

Manufacture of Kariesh Cheese Supplemented with Cumin Aqueous Extract



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Abstract

The aim of this work was to study the influence of cumin aqueous extract on coagulation time, the chemical composition and microbiological quality as well as organoleptic properties of the Kariesh cheese. Different concentrations of cumin aqueous extract (0.0, 0.5, 1.0, 2.0 and 3.0 %) were added to skim milk and used for making Kariesh cheese. The obtained cheese stored for two months at $5 \pm 2^{\circ}\text{C}$. Acid content was increased by increasing the concentration of the cumin aqueous extract. Ash, total nitrogen, amino nitrogen, total protein, total protein in dry matter, fat, fat in dry matter, salt and salt in serum percentages while the soluble nitrogen and total solids contents were decreased. It was observed that this extract have a significant effect on decrease total bacterial counts of Kariesh cheese.

Regarding to organoleptic properties of Kariesh cheese supplemented with cumin aqueous extract comparable with control one it has better scores than control.

Keywords: *Cumin, Kariesh cheese, Aqueous extract.*

Introduction:

Aromatic plants are defined as plant species with characteristic aromas and/or tastes, whose importance lies in having volatile components in denominated essential oils, with specific properties (Gouvea *et al.*, 2017).

Length of coagulation time in Kariesh cheese manufacture may be increase the risk of contamination with undesired microorganisms or bacteriophage activity so, it's important to add spices during its manufacture (Breene *et al.*, 1964, O'Keeffe *et al.*, 1975, Bayoumi and Reuter, 1986).

Wahba *et al.* (2010) found that the addition of plant materials to Kariesh cheese reduced the total bacterial and coliform populations, Saad and abdel-Salam (2015) illustrate that the total colony count of plain cheese

significantly increased ($P < 0.05$) through the storage period.

Ismail and El-Demerdash (2003) and Hamad (2011) revealed that total bacterial count in Kariesh cheese was decrease during storage. Blassy and Ismail (2003), Hamad (2011) and Ismail and El-Demerdash (2003) stated that acidity, ash, total solids, SN, fat, fat/DM and salt contents of Kariesh cheese gradually increased during storage period percentage of Kariesh cheese. Mohran *et al.* (1984) found that protein content in Kariesh cheese was 26.06%.

The aim of this study was to throw light on the effect of cumin aqueous extract on coagulation time, chemical composition, microbiological quality and organoleptic properties of Kariesh cheese.

Materials and Methods

1- Materials

Cumin seeds were obtained from local market at Assiut city. Fresh raw buffalo's milk was obtained from Misr El- Khair farm, Arab El-Awamer, Abnoub, Assiut. *Yoghurt starter (Lactobacillus delbrueckii subsp bulgaricus & Streptococcus thermophilus)* were obtained from Assiut University, faculty of agriculture, dairy science department. Iodized salt produced by El-Max Saline's Co. Alex, Egypt.

2- Methods

Preparation of cumin aqueous extract:

Cumin aqueous extract were prepared according to the method of El-Mesery, (2010) with some modifications. Briefly, cumin seeds were cleaned using distilled water to remove any dirt, and exposed to 40°C to dry. Ten grams of cleaned dried seeds was soaked in 100 ml boiled water with stirring for 2 h then allowed to stand in the refrigerator at 5±2°C overnight, then filtered through a four-layer of cloth cheese and re-filtered through filter paper.

Manufacture of Kariesh cheese:

Kariesh cheese was made according to the method of Effat *et al.* (2001). Cheese was manufactured at Agriculture Research Station (ARS), Arab El-Awamer, Assiut Governorate. Fresh skimmed buffalo's milk was heated at 80°C/ 15 second and cooled down to 38-40°C. The cheese milk was inoculated with the Yoghurt's starter in a portion of 1% then it was divided into five portions, 2 kg each. First one was taken as 0.0 (control), and the Cumin aqueous extract was added at level of 0.5, 1.0, 2.0,

3.0%. Then the milk was incubated at 40°C. After complete coagulation, the curd was ladled in cloth cheese till complete draining. Each Kariesh cheese treatment was taken out and weighted, 3 % salt was added to the curd, and then the cheese was pickled in its whey (10% salt) at 5±2°C for 2 months.

Chemical analysis:

Titrate acidity, moisture, ash, total nitrogen (TN %) and soluble nitrogen (SN %) were estimated according to A.O.A.C (2000). Total solids (TS %) content was obtained by subtracting the moisture content of 100. The total protein (TP %) was calculated as $TN \% \times 6.38$ (Plummer, 1988) while protein in dry matter (TP/DM %) was obtained as follow:- Protein in dry matter % = (crude protein /total solids) ×100. The percentage of fat content in cheese has been estimated by using Gerber method according to Ling (1963), while fat in dry matter (fat/DM %) was calculated as follow:- % Fat in dry matter = (fat percentage /total solids percentage) × 100. Salt content were determined by using the "Mohr method" of A.P.H.A (2004), Salt % in cheese water = salt % in cheese × 100 / % moisture content of cheese.

Microbiological analysis:

Total Bacterial Count (T.B.C.) in cheese samples was determined with the standard plate count technique according to A.P.H.A., (2004). Appropriate dilutions of cheese samples were plated in duplicate on nutrient agar medium according to (Difco manual, 1998), The presence of coliform bacteria was detected by the multiple tube technique. The sample dilutions were inoculated into

MacConky broth medium according to (Difco manual, 1998).

Organoleptic analysis:

Panel test of cheese samples was carried out according to El-Hofi *et al.* (1991).

Statistical analysis:

The obtained data were subjected to statistical analyses. Data were performed in computer using the SPSS package (SPSS 1998).

Results and Discussion

Coagulation time:-

Results in Table (1) showed the coagulation time of Kariesh cheese supplemented with cumin aqueous extract at four levels as follows 0.5, 1.0, 2.0 and 3.0%. Results indicated that extract had a positive effect on coagulation time, which decreased with increasing the aqueous extract added. Kariesh cheese without extract added recorded 1:35h for coagulation, while Kariesh cheese manufactured with 0.5, 1.0, 2.0 and 3.0% concentrations recorded 1:30, 1:27, 1:20 and 1:18h, respectively.

Table 1. Coagulation time of Kariesh cheese supplemented with cumin aqueous extract.

Concentrations	Control	0.5%	1%	2%	3%
Coagulation time/hours	1:35	1:30	1:27	1:20	1:18

Microbiological properties:

Table (2) showed microbiological properties of Kariesh cheese supplemented with different concentrations of cumin aqueous extract (0.0, 0.5, 1.0, 2.0 and 3.0%) during storage period (0, 15, 30, 45 and 60 days). As seen from data in the Table, control sample had the highest bacterial counts (6.83 ± 0.01) log cfu/g, while other concentrations were 6.6 ± 0.03 , 6.5 ± 0.03 , 6.46 ± 0.03 and 6.23 ± 0.06 log cfu/g for 0.5, 1.0, 2.0 and 3.0% cumin extract concentration, respectively. Results also showed that bac-

terial load were increased during storage periods and it reached 7 ± 0.01 log cfu/gm in control sample after 60th days, while at 3.0% cumin it reach 6.57 ± 0.03 after 60th days with high significant differences (F-test, $P < 0.01$) between storage periods at different concentrations, respectively.

Regarding to coliform bacteria detection, it could be observed that coliform bacteria had not been detected at all investigated samples. This may be attributed to a good quality of raw material and a good heat treatment which applied.

Table 2. Microbiological properties of Kariesh cheese supplemented with cumin aqueous extract during storage period

Concentrations	Storage periods/ days							
	fresh	15	30	45	60	F-test	LSD 0.05	LSD 0.01
	Log (cfu/gm)							
Control	6.83± 0.01 ^{aE}	6.88± 0.01 ^{aD}	6.93± 0.01 ^{aC}	6.97± 0.01 ^{aB}	7.00± 0.01 ^{aA}	**	0.03	0.04
0.5 %	6.6± 0.03 ^{bD}	6.62± 0.02 ^{bD}	6.71± 0.02 ^{dC}	6.77± 0.01 ^{bB}	6.85± 0.01 ^{bA}	**	0.04	0.059
1 %	6.5± 0.03 ^{cD}	6.52± 0.01 ^{cD}	6.67± 0.01 ^{cC}	6.74± 0.02 ^{bB}	6.79± 0.02 ^{cA}	**	0.04	0.05
2 %	6.46± 0.03 ^{cD}	6.47± 0.04 ^{cD}	6.61± 0.02 ^{dC}	6.69± 0.01 ^{cD}	6.77± 0.01 ^{cA}	**	0.05	0.07
3 %	6.23± 0.06 ^{dC}	6.25± 0.08 ^{dC}	6.44± 0.03 ^{eB}	6.5± 0.03 ^{dAB}	6.57± 0.03 ^{dA}	**	0.09	0.13
F-test	**	**	**	**	**	-	-	-
LSD 0.05	0.07	0.08	0.04	0.04	0.03	-	-	-
LSD 0.01	0.1	0.11	0.05	0.05	0.05	-	-	-

abcdef letters indicate significant differences between concentrations.
 ABC letters indicate significant differences between storage periods

** : Highly Significant.

Chemical composition:

Table (3) represents the changes in acidity, ash, T.S and S.N% of Kariesh cheese supplemented with cumin aqueous extract during storage periods up to 60 days. It could be revealed that acidity percentage was increased by increasing the added extract concentrations which recorded 0.36±0.009, 0.456±0.03, 0.493±0.02, 0.5±0.02 and 0.51±0.03% for control, 0.5, 1.0, 2.0 and 3.0 %, respectively, with high significant differences (F-test, P<0.01) among different concentrations at all storage periods. Data obtained during different storage periods showed that acidity percent were increased from 0.36±0.029% at zero time to 0.546±0.05% after 60th days storage period of control and

from 0.513±0.03% to 0.78±0.03 at concentration of 0.5% after 60th days of storage period. High significant differences (F-test, P<0.01) were found among different storage periods at all concentrations of add aques cumin extract.

High significant differences (F-test, P<0.01) were found among different concentrations of the used extract, ash values were as follows 1.94±0.09, 3.03±0.15, 3.33±0.23, 3.68±0.21 and 3.63±0.4% for control, 0.5, 1.0, 2.0 and 3.0%, respectively. The ash values were slightly increased by increasing the storage period. The differences among storage periods at all concentrations were statistically non-significant differences (F-test), except in control sample

which has high statistically significant differences (F-test, $P < 0.01$).

The obtained results suggested that TS% of control was 25.54 ± 1.27 while, for 0.5, 1.0, 2.0 and 3.0% were 24.75 ± 1.35 , 24.68 ± 1.01 , 24.59 ± 1.25 and $24.5 \pm 1.36\%$, respectively without significant differences (F-test). After

60 days of storage at $5 \pm 2^\circ\text{C}$, values of TS% were 27.13 ± 0.7 , 26.9 ± 1 , 26.5 ± 1 , 26.43 ± 0.7 and $26.06 \pm 0.4\%$ for control, 0.5, 1.0, 2.0 and 3.0%, respectively. Non-significant differences (F-test) were appeared during all storage periods at all concentrations.

SN% of treated samples with 0.5, 1.0, 2.0 and 3.0% cumin extract are (0.16 ± 0.01 , 0.16 ± 0.01 , 0.13 ± 0.01 and $0.12\pm 0.009\%$, respectively). It was observed that the previous values of treatments were lower than control sample ($0.185\pm 0.005\%$). High significant differences (F-test, $P<0.01$) were reported among storage periods at different concentrations. Also the results showed that SN% was increased during storage periods to become (after 60 days) 0.59 ± 0.001 , 0.57 ± 0.009 , 0.57 ± 0.009 , 0.57 ± 0.004 and $0.55\pm 0.005\%$ for control, 0.5, 1.0, 2.0 and 3.0%, respectively. On the other hand among concentrations, high significant differences (F-test, $P<0.01$) were recorded at zero, 45 and 60 days, while significant differences ($P<0.05$, F-test) were recorded at 15 and 30 days.

Data in Table (4) reported the changes occurred during storage periods of Kariesh cheese for different storage periods at different concentrations of cumin extract in TN, A.N, TP and TP/DM%. Regarding to TN%, control sample was 2.9 ± 0.28 while it were 2.91 ± 0.3 , 3.1 ± 0.2 , 3.2 ± 0.2 and $3.21\pm 0.2\%$, in samples with 0.5, 1.0, 2.0 and 3.0% cumin extract, respectively. Non-significant differences (F-test) were observed among concentrations in case of zero, 15 and 30 days, while significant differences ($P<0.05$, F-test) were reported for 45 days and high significant differences (F-test, $P<0.01$) were occurred after 60 days. TN% was decreased gradually during storage period. The total nitrogen percentage after 60 days of storage were 2.5 ± 0.05 , 2.58 ± 0.05 , 2.64 ± 0.04 , 2.85 ± 0.05 and $2.5\pm 0.05\%$ for control, 0.5, 1.0, 2.0 and 3%, respec-

tively. Non-significant differences (F-test) were found among storage periods at all concentrations except for 1% cumin aqueous extract which has significant differences ($P<0.05$, F-test).

As shown in the mentioned Table AN % didn't appear in all fresh samples because it's a result of protein degradation. Non-significant differences (F-test) were found among concentrations in zero day while, high significant differences (F-test, $P<0.01$) were observed in all concentrations after 15, 30, 45 and 60 days storage. High statistically significant differences (F-test, $P<0.01$) were observed during storage periods that AN% begin with 0.0 in fresh sample and reach to 0.63 ± 0.02 in control sample and $1.1\pm 0.09\%$ at 3% cumin concentration after 60 days.

From the results it could be concluded that TP% of control sample at zero day was 18.5 ± 1.8 while in 0.5, 1.0, 2.0 and 3.0% were 18.6 ± 1.92 , 19.13 ± 1.27 , 19.3 ± 1.3 and $19.92\pm 1.3\%$, respectively. No significant differences (F-test) were found among concentrations in zero, 15 and 30 days of storage while significant differences (F-test, $P<0.05$) were observed after 45 days and high significant differences (F-test, $P<0.01$) were observed after 60 day. At the end of storage period (60 days), the results of total protein were 16.38 ± 0.34 , 17.64 ± 0.38 , 18.06 ± 0.3 , 18.5 ± 0.34 and $18.6\pm 0.37\%$ for control, 0.5, 1.0, 2.0 and 3.0% cumin extract concentration, respectively without significant differences (F-test) among all storage periods at different concentrations.

Kariesh cheese characterized with higher content of protein in dry matter which was $70.52 \pm 7.08\%$ of control sample while, it reach 75.35 ± 7.45 , 77.53 ± 5.17 , 78.5 ± 5.32 and $81.31 \pm 5.31\%$ at 0.5, 1.0, 2.0 and 3.0% of cumin concentration respectively at zero day sample with non-significant differences, while significant differences ($P < 0.05$, F-test) were recorded after 15 and 30 days and high significant differences (F-test, $P < 0.01$) were found after 45 and 60 days of storage. TP/DM% were de-

creased during storage periods as a results of decreased of TP% and increase of dry matter during storage accordingly TP/DM% in control sample increased to $60 \pm 1.2\%$ and for 0.5, 1.0, 2.0 and 3.0% values were 65.5 ± 1.4 , 68.12 ± 1 , 73.01 ± 1.3 and $74.8 \pm 1.4\%$, respectively. No significant differences (F-test) were found during storage periods at control and 5% samples while significant differences ($P < 0.05$, F-test) were found in other concentrations.

Results in Table (5) indicated that fat, fat/DM, salt and salt/serum contents in Kariesh cheese supplemented with cumin extract at different concentrations during storage periods.

Kariesh cheese characterized with low fat then, fat content in control sample at zero day was $0.8\pm 0.099\%$ and it recorded 0.86 ± 0.06 , 0.83 ± 0.011 , 0.89 ± 0.05 and $0.92\pm 0.025\%$ for 0.5, 1.0, 2.0 and 3.0%, of cumin extract respectively. No significant differences (F-test) were found among concentrations at zero, 30 and 45 days while significant differences ($P<0.05$, F-test) were found in 15 and 60 days. Non-significant differences (F-test) were found among different storage periods at all concentrations. Fat percent became after 60 days of storage as follow: 0.96 ± 0.04 , 1 ± 0.09 , 1 ± 0.04 , 1.1 ± 0.09 and $1.2\pm 0.09\%$ for control, 0.5, 1.0, 2.0 and 3.0%, respectively.

The results presented in Table (5) showed the fat/DM% in Kariesh cheese. Non-significant differences (F-test) were appeared among concentrations at zero day and the values were 3.13 ± 0.38 , 3.49 ± 0.26 , 3.38 ± 0.48 , 3.65 ± 0.2 and $3.76\pm 0.1\%$ for control, 0.5, 1.0, 2.0 and 3.0%, respectively also non-significant differences (F-test) were found among concentrations after 30 and 45 days of storage. Significant differences ($P<0.05$, F-test) were observed after 60 days and the differences observed after 15 days of storage were high significant differences (F-test, $P<0.01$). After 60 days of storage period, it could be observed that fat/DM were 3.56 ± 0.15 , 3.91 ± 0.36 , 4 ± 0.15 , 4.15 ± 0.37 and $4.62\pm 0.34\%$ for con-

trol, 0.5, 1.0, 2.0 and 3.0%, respectively without significant differences (F-test) among storage periods.

Salt content begin with $1.68\pm 0.16\%$ in control sample at zero day and reach to 2.57 ± 0.201 , 2.54 ± 0.15 , 2.52 ± 0.2 and $2.53\pm 0.18\%$ for 0.5, 1.0, 2.0 and 3.0%, respectively. Salt in cheese reached after 60 days of storage to 2.27 ± 0.15 , 3.63 ± 0.15 , 3.65 ± 0.05 , 3.7 ± 0.04 and $3.78\pm 0.01\%$ for control, 0.5, 1.0, 2.0 and 3.0%, respectively. Regarding to storage periods, high significant differences (F-test, $P<0.01$) were found among different storage periods for all concentrations except control sample which has significant differences ($P<0.05$, F-test).

Salt/water% begin with 2.25 ± 0.21 in control sample at zero day while in other treatments it was 3.42 ± 0.26 , 3.42 ± 0.21 , 3.34 ± 0.26 and $3.35\pm 0.24\%$ for 0.5, 1.0, 2.0 and 3.0%, respectively. High significant differences (F-test, $P<0.01$) were found among all concentrations along storage periods. Data of salt/water in samples treated with 0.5, 1.0, 2.0 and 3.0% cumin extract after 60 days were 4.96 ± 0.2 , 4.96 ± 0.06 , 5.02 ± 0.06 and $5.34\pm 0.39\%$, respectively were higher than control sample which had $3.12\pm 0.21\%$. High significant differences (F-test, $P<0.01$) were found among storage periods at all concentrations except control sample which had significant differences ($P<0.05$, F-test).

Organoleptic properties:-

Table (6) listed organoleptic properties of Kariesh cheese supplemented with cumin extract at different concentrations and during different storage periods. Non-significant

differences (F-test) were found among concentrations during storage periods in all properties. Molds were appeared on the surface of control sample after 30 days of storage accordingly, organoleptic properties didn't done during this period. The

highest total score recorded were 86.11 for cheese manufactured with 3% cumin aqueous extract followed by 85.55, 85.44, and 83.44 for cheese with concentration of 1, 0.5 and 2% after 60 days of storage period in the same respect.

Table 6. Organoleptic properties of Kariesh cheese supplemented with cumin extract during storage period at 5±2° C

Concentrations	Body & Texture (40)					Flavour (50)				
	Storage periods/ days									
	0	15	30	45	60	0	15	30	45	60
Control	37.2±3.52	31.83±4.16	35.75±3.86	-	-	46.7±4.57	42.33±4.45	46.2±2.77	-	-
0.5 %	38.4±2.45	35.9±4.43	34.9±4.38	34.9±4.04	35.88±4.53	48±3.23	41.4±7.79	45±6.23	44.3±3.59	41.66±8.74
1 %	35.6±4.14	37.3±3.19	36.8±1.87	37.4±2.91	35.22±6.11	45.8±3.42	44.2±4.31	45.5±5.83	44.5±5.35	42.11±9.71
2 %	36.8±4.49	34.5±5.44	38.2±3.15	34.5±5.91	34.44±6.38	46±3.88	39.4±9.33	47.4±4.78	43.8±6.61	41.33±11.95
3 %	36.3±6.16	37.2±2.93	36.8±3.91	37.5±2.5	36.44±8.07	44.6±5.48	45±6.66	45.2±6.97	43.5±9.31	41.66±12.83
F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD 0.05	-	-	-	-	-	-	-	-	-	-
LSD 0.01	-	-	-	-	-	-	-	-	-	-
Concentrations	General appearance (10)					All over scores (100)				
	Storage periods/ days									
	0	15	30	45	60	0	15	30	45	60
Control	9±1.05	9.1±1.3	9.2±1.3	-	-	92.9±7.5	81.83±10.10	92±6.2	-	-
0.5 %	9.4±0.84	8.4±1.5	8.7±0.82	8.15±1.41	7.88±1.9	95.8±5.24	85.7±12.64	89.2±9.48	87.35±8.43	85.44±14.06
1 %	8.6±1.34	9.2±0.78	8.8±0.91	8.6±0.96	8.22±1.85	89.8±7.25	90.7±6.92	89.3±9.84	90±9.5	85.55±16.33
2 %	8.2±1.31	7.4±1.57	9.3±0.82	8.15±1.29	8±2.06	91.1±8.99	80.9±14.96	97±3.55	86.45±13	83.44±22.05
3 %	8±2	8.7±1.56	9±0.66	8.45±1.7	8±2.44	89.6±13.2	90.9±10.36	92.7±9.04	89.4±12.7	86.11±22.98
F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD 0.05	-	-	-	-	-	-	-	-	-	-
LSD 0.01	-	-	-	-	-	-	-	-	-	-

NS: non-significant

Conclusion:

From the obtained results, it could be recommended that using aqueous extract in manufacturing of Kariesh cheese resulted in improving both keeping quality and sensory properties. Extracts of aromatic and medicinal plants such as cumin demonstrated satisfactory antimicrobial activity against pathogens and spoilage microorganisms associated with cheese contamination thus indicating great potential in their use as natural preservatives which has better effect in promoting health.

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صناعة جبن قريش مدعم بمستخلص مائي للكمون

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الملخص

الهدف من الدراسة معرفة تأثير المستخلص المائي للكمون على زمن التجبن، التركيب الكيميائي و الخصائص الميكروبيولوجية و كذلك الحسية على الجبن القريش. تم اضافة تركيزات مختلفة من المستخلص المائي للكمون (0، 5، 10، 15، 20 و 30%) للبن الفرز المستخدم في صناعة الجبن القريش. الجبن الناتج تم تخزينه لمدة شهرين على $5 \pm 2^\circ \text{C}$. حدثت زيادة في محتوى الحموضة بزيادة تركيز المستخلص المائي للكمون كذلك نسب الرماد، النيتروجين الكلي، النيتروجين الاميني، البروتين الكلي، البروتين الكلي في المادة الجافة، الدهن، الدهن في المادة الجافة، الملح و الملح في السيرم بينما انخفضت قيم النيتروجين الذائب و الجوامد الكلية. لوحظ ان هذا المستخلص له تأثير معنوي لتقليل المحتوى الكلي البكتيري للجبن القريش. بالنسبة للخصائص الحسية للجبن القريش المدعم بمستخلص الكمون المائي مقارنة بالعينة الكنترول فقد حصلت على نقاط أعلى عن الكنترول.