J. Food and Dairy Sci., Mansoura Univ., Vol. 8 (7): 295 - 302, 2017

Effect of Propolis Extract as a Natural Preservative on the Microbial Content of Kareish Cheese

Amany M. El-Deeb[1]and Sabrien A. Omar[2]
[1]Food Technology Research Institute, Agriculture Research center, Giza, Egypt.
[2]Dept. of Microbiol., Fac.of Agric. Mansoura Univ.,Mansoura, Egypt.

This article was CHECKED against plagiarism using TurnitIn software

ABSTRACT

The present study aimed to utilize propolis extract as natural preservative and attractive healthy ingredients on the microbial content of kareish cheese during storage. Effect of two extracts of proplis (ethanolic and water extract) were used at different concentrations on the growth of three bacterial strains, *Streptococcus thermophilus*, *Lactobacillus bulgaricus* and *Bifdobacterium bifidium* being used as starter. The affect of these extracts on some spoilage contaminants of dairy microorganisms in milk medium were also studied. The resultant kareish cheeses from different treatments (with ethanol and water propolis extracts) were analyzed for phenolic compounds, antioxidant activity, microbiological and sensory properties when fresh and during storage (28 day) at 5±1°C. The counts of *Str. thermophilus* and *Lb. bulgaricus* in milk with different concentrations of propolis extracts were significantly higher than those in control. Ethanol extraction of propolis (EEP) and water extraction of propolis (WEP) at 600 and 1000 mg /100ml displayed a bactericidal effect with all of the tested spoilage microorganisms.The addition of propolis extract had a negligible effect on the content of cheese moisture, and slight decrease in total protein of cheese was observed along the storage period. High acidity of kareish cheese observed with increasing the concentration of added propolis extracts. Addition of different concentrations (6 and 10%) of propolis extracts (ethanolic and water) increased of the phenolic compounds, flavonids and antioxidant activity with the increase of propolis extracts. The counts of *Lb. bulgaricus* and *Str. thermophilus* in kareish cheese treatments were significantly ($p \leq 0.05$) higher than these in the control. However, counts of mesophilic (MBC) and psychrophilic (PBC), coliform bacteria and moulds & yeasts in kariesh cheese treatments were not detected until 21 days. Kareish cheeses made with water propolis extract (T3 andT4) were of higher sensory evaluation and with the best acceptablility during storage period, compared with cheese made by ethanolic propolis extract (T1 and T2).

Keywords: Kareish cheese, propolis extract, benefits bacteria, spoilage microorganisms, physicochemical, phenolic compounds, microbiological and sensory evaluation.

INTRODUCTION

Kareish cheese is one of the most traditional cheese consumed by Egyptians, a fat free, and characterized with its lower price. It is recommended for persons suffering from obesity, cholesterol and heart diseases. Kareish cheese contains highs protein content and excellent source of calcium, phosphorous, and water-soluble vitamins. It contains high moisture content, and is not pickled after processing, it must be consumed fresh. Its maximum shelf-life does not exceed 12 days at 5 ºC (Abou-Dawood and Gomai, 1977, Aman, 1994; El Bagoury and Mosaad, 2002, Fahmi, 1960 and Osman *et al*., 2010).

Spoilage organisms in kareish cheese are various pathoges such as *Salmonella*, *Listeria spp,* coliforms*, Staphylococcus aureus* and yeasts and molds may also be found in milk and dairy products (De Buyser *et al*., 2001 and Reps *et al*., 2002)

Therefore, there is a great effort exerted to improve the kareish cheese quality, and to increase its shelf life. However, the food industry is now facing challenge to reduce the use of synthetic antimicrobial chemical compounds, so there is a growing demand for using 'natural' additives (Burt, 2004).

Propolis is a resinous material collected by bees from plant. It acts as an antimicrobial, antifungal, antiviral against certain spp. of bacteria, fungi and virus. Flavonoids, aromatic acids, diterpenic acids and phenolic are the principal compounds responsible for the biological activities of propolis. The above mentioned compounds could have an activating or inhibiting effect on growth and metabolism of bacteria. (Kujumgiev *et al.,*1999, Bankova, 2005, Lu *et al.* 2005; Orsi *et al*., 2005, Satoshi *et al*. , 2005; Vargas-Sanchez *et al.,* 2014 and Boubakeur *et al*., 2015).

The aim of this study was to develop kareish cheese with healthy benefits by using ethanolic extract and water extract of propolis natural preservatives at different concentrations as a functional food during cold storage at 5±1 ^{o} C for 28days.

MATERIALS AND METHODS

Propolis used in this work was obtained from Plant Protection Department at the Faculty of Agriculture, Mansoura University. Propolis was kept at room temperature in the dark until processing. Skim milk powder (SMP) produced by Australian Dairy products, Pty Ltd., Australia was used. Fresh buffalo skim milk used in kareish cheese making was obtained from the herd of the Faculty of Agriculture, Cairo University, Egypt. Guar Gum was obtained from Danisco Ingredients (Juelsminde, Denmark) by Misr Food Additives Company (MIFAD), Egypt. Commercial table salt obtained from local market.

Table 1. Chemical composition (%) of buffalo skim milk used in manufacture of kareish cheese

Item	fat	Moisture	protein	Carbohydrate*	Ash	Acidity	pH
Buffalo skim milk	0.4	89.27	4.40	4.97	0.96	0.16	6.67

By difference *

Freeze-dried culture DVS of *Lb. delbrueckii ssp. bulgaricus* , *Streptococcus thermophilus* and *B. bifidum* DI were obtained (from Chr. Hansen Laboratory, Copenhagen, Denmark). Pure bacterial strains of LAB and *B. bifidum* DI were prepared separately as mother cultures in autoclaved (121 ºC/10 min) reconstituted

skim milk powder (10%w/v) in conical flasks using 0.02% (w/v) inoculums after cooling to 37 ºC for 16h. Cultures were prepared 24 h before use. Three bottles of sterialized skim-milk were inoculated with loopfuls of freshly-prepared cultures of *Lb. delbrueckii ssp. bulgaricus*, *Streptococcus thermophilus* and *B. bifidum* DI. The bottles were then incubated at 37ºC for 12 h (Haddadin *et al.,* 2007), followed by storage at 4±1º C until used.

Three spoilage bacterial species; *Staphylococcus aureus, Bacillus cereus* and *E. coli* were grown on nutrient agar at 37 °C, and maintained at 4°C. Two spoilage fungal species; *Rodotorula glutinis* (yeast) *and Aspergillus oryzae* were cultured in potato dextrose agar at 28°C and maintained at 4°C. All cultures were kindly provided by Microbiology Dept. Faculty of Agric., Mansoura University, Egypt. Bacterial inocula were prepared by growing the cells in nutrient broth at 37 ºC for 24 h. Cell suspensions were diluted with peptone water to provide initial cell counts of 10^5-10^7 CFU/ ml, fungal inoculum was prepared as spore suspension in peptone water to provide 10^5 spore /ml.

Ethanolic extraction of propolis (EEP) was prepared according the method mentioned by (Abd El Hady and Hegazi, 2002).Water extraction of propolis (WEP) was prepared with the same technique, with the exception of using water instead of alcohol for dissolving the propilis.

As with the effect of propolis extracts on LAB and *B. bifidum*, different concentrations of propolis extracts (namely 0, 300,600 and 1000 mg) were added to 100 ml reconstituted skim milk (10%w/v), followed by pasteurization at 63ºC for 30 min. Duplicate conical flasks of each propolis concentration were inoculated with *Streptococcus thermophilus , Lb. delbrueckii ssp. bulgaricus* and *B. bifidum* DI (0.5 ml aliquots of a culture in skim-milk), and incubated at 37ºC for 16 h in ;duplicate flasks of the control milk were treated similarly. After incubation, serial dilutions were made in sterile peptone water (15 g/l) and aliquots (0.1 ml) were spread onto pre-poured plates of selective media for each strain (M17 agar was used to enumerate *Streptococcus thermophilus* ; *Lb. delbrueckii ssp. bulgaricus* on MRS agar ,while MRS agar supplemented with 0.05% (w/v) L-Cys-HCI (Merck) for *B. bifidum* DI count at 37±1°C for 48h under anaerobic condition. The results were recorded as colony-forming units (cfu) per ml of milk. (Haddadin *et al.,* 2008)

For examining the effect of propolis extracts on some spoilage microorganisms, different concentrations of propolis extracts (namely 0, 300,600 and 1000 mg) were added to 100 ml skim milk, carefully mixed, followed by pasteurizion at 63°C for 30 min in screw-cap bottles. Control samples of milk without propolis were prepared. Duplicate bottles of each propolis concentration were inoculated with *E. coli, S. aureus*, *B. cereus* at 37ºC, *Rodotorula glutinis* and *A. oryzae* and incubated at 25ºC for 24 h and 3-5 days (for fungi) (0.5 ml aliquots of a culture in skim-milk) duplicate bottles of the control milk were treated similarly. After incubation, serial dilutions were made in sterile peptone water and were spread onto pre-poured plates of specific media for each microbe; the results were recorded as colony-forming units (cfu) per ml of milk.

Kareish cheese was manufactured according to the method adopted by Fahmi (1960). Five batches of kareish cheese were made, first batch was served as control (C) being made from fresh buffalo skim milk without propolis extract. The other batches were fortified with propolis extracts (ethanolic and water) at the rate of 6 and 10 %. All treatments were heated at 75 ºC for 15 sec, before the addition of extracts, and immediately cooled to 40ºC. Propolis extracts (in four treatments) and starter culture (*Lb. delbrueckii ssp. bulgaricus* and *Streptococcus thermophilus* (1:1) were added at level of 2% in control and all treatments for coagulation. After complete coagulation, the curd was separately transferred into gauze for wheying off in 24h. With 1% salt was dispersed on curd , then cut and stored in plastic bags contained pasteurized salted whey (3% salt). The resultant cheese was analyzed when fresh and after 7, 14. 21 and 28 day during storage at refrigerator (5± 1ºC). All treatments were of three replicates.

The pH value of cheese was measured using pH meter (HANNA 8417). Titratable acidity (TA) as described by Ling (1963), moisture, protein, ash and soluble nitrogen contents were determined according to AOAC (2000). All chemical measurements were prepared in triplicates. Phenolic compounds and antioxidant activity were measured according to Li *et al.*, (2009).

M 17 agar was used to enumerate *Streptococcus thermophilus*, while MRS agar used for the enumeration of *Lb. delbrueckii ssp. bulgaricus* in Karish cheese

Skim milk agar was used to determine the total counts of mesophilic (MBC) and psychrotrophic (PBC) bacteria. Incubation was carried out at 30°C for 48 hours in MBC and at 6.5°C for 10 days in PBC. Coliform group was determined using MacConkey agar. Sorbitol MacKonky agar was used for *E. coli*, and *Salmonella & Shigella* agar (SS) were used for *Salmonella typhymuruim*.

Counts of *S. aureus* of cheese samples were estimated by Baird parker Agar medium at 37°C for 48 h. Potato dextrose agar was used for counting molds and yeasts at 25°C for 5 days (APHA, 1992).

Cheese samples were sensory scored by 8–10 panelists including the staff members of Dairy Research Department, Food Technology Research Institute, agricultural Research Center according to their consistency in attending as mentioned by Nelson and Trout (1964) for flavor (50 points), body and texture (35 points) and appearance (15 points). Data were statistically analyzed using SPSS (Ver.11) software program ANOVA with two independent factors at significant level of 0.05 (Steel *et al*., 1997). Multiple comparisons were carried out applying the least significant difference (LSD).

RESULTS AND DISCUSSION

The effect of different concentration of two extracts of propolis (ethanolic and water extracts) on the growth of three bacterial strains, namely *Streptococcus thermophilus*, *Lactobacillus bulgaricus* and *Bifdobacterium bifidium* over

16h at 37ºC is presented in (Table 2). Data showed that the counts of *Str. thermophilus* and *Lb. bulgaricus* in milk with different concentrations were significantly higher than in the control. Data also showed that the counts increased by increasing of the concentrations of propolis extracts. Enhancement of the growth was also demonstrated by Abd El Hady and Hegazi (2002) and Huang *et al*., (2014). The positive effect of popolis might be attributed to the flavonoid content, which acts as antioxidants by chelating with free radicals (Boubakeur *et al*., 2015).

On the other hand, the count of *Bif. bifidum* in milk in the presence of 300 and 600 mg/100 ml milk of each propolis extracts are not of significantly effect, compared to control. However, the two extracts of propolis at concentration 1000 mg/100ml milk had adverse effect on the count of *Bif. bifidum*. These results could be relevant for those using propolis as a medicine, and they are similar with those reported by Haddadin *et al*., (2008). Probiotics, especially, bifidobacteria, grow poorly in milk, compared to the traditional yoghurt bacteria due to the lack of proteolytic and glycolytic activities, and also due to the higher nutritional demands of some nutrients (Mohammadi and Mortazavian, 2011).

Table 2. Effect of ethanolic and water extracts of propolis on the growth of *Str. thermophillus, Lb. bulgaricus* and *B .bifidium* (log,cfu/ml).

Strains	*Str. thermophillus*		*Lb. bulgaricus*		*B .bifidium*	
	EEP	WEP	EEP	WEP	EEP	WEP
C	6.43^{b}	6.73^{b}	7.17^{b}	7.66^{c}	6.22^{ab}	6.49^{a}
300	6.86^{b}	7.26^{a}	8.31^{a}	8.22^{bc}	6.37^{a}	6.70^{a}
600	7.41^{a}	7.48^{a}	8.53^{a}	$8.51a^{b}$	6.86^{a}	6.87^{a}
1000	7.60^{a}	7.75^{a}	8.92^{a}	8.90^{a}	5.68^{b}	5.47^{b}
LSD	0.0076	0.0394	0.0021	0.0104	0.0237	0.0026

a, b, c: means with the same letter in the same column between different concentrates are not significantly different (p<0.05).

The count of *S. aureus, E. coli, B. cereus, R. glutinis and A. oryzae* in sterilized milk medium supplemented with 300, 600 and 1000 mg/100 ml of each EEP and WEP at 37ºC are presented in Table (3).

Table 3. Effect of ethanolic and water extracts of propolis on some spoilage microorganisms (log,cfu/ml) in milk medium.

Treatment & concentrations mg/100ml		Microorganisms				
		S. aureus	*E. coli*	*B. cereus*	*R. glutinis*	*A. oryzae*
EEP	Control	5.15^{a}	5.25^{a}	5.44^{a}	7.25^{a}	7.26^{a}
	300	3.51^{b}	4.84^{b}	4.30^{b}	5.56^{b}	5.67^{b}
	600	ND^{c}	ND^{c}	ND^{c}	ND^{c}	ND^{c}
	1000	ND^{c}	ND^{c}	ND^{c}	ND^{c}	ND^{c}
LSD		0.0127	0.1028	0.0761	0.0201	0.0081
WEP	Control	5.15^{a}	5.25^{a}	5.44^{a}	7.25^{a}	7.26^{a}
	300	3.77^{b}	4.89^{b}	4.57^{b}	5.67^{b}	5.56^{b}
	600	ND^{c}	ND^{c}	ND^{c}	ND^{c}	ND^{c}
	1000	ND^{c}	ND^{c}	ND^{c}	ND^{c}	ND^{c}
LSD		0.0204	0.0141	0.0046	0.0275	0.0124

a, b, c: means with the same letter in the same column between different concentrates are not significantly different (p<0.05).

The results reveal that at concentration 300 mg of each EEP and WEP, the log cfu significantly reduced from the initial counts, compared with control These results were observed with all of the tested spoilage microorganisms. The obtained results also illustrate that EEP and WEP at concentration 300 mg may have bacteriostatic effect. Whereas, by increasing the concentration of each them up to 600 and 1000 mg, the growth completely inhibited. These results indicated that EEP and WEP at 600 and 1000 mg displayed a bactericidal effect. The previous results are in a good agreement with those of Grange and Davey, (1990) and Temiz *et al*., (2011). Confirmatory to the obtained results are also observed by Hanaa *et al*., 2013 and Kubiliene *et al*., 2015), who noticed that the propolis are antimicrobial activity. According to the obtained results, propolis could be considered as an ideal natural preservative.

Phenolic compounds, flavonids and total antioxidant activity of (ethanolic and water) propolis extracts are illustrated in Table (4). Data showed that the phenolic compounds and flavonids of ethanolic propolis were higher than in water propolis extract. Biologically active substances mostly have low solubility in water, and the amount of phenolic compounds in water extracts is 10-fold lower than in ethanolic extracts (Mello *et al.,*2010 and Moura *et al.,*2009) . While,(Volpert and Elstner 1993) found that the propolis extract in water suppresses is of more effective in suppressing the generation of free radicals than ethanolic extract agree with (Orsolic and Basic 2003 and Nagai *et al.,*(2003).

Table 4. Phenolic compounds, flavonids and total antioxidant activity of ethanolic and water extracts of propolis.

Material	phenolic compounds (mg/g)	Flavonids (mg/g)	Antioxidant activity (%)
EPE	13.64 ± 0.440^{a}	10.57 ± 0.605^{a}	67.12 ± 0.288^{b}
WPE	11.18 ± 0.511^{b}	7.716 ± 0.587^{b}	70.44 ± 0.327^{a}
LSD	0.0810	0.3510	0.3012

a, b: means with the same letter in the same column between different concentrates are not significantly different (p<0.05).

Chemical composition of kareish cheese treatments made with ethanolic extract of propolis (EEP) and water extracts of propolis is shown in Table (5). It is obvious that the addition of propolis extract had a negligible effect on the moisture contents of cheese, and slight decrease in moisture and total protein of cheese treatments along the storage period. These data in agreed with Abd El-Aziz *et al., (*2012). The slight differences of moisture in T2 and T4 might be due to the increase of the concentration of ethanolic and water propolis extracts, which came in agreement with Moawad *et al.,* (2001).Ash contents of kareish treatments showed slightly increase, compared with control when fresh and during the storage period. These results are in agreement with that reported by Ismail *et al.,* (2006) and Todaro *et al.,* 2013).

Soluble nitrogen content of kareish cheese varied significantly and increased directly with the storage period according to the microbial activity and due to the effect of propolis extract on lactic acid bacteria, especially, in T3 and T4 treatments. These results were in agreement with Moawad *et al.,* (2001) and Mahmoud *et al.*, (2013).

The changes in pH values and the titratable acidity values during storage at (5± 1ºC) of different variants of Karish cheese using different concentrations of propolis extracts (ethanolic and water) are given in Fig. 1. Data showed that little differences between all

treatments including the control cheeses in pH values when fresh. In addition, it could be noticed that the pH values of all kareish cheeses gradually decreased during the storage period at (5± 1ºC) for 28 days . The decrease in pH values during storage could be related to the hydrolysis occurred in lactose and protein contents. The results of the present study are in agreement with Magdoub *et al.*, (1995) and Janhøj *et al.,* (2008).

Table 5. Chemical composition (%) of Kareish cheese as affected by different concentrates of ethanolic and water extracts of propolis during storage period.

Treatments& Storage preiod	Moisture	Protein	Ash	S.N
Control				
Fresh	74.61^{Ba}	16.94^{Aa}	3.65^{ABc}	0.43^{Ae}
7day	74.14^{Bb}	16.81^{Ab}	3.70^{ABbc}	0.58^{Bd}
14day	73.80^{Bb}	16.54^{Ac}	3.77^{Cab}	0.79^{Bc}
21day	72.81^{BCc}	15.91^{Abe}	3.79^{Ca}	0.90^{ABb}
28day	72.15^{Bd}	15.29^{Cd}	3.84^{BCa}	0.98^{Ba}
T1				
Fresh	74.72^{Ba}	16.92^{Aa}	3.73^{Ae}	0.42^{Ae}
7day	73.81^{Cb}	16.81^{Aa}	3.77^{ABd}	0.56^{Bd}
14day	73.28^{BCc}	16.63^{Ab}	3.83^{ABc}	0.75^{BCc}
21day	72.83^{BCd}	16.23^{Ac}	3.90^{Bb}	0.86^{Bb}
28day	72.29^{Be}	16.01^{Ad}	3.96^{Ba}	0.97^{Ba}
T2				
Fresh	75.36^{Aa}	16.73^{Aa}	3.75^{Ae}	0.38^{Be}
7day	75.15^{Aa}	16.52^{ABb}	3.82^{Ad}	0.52^{BCd}
14day	74.55^{Ab}	16.32^{ABc}	3.92^{Ac}	0.67^{Cc}
21day	74.20^{Acb}	15.94^{ABd}	4.02^{ABb}	0.78^{Cb}
28day	73.68^{Ac}	15.65^{BCc}	4.14^{ABa}	0.93^{Ca}
T3				
Fresh	74.64^{Ba}	16.58^{ABb}	3.68^{ABe}	0.42^{Ae}
7day	74.41^{Ba}	16.37^{Bb}	3.74^{ABd}	0.61^{Ad}
14day	73.90^{Bb}	16.14^{Bc}	3.82^{ABc}	0.79^{Bc}
21day	73.50^{Bc}	15.89^{Bd}	3.91^{Bb}	0.93^{Ab}
28day	73.22^{ABc}	15.58^{Cde}	4.11^{ABa}	1.04^{Aa}
T4				
Fresh	75.67^{Aa}	16.76^{Aa}	3.79^{Ac}	0.44^{Ae}
7day	75.26^{Ab}	16.56^{ABa}	3.87^{Abc}	0.59^{ABd}
14day	74.66^{Ac}	16.13^{Bb}	3.96^{Ab}	0.82^{Ac}
21day	74.33^{Ad}	15.72^{Bc}	4.17^{Aa}	0.94^{Ab}
28day	73.94^{Ae}	15.35^{Dd}	4.22^{Aa}	1.06^{Aa}

A, B, C: Means with same letter among treatments in the same storage period are not significantly different.

a, b, c: Means with same letter for same treatment during storage periods are not significantly different

T1: kareish cheese with 6% EEP T3: kareish cheese with 6% WPE

T2: kareish cheese with 10% EEP T4: kareish cheese with 10% WPE

The changes in titratable acidity of cheese followed an opposite trend to pH. The obtained results indicate that cheese acidity was not greatly affected, while there was increase in acidity values of cheese with increasing the concentration of added propolis extracts. Then the cheese acidity greatly increased as the storage time prolonged. It was also noticed that after 28days of storage there were slight differences between the acid values of the control and the supplemented with propilis cheeses (Fig.1). The cheese acidity was affected with the storage period more than with adding propolis extracts (ethanolic and water). Similar results were also found by Moawad *et al.,* 2001 and Staffolo *et al.*, (2004)..

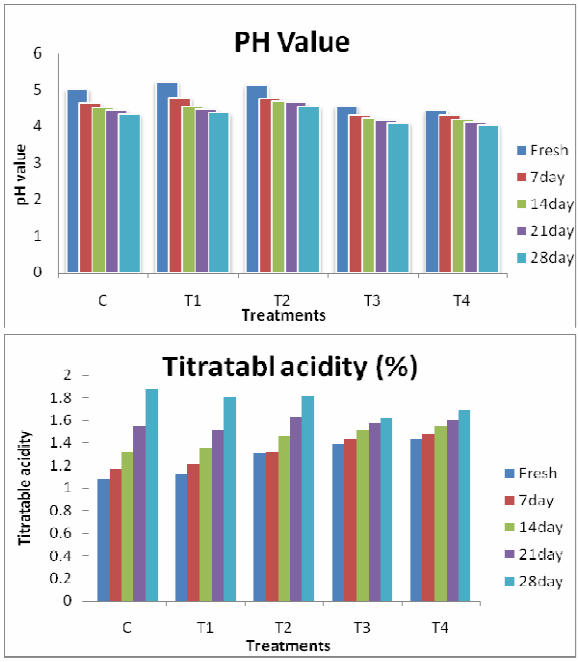

Fig 1. Changes in pH values and acidity (%) of kareish cheese treatments as affected by different concentrates of ethanolic and water extracts of propolis during storage period.

Table 6. Phenolic compounds, flavonids and total antioxidant activity of kareish cheese treatments.

Treatments	phenolic compounds (mg/g)	Flavonids (mg/g)	Antioxidant activity(%)
Raw milk	0.77 ± 0.219	0.39 ± 0.506	46.56 ± 0.150
Treatments			
Control	0.69 ± 0.461	0.34 ± 0.250	42.64 ± 0.000
T1	1.38 ± 0.089	0.94 ± 0.416	48.74 ± 1.209
T2	2.02 ± 0.352	1.35± 0.212	51.23 ± 2.027
T3	1.24 ± 1.409	0.76 ± 0.225	49.78 ± 0.209
T4	1.4 3± 0.256	1.06 ± 0.457	52.94 ± 0.031
LSD	0.1415	0.1524	0.1201

T1: kareish cheese with 6% EEP T3: kareish cheese with 6% WPE

T2: kareish cheese with 10% EEP T4: kareish cheese with 10% WPE

The effect of adding different concentrations of propolis extracts on phenolic compounds, flavonids and antioxidant activity of kareish cheese at fresh are illustrated in Table (6). As generally kareish cheese with adding different concentrations (6 and 10%) of propolis extracts (ethanolic and water) increased of the phenolic compounds, flavonids and antioxidant activity with the increase ratio of propolis extracts. Adding different propolis extracts increased the antioxidant capacity of dairy beverages. On the other hand, pasteurization didn't affects on the antioxidant capacity of beverages with added ethanolic propolis extract. (Cottica *et al*., 2015).

Table (7) showed the effect of adding different concentrations of EEP and WEP on the count of *Lb. bulgaricus* and *Str. thermophilus* in fresh kareish cheese and during storage periods at 5 ± 1ºC for 28 days. Data show that the counts of *Lb. bulgaricus* and *Str. thermophilus* in EEP or WEP supplement kareish cheese

were significantly ($p \leq 0.05$) higher than in the control cheese. The increase in counts could be attributed to the presence of propolis extracts. These results are similar to those reported by Saddiq and Danial,(2014). The counts of *Str. thermophilus* and *Lb. bulgaricus* in kareish cheese samples (T1) with the addition of EEP were higher than these detected in all treatments after 21days storage. Prolonging the storage period resulted in an increase in counts of two bacterial strains until 14 days in cheese control, while the increase in cheese with added EEP and WEP continued until 21 days. These results are similar to those obtained by Haddadin *et al*., 2008 and El-Bialy (2016).

Table 7. Effect of EEP and WEP on growth of *Str. thermophillus* and *Lb. bulgaricus* in Kareish cheese treatments during storage period.

Storage Period	Treatments				
Days	C	T1	T2	T3	T4
			Str. thermophillus		
Fresh	5.87^{b}	6.29^{e}	6.19^{e}	6.32^{e}	6.15^{e}
7	5.91^{b}	6.71^{d}	6.50^{d}	6.59^{d}	6.30^{d}
14	6.22^{a}	6.95^{c}	6.91^{c}	6.84^{c}	6.85^{c}
21	5.97^{b}	7.43^{a}	7.40^{a}	7.40^{a}	7.25^{a}
28	5.32^{c}	7.09^{b}	7.06^{b}	7.06^{b}	7.02^{b}
LSD	0.0204	0.0363	0.0247	0.0168	0.0016
			Lb. bulgaricus		
Fresh	6.90^{e}	7.09 ^{e}	6.54^{e}	6.25^{d}	6.44^{d}
7	7.25 ^{b}	7.49^{d}	6.91^{d}	6.54^{c}	6.76^{c}
14	7.63^{a}	7.81^{c}	7.25^{b}	6.84^{b}	6.97^{b}
21	7.05^{c}	8.23^{a}	7.64^{a}	7.10^{a}	7.31^{a}
28	6.64^{d}	8.01^{b}	7.07^{c}	6.84^{b}	6.83^{c}
LSD	0.0248	0.0405	0.0113	0.0323	0.0211

Different small letters within each treatment during storage on the same column are differing significantly at $p \leq 0.05$.

The effect of adding different concentrations of EEP or WEP on the counts of mesophilic and psychrophilic (MBC, PBC), total coliform, *E. coli*, *S. aureus*, *Salmonella* sp. and M&Y in Kareish cheese during storage periods at 5± 1ºC for 28 days is presented in Table (8). The obtained results showed that MBC and PBC were not detected in control of kariesh cheese when fresh or during storage until 7 days. By increasing the storage period the counts of MBC or PBC increased until 28 days. MBC and PBC in the treated kariesh cheese were not detected until 14 and 21 days, respectively. This might be due to the post contamination during storage. Also, the obtained results reveal that the water extract of propolis (WEP) at 10% was more effective than other treatments.

Counts of coliform detected in the control cheese was 3.63 log cfu/g and 4.18 log cfu/g after 14 and 28 days of storage, respectively. The treated cheese with propolis extracts resulted in the inhibition of coliform group and lowered the maximum growth level in the cheese at the end of storage period. Kareish cheese samples made by the addition of 10% EEP was found completely free from coliforms.

Salmonella spp. and *S. aureus* were not detected in all cheese treatments when fresh or during the storage period. This might be due to the antimicrobial substances formed by lactic acid bacteria against the majority of other bacteria, from one side (Jacobsen *et al.,* 1999), and the high hygienic condition during making and storage of cheese, from othe side.

Moulds and yeasts count detected in the control cheese after 7 days of storage. While the treated kariesh cheese with propolis extracts lead to the inhibition and retardation of moulds and yeasts growth, as they were not detected in treated cheeses until 21 days.

From the achieved results, it is clear that the addition of water extract of propolis at concentration of 10% is relatively more effective than other concentrations. These results are confirmed with those observed by Cowan, (1999), Temiz *et al.*, (2011), Abou Dawood (2002) and Ismail *et al*., (2006)

Sensory evaluation of dairy products is of importance of the potential preference of the consumer. Sensory properties of Kareish cheese were affected by different concentrates of propolis extracts when fresh and during the storage period at (5± 1ºC) for 28 days (Table(9). Significant differences ($p \leq 0.05$) were found between cheeses, where the type of propolis extracts (ethanolic or water) were the principle factors influencing the sensory properties of the treated cheeses . Also, the score for flavor and texture were affected by the level of ethanol and water propolis extracts. kareish cheeses made with water propolis extract (T3 andT4) were more accepted by the panelists, as compared with cheese made by ethanolic propolis extract (T1 and T2), which characterised by higher acid flavour and of non-acceptance. In addition, the score of fresh samples indicated that kareish cheese treatments (T4) with 10% water extracts of propolis (WEP) gained the highest score, compared with other treatments, followed by the control. These results are in agreement with Moawad *et al.,* 2001 and Metwalli, 2011). On the other hand, the addition of higher concentration of ethanolic extract of propolis (EEP) in kareish cheese(T2) decreased the flavor , texture and appearance score, compared with other treatments.

Statistical analysis for total score values of kareish cheese treatments cleared that treatments T3 and T4 were significantly different than control. This was noticed among fresh and stored samples. Storage of kareish up to 28 day decreased the quality of all treatments including the control. Treatments containing water propolis extract remained as the best acceptable product, followed by control treatment, while treatments containing ethanolic propolis extract (T1, T2) came last and were of less preferable to panelists at the end of storage. Ethanolic extract of propolis (EEP) has some disadvantages such as a strong taste and adverse reactions or intolerance to the alcohol (Mello *et al.,*2010 and Matsui *et al.,*2004).

Table 8. Microbiological analysis of kareish cheese treatments with WEP and EEP extracts at different concentrations during cold storage

Treatments	Storage Period (days)	MBC	PBC	Total coliform	*E.coli*	*Salmonella sp.*	*S. aureus*	M&Y
C	Fresh	ND^{c}	ND^{d}	ND^{d}	ND	ND	ND	ND^{d}
	7	ND^{c}	ND^{d}	ND^{d}	ND	ND	ND	ND^{d}
	14	4.80^{b}	3.61^{c}	3.63^{c}	ND	ND	ND	3.27^{c}
	21	5.37^{ab}	4.27^{b}	4.27^{b}	ND	ND	ND	3.27^{b}
	28	5.76^{a}	4.82^{a}	4.18^{a}	ND	ND	ND	3.94^{a}
	LSD	0.0075	0.0155	0.0108	-----	----	-----	0.0194
T1	Fresh	ND^{c}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	7	ND^{c}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	14	ND^{c}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	21	3.52^{b}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	28	4.28^{a}	3.37^{a}	2.34^{a}	ND	ND	ND	4.33^{a}
	LSD	1.0218	0.0192	0.1009	----	-----	-----	0.0276
T2	Fresh	ND^{b}	ND	ND	ND	ND	ND	ND^{b}
	7	ND^{b}	ND	ND	ND	ND	ND	ND^{b}
	14	ND^{b}	ND	ND	ND	ND	ND	ND^{b}
	21	ND^{b}	ND	ND	ND	ND	ND	ND^{b}
	28	4.24^{a}	ND	ND	ND	ND	ND	4.33^{a}
	LSD	0.0040	-----	----	----	-----	----	0.0576
T3	Fresh	ND^{c}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	7	ND^{c}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	14	ND^{c}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	21	3.43^{b}	ND^{b}	ND^{b}	ND	ND	ND	ND^{b}
	28	4.52^{a}	3.76^{a}	3.26^{a}	ND	ND	ND	4.27^{a}
	LSD	0.0739	0.0807	0.1091	-----	-----	-----	0.1052
T4	Fresh	ND^{b}	ND	ND^{b}	ND	ND	ND	ND^{b}
	7	ND^{b}	ND	ND^{b}	ND	ND	ND	ND^{b}
	14	ND^{b}	ND	ND^{b}	ND	ND	ND	ND^{b}
	21	ND^{b}	ND	ND^{b}	ND	ND	ND	ND^{b}
	28	4.26^{a}	ND	3.13^{a}	ND	ND	ND	3.86^{a}
	LSD	0.1173	-----	0.0937	----	-----	----	0.1040

Different small letters within each treatment during storage on the same column are differ significantly at $p \leq 0.05$

Table 9. Sensory evaluation of kareish cheese treatments as affected by ethanolic extract of propolis (EEP) and water extracts of propolis (WEP)during storage.

Storage perio (days)	Treatments C	T1	T2	T3	T4
			Flavor(50)		
Fresh	40.33^{Ea}	45.00^{Ca}	48.33^{Aa}	42.33^{Da}	46.30^{Ba}
7	44.70^{Bab}	40.33^{Cab}	35.01^{Db}	44.33^{Bb}	47.67^{Ab}
14	44.00^{Bb}	37.00^{Dbc}	36.00^{DEab}	41.00^{Cc}	46.33^{Ac}
21	41.02^{Bc}	34.67^{Cc}	33.12^{CDbc}	41.67^{Bc}	45.33^{Ad}
28	35.04^{Cd}	30.00^{Dd}	28.33^{Ec}	41.67^{Bc}	43.67^{Ae}
			Body & Texture (35)		
Fresh	33.70^{ABa}	30.33^{BCa}	31.00^{Ba}	33.00^{ABa}	34.00^{Aa}
7	32.72^{Aa}	26.33^{BCb}	28.67^{Bab}	32.00^{Aab}	32.67^{Aab}
14	30.33^{ABa}	24.00^{Dbc}	26.00^{Cbc}	29.33^{Bbc}	31.33^{Aabc}
21	26.04^{BCb}	21.33^{CDcd}	22.33^{Ccd}	27.67^{Bcd}	29.67^{Abc}
28	24.15^{BCb}	18.25^{CDd}	19.03^{Cd}	25.00^{Bd}	27.67^{Ac}
			Appearance (15)		
Fresh	14.00^{Aa}	12.00^{BCa}	12.33^{Ba}	12.67^{Ba}	13.67^{ABa}
7	14.00^{Aa}	11.02^{Ca}	8.07^{Db}	12.00^{Ba}	13.33^{ABa}
14	12.12^{ABa}	10.33^{Ba}	7.33^{Cb}	10.03^{BCab}	13.33^{Aa}
21	11.30^{ABab}	9.25^{Bab}	6.33^{Db}	8.33^{Cb}	12.06^{Aab}
28	9.11^{Bb}	7.31^{Db}	6.03^{Eb}	8.33^{Cb}	10.25^{Ab}
			Total(100)		
Fresh	96.33^{ABa}	83.67^{CDa}	84.00^{Ca}	92.67^{Ba}	96.67^{Aa}
7	92.67^{Ba}	77.33^{Db}	76.33^{DEb}	89.00^{Ca}	95.03^{Aab}
14	86.33^{Bb}	71.67^{Dc}	69.00^{Ec}	84.05^{Cb}	90.67^{Abc}
21	76.67^{Cc}	65.33^{Dd}	62.13^{Ed}	80.33^{Bb}	87.00^{Acd}
28	67.67^{Cd}	55. 33De	53.67^{Ee}	74.33^{Bc}	82.33^{Ad}

A, B, C: Means with same letter among treatments in the same storage period are not significantly different.
a, b, c: Means with same letter for same treatment during storage periods are not significantly different

CONCLUSION

The present study confirmed that adding of 6 and 10% of water extracts of propolis (WEP) to kareish cheese can be recommended as natural and safe sources of phenolic compound, high acceptability and antimicrobial agents during storage periods.

REFERENCES

Abd El-Aziz, M.; Sahar, H.S. Mohamed and Faten, L. Seleet (2012).Production and evaluation of soft cheese fortified with ginger extract as a functional dairy food. Pol. J. Food Nutr. Sci., 62 (2): 77-83.

Abd El Hady, F.K. and A.G. Hegazi (2002). Egyptian propolis: 2. Chemical composition, antiviral and antimicrobial activities of east Nile delta propolis.Zeit. Naturforsch, 57: 386-394.

Abou-Dawood, A.E. and Gomai, A.Y. (1977). The use of high total solids reconstituted skim milk in Kareish cheese making. Egyptian J.Dairy Sci. 5:229–234.

Abou Dawood S. A.I. (2002). Sensitivity of yeast flora of labneh to spices. Egyptian J. Dairy Sci., 30:35.

Aman, I. M. (1994). Microbiological quality of Kareish cheese in Kafr ElSheikh City. Assiut. Vet. Med. J., 31:182–189.

AOAC(2000). Association Official Analytical Chemists. Official Methods of Analysis, 17th ed. Arlington, VA, USA.

APHA, American Public Health Association,(1992). Standard Methods for the Examination of Dairy Products, Amer. Publ. Health Assoc. Inc. 12th Ed., New York.

Bankova, V. (2005). Recent trends and important developments in propolis research. Evidence-based complementary and alternative medicine 2 (1): 29-32.

Boubakeur, B.; Tirtouil, A.; Meddah, B.and Khadem H. (2015). The evaluation of the effect of synthetic flavonoids on growth of pathogenic and probiotic bacteria. J. of Chemical and Pharmaceutical Res., 7(10): 228-236

Burt, S. (2004). Essential oils: Their antibacterial properties and potential applications in foods – A review, Int. J. Food Microbiol., 94: 223–253.

Cottica, S. M.; Hassan, S.; Denis B.; Hélène, J. G.; Jesui, V. V. and Michel, B. (2015). Use of propolis extracts as antioxidant in dairy beverages enriched with conjugated linoleic acid. Eur. Food Res. Technol.; 26 (6): 2483-2491.

Cowan, M.M. (1999). Plant products as antimicrobial agents. Clin Microbiol Rev 12:564– 82.

De Buyser, M. L.; Dufour, B.; Maire, M. and Lafarge, V. (2001). Implication of milk and milk products in food-borne diseases in France and in different industrialized countries. Int. J. of Food Microbiol., 67: 1–17.

El Bagoury, A. N. and Mosaad A. A. (2002). Incidence of Salmonella and Escherichia coli in Kareish cheese with special reference to heat stable enterotoxin producing Escherichia coli using polymerase chain reaction. Minufia Vet. J., 2:59–66.

El-Bialy, R. Amany (2016). Improvement of nutritional, hygienic and sensory properties of kariesh cheese using thyme and black seeds. Int. J. of Advanced Res., 4(7): 1872-1880.

Fahmi, A. H. (1960): Note "Manufacture of Kareish cheese" J. Agric. Sci., 3(1): (InArabic).

Grange, J.M. and Davey, R.W. (1990). Antibacterial properties of propolis. J. R. Soc. Med., 83: 159-160.

Haddadin, M.S.Y., S.S. Awaisheh and R.K. Robinson, (2007). Production of yoghurt with probiotic bacteria isolated from infants in Jordan. Pak. J. Nutr., 3: 290-293.

Haddadin, M.S.Y.; I. Nazer, S. J.Abu- Raddad and R.K. Robinson (2008). Effect of Propolis on Two Bacterial Species with Probiotic Potential. Pakistan J. of Nutrition 7 (2): 391-394.

Hanaa, H.A. EL-Mssallam and Abdel-Hakeim, Y.A. (2013). Using of propolis extract as a trial to extend the shelf-life and improving the quality criteria of fresh Egyptian sausages. Assiut Vet. Med. J. 59(139): 23-33.

Huang, S.; Zhang, C.P; Wang, K.; Li, G.Q. and Hu, F.L. (2014). Recent Advances in the Chemical Composition of Propolis. Molecules, 19: 19610-19632.

Ismail, A.M.; S. Harby and Aida. S. Salem (2006). Production of flavored labneh with extended shelf life. Egyptian J. diary sci., 34:59-68.

Jacobsen C.N.; Rosenfeldt-Nielsen V.; Hayford A.E.; Møller P.L.; Michaelsen K.F.; Paerregaard A.; Sandström B.;Tvede M. and Jakobsen M. (1999). Screening of probiotic activities of forty-seven strains of Lactobacillus spp by in vitro techniques and evaluation of the colonization ability of five selected strains in humans. Appl Environ Microbiol., 65: 4949-4956.

Janhøj, T.;M. B .Frøst and R. Ipsen (2008). Sensory and rheological characterization of acidifiedmilk drinks. Food Hydrocolloids; 22:798–806.

Kubiliene, L.; Laugaliene, V.; Pavilonis, A.; Maruska, A.; Majiene, D.; Barcauskaite, K.; Kubilius, R.; Kasparaviciene, G.and Savickas, A. (2015). Alternative preparation of propolis extracts: Comparison of their composition and biological activities. BMC Complement. Altern. Med.:156: 1–7.

Kujumgiev, A.; Tsvetkova, I.; Serkedjieva, Y.; Bankova, V. S.; Christov, R. and Popov, S. (1999). Antibacterial, antifungal and antiviral activity of propolis of different geographic origin. Journal of Ethnopharmacology, 64 (3): 235-240.

Li, W.; Hydamaka, A. W.; Lowry, L. and Beta, T. (2009).Comparison of antioxidant capacity and phenolic compounds of berries, chokecherry and seabuckthorn. Central European Journal of Biology, 4: 499-506.

Ling, E.R.(1963). A text book of dairy chemistry, vol. II, Chapan and Hall, Ltd., London. Lu, L. C.; Chen, Y. W. and Chou, C. C. (2005). Antibacterial activity of propolis against Staphylococcus aureus. Int. J. of Food Microbiol., 102: 213–220.

Magdoub, M.N.I.; Osman, S.H.G. and EL-Kenawy, M.M.(1995). Effect of different starter cultures on composition and microbiological quality of cheese. Egyptian J. Appl. Sci. 10 (1):132–141.

Mahmoud, S. F.; Y. El-Halmouch and M. M. Montaser (2013).Effect of probiotic bacteria on Karish Cheese production.Life Science J.;10 (2): 1279-1284.

Matsui, T.; S. Ebuchi and T. Fujise (2004). Strong antihyperglycemic effects of water-soluble fraction of Brazilian propolis and its bioactive constituent, 3, 4, 5 -tri- O- caffeoylquinic acid. Biological and Pharmaceutical Bulletin ; 27 (11) : 1797 – 1803.

Mello, B.C.B.; Petrus, J.C. and Hubinger, M.D. (2010). Concentration of flavonoids and phenolic compounds in aqueous and ethanolicpropolis extracts through nanofiltration. J Food Process Eng.;96:533–9.

Metwalli ,A. H. Sonia(2011). Extended shelf life of kareish cheese by natural preservatives. Egypt. J. Agric. Res., 89 (2): 639-649.

Moawad, A.A.; E.A.Galal and W. A. Metry (2001). Egyptian bee propolis as natural preservative for ultra filtered soft cheese.Proc.8th Egyptian Conf.Dairy Sci.&Techn: 243-255.

Mohammadi, R. and Mortazavian, A.M. (2011). Review Article: Technological Aspects of Prebiotics in Probiotic Fermented Milks. Food Reviews International, 27:192-212.

Moura, S.A; Negri, G.; Salatino, A.; Lima, L.D.; Dourado, L.P.and Mendes, J.B.(2009).Aqueous extract Brazilian propolis: primary components, evaluation of inflammation and wound healing by using subcutaneous implanted sponges. Evid. Based Complement Alternat Med.,18 :1–9.

Nagai.T.; R. Inoue, H. Inoue and N. Suzuki (2003). "Preparation and antioxidante properties of water extract of propolis," Food Chemistry; 80 (1): 29–33.

Nelson, J.S. and Trout, G.M.(1964). Judging Dairy Product, 3rd ed. The Olsen Publishing Co., Milwauke, USA.

Orsi, R.O.; Sforcin, J.M.; Rall, V.L.; Funari, S.R.; Barbosa, L. and Fernandes J. A. (2005). Susceptibility profile of Salmonella against the antibacterial activity of propolis produced in two regions of Brazil. J Venom Anim Toxins incl Tropl Dis 11: 109-116.

Orsolic, N. and Basic,I.(2003). Immunomodulation by water-soluble derivative of propolis: a factor of antitumor reactivity. J. Ethnopharmacol., 84:265–73.

Osman,O; I. OzturK,; O. Bayram; Z. Kesmen and M.T. Yilmaz (2010). Characterization of cheese spoiling yeasts and their inhibition by some spices. Egyptian J. Dairy Sci., 75 (2): 637–640.

Reps, A.; Drychowski, L.J.; Tomasik, J. and Niewska, K.W. (2002): Natamycin in ripening cheeses. Pakistan Journal of Nutrition, 1(5):243-247.

Saddiq, A.A. and Danial, E. N. (2014). Effect of Propolis as a food additive on the growth rate of the beneficial bacteria. Main Group Chemistry, 13(3): 223-232.

Staffolo, M.D.; N. Bertola; M. Martino and A. Bevilacqua (2004) .Influence of dietary fiber addition on sensory and rheological properties of yogurt. Int. Dairy J., 14:263–268.

Satoshi, M.; Yoshikazu, I.; Yukio, N.; Shozo, O.; Takashi, S.; Yoko, A. and Yoshinori, N.(2005). Identification of caffeoylquinic acid derivatives from Brazilian propolis as constituents involved in induction of granulocytic differentiation of HL-60 cells. Bioorganic & Medicinal Chemistry, 13: 5814–5818.

Steel, .G.D.; J.H. Torrie andD. A. Dickey (1997). Principles and procedures of Statistics: A Biometrical Approach, 3rd Edn., McGraw-Hill Co., New York ,USA.

Temiz, A.; Sener, A.; T, Ö.A.; Sorkun, K. and Salih, B. (2011). Antibacterial activity of bee propolis samples from different geographical regions of Turkey against two foodborne pathogens, Salmonella entritidis and Listeria monocytogenes. Turk. J. Biol., 35: 503-511.

Todaro, A.; Adly,F.A. and Omar, O.A.H. (2013). History, Processing and QualityEnhancement of Traditional Egyptian Kariesh Cheese: A Review. Food Sci. Technol. 1(1):1-6.

Vargas-Sánchez, R. D.; G. R. Torrescano-Urrutia; A. M. Mendoza-Wilson; B.Vallejo- Galland; E. Acedo-Félix; J. J. Sánchez-Escalante; M. C. Peñalba-Garmendia and A. Sánchez-Escalante (2014). Mechanisms involved in antioxidant and antibacterial activity of propolis. Biotecnia 16: 32-37.

Volpert, R. and Elstner, E.F. (1993). Biochemical activities of propolis extracts. Photodynamic activities. Z. Naturforsch C.; 48: 858–62.

تأثير مستخلص البروبليس كمادة حافظة طبيعية علي المحتوي الميكروبي في الجبن القريش

أماني محمد الديب[١] و صابرين أحمد عمر[٢]

[١]معهد بحوث تكنولوجيا الأغذية-مركز البحوث الزراعية – الجيزة – مصر

[٢] قسم الميكروبيولوجي- كلية الزراعة – جامعة المنصورة – المنصورة – مصر

تهدف الدراسة إلي استخدام مستخلص البروبوليس كمادة حافظة طبيعية لانتاج جبن قريش ذو قيمة غذائية وصحية عالية. تم استخدام نوعين من مستخلص البروبوليس (الكحولي والمائي) بتركيزات مختلفة ودراسة تأثيرهم علي نشاط بكتيريا *Streptococcus thermophilus*, *Lactobacillus bulgaricus* و *Bifdobacterium bifidium* وبعض الميكروبات الملوثة لمنتجات الألبان في بيئة لبن سائلة. كذلك تم تحليل الجبن القريش المصنع بالمعاملات المختلفة (٦و١٠%) لكل من البروبوليس الكحولي والمائي لدراسة الخواص الكميائية ،المواد الفينولية ، مضادات الأكسدة ، الخواص الميكروبيولوجية والحسية بعد التصنيع وأثناء فترات التخزين المختلفة حتي ٢٨ يوم عند ٥ ± ١٥م. أظهرت النتائج أن العد الكلي لبكتريا *Streptococcus thermophilus*, *Lactobacillus bulgaricus* في المعاملات المختلفة أعلي بدرجة معنوية عن الكنترول، كما لوحظ عدم ظهور أي أعداد ميكروبية علي بيئات العد للميكروبات الملوثة تحت الدراسة عند تركيزات ٦٠٠ ،١٠٠٠مج/١٠٠مل لبن. وأوضحت نتائج التحليل الكيماوي أن تأثير مستخلص البروبوليس ضعيف علي محتوي الرطوبة أو البروتين،حيث أن هناك نقص طفيف في معاملات الجبن القريش أثناء التخزين. بينما أظهرت نتائج الحموضة ، والمواد الفينولية ومضادات الاكسدة ارتفاعاً في القيم بزيادة نسبة المستخلص المضافة (٦و١٠%) .أيضاً أظهرت النتائج أن العد الكلي لبكتريا *Streptococcus thermophilus*, *Lactobacillus bulgaricus* في معاملات الجبن القريش زيادة معنوية، بينما لم تظهر أي اعداد من البكتريا الميزوفيلية ،السيكروفيلية ، بكتريا الكوليفورم والخمائر والفطريات حتي ٢١ يوم من التخزين. وأشارت نتائج التحكيم الحسي أن المعاملات T3وT4 المضاف لها مستخلص البروبوليس المائي كانت أعلي درجات التحكيم ، بالإضافة إلي تحسين الخواص الحسية طوال فترة التخزين مقارنة بالكنترول والمعاملات T1وT2 المضاف لها مستخلص البروبوليس الكحولي .لذلك توصي الدراسة بانتاج الجبن القريش بإضافة مستخلص البروبوليس المائي.