SINAI Journal of Applied Sciences (ISSN: 2314-6079) Vol. (6) Is. (3), Dec. 2017 317-328

SINAI Journal of Applied Sciences

ARU-EGYPT SJAS Trust Science | It Creates

IMPRVING KARIESH CHEESE QUALITY BY THE ADDITION OF ALOE VERA GEL

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ABSTRACT

In this study, kariesh cheese was manufactured with different concentration of Aloe vera gel (15, 20, and 25%). the chemical composition of Aloe vera gel was determined. Also chemical, antioxidant, microbiological and sensory properties of kariesh cheese was measured in fresh and during storage up to 28 days at 4°C±2. Treatments showed good quality prarameter, and good stability in fresh and during storage period with values very close to the control (T_1) one. Moreover sensory evaluation showed that all treatments were accepted specially addition of 15 aloe vera (T_2). Total bacterial counts (TC) demonstrated that at high concentrations of Aloe vera gel (20 and 25%) in a dramatic fall in the levels of total bacterial counts, take pleace.

Key words: Aloe vera, gel, kariesh cheese, antioxidant.

INTRODUCTION

Kariesh cheese is one of the indigenous white soft cheese types in Egypt. It composes about 50% of white soft cheese produced in Egypt (**Hegazi *et al*., 2012**). Production of natural flavoured cheese in short time with highly nutritive value and good microbiological quality as for human consumption (**Hosny *et al*., 2011**). The most accepted ways to extend the shelf life of the products is the use of bio-preservatives (**Dabiza, 2006; Ismail *et al*., 2006**). Herbs and spices have been used for many centuries to improve the sensory characteristics and to extend the shelf life of foods. As a result, considerable research has been carried on the assessment of the antioxidants activity of many herbs, spices and their extracts when added to a variety of foods and food model systems. **(Ismael *et al*., 2006)**. New functional food products launched in the global food and drinks market have followed the route of fortification or addition of desirable nutrients and bioactives including vitamins, minerals, antioxidants, omega-3 fatty acids, plant extracts, prebiotics and probiotics, and fibre enrichments.

Successful functional food product development in mainstream food categories requires special consideration as there is usually little room for reformulation and process modification as a result of adding the new active ingredient. This means that the ingredients used in the production of food products must already be on the product label, and the active ingredients must survive the processes that the product has to go through without affecting its sensory properties (**Smith and Charter, 2010**). Aloe vera is one of the many food products that can be considered as new food or new food ingredient (**Rodriguez *et al*., 2010).** Due to the numerous beneficial effects attributed to Aloe gel, its production is an emerging industry for making cosmetics, functional food, and drug.

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The food and beverage market is a promising arena for Aloe vera. It has been used as a resource of functional food such as yoghurt or for the preparation of health drinks, including tea **(Gage, 1996; Eshun and He, 2004)**. Aloe vera does not appear to affect food taste or appearance. So, it seems to be promise as a safe, natural and environmentally friendly alternative solution to conventional synthetic preservatives **(Serrano *et al.*, 2006).**

Food and Drug Administration (FDA), in the United States has approved the internal use of gel as a "dietary supplement". In the European Commission (EC) according to Annex I of Regulation No 1831/2003, *Aloe vera* can be used by the feed industries as sensory additive functional group "flavoring compounds", to increase smell or palatability of feedings stuff **(WHO, 1999; Franz *et al*., 2005)**.

Aloe contents of different market products are about 20% (sunburn treatments, creams and ointments), 95% (juices), 50% (beverages), 10% (drinks), and 5-10% (capsules) **(Nandal and Bhardwaj, 2012**). **(Kasetsart and Bangkok**, **1997)** made optimal formula for yoghurt production contains 40% fresh milk, 12% skim milk powder, 0.1% gelatin and 46% water. Fresh and processed aloe vera had no effects on the growth of lactic acid bacteria.

Sensory evaluation by Response Surface Method (RSM) showed that the suitable amount of aloe vera and sugar for yoghurt production was 13 % and 7 %, respectively. While, *Salmonella* sp., *Listeria* sp., *Staphylococcus* sp., yeast and mold were not found during storage time.

The trained panels accepted the yoghurt when it was stored for 18 days while consumers accepted it before 24 days. Consumers liked this product moderately to like strongly.

The aim of this work was to find out the best ratio of aloe vera gel required to improve the nutritive and preservative values for the production of kariesh cheese.

MATERIALS AND METHODS

This study was carried out, at milk and food processing laboratory, Faculty of Environmental Agricultural Science, El-Arish University, Egypt, and Food Technology Research Institute, Ministry of Agriculture and Land Reclamation.

Materials

Aloe vera gel

- Name: Aloe barbadensis Botanical name: *Aloe vera* (L.) Burm. f. (**GRIN, 2013**).
- The leaves of Aloe vera plant were collected from Rafah City, North Sinai, Egypt on January 2014.
- Raw cow's milk obtained from private farm, near of EL-Arish City.
- All chemical purchased from Nasr Company, El Ameria, Egypt, and Food Technology Research Institute.

Preparation of aloe vera leaf gel

The fully expanded, mature, healthy and fresh leaves of Aloe vera having a length of approximately 55 to 80 cm were selected from the plants and washed with fresh water. The tapering point of the leaf top, and the short sharp spines located along the leaf margins were removed by a sharp knife, then the knife was introduced into the mucilage layer below the green rind avoiding the vascular bundles. The top and the bottom rind were removed, then the Aloe vera gel was obtained and put in clean and sterilized glass bottles. These bottles were stored at 4-8°C until used as described by **Ramachand and Rao (2008) and Waller *et al.* (2004)**. The addition ratios were used according to method described by **Mohamed *et al*. (2012)**.

Preparation of kariesh cheese

25kg of cow's skim milk was heated to 80°C for 15 sec and cooled to 38°-40°c. Active starters *Streptococcus thermophilus* and *Lactobacillus. bulgaricus* (2% *W/W*)

were added and mixed well, cheese culture (*Streptococcus thermophillus, Lactobacillus delbrueckii* ssp. *bulgaricus*) were obtained from DANISCO, Rue de clemencieres-BP 32, Sassenage, Denmark.

Kariesh cheese was manufactured as described by **Fahmi (1960) and Effat *et al.* (2001).** The cheese was divided into four portions (A – D) as following:

A. Cheese without Aloe vera gel, was considered as a control (T_1).

B. Cheese fortified with 15% Aloe vera gel. (T_2).

C. Cheese fortified with 20% Aloe vera gel. (T_3).

D. Cheese fortified with 25% Aloe vera gel. (T_4).

1 kg of Kariesh cheese of each treatment were prepared as a stock. This stock was used to prepare 20 bottles for each treatment. These bottles stored at 4°C for 28 days and analyzed at the zero time seventh, fourteenth, twenty first and at the twenty eighth days.

Methods of Analyses

Chemical analyses

Moisture

Moisture was determined according to the method which was used by **Askar and Treptow (1993)**.

Total solids content

Total solids contents was determined by drying method according to the method described in **AOAC (2011).**

Total protein content

Total protein was assayed by Kjeldahl method according to the method described in **AOAC (2011).**

Fat content

Fat content of kariesh cheese was determined by Gerber's according to the method described in **AOAC (2011).** Fat of Aloe vera contents was determined according to the method described in **AOAC (1990)**.

Determination of titratable acidity

Titratable acidity of karish cheese was determined as lactic acid by titrating with 0.1NaOH using phenolphthalein as an indicator according to the method described in **AOAC (2011).** Titratable acidity of Aloe vera contents was determined according to the method described in **(Ranganna, 2004).**

pH values

pH values were measured using Jenway pH meter with Jenway spear electrode No: 29010 (Jenway limited Gransmore Green, Felsted, lkf.

Crude fibre

Crude fibre in Aloe vera contents was determined according to the method described in **AOAC (1990).**

Sample preparation for antioxidant analysis

Extraction of antioxidative compounds in cheese was carried out according to methods described by **Li *et al.* (2009)** with some modifications. One normal solution of HCl (lN)/95% ethanol (*V/V*, 15/85) was used for extraction. The extraction procedure involved the addition of 20 ml of solvent to 10 g of cheese in 50-ml brown bottles and shaking the powder for 90 min at 30°C in a shaker (Julabolabortechnik, GMBH D-7633 seelbach, Germany) set at 200 rpm. The mixture of solvent and powder was then centrifuged at 2500 rpm (model pr-7000 centrifuge from INTER National EQUIPMENT COMPANY mad in USA) at 5°C for 45 min. The supernatant fluids were kept at 20°C in the dark area until further analysis for DPPH.

Microbiological Analysis

Total bacterial counts

The total bacterial counts were determined as described by the **American Public Health Association (1992).**

Moulds and yeasts count

Moulds and yeasts were determined on oxytetracycline glucose yeast extract agar medium as suggested by **Harrigan *et al*. (1996)**. Plates were incubated at 25°C for 3 days.

Coliform group

Coliform were determined according to the **American Public Health Association (1992)**. Appropriate dilutions of samples were plated on Mac Conk's agar medium and incubated at 37°C for 48 hr.

Lactic acid bacterial count

Enumeration of lactic acid bacteria was done on (MRS) medium being prepared according to **Difico Manual (1971).**

Organoleptic Properties of Kariesh Cheese

Kariesh cheese was evaluated according to the method of **El-Samrdgy and Zall *et al*. (1988)**.

1. Flavour	50 points
2. Colour	15 points
3. Body & Texture	35 points
4. Total scores	100 points

RESULTS AND DISCUSSION

Chemical Composition of Aloe vera Gel

Table 1 shows that the moisture percentage of Aloe vera gel was 96.8 (%); this value agree with the result obtained by **Eshun and He (2004)**. Morever this value rather lower than the result obtained by **Goyal and Sharma (2009)** who found that moisture percentage in fresh Aloe vera gel was 97.2(%). Acidity and pH of Aloe vera gel were 0.10 and 4.30 respectively, these results were similar to the results of **Bozzi *et al*. (2007)** who found that the pH of Aloe vera gel was between 4.0 - 5.0, this high acidity value of the Aloe vera gel may be due to the accumulation of some organic acids, such as malic acid.

Also Table 1 shows that, the values of sodium, potassium, magnesium, zinc, and Calcium of Aloe vera gel were (49.450, 127.550, 21.700, 0.114 and 70.480) mg/ 100 g, respectively. These results were higher than, who found that the values of sodium, potassium, magnesium, zinc, and calcium of Aloe vera gel were (19.0, 39.0, 6.0, 0.04, and 34.0) mg/100g, respectively. Regarding proteins, lipids and crude fibre, contents were similar to those reported by **Miranda (2009)**

Effect of Storage Period on the Chemical Properties of Kariesh Cheese fortified with Aloe vera gel

Moisture

Results presented in Table 2 indicated that, moisture (%) decreas during storage period in kariesh cheese. Changes in moisture content of cheese during storage period were determined periodically every 7days up to the 28^{th} day. The initial percentage of moisture in treatments T1, T2, T3 and T4 were 72.75, 75.76, 76.59 and 77.36, respectively. These increases in moisture (%) were due to the Aloe vera gel content of moisture.

Protein

Table 2 indicates a difference among kariesh cheese treatments during storage process up to 28 days. The results also, indicated that the value of control treatment possessed the highest protein content compared to other treatments. Total protein ratios in treated cheese (T_2, T_3 and T_4) were affected by addition of Aloe vera speciality at the end of storag period.

Fat

Table 2 shows the fat content of all treatments. The values were slightly increased during the period of storage. The fat value of control was lower than the other treatments over the storage period.

Table (1): Chemical composition of Aloe vera gel.

Item	Aloe vera gel (%)	Item	Aloe vera gel (mg/100g)
Moisture	96.8	Na	49.450
T.S	3.292	K	127.550
Crude fibre	0.15	Mg	21.700
Fat	0.90	Zn	0.114
Protein	1.9	Ca	70.480
Acidity	0.10		
pH	(4.30)		

Table (2): Effect of storage period on the chemical properties of kariesh cheese fortified with Aloe vera gel for up to the day at 4°C±2 28th.

	Storage period (day)				
Treatment	**zero**	**7**	**14**	**21**	**28**
		Moisture (%)			
T_1	72.75	72.44	71.88	70.75	69.90
T_2	75.76	75.43	71.88	70.75	69.90
T_3	76.59	76.26	75.67	74.48	73.59
T_4	77.36	77.03	76.43	75.23	74.32
		Protein (%)			
T_1	16.50	16.60	16.88	17.40	17.50
T_2	14.60	14.77	15.07	15.67	16.13
T_3	14.07	14.23	14.52	15.10	15.54
T_4	13.58	13.73	14.01	14.58	15.00
		Fat (%)			
T_1	1.10	1.10	1.10	1.20	1.20
T_2	1.00	1.00	1.00	1.00	1.00
T_3	1.00	1.00	1.00	1.10	1.10
T_4	1.00	1.00	1.00	1.10	1.10
		Acidity %			
T_1	0.96	1.12	1.23	1.26	1.35
T_2	0.97	1.13	1.25	1.28	1.35
T_3	0.97	1.12	1.24	1.27	1.36
T_4	0.98	1.14	1.25	1.28	1.37
		PH			
T_1	4.62	4.62	4.57	4.55	4.51
T_2	4.32	4.50	4.30	4.29	4.27
T_3	4.31	4.30	4.25	4.24	4.24
T_4	4.31	4.26	4.24	4.23	4.23

T_1: control, T_2: 15(%) Aloe vera, T_3: 20(%), Aloe vera, T_4: 25(%) Aloe vera.

Increasing in fat content in all treatments during storage might be due to the loss of moisture. These results were in agreement with those obtained by **Ismail *et al*. (2006)**.

Acidity

Table 2 shows the acidity of kariesh cheese made with Aloe vera. It is clear from this Table that the acidity values of all treatments increased during the storage period. Moreover, the acidity of (T_1, T_2, T_3 and T_4) were 0.96, 0.97, 0.97 and 0.98% at zero time and increased to 1.35, 1.35, 1.36 and 1.37%, respectively, at the end of storage period up to 28 day.

pH

Table 2 shows the average of pH contents of cheese fortified with Aloe vera. A slight differences in pH values between control kariesh cheese and treated cheese at ziro time was observed. Moreover, the pH values decreased from 4.62 (T_1) to 4.32, 4.31 and 4.31 of the treatments (T_2, T_3, and T_4), respectively.

Effect of Storage Period on the Antioxidant Activity of Kariesh Cheese Fortified with Aloe vera Gel.

It is clear from Table 3 that the antioxidant activity in fresh kariesh had cheese fortified with Aloe vera (T_4) 84.54 (%) the highest activity, followed by (T_3) 83.78%, while the control kariesh cheese was found to be a lower scavenging effect of 79.84%.

On the other hand DPPH radical scavenging activity of all treatments dropped at the 7^{th} day of storage. The highest antioxidant activity of 70.32% was observed in (T_4), followed by (T_3) 68.63%, while the control kariesh cheese was found to be a lower scavenging effect of 65.85%.

High potential of antioxidant activity of additives may be due to their rich photochemical contents, which possessed high antioxidant effect it has been reported by several authors that different fractions of Aloe vera gel have anti-oxidant effects.

Also glutathione peroxidise activity, superoxide dismutase enzymes and a phenolic anti-oxidant were found to be present in Aloe vera gel, which may be responsible for these antioxidant effects **(Langmead *et al*., 2004).**

Effect of Aloe vera on the Microbiological Properties of Kariesh Cheese

Total bacterial count

The results in Table 4 shows the effect of Aloe vera gel on total bacterial counts in kariesh cheese during storage period up to 28 days at 4°C±2. Total bacterial counts were determined as cfu/ml at zero time then weekly up to the fourth week of storage. The mechanism action of the Aloe vera gel on the lysis of bacterial cells may be due to the pore formation in the cell wall and the leakage of cytoplasmic constituents by the active components such as alkaloids present in the gel as revealed by **Shelton (1991)**.

Molds and yeast

It is clear from the data in Table 4 that yeasts and molds could not be detected in fresh samples. However, the counts started to be detected and counted after 1 week of storage in all treatments including control. These results are in line with the results reported by **Mehanna *et al*. (1990)** who found that the yeast and molds of soft cheese began to appear after 7 days of storage. The data in the same Table illustrated that the yeast and molds counts of all kariesh cheese samples increased during storage may be due to the post contamination.

Lactic Acid Bacteria

There are very few studies conducted on Aloe vera fermentation. **Kim *et al*. (2014)** had developed a preliminary investigation of Aloe vera pulp fermentation and found

Table (3): Changes in antioxidant of kariesh cheese fortified with Aloe vera gel during storage period up to the 28th day at 4°C±2.

Treatment	Storage period (day)				
	Zero	7	14	21	28
T1	79.84	65.85	55.64	44.60	35.40
T2	81.74	69.70	62.43	56.20	48.90
T3	83.78	68.63	63.55	58.50	49.34
T4	84.54	70.32	64.31	59.21	50.43

T1: control, T2: 15(%) Aloe vera, T3: 20(%), Aloe vera, T4: 25(%) Aloe vera.

Table (4): Effect of Aloe vera gel on the microbiological properties of kariesh cheese during storage up to the 28th day at 4°C±2.

	Storage period (day)				
Treatment	Zero	7	14	21	28
	Total bacterial count $X10^5$ cfu/g				
T_1	80	75	62	58	57
T_2	80	70	57	50	47
T_3	78	64	56	48	45
T_4	77	62	54	48	42
	Molds and Yeast $X10^2$ cfu/g				
T_1	ND	13	19	22	28
T_2	ND	14	16	18	20
T_3	ND	12	15	17	18
T_4	ND	13	16	17	17
	Lactic acid bacteria $X10^5$ cfu/g				
T_1	18	17	14	12	10
T_2	21	21	17	15	12
T_3	23	22	16	13	11
T_4	24	22	16	14	13

T_1: control, T_2: 15(%) Aloe vera, T_3: 20(%), Aloe vera, T_4: 25(%) Aloe vera.

the presence of lactic acid bacteria (LAB). Based on these findings they hypothesized that LAB can produce compounds with antimicrobial activities in the pulp of Aloe vera and that these bacteria could proliferate after plant's antimicrobial compounds deteriorate.

These researchers isolated five *Lactobacillus brevis* novel strains from naturally fermented Aloe vera pulp and evaluated their probiotic properties, *i.e.,* antimicrobial activity and tolerance to acid and bile salt.

Moreover, values presented in Table 4 show the lactic acid bacteria (LAB) of kariesh cheese during storage after the addition of different concentrations of Aloe vera. Result indicated that during the progress of storage period lactic acid bacteria of kariesh cheese of all treatments gradually decreased. Also, it could be noticed that kariesh cheese containing aloe vera showed higher LAB than control one either fresh or during storage period.

Sensory evaluation

Table 5 shows that the flavour, colour, body and texture and all acceptability were decreases during storage period up to 28 days these results agree with that obtained by **Taha *et al.* (1997)**. On other hand the acceptability value of T1 treatment use the highest.

The highest score of acceptability was achieved with T1 treatment which was supported with 15%. Aloe vera gel. So it was recommended to add 15%. Aloe vera to kariesh cheese during manufacture to improve its quality and acceptability.There is a convergence between control and other treatments in the degree of colour and degree of Flavor due to the gel is a colourless, odourless, hydrocolloid with several natural beneficial substances (**Pisalkar *et al.,* 2011**).

Table (5): Changes in Sensory evaluation of kariesh cheese fortified with Aloe vera gel during storage up to the 28th day at 4°C±2.

	Storage period (day)				
Treatment	**Zero**	**7**	**14**	**21**	**28**
		Flavour (50)			
T_1	48	48	47	46	44
T_2	48	48	47	46	44
T_3	47	47	47	45	41
T_4	45	45	44	40	40
		Colour (15)			
T_1	14	14	14	13	12
T_2	14	14	13	12	11
T_3	14	14	14	14	13
T_4	13	14	14	13	13
		Body & Texture (35)			
T_1	34	33	33	33	32
T_2	34	33	33	32	32
T_3	34	32	32	32	30
T_4	32	31	30	30	30
		Total score(100)			
T_1	96	95	94	92	88
T_2	96	95	93	92	87
T_3	95	93	93	85	84
T_4	90	90	88	83	83

T_1: control, T_2: 15(%) Aloe vera, T_3: 20(%), Aloe vera, T_4: 25(%) Aloe vera.

Conclusion

The obtained results indicated that the addition of 15% Aloe vera gel to kariesh cheese was the best ratio for the sensory properties. On the other hand this ratio led to decreasing in the values of protein, fat, and pH moreover this addition may improve the therapeutic and nutrition values. Also it expanded the storage period of the final product due to its anti-oxidant and antimicrobial properties.

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الملخص العربي

تحسين جودة الجبن القريش بإضافة جيل الالوفيرا

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الهدف من هذه الدراسة هو تدعيم جبن القريش بجيل الالوفيرا كمضاد للأكسدة والميكروبات وأيضاً لرفع القيمة الغذائية والعلاجية لهذا النوع من الجبن حيث أن جيل الالوفيرا يتميز بقيمة غذائية عالية فهو يحتوى على ٧٥ مكون غذائي من فيتامينات وأملاح معدنية وانزيمات وسكريات وأحماض أمينية بالإضافة إلى الصابونين واللجنين وحمض السلسليك، كما أنه يتميز باستخداماته العلاجية المتعددة في هذه الدراسة تم إضافة جيل الالوفيرا بنسب ١٥، ٢٠ و٢٥% إلى الجبن القريش وهو مادة عديمة اللون والطعم والرائحة لها العديد من الفوائد الصحية، حيث أظهرت النتائج إن إضافة ١٥% من جيل الالوفيرا إلى الجبن القريش هي الأفضل من الناحية الحسية. وقد لوحظ انها أدت إلى انخفاض في قيم كلا من البروتين والدهن والـ pH ومن ناحية أخري أدت إلى تحسين فى القيم العلاجية والغذائية للمنتج النهائي، كما أنها عملت على زيادة مده الحفظ للجبن القريش وذلك بسبب خصائصه كمضاد للأكسدة ومضاد للميكروبات.

الكلمات الإسترشادية: جيل الالوفيرا، الجبن القريش، مضادات للأكسدة، مضادات للميكروبات.

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