

Evaluation of the Effect of the Activity of Gum Arabic Aqueous Solution and Ozonated Water on the Chemical and Organoleptic Properties of Locally Produced Soft Cheese in Baghdad City

Hind Suhail¹, Zina Saab Khudhir²

¹MSC. Student, ²Assist. Prof., Department of Veterinary Public Health, College of Veterinary Medicine, University of Baghdad, Iraq

Abstract

Evaluated the effects of Gum Arabic (GA) combined with ozonated water (OW) at refrigeration (4°C) storage temperature on the chemical and organoleptic properties of bovine locally produced Cows and buffalos', Fifty Soft cheese (25 for each kinds) were collected from homemade local producers in the different regions of Abu-Ghraib villages/Baghdad city. Soft cheese samples were analyzed for Moisture percentage %, Total solids, pH levels, Protein, Fat as dry matters and ash contents before and after immersion in mixture decontamination solution of (GA) at concentration of (3% and 5%) with ozonated water (0.5) ppm during (30) minutes of exposure time at refrigeration (4°C) temperature. The results showed that the moisture, fat as dry matter and ash content increased, while total solids (TS) and protein decrease after subjecting to natural decontamination solution. pH value was non significantly affected by the washing treatment. In conclusion evaluation of sensory properties showed that local cows soft cheese demonstrates higher values for sensory parameter compared to local buffalo's soft cheese.

Keywords Ozone, Gum Arabic, Cheese, Coating, Yeasts and molds.

Introduction

Cheese is food that increasingly consumed in all over the world characterized by elevated in the nutritional values with good taste and flavor [1]. This dairy product can be prone to both physical, chemical, and biological damage [2]. Development the hurdle technique to control the microorganism's survival without affecting in the nutritional and sensory properties of food; Physical and chemical stressor such

as heat treatment, refrigeration, ozonation treatment and antimicrobial methods could be used under this approach [3,4]. Ozone is powerful antimicrobial agent that is used as alternative to other sanitizers , its effective even at low concentrations without toxic by-products, used in the food as rinsing ,dipping without noticeable effects in the qualities of food [5], Low temperature increase both of solubility and stability of ozone resulting increasing in the ozone efficacy [6].Gum Arabic (GA) is polysaccharide exudate , acacia trees are source of this substance used in the food industry due to its adhesive, viscosity and the stabilization, emulsification properties [7]. GA as an edible coating that can protect food from microbial

Corresponding author:

Hind Suhail:

email: firmas_rashad@yahoo.com

alteration [8]. The aim of this study was to evaluate the effect of GA combined with OW at refrigeration (4°C) temperature on the chemical and organoleptic properties of bovine locally produced soft cheese samples in Baghdad.

Materials and Methods

Fresh Soft cheese samples were purchased from local producers in the different regions of Abu-Ghraib villages and transported in sterile ice-cooled box to the laboratory of Veterinary Public Health for the evaluation chemical and sensory analysis. GA powder (Elnasr/Sudan) obtained from local market.

Ozone generation ozone generator (A₂Z, USA) as gas bubbling in the sterile water at concentration (0.5) ppm, Sterile large plastic containers were used for the ozonation washing process by inserting the stone inside the sterile distal water at refrigeration temperature (4°C) [9]

Ozonated water with Gum Arabic treatment; GA powder at level of (3% and 5%) w/v were dissolved in the ozonated water (0.5 ppm), mixed by glass rod until dissolving completely with stirrer, both of locally produced bovine soft cheese cubes (2.5 cm) were submerged in the mixture of ozonated water (0.5ppm) and GA (3% and 5%) solution for 30 minutes as a contact time at refrigeration (4°C) , both treated and untreated soft cheese samples were analyzed for chemical and organoleptic properties.

Chemical analysis of soft cheese

The fat contents were determined by Gerber method [10]. protein content by Kjeldhal method [11]. Both of moisture and total solids were determined by drying in oven at 102°C [12]. The ash content by burning in furnace at 550°C for (three)hr [13]. pH was determined by using digital pH meter [14]. With triplicate.

Sensory analysis of soft cheese

The organoleptic properties of locally produced

cows and buffalos' soft cheese were evaluated before and after subjecting to combined treatment of GA (5%) with ozonated water (0.5) ppm for (30) minutes at refrigeration temperature (4°C). Five panelists from the department of veterinary public health to access the reaction by rating on the (nine points) scales. Scores range from 1 (poor) to the 9 (excellent), color, odor, taste, and overall acceptability were the sensory tests that performed in the current study with triplicate.

Statistical analysis Data was performed using SAS (Statistical Analysis System - version 9.1). One ways ANOVA with Least significant differences (LSD) post hoc test were performed to assess the significant differences among means. unpaired t test was used for detecting the significant difference between two groups (P < 0.05) is considered statistically significant.

Results

The moisture contents in both type of soft cheese samples was increased significantly (P<0.05) with increased concentration of GA in combination with ozonated water at (0.5)ppm. The moisture content increased from (68.61±0.49 and 55.24±0.05) in cows and buffaloes control soft cheese samples to (72.50±0.50 and 56.32±0.02) respectively after exposed to combination of GA (5%) and ozonated water (0.5) ppm after 30 minutes. This could be attributed to an increase in the water retention capacity. The Chemical composition of cows and buffalos' soft cheese are shown in table 1 and 2. These results agreed with Ghamgui *et al* [15] Recorded that the addition of Almond Gum as a functional additive in the Sardinia-type cheese has improved level of moisture, Lafta *et al* [16] reported that addition of Gum Arabic increase the moisture content of low-fat soft cheese. The total solids contents in both type of soft cheese samples decrease significantly (P<0.05) with increased concentration of GA combined with ozonated water (0.5). The total solid content decreased from (31.34±0.45 and 44.76±0.04) in cows and buffaloes control soft cheese samples to (28.01±0.01

and 43.67±0.01) respectively. This due to the high moisture contents in the local soft cheese samples. Similar results reported by Elkhidir [17] who study the physicochemical and sensory characteristics of soft white cheese made with different levels of Gum Arabic.

pH level of local cows and buffaloes soft cheese samples were slightly reduced after treatment, the reduction was non-significant (P>0.05). The pH level reduced from (6.27±0.005 and 6.47±0.06) in cows and buffaloes control soft cheese samples to (6.25±0.01 and 6.43±0.01) respectively after Gum Arabic (5%) and ozonated water (0.5) ppm treatment. The slightly variation in the pH value was not related to Ozonation affect, Cavalcante *et al* [18] demonstrated that sanitation of Minas Frescal cheese with Ozonated water did not change the pH of cheese. These results agreed with Murad *et al* [19] that studied the effect of Xanthan Gum in the low fat Karish cheese the pH value showed non-significant increase in cheese after using Xanthan Gum at different concentration.

The fat percentage as dry matter in the cheese samples slightly increased after submerged in the solution, fat content increased from (13.04±0.01 and 23.46±0.01) in the control to (13.75±0.01 and 23.76±0.05) respectively after exposed to a combination of Gum Arabic (5%) and ozonated water

(0.5). these results were in -agreement with Shendi *et al* [20]. Kiiru *et al* [21] reported that the addition of Gum Arabic slightly diminishes in the fat contents in mozzarella cheese.

The protein contents in the cheese were significantly reduced (P < 0.05) with increase concentration of GA in combination with ozonated water. The protein content decreased from (16.42±0.01 and 20.78±0.05) in control to (13.05±0.04 and 18.01±0.02) respectively after exposed to a combination mixture. These results agreed with Uzun *et al* [22]. Reported that high concentration of ozone can affected the whey protein resulted in the protein oxidation. The reduced protein content could be attributed to an increase in moisture content or the low amount of protein in Gum [21].

Increase in ash contents is observed after treatment. The ash contents in the control samples increased significantly (P<0.05) from (1.22±0.005 and 1.69±0.02) to (1.81±0.03 and 2.38±0.06) after subjecting to sanitating solution. Sharafi *et al* [23] indicated that the direct effects of galactomannan and novagel gum can increased the ash content in the low-fat cheese. These results were disagreed with Murtaza *et al* [24] who reported that there was no effect in the ash contents after addition of Gum to the low-fat cheddar cheese.

Table (1) Chemical composition of cow’s soft cheese after subjecting to the GA (3% - 5%) and ozonated water (0.5 ppm) for 30 minutes at refrigeration temperature

N0	Cows soft cheese	Moisture%	Total solid %	pH	Protein%	Fat%	Ash%
1	control	68.61±0.49b	31.34±0.45a	6.27±0.005a	16.42±0.01a	13.04±0.01b	1.22±0.005c
2	3%+OW	71.02±0.02a	28.98±0.005b	6.25±0.005a	13.123±0.04b	13.05±0.06b	1.65±0.01b
3	5%+OW	72.50±0.50a	28.01±0.01b	6.25±0.01a	13.05±0.04b	13.75±0.01a	1.81±0.03a
LSD		1.829	1.183	0.0318	0.0412	0.039	0.0318

Means with a different small letter in the same column are significantly different (P<0.05).

Table (2) Chemical composition of buffalo's soft cheese after subjecting to the Gum Arabic (3% - 5%) and ozonated water (0.5 ppm) for 30 minutes at refrigeration temperature.

N0	Buffaloes soft cheese	Moisture%	Total solid %	pH	Protein%	Fat%	Ash%
1	Control	55.24±0.05c	44.76±0.04a	6.47±0.06a	20.78±0.05a	23.46±0.01b	1.69±0.02c
2	3%+OW	55.81±0.01b	44.21±0.01b	6.45±0.02a	18.59±0.05b	23.49±0.04b	1.81±0.01b
3	5%+OW	56.32±0.02a	43.67±0.01c	6.43±0.01a	18.01±0.02c	23.76±0.05a	2.38±0.06a
LSD		0.039	0.0481	0.0486	0.0431	0.0318	0.0318

Means with a different small letter in the same column are significantly different ($P < 0.05$).

Table (3) Organoleptic properties of cows locally produced soft cheese that subjected to the Gum Arabic (5%) and ozonated water (0.5) ppm for 30 minutes at refrigeration temperature.

		Organoleptic properties		
		Means ±SE		
Groups	Overall acceptability	Taste	Odor	Color
Control	7.80±0.37a	7.80±0.37a	6.60±0.24a	7.40±0.24a
Panelists	7.80±0.20a	7.40±0.24a	6.80±0.48a	7.60±0.24a
P-value	1.00	0.47	0.09	0.09

*Organoleptic properties of Cows locally produced soft cheese after subjecting to dipping in the antimicrobial solution was statistically non-significant at ($P > 0.05$) (Unpaired t test).

Table (4) Organoleptic properties of Buffaloes locally produced soft cheese that subjected to the Gum Arabic (5%) and ozonated water (0.5) ppm for 30 minutes at refrigeration temperature.

		Organoleptic properties		
		Means ±SE		
Groups	Overall acceptability	Taste	Odor	Color
	Control	8.40±0.11a	8.00±0.11a	7.60±0.14a
Panelists	7.40±0.10b	7.40±0.09b	6.20±0.08b	7.80±0.12b
P-value	0.04	0.05	0.03	0.03

* Organoleptic properties of Buffaloes locally produced soft cheese after subjecting to dipping in the antimicrobial solution was statistically significant at ($P < 0.05$) (unpaired t test)

Organoleptic evaluation

The mean values of the organoleptic properties of soft cheese sample after subjecting to GA (5%) combined with ozonated water (0.5) ppm for 30 minutes at 4°C are shown in Table 3 and 4. The results showed that there was no significant differences ($P > 0.05$), in the organoleptic properties (color, odor, taste and overall acceptance) between the treated cows samples and the control samples, there was no change in overall acceptability and there was improvement in odor and color of the treated samples, results were in agreement with previous studies that deal with organoleptic properties of various kinds of cheese, another results indicate that controlled the Ozone concentration resulting no flavor defects or adverse effects were recorded [25]. Kiiru *et al* [21] illustrated that the use of GA up to a level of (3%) in mozzarella cheese improved the functional, nutritional, and sensory quality. Results of study of Cooke *et al* [26] showed that supplement of full fat cheddar cheese with tragacanth gum reduced in the hardness and increased in the softness during the period of production, there was no sign of adverse effects on the organoleptic properties of the cheese. Other researchers have reported the ability of Gum Arabic to encapsulate flavor and aromatic composition in the food products that explain the flavor retention in the food [27]. Buffaloes cheese samples had a significant difference ($P < 0.05$), in the sensory parameter after subjecting to treatment, this could be attributed to the fact that buffalo's cheese was made from milk in which the fat has been removed, fat in the food carries much of its flavor and satisfying characteristic of texture, improves appearance, good mouth-feel and overall acceptability, Several studies have shown that the fat content of cheese is essential for its overall acceptability [28].

Conclusion

Gum Arabic and/or ozonated water as decontamination solution can enhance the chemical quality parameters of the locally produced cows and buffaloes' soft cheese. Subjecting local cheese to the natural antimicrobial solutions recorded that cows soft cheese show higher values for sensory parameter compared to local buffaloes' soft cheese, sold in the rural parts of Baghdad city.

Conflict of Interest: Nil

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Ethical Clearance: Obtained from Institutional ethical committee

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