analysis:

Data were subjected to statistical analysis using computerized analysis of variance and Duncan's multiple range test procedures within (SAS, 1998).

RESULTS AND DISCUSSION

1- Chemical composition of ostrich eggs comparable to chicken eggs:

Chemical composition and minerals of both ostrich and chicken eggs were studied and data presented in Table 1. Results indicated that protein and total lipid contents of ostrich eggs were approximately similar to that of *chicken eggs.* However, ash content in ostrich eggs was higher than that found in chicken eggs by 22.3 % db. Moreover, total carbohydrates of chicken eggs was higher (4.71 % db.) than ostrich eggs (4.03 % db.).The above findings are in harmony with Makhlouf *et al.* (1996). Who reported that content of protein, total lipids, ash and *total carbohydrates in chicken eggs* were 46.68, 44.99, 3.02 and 5.31 % d.b, respectively. In addition, the content of protein and total lipids in pasteurized eggs were 47.3 and 45.2 % d.b, respectively (Caboni *et al.*, 2005). Data also coinicid with those reported by Di Meo *et al.* (2003) who showed that protein and fat contents in ostrich eggs ranged between (47.7 to 48.2 % d.b) and, (43.8 to 44.2 % d.b), respectively. However, ash content (5.2 to 5.5 % d.b) was higher than that detected in our study (3.79 % d.b). They also reported that ostrich eggs have similar chemical characteristics compared with the hen's egg.

Data in Table (1) indicated also, that calcium, phosphorus and iron contents in ostrich eggs were higher by 16.0, 1.7 and 13.3 % db, respectively compared with chicken eggs. *On the contrary potassium, sodium and zinc in* ostrich eggs were lower by about 7.5, 1.7 and 17.5 % (d.b.), respectively than those of chicken eggs. These findings are in accordance with Makhlouf *et al.* (1996) who reported that mineral contents of Ca, P, Fe, K, Na and Zn in chicken eggs were 192.45, 720.75, 9.85, 539.62, 407.55 and 5.41 mg/ 100 g d.b., respectively. On the other hand, Sungino *et al.* (1997) found that total

mineral content in egg yolk, egg white and egg shell were 0.3, 0.2 and 5.9, respectively. In addition, composition of an egg (excluding the shell)- based on a 59 gram shell egg was reported by Agriculture and Agri- Food Canada (1999). Results obtained indicated that (Ca + P), (Mg + Fe) and (iodine + K + chlorine + Cu + Mn + Na + sulfur + zinc) were 114, 5.72 and 235.663 mg, respectively.

2- Chemical and microbiological quality of mayonnaise manufactured from ostrich eggs comparable to chicken eggs:

Mayonnaise, in common with all high fat foods, is susceptible to spoilage due to auto-oxidation, its stability is depending on the type of oil used. Salt, as well as vinegar and mustard being important in the development of the flavor and stability appears to influence the rate of oxidation of the oil in the emulsion (Depree and Savage, 2001). Generally, mayonnaise stability is dependent on several factors such as amount of oil, amount of egg yolk, viscosity, relative volume of oil phase to aqueous phase, method of mixing, water quality, and temperature (Harrison and Cunningham, 1985). The quality of unpasteurized and pasteurized mayonnaise manufactured from ostrich eggs comparable to chicken eggs were evaluated chemically and microbiologically and the obtained data are found in Tables (2 to 6).

Table (1): Chemical composition of ostrich eggs comparable to chicken eggs.

Component (%)	Chemical composition			
	Ostrish eggs		Chicken eggs	
	wet.wt.	d.b	Wet.wt.	d.b
Moisture	74.92	-	74.50	-
Protein	11.81	47.09	12.01	47.14
Total lipids	11.31	45.10	11.50	45.13
Ash	0.95	3.79	0.79	3.10
Total carbohydrates*	1.01	4.03	1.20	4.71
Mg/100g				
Calcium	51.8	206.5	45.4	178.0
Phosphorus	171.5	683.8	171.4	672.2
Iron	2.80	11.20	2.50	9.80
Potassium	115.6	460.9	127.1	498.4
Sodium	102.5	408.7	106.0	415.7
Zinc	1.30	5.20	1.60	6.30

*** Calculated by differences.**

3- Chemical quality:

3.1- Changes in titratable acidity (T.A) and pH value:

Data presented in Table (2) shows that titratable acidity of unpasteurized mayonnaise made from ostrich eggs increased significantly as the storage period increase up to 20 weeks, compared with the pasteurized one, which snowed unsignificant changes during storage. On the other hand, the pH of pasteurized mayonnaise made from ostrich eggs was stable up to 15 weeks, compared with unpasteurized one which decreased significantly after 10 weeks of storage. However, in mayonnaise from chicken eggs, either

T.A or pH were significantly steady in pasteurized or unpasteurized mayonnaise during storage. Data revealed that, at the end of storage (20 weeks), the T.A increased by 2.9 and 1.3 % in unpasteurized and pasteurized mayonnaise made from ostrich eggs, respectively. These increases may be due to excesses of deterioration occurred in egg protein and the liberation of ammonia and other volatile basis which was caused frequent increasing in acidity values of mayonnaise samples during subsequent storage (Kishk, 1997). Also, the activity of lactic acid bacteria led to decreases in pH values (increases in acidity) during storage (Worrasinchai *et al.*, 2006). The percent of increasing acidity in this investigation was lower than that recorded by Stefanow (1989) who reported that the acidity increased from 7 to 8 % after 20 days storage at temperature between -2 and -5 °C and 4 % during storage at temperature between 4 and 10 °C. The pH of mayonnaise can have a dramatic effect on the structure of the emulsion. The viscoelasticity and stability of the mayonnaise should be at its highest when the pH is close to the average isoelectric point of the egg yolk proteins and hence the charge on the proteins is minimized. If the proteins on the surface of the droplets were highly charged, this would prevent any further protein from adsorbing and also cause the droplets to repel one another, which would prevent flocculation. Both of these factors tend to lead to an emulsion with lower viscosity and lower stability (Depree and Savage, 2001). Kiosseoglou and Sherman (1983) found that the viscoelasticity of their mayonnaise was highest at a pH of 3.9.

Table (2): Titratable acidity and pH of unpasteurized and pasteurized mayonnaise from ostrich and chicken eggs during storage at 4 °C.

Storage periods (week)	Mayonnaise from ostrich eggs				Mayonnaise from chicken eggs			
	Unpasteurized		Pasteurized		Unpasteurized		Pasteurized	
	T.A %	PH	T.A %	PH	T.A %	PH	T.A %	PH
0	0.239^{d}	3.59^{a}	0.239^{d}	3.59^{a}	0.238^{a}	3.63^{a}	0.238^{a}	3.63^{a}
5	0.241^{cd}	3.59^{a}	0.239^{d}	3.59^{a}	0.239^{a}	3.62^{a}	0.240^{a}	3.62^{a}
10	0.243^{bc}	3.58^{a}	0.240^{cd}	3.59^{a}	0.241^{a}	3.60^{a}	0.241^{a}	3.60^{a}
15	0.245^{ab}	3.52^{b}	0.241^{cd}	3.55^{ab}	0.241^{a}	3.60^{a}	0.241^{a}	3.60^{a}
20	0.246^{a}	3.51^{b}	0.242^{cd}	3.53^{b}	0.242^{a}	3.59^{a}	0.242^{a}	3.59^{a}

Means with different superscript (a,b,c,d) within a raw or column in each mayonnaise type are different significantly ($P<0.05$).
T.A: Titratable acidity

3.2- Changes in acid values (AV) and thiobarbituric acid (TBA) number:

The acid values significantly ($P< 0.01$) increased as affected by storage periods in either unpasteurized or pasteurized mayonnaise manufactured from ostrich or chicken eggs compared to fresh ones (Table 3). These increasing were significantly ($P< 0.05$) inferior in pasteurized mayonnaise compared with unpasteurized samples manufactured either from ostrich or chicken eggs at every period of storage. Data under investigation indicated that acid values of mayonnaise manufactured from ostrich eggs were lower than that recorded with mayonnaise from chicken eggs. It means

that the acid values in both pasteurized mayonnaise from ostrich and chicken eggs were lower than that observed with unpasteurized samples. After 20 weeks of storage, the acid values were 0.50 and 0.78 in unpasteurized mayonnaise from ostrich eggs and mayonnaise from chicken eggs, respectively. The corresponding values of pasteurized mayonnaise were 0.47 and 0.59. The increase of acid values in different mayonnaise samples was probably due to the activity of hydrolytic and oxidative enzymes presented in egg. (Stefanow, 1989). The free fatty acids may also, produced by the oxidation of double bonds of unsaturated fatty acid esters. In advanced stage of oxidation, free fatty acids with low molecular weight were developed through the accumulation of acidic cleavage products and subsequently increased the acid value. This oxidation could be occurred with the aid of oxidative enzymes and the presence of a proportion of atmospheric oxygen in the headspace and incorporated in mayonnaise (Kishk, 1997).

Table (3): Acid value and TBA number of unpasteurized and pasteurized mayonnaise from ostrich and chicken eggs during storage at 4 °C.

Storage periods (week)	Mayonnaise from ostrich eggs				Mayonnaise from chicken eggs			
	Unpasteurized		Pasteurized		Unpasteurized		Pasteurized	
	AV	TBA	AV	TBA	AV	TBA	AV	TBA
0	0.27^{g} ± 0.01	0.15^{h} ± 0.01	0.27^{g} ± 0.01	0.15^{h} ± 0.01	0.30^{e} ± 0.01	0.18^{h} ± 0.01	0.30^{e} ± 0.01	0.18^{h} ± 0.01
5	0.32^{ef} ± 0.01	0.19^{g} ± 0.01	0.31^{f} ± 0.00	0.19^{g} ± 0.01	0.38^{d} ± 0.01	0.27^{f} ± 0.01	0.36^{d} ± 0.01	0.22^{g} ± 0.01
10	0.37^{cd} ± 0.01	0.30^{e} ± 0.01	0.35^{ed} ± 0.01	0.23^{f} ± 0.01	0.47^{c} ± 0.01	0.41^{d} ± 0.02	0.40^{d} ± 0.01	0.34^{e} ± 0.01
15	0.44^{b} ± 0.01	0.40^{c} ± 0.01	0.39^{c} ± 0.01	0.35^{d} ± 0.01	0.61^{b} ± 0.02	0.49^{c} ± 0.02	0.49^{c} ± 0.01	0.43^{d} ± 0.01
20	0.50^{a} ± 0.01	0.56^{a} ± 0.01	0.47^{b} ± 0.01	0.49^{b} ± 0.01	0.78^{a} ± 0.01	0.65^{a} ± 0.02	0.59^{b} ± 0.02	0.60^{b} ± 0.01

Means with different superscript (a,b,c,...g) within a raw or column in each mayonnaise type are different significantly (P<0.05).

AV: Acid value TBA: Thiobarbituric acid

As is the case with all fat-containing foods, mayonnaise is susceptible to spoilage through auto-oxidation of the unsaturated and polyunsaturated fats in the oil. Lipid oxidation was measured using TBA numbers during storage period of different samples and data is presented in (Table 3). TBA of unpasteurized and pasteurized mayonnaise manufactured either from ostrich or chicken eggs were significantly ($P< 0.01$) increased as storage period increased, compared with fresh ones (Table 3). The numbers of TBA after 20 weeks were 0.56 and 0.65 (mg malonaldehyde/kg) in unpasteurized mayonnaise made from ostrich eggs and chicken eggs,

respectively. Significant (P< 0.05) decreased in TBA was detected at every storage period due to pasteurization compared with unpasteurized mayonnaise manufactured either from ostrich or chicken eggs. TBA in pasteurized mayonnaise made from ostrich eggs was 0.49 mg/kg and from chicken eggs was 0.60 mg/kg after storage for 20 weeks. Results also indicated that mayonnaise from ostrich eggs contained a lower TBA value than that detected in mayonnaise made from chicken eggs.

TBA test determines the amount of malonaldehyde, a major secondary by- product of lipid oxidation in a sample. Botsoglou *et al.*, (1994).

4- Microbiological quality:

The quality of mayonnaise manufactured from ostrich and chicken eggs with or without pasteurization were evaluated microbiologically (Tables 4 and 5). Because of its low pH and high fat content, mayonnaise is relatively resistant to microbial spoilage, although, the growth of bacteria may occur in mayonnaise ingredients. Data in Table 4 indicated that mayonnaise made from ostrich eggs with or without pasteurization contained lower total bacterial counts than those detected in mayonnaise made from chicken eggs. It was noticed also that the pasteurization reduced the growth rate of bacteria in both mayonnaise types (from ostrich or chicken eggs). During storage period, the total bacterial count of mayonnaise increased which might be due to the growth of acid tolerant microorganisms such as lactic acid bacteria (Karas *et al.*, 2002). After 20 week of storage, the unpasteurized mayonnaise made from ostrich or chicken eggs were 3.6×10^4 and 4.4×10^4 c.f.u.. The corresponding values of pasteurized mayonnaise were 2.6×10^4 and 3.3×10^4, respectively. In the contrary, Worrasinchai *et al.* (2006) reported that after 64 days storage, the total bacterial count of mayonnaise samples decreased. The reduction of microbial loading was probably due to the effect of undissociated acetic acid solubilized into the oil phase (Karas *et al.*, 2002).

Table (4): **Total bacterial counts of unpasteurized and pasteurized mayonnaise from ostrich and chicken eggs during storage at 4 °C.**

Storage periods (week)	Total bacterial counts (c.f.u/gm)			
	Mayonnaise from ostrich eggs		Mayonnaise from chicken eggs	
	Unpasteurized	Pasteurized	Unpasteurized	Pasteurized
0	7.4×10^2	5.4×10^2	8.3×10^2	6.4×10^2
5	7.7×10^2	5.4×10^2	8.6×10^2	6.6×10^2
10	8.7×10^2	6.4×10^2	9.4×10^2	7.7×10^2
15	7.5×10^3	3.2×10^3	6.9×10^3	4.3×10^3
20	3.6×10^4	2.6×10^4	4.4×10^4	3.3×10^4

Data in Table 5 indicate that molds and yeast's were not detected in different mayonnaise samples during the first 5 weeks. However, they were occurred after that and their growth rate was increased during the storage period. The maximum counts were observed after 20 weeks. The growth rate

of pasteurized mayonnaise was lower than that recorded in unpasteurized mayonnaise. On the other hand, mayonnaise made from ostrich eggs was fewer contaminated than those made from chicken eggs. After 20 weeks of storage the counts of molds and yeast's were 1.1×10^2 and 2.1×10^2 in pasteurized mayonnaise made from ostrich and chicken eggs, respectively. The corresponding values in unpasteurized mayonnaise were 1.7×10^2 and 2.9×10^2.

Table (5): Mold and yeast counts of unpasteurized and pasteurized mayonnaise from ostrich and chicken eggs during storage at 4 °C.

Storage periods (week)	Mold and yeast counts (c.f.u/gm)			
	Mayonnaise from ostrich eggs		Mayonnaise from chicken eggs	
	Unpasteurized	Pasteurized	Unpasteurized	Pasteurized
0	-	-	-	-
5	-	-	1.0×10^1	-
10	1.0×10^1	-	1.1×10^2	1.1×10^1
15	1.5×10^2	1.8×10^1	2.2×10^2	1.7×10^2
20	1.7×10^2	1.1×10^2	2.9×10^2	2.1×10^2

Data also revealed that no pathogenic bacteria (E.coli, S.aureus, Salmonella sp.) were detected in any of the different samples after preparing and during the storage.

From a microbiological safety point of view, it is generally recommended that mayonnaise made with unpasteurized eggs is prepared with vinegar to a pH of 4.1 or less and held at room temperature (18-22 °C) for at least 24 h to reduce the risk from microorganisms (Radford and Board, 1993). They added also that the addition of mustard and salt to mayonnaise at concentrations of 0.3-1.5 % (w/w) results in an increase in the death rate of Salmonella.

5- Sensory evaluation of mayonnaise:

Sensory analysis were carried out on mayonnaise samples made from ostrich or chicken eggs and with or without pasteurization during storage period for 20 weeks at 4°C (Table 6). The taste and flavor scores of ostrich eggs mayonnaise showed significantly ($P< 0.05$) lower values at the end of storage period (20 weeks) with or without pasteurization compared to fresh or 10 weeks storage (Table 6). Same trend was found with mayonnaise made from chicken eggs after 10 or 20 weeks storage periods, compared to fresh ones. However, the taste scores of the two type of mayonnaise was not affected significantly during the storage periods. These results are in accordance with Hoffmann, (1989) and Kishk (1997). Mayonnaise contained balancing proportions of salt, vinegar and spicing (mustard) that contributed its taste. Because the relatively high content of vinegar, a mayonnaise is characterized by sour taste. Also, the decrease in flavor scores occurring during storage by different rates were contributed to the degree of further

hydrolysis and development of oxidative changes during storage, which led to several intermediate by products and finally to a series of aldehydes, ketones, alcohol's and other compounds that affected flavor (Daugaard, 1993 and Kishk, 1997).

Table (6): Sensory properties of unpasteurized and pasteurized mayonnaise manufactured from ostrich and chicken eggs during storage at 4 °C.

Sensory properties		Storage periods at 4 °C					
		0. time		10 weeks		20 weeks	
		A	B	A	B	A	B
Taste	1-	9.0^{a} ± 0.00	9.0^{a} ± 0.11	8.8^{ab} ± 0.11	8.8^{ab} ± 0.17	8.5^{b} ± 0.17	8.5^{b} ± 0.11
	2-	9.0^{a} ± 0.11	9.0^{a} ± 0.11	8.3^{bc} ± 0.11	8.5^{b} ± 0.11	8.0^{c} ± 0.11	8.2^{bc} ± 0.11
Flavor	1-	9.0^{a} ± 0.14	9.0^{a} ± 0.11	8.8^{a} ± 0.17	9.0^{a} ± 0.11	8.2^{b} ± 0.11	8.8^{a} ± 0.17
	2-	9.0^{a} ± 0.11	9.0^{a} ± 0.11	8.5^{bc} ± 0.11	8.6^{b} ± 0.08	8.2^{c} ± 0.11	8.4^{bc} ± 0.11
Color	1-	9.5^{a} ± 0.11	9.5^{a} ± 0.11	8.8^{b} ± 0.17	9.0^{b} ± 0.11	8.3^{c} ± 0.11	8.8^{b} ± 0.17
	2-	9.5^{a} ± 0.11	9.5^{a} ± 0.11	8.6^{b} ± 0.17	9.0^{b} ± 0.05	8.1^{c} ± 0.05	8.6^{b} ± 0.17
Appearance	1-	9.5^{a} ± 0.11	9.5^{a} ± 0.11	8.8^{bc} ± 0.17	9.0^{b} ± 0.08	8.1^{d} ± 0.05	8.5^{c} ± 0.12
	2-	9.5^{a} ± 0.11	9.5^{a} ± 0.11	8.6^{c} ± 0.17	9.0^{b} ± 0.11	8.0^{d} ± 0.11	8.3^{cd} ± 0.11
Overall Acceptability	1-	9.3^{a} ± 0.17	9.3^{a} ± 0.17	8.7^{b} ± 0.11	9.0^{ab} ± 0.11	8.2^{c} ± 0.11	8.7^{b} ± 0.11
	2-	9.3^{a} ± 0.17	9.3^{a} ± 0.17	8.5^{b} ± 0.11	8.8^{b} ± 0.17	8.0^{c} ± 0.11	8.5^{b} ± 0.1

Means with different superscript (a,b,c,d) within a raw are different significantly ($P<0.05$).
(A) Unpasteurized samples (B) Pasteurized samples
1- Mayonnaise from ostrich. 2- Mayonnalse from chicken

Regarding to color, appearance and the overall acceptability scores of ostrich or chicken eggs mayonnaise, received showed significantly ($P< 0.05$) lower score values after 10 or 20 weeks storage with or without pasteurization compared to fresh ones (Table 6). However, the color, appearance and the overall acceptability scores were not affected significantly by the two types of mayonnaise during the storage periods.

Color is one of the most important quality attribute of mayonnaise because color is one criterion a consumer uses to select mayonnaise brand from the grocer's shelf. The yellowish color of mayonnaise is primarily provided by egg yolk carotenoids. The oil used and mustard do not contribute a color simulating that provided by egg yolk (Kishk, 1997), The average data in Table 6 indicated that the received color scores of mayonnaise from ostrich eggs and chicken eggs had insignificant values between unpasteurized and pasteurized samples, being 9.5 of both before storage. As storage period increased the color scores slightly and gradually decreased reaching their minimal values of 8.3 and 8.8 for unpasteurized and pasteurized mayonnaise from ostrich eggs, respectively. The corresponding values of chicken eggs mayonnaise were 8.1 and 8.6. It was obviously clear that using either ostrich eggs or chicken eggs in mayonnaise showed not significant decreasing in color scores during subsequent storage period for 20 weeks at 4°C. The decreasing in panelist's scores of studied mayonnaise samples with prolonged storage period may be due to the reduction of color as a result of certain oxidation of carotenoids which occurred on storage. This finding is in accordance with those of Hoffmann (1989) and Kishk (1997).

Finally, it could be concluded that ostrich eggs are a good source of protein, total lipids, carbohydrates, and minerals such as calcium, phosphorus, potassium, sodium and zinc. Ostrich eggs can be used in different products such as mayonnaise. The chemical and microbiological quality of mayonnaise made from ostrich eggs is relatively resistant than that from chicken eggs.

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التقييم الكيميائى والميكروبيولوجى والحسى للمايونيز المصنع من بيض النعام

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فى هذا البحث تم تقييم بيض النعام من حيث التركيب الكيميائى والعناصر المعدنية وكذلك دراسة الجودة الكيميائية والميكروبيولوجية والحسية للمايونيز المصنع من بيض النعام بالمقارنة بمثيله المصنع من بيض الدجاج. وقد أوضحت النتائج أن بيض النعام يعتبر مصدر جيد للبروتين(٠٩ر٧٤% وزن جاف) والدهن (١٠ر٤٥% وزن جاف) والكربوهيدرات (٠٣ر٤% وزن جاف) كما أنه مصدر جيد لبعض العناصر المعدنية مثل الكالسيوم (٥ر٢٠٦ملجم/١٠٠ جم وزن جاف) والفوسفور (٨ر٦٨٣ملجم/١٠٠ جم وزن جاف) والبوتاسيوم (٤٦٠ ملجم/١٠٠ جم وزن جاف) والصوديوم (٧ر٤٠٨ملجم/١٠٠ جم وزن جاف) والزنك (٢ر٥ملجم/١٠٠ جم وزن جاف). ويلاحظ أن هذا التركيب يقارب إلي حد كبير تركيب بيض الدجاج

وبتقييم المايونيز المصنع من بيض النعام المبستر أو غير المبستر كيماويا. أوضحت الدراسة أن هذا المايونيز كان أكثر ثباتا للفساد الكيميائى نتيجة الأكسدة الذاتية وذلك بالمقارنة بالمايونيز المصنع من بيض الدجاج. وقد أوضحت النتائج أيضا أن حموضة المايونيز غير المبستر زادت زيادة معنوية ($p< 0.05$)

خلال فترات التخزين وذلك على العكس من المايونيز المبسترو الذى لم تتغير حموضته أثناء التخزين. أما فى حالة المايونيز المصنع من بيض الدجاج فان الحموضة لم تتغير سواء مع العينات المبسترة أو غير المبسترة ٠وقد أظهرت النتائج أيضا أن رقم الحامض و حمض الثيوباربتيوريك للمايونيز المبستر أو غير المبستر والمصنع سواء من بيض النعام أو الدجاج أظهرت زيادة معنوية ($p< 0.01$) بزيادة مدة التخزين كما أظهرت معنوية أقل ($p< 0.05$) فى عينات المايونيز المبسترة بالمقارنة بالغير مبسترة.

وقد أظهر التقييم الميكروبيولوجى للمايونيز المصنع من بيض النعام درجة عالية نسبيا من الثبات ضد الفساد الميكروبى وانخفاض الـ pH (زيادة الحموضة) كما أوضح التقييم الحسى أن درجات الطعم والرائحة واللون والمظهر والقبول العام للمايونيز المصنع من بيض النعام كانت أكثر من المايونيز المصنع من بيض الدجاج.