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Antimicrobial Activity of some Herbs against Pathogenic Microorganisms in Raw Soft Cheese (Kurdish Cheese)

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ABSTRACT

Cheese is a versatile, nutrient-rich dairy product because they include nutrients that the body needs in high amounts. The present study aimed to prolong local soft cheese storage duration with some natural herbs by antimicrobial Activity against pathogenic microorganisms. The analysis of chemical parameters was Fat, Protein, salt, Moisture, and PH by the technique (Application of DA 7250 At-line NIR Analyzer) was conducted to uncover the percentages of local Cheese during the period of blank, mixed with herb, without herb and salt. Our study showed that the local chees mixed with herb had high significant values ($p< 0.01$) as fat 28.32, protein 21.37, salt 0.57 and moisture 45.76, compared with other parameters of blank, and salt ($p< 0.01$). The PH texture analyzer from the additive herbs of local cheese observed increased values of 5.64, 5.84 from 12, and 18 days in line equation $y = 0.136x + 5.27$ ($R2 =0.9755$). Therefore, the inhibition zone of local cheese mixed with herbs such as thyme, rosemary, and chamomile was a significant zone to prevent the growth of microbes as antibiotics to prolong the shelf life of cheese, especially the thyme has a more significant zone of antimicrobial activity to inhibition of the growth, Escherichia coli 12.04 mm, Staphylococcus 11.12 mm, Mucor 9.06 mm and Penicillium 7.09 mm. The total viable count (TVC) of coliform bacteria that the local cheese sample was detected to be the interval of herb $81*10^4$-$10.^7*10^4$ and salt $36*10^4$-$56*10^4$ during storage in 5 and 12 days, and the yeasts and moulds were increased from $5*10^3$ to $2.8 *10^4$ CFU/ml after 12 days when adding thyme herbs according to a different time. Sensory evaluation of the local cheese with herbs especially thyme could be successfully used by tasters. In conclusion, thyme and other herbs can be use as an effective and great nutritional source for local cheese to extend its shelf life as it has preservative properties as antioxidant for both nutrition and human against microbes and illnesses.

INTRODUCTION

One of the most significant health issues is the availability of food. As per a report from the World Health Organization [1][2], Human contamination occurs mainly by consuming uncontrolled raw milk [3] [4].

An important food product in every country is soft cheese. The average time from manufacturing to consumption in Iraq is 3 to 4 weeks. In rural areas and far-flung communities, traditional unripened soft cheese is produced from non-pasteurized milk[5].

Therefore, Cheese is a versatile, nutrient-rich dairy product because they include nutrients that the body needs in high amounts, such as lactic acid, lactose, lipids, and milk casein (the primary

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component of the coagulum), as well as rich source of protein, minerals like calcium and phosphorus, which are needed for the majority of commonly consumed diets. They also contain significant amounts of mineral salts [6], also that can become spoiled physically, chemically, or biochemically. [7] .

Production of cheese is one of the most significant traditional businesses used to protect milk ingredients from pollution [8], and allow for long-term storage. Natural plant additives to cheese increased its storage life; as a result, that advocate using them in food production rather than artificial preservatives. [7]. The product differs depending on the components utilised in production, as well as production and marketing techniques [7].

As a result, plant materials having antibacterial capabilities could be used to preserve food [9] [10]. According to [11] . There has been an ongoing increase in the quest for effective alternatives to antimicrobial chemical additions for food preservation. Harmful bacteria can infect milk and milk products due to mastitis, contaminated air, or faulty storage and shipping methods [12].

Many civilizations around the world use spices and herbs, often known as aromatic plants, to enhance the flavour, nutritional content, and shelf life of food. They are a significant group of agricultural products. These herbs can also treat a variety of physical, mental, and emotional issues and improve people's health [13][14].

The plant-based additives are healthy, all-natural ingredients. Some of them function as antimicrobials and antioxidants. Additionally, they are abundant in important nutrients due to the presence of thyme, orange fruit, and bananas. Unfortunately, these fruits' peels are thrown away without being useful. Therefore, the objective of the current study was to employ thyme leaves and the peels of oranges and bananas as preservatives to increase the shelf life of local soft cheese

Furthermore,the Labiatae family includes the aromatic herb thyme (Thymus vulgarisL.). Thyme is a common culinary component and serves as a preservative for foods thanks to its antioxidant action. It is also utilised in the food and scent sectors. Thymol, which makes up around 50% of the components in thyme's essential oil extract, makes it a great source of essential oils and has natural antibacterial qualities. Carvacrol is important in this regard as well [15].

Also. the rosemary (Rosmarinus officinalis L.), a spice and medicinal plant, is one of the spices with the highest antioxidant activity and is used widely around the world [16]. Additionally, rosemary essential oil extract has antifungal and Antibacterial properties [17]. The primary ingredients that provide the antibacterial activity are 1, 8-cineole, camphor, bornyl acetate, and -pinene.

The current study aimed to prolong the storage duration of local soft cheese with some natural herbs as nutrition, also to prevent the growth of pathogenic microbes during natural herbs as the antibiotical agents.

MATERIALS AND METHODS

Preparation of samples

The (1 g) of the various herbs (rosemary, thyme and chamomile) were ground with mortar and overnight soaked in water, pestle along with 10 ml of distilled water. The samples were then centrifuged (5000 RPM, 10 min) and the supernatants obtained were used as an extract. The pooled supernatants were used as sample (extract) and represented as µg/ml [18].

Preparation of inoculums (microbial cultures)

All cultures were obtained from (Media Diagnostic Center) MDC Erbil Accredited as (Salmonella, E. coli, Staphylococcus and Pseudomonas, Penicillium and Mucor). Therefore, A loop full of Coliny from each culture sours of samples are inoculated in saline and adjusted. the using a spectrophotometer. This saline suspension is used for the turbid metric method. For the paper Agar ditch method dense cultures inoculated in N- broth was used [18],[19].

Application of DA 7250 At-line NIR Analyzer

The DA 7250 NIR analyzer is the third generation diode array NIR instrument from

PerkinElmer, The DA 7250 is a proven, full-spectrum NIR instrument designed for use in the food industry. Using novel diode array technology, it performs a multicomponent analysis in less than ten seconds.During this time a large number of full spectra are collected and averaged. The analysis of full spectra makes it possible to determine complex parameters and to analyze different extruded snacks without recalibration. The DA 7250 is IP65 rated and available in a sanitary design version, making it suitable for use in the lab as well as in production.

Also designed for use in the analysis cheese, butter, milk, cream and powders with no sample preparation and no clean-up after analysis in the DA 7250 NIR instrument. Using the disposable cup system, the sample is simply placed in a plastic cup which is disposed of after analysis. This makes the DA 7250 extremely rapid and easy to use. Its accuracy makes it possible for you to control production to very tight limits [20]

Turbid metric Method

With the help of cork borer four ditches were made per plate in the pre inoculated N-agar plates. Different extracts were added to these ditches (100µl) and plates were incubated then at 37°C. for bacteria and at 35°C for 48 hrs for fungi After 24 hrs diameter of clear zone produced surrounding the ditches were measured to the nearest mm with the help of scale and were presented in the graph [18], [19] [21],[22]

Cheese Processing and Adding Plant Extract

Milk samples

The full-fat milk was brought from the township in Erbil city in the morning in sterile bottles. The Iraqi soft cheese was produced using a protocol from the Al-Dahan (1983). The 1g of Thyme was added separately to 1 L of milk before clotting the milk. The clot was cut after coagulation and left for 5min, then it was placed in a gauze, squeezed, and drained. The clot was packed in plastic containers and stored in a refrigerator at 5^0 C until the appearance of unwanted odor, color, or appearance growth of microorganisms.

The Shelf Life and Quality Determination of Soft Cheese

Microbial count using total count method A piece of cheese was taken for the total count on the first day and 1ml of the previously prepared decimal dilutions were inoculated into duplicate Plates of nutrient agar and incubated then at 37 ºC for 24 hours (ISO 2006).

Sensory evaluation: -

Sensory evaluation of cheese was conducted by using members selected from the college staff at the Department of Food Science, Salahadin University. A list of descriptive terms of sensory properties was shown in tables. analysis of whey cheese was carried out for flavor, texture, color with other according to the method of [23].

Determination of cheese hardness

Firmness and hardness of stored cheese were measured using a texture analyzer with probes TA7, TA 6, using penetration speed of 0.5 mms -1 and penetration distance of 0.5 mm cheese hardness were expressed in gm cm 2 indicating the force required to break the curd [24] [25].

The pH value

PH value was measured using a digital pH meter [26]

Mould and yeasts count

Moulds and yeasts were counted on Sabourate Dextrose agar with aerobic incubation at 30 °C for 5 days [22].

Statistical Analysis

The plant of Crataegus azarolus L. was analyzed and expressed as values of means ± S.E (standard errors) of triplicate calculated all parameter. The results of the three groups were compared using the analysis of One-way ANOVA-samples F-test with significantly different ($p<0.01$), by (IBM SPSS for Windows (version 20.).

RESULTS AND DISCUSSION

The analysis of chemical parameters by the technique (Application of DA 7250 At-line NIR Analyzer) was conducted to uncover the percentages of Local Cheese (Kurdish Cheese) during the period (Table 1). Observed a significant value (P< 0.01) with salt and herbs. in this study, the local Kurdish Cheese with herbs gave high significant quality for all Fat, Protein, Salt, and Moisture for extent shelf life.

Table 1 . Results of Changes of Chemical nutrtuion Composition During the Ripening of Kurdish Cheese

	Chess ithout Herb		Chess with Herb		
Parameter %	Mean S.E	p< 0.01	Mean S.E	p< 0.01	T-Test
Fat%	26.31±0.479	0.006	28.32±0.006	0.025	-4.202
Protein%	17.86±0.645	0.004	21.37±0.408	0.006	-4.596
Salt%	0.76±0.006	0.000	0.57±0.000	0.000	29.828
Moisture%	51.88±0.002	0.000	45.76±0.000	0.000	27.842

Independent-samples t-test significantly different (P<0.01), values are Mean±SE of Triplicate Samples

The results obtained regarding the composition of mixed chees with herbs were observed highly significant values (p< 0.01) as Fat 28.32, Protein 21.37, Salt 0.57, Moisture and 45.76 respectively. Whereas the analysis parameters without mixed herbs obtained limited significant values as Fat 26.31, Protein 17.86, Salt 0.76, Moisture and 51.88 for each parameter in Table 1 accordinag to the Iraqi standard (1/693:1988) for chemical properties of cheese.

Our study shows that the average of chees mixed with herb showed high significant values (p< 0.01) as as fat 28.32, protein 21.37,salt 0.57 and moisture 45.76, compared with other parameter cheese without herbs respectively. that approved with [27] reported that the The results found Cheese produced in Erbil are not agree with the Iraqi Standard. Also, the moisture content of cheeses mixed with herb teadily to decreased throughout ripening to, due to water mixed by herbs surface evaporation, our study agree with in [28][29] [30]. Also our results in agree with [31] that the treatment with herb ginger extract increased the shelf life of cheese by 15 days. Ginger extract may not significantly change the nutritional quality of West African soft cheese, but it showed promise because it has a preservation characteristic.

Table 2. PH texture analyzer% of cheese for different times with all additive of blank,salt, and herb

PH Texture analyzer %	Blank	Salt	Herb
LoD gram with speed &distance 0.5 mm/sec	337	309	333
1 DAY	5.58	5.49	5.42
5 DAY	5.6	5.67	5.54
12 DAY	5.6	5.97	5.64
18 DAY	6.1	6.2	5.84
line equation	y = 0.156x + 5.33	y = 0.243x + 5.225	y = 0.136x + 5.27
R^2	0.63	0.99	0.97

On the other hand, Our finding indicates that, the analysis parameterer by in pH range between different times and texture analyzer used all three types of local cheese as blank, salt, and herb. the results are shown Table 2 and Figure 1. The PH values texture of stored cheese from blank ranged from 5.58, 5.6, 5.6, 6.1 in difference days as (1 day, 5 days, 12 days and 18 days) in the line equation R^2 0.631. Also, the texture analyzer of additve salt on local cheese ranged from different days, therefore the PH values was increasly (5.49, 5.67, 5.97, and 6.2) in the line equation 0.9918. Hence, the PH texture analyzer from additive herbe of local cheese was observed increasly values from different days as (5.42, 5.54, 5.64, and 5.84 Days) in line R^2 =0.9755

In our study was found that the blank cheese had higher texture compared to the other two types of herb and salt. but for storage shelf life not suitable. Also the PH texture analyzer for all three types of cheese it was blank in the first day PH 5.58 % and salt pH of zero and pH of herb 5.42, hence, observed that the pH of the blank was higher compared to both salt and herb pH similar to the first day. The fifth days, that measured the pH for all three types of cheese the blank was obtained 5.6, salt 5.54, and herb is 5.54. furthermore, that the pH of salt was higher than compare tp other types of cheese. In addition, the 12th days of cheese storage, that measured the pH for all the types of cheese as blank 5.6, 5.97 and herb 5.64 was found that the pH of salt higher than compare to the other two types additive of cheese. In last day of 18 , the pH values from storage local cheese in blank 6.1 salt 6.2 herb 5.84 that was found the pH of herb much lower than compare to blank and salt[28][27] .

The results of This study showed that the herbs are the best quality to prevent and extend shelf life of local cheese flavor to showed improved PH texture Analyzer than additives of blank and salt ($y = 0.136x + 5.27$), $R^2 = 0.97$ [32].

Also, agrees with [33] reported, who had that the Herbs and spices have been a significant part of human life since the beginning of time. They have been utilised for their anti-oxidative, preservative, and therapeutic characteristics in addition to flavouring food [10].

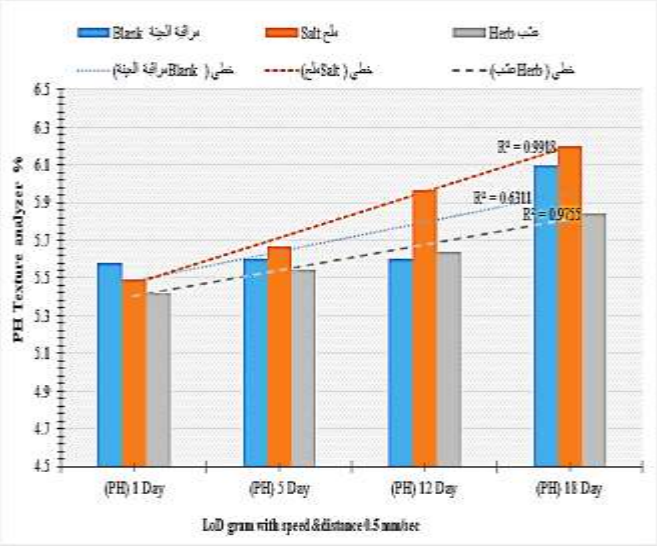

Figure 1. PH texture analyzer% of cheese for different times with all additive of blank,salt, and herb

Table 3: Antimicrobial activity of rosemary, thyme powder, and chamomile

Zone of inhibition (mm)			
Plant extraction			
Microbes	**Chamomile**	**Thyme**	**Rosemary**
Salmonella	**7.11**	**10.12**	**6.20**
E.coli	**10.00**	**12.04**	**6.4**
Staphylococcus	**8.02**	**11.12**	**6.31**
Pseudomonas	**6.06**	**9.08**	**7.11**
Penicillium	**6.45**	**7.09**	**6.05**
Mucor	**8.43**	**9.06**	**5.78**

The antimicrobial activity of cheese mixed with *Thyme*, *Rosemary*, and *Chamomile*, was examined depending on the diameter of growth inhibition zone against *Salmonella*, *E.coli*, *Staphylococcus*, *Pseudomonas*, *Penicillium*, and *Mucor* was observed (Table 3).

Mowever, The mixed thyme with local cheese showed maximum significant zone could inhibit to growth the *Escherichia coli* 12.04 mm, *Staphylococcus*11.12 mm, *Salmonella* 10.12 mm, *pseudomonas* 9.08 mm, *Mucor* 9.06 mm and *Penicillium* 7.09 mm respectively. compare to rosemary(6.20 mm, 6.4 mm, 6.31 mm, 7.11 mm, 6.05 mm, and 5.78 mm) and chamomile (7.11 mm , 10.00 mm, 8.02 mm, 6.06 mm, and 6.45 mm) were found to inhibit those species at moderate level to prevent microbes. Thyme has more potential as an antibacterial source which can be used as effective food preservation and also as an antibiotic.

Generally, All the spices showed zone of inhibition in which *Thyme*, *rosemary* and *chamomile* , has significant effect with all microbes *as Escherichia coli*, *Staphylococcus*, *Salmonella*, *pseudomonas*, *Mucor* and *Penicillium.* respectively. Therefore, the Plant substances that have antibacterial characteristics may be used to preserve food [34][35]. The findings of our studies elaborate the antibacterial properties of different natural plant mixed with local cheese used as an effective antibacterial source against many bacterial diseases to extend shelf life of local cheese and also used as a protective of natural food. Our study agrees with [34], reported , that all the spices and herbs

prevent the growth of bacteria. too, our research did not agreement with[36], this study reported the role that lysozyme plays in cheese and its inherent ability to fight bacteria.

Table 4. Microbiological content of local cheese with additive different during storage periods [Log CFU/ml).

Treatments	0 time	5 day	12 day	18 day
Blank	$6.3*10^4$	$10.3*10^4$	$1.23*10^4$	$3.14*10^5$
Salt	$6.3*10^4$	$81*10^4$	$10.7*10^4$	$1.93*10^5$
Herb	$2.6*10^4$	$36*10^4$	$56*10^4$	$1.31*10^5$

Other hand, The total viable count (TVC) of plain cheese, cheese with salt, and cheese with herb was calculated shown in table 4.

After the first, 5, 12, and 18 days, samples were examined. The cheese with herb had a lower bacterial count on the first day of production than the control cheese and cheese with salt ($2.6*10^4$, $6.3*10^4$, and $6.3*10^4$ (cfu/ml), respectively). All cheese samples displayed the same trend during refrigerated storage, in which TVC grew progressively as storage period advanced until the end of storage. After 5, 12, and 18 days of refrigerated storage, remained practically stable for cheese manufactured with herb.

The TVC of the control cheese after 18 days of storage was 3.18 * 105 cfu/ml, while the TVC of the cheese samples with salt and herb was 1.93 * 10^5 cfu/ml and 1.31 * 10^5 cfu/ml, respectively. on the first day of the storage term in cheese samples. Additionally, the local soft cheese made with herbs had a lower overall bacterial count than the salt and empty control. Our study agreement with [19].

Table 5. Yeasts and moulds were not detected on nutritional of soft cheese and with adding different herbs during storage periods [Log CFU/ml).

Treatments	0 time	5 day	12 day	18 day
Blank	-	$1.4*10^4$	$3*10^4$	$1.96*10^5$
Salt	-	$4*10^3$	$2.6*10^4$	$9*10^4$
Herb	-	$5*10^3$	$2.8*10^4$	$1.48*10^5$

However from Table 5. The control cheese, yeasts and moulds have proliferated during storage and their count increased from $1.4*10^4$ to $3*10^4$ cfu/ml after 12 days of storage and to $1.96*10^5$ cfu/ml after 18 days of storage. while the yeasts and moulds have growth during storage of cheese with salt and their count increased from $4*10^4$ to $2.6*10^4$ cfu/ml after 12 days of storage and to $9*10^4$ after 18 days of storage. For cheese with herb the yeasts and moulds increased from $5*10^3$ to 2.8 $*10^4$ cfu/ml after 12 days of storage and to 1.48 $*10^5$ cfu/ml after 18 days of storage.

These results prove the effectiveness of added Thyme on yeasts and molds. Consequently, it was found in our study that adding thyme herbs to the local soft cheese reduces the number of microbes present during the storage period according to different times, improving product quality and extending shelf life. This might be as a result of the antioxidant content of thyme, which helps to stabilize free radicals.

Our results are in agreement with [19] that the adding thyme, cumin, and turmeric to soft cheese can result in multiple biological activities such as antioxidant, antibacterial, antifungal, and free radical scavenging properties in soft cheese to produce soft cheese with different herbs high nutritional value and quality at the end of storage period. Also agrees with [37][38]. This may be due to thyme having contained a number of antioxidants such as ß-carotene, total phenols and total flavonoids.

Table 6. The sensory of chemical and phesical composition of local soft nutritional cheese in Storage periods (day)

treatment	Storage periods (day)	color	odor	flavor	Texture appearance	overall uality
Blank	Zero	8	7	8	8	8	8
	5 days	6	5	6	6	6	6
	12 days	5	4	5	5	5	4
	18 days	2	1	0	2	1	1
salt	Zero	8	8	8	8	8	8
	5 days	6	7	6	7	7	7
	12 days	5	6	5	6	5	5
	18 days	4	3	2	1	2	2
Herb	Zero	8	9	9	8	9	9
	5 days	8	8	9	8	8	8
	12 days	7	7	7	7	7	7
	18 days	5	5	5	5	6	5

The sensory of chemical analyses and physical properties which include colour, odour, flavour, texture and appearance, and overall quality were determined in local soft cheese with the effect of the storage duration (days) on sensory attributes evaluation indicated variations between local cheese mixed with blank, salt, and herb [26] [39], Shown in Table 6.

The results of this study indicated that there was significant difference in sensory characteristic of local soft cheese by increasing the length of the storage period up to 18 days with blank, salt, and herbs(*Thymus vulgaris*). While there was a significant difference in all sensory characteristic by increasing the period of days from 1, 5, 12 days, especially for 5, and 12 days of storage. Therfore, the all sensory characteristic changed by *Thymus* addition compared with other additive of salt and blank. While storage from 12, and 18 days by blank and salt addition was affect the sensory character compared with the herb sample. Sometimes salt is added in a very small amount to produce a good texture, taste, flavour and odour which are desired by the consumer. Generally our results showed that there was no significant difference for sensory characteristics such as colour, odour, flavour, texture and appearance, and overall quality.

The spoilage flavour and color change was not detected significantly and stable for local cheese with *Thymus* from storage at day, 5 days, and 12 days, but the change of sensory slight was detected with blank in days 5,12,18 , compared with salt at 12 and 18 days of refrigerated storage. Therefore, the beneficial effect of these *Thymus vulgaris* is likely due to their bioactive content, which acts as an antioxidant and an antimicrobial growth.

Therefore, the herbs and spices were utilised to improve dairy products, especially local cheeses, by adding colour, odour, flavour, texture, look, and overall outstanding taste. This was done in order to cover the local cheese's well-known flavour, which is not particularly liked by many consumers. Furthermore, there are herbs and spices that have medicinal qualities including antioxidants, anti-diabetic, anti-inflammatory, anti-hypertensive, and anti-microbial capabilities. As a result, it can be used to supplement dairy products with herbs and spices to boost nutritional and therapeutic benefits, increase shelf life, and supply active ingredients.

These results came close to what he found [25], reported that the study came to the conclusion, it is crucial to produce milk products that have been fortified with medicinal herbs and spices and to make them accessible to a large number of customers who wish to use these products to maintain and improve their health.

Also, our study were close to the results of [40] that the Increasing age and/or familiarity with the product did not appear to change the tasters' perceptions of the cheeses to the extent that might have been anticipated.also agree with [41], that the majority of the sensory aspects that consumers seek in cheese, it was determined that the time period between 1 and 14 days is the optimal time to store cheese enhanced with various spices. all the sensory attributes. It was discovered that cheese flavoured with cinnamon had the highest proportion of phenol levels [25].

CONCLUSION

Cheese is a versatile, nutrient-rich dairy product with many health benefits. our finding observed that the local chees mixed with herb had high significant values ($p< 0.01$) as fat 28.32, protein 21.37, compared with other parameters of blank, and

salt (p< 0.01). Also, the PH texture analyzer with herbs of local cheese has increased values of 5.64, and 5.84 from 12, and 18 days. On the other hand, the herb of thyme has a more significant zone antimicrobial to inhibition of the growth to prolong the shelf life of cheese. Therfore, the total viable count (TVC) of coliform bacteria during storage in 5 and 12 days, yeasts and moulds during storage in 12 days, with adding thyme herbs was increased. Hence, sensory evaluation of the local cheese with herb especially thyme could be successfully used by tasters. Generally, thyme and other herbs can be used as an effective and good source for local cheese to extend its shelf life as it has preservative properties as a natural herbal antibiotic against microbes.

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النشاط المضاد للميكروبات لبعض الأعشاب ضد الكائنات الحية الدقيقة المسببة للأمراض في الجبن الطري الخام (الجبن الكوردي)

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الخلاصة:

الجبن منتج ألبان متعدد الاستخدامات وغني بالمغذيات لأنه يحتوي على العناصر الغذائية التي يحتاجها الجسم بكميات كبيرة. هدفت الدراسة الحالية إلى إطالة مدة تخزين الجبن الطري الموضعي مع بعض الأعشاب الطبيعية عن طريق النشاط المضاد للميكروبات ضد الكائنات الحية الدقيقة المسببة للأمراض. تم تحليل المعلمات الكيميائية للدهون والبروتين والملح والرطوبة و PH باستخدام تقنية (تطبيق DA 7250 At-line NIR Analyzer) التي أجريت للكشف عن النسب المئوية للجبن المحلي خلال فترة الطحن ، الممزوج بالعشب ، بدون عشب وملح. أظهرت دراستنا أن الأجبان المحلية الممزوجة بالأعشاب كانت لها قيم معنوية عالية ($P < 0.01$) مثل الدهون 28.32 ، البروتين 21.37 ، الملح 0.57 والرطوبة 45.76 ، مقارنة مع المعلمات الأخرى للخلطة ، والملح ($p < 0.01$). لاحظ محلل نسيج PH من الأعشاب المضافة للجبن المحلي زيادة في القيم 5.64 و 5.84 من 12 و 18 يومًا في المعادلة الخطية ($y = 0.136x + 5.27$ ($R2 = 0.9755$). لذلك ، كانت منطقة تثبيط الجبن المحلي الممزوج بالأعشاب مثل الزعتر وإكليل الجبل والبابونج منطقة مهمة لمنع نمو الميكروبات كمضادات حيوية لإطالة العمر الافتراضي للجبن ، خاصةً الزعتر الذي يحتوي على منطقة أكثر أهمية من النشاط المضاد للميكروبات لتثبيط النمو ، الإشريكية القولونية 12.04 مم ، المكورات العنقودية 11.12 مم ، المكور 9.06 مم ، البنسليوم 7.09 مم. العدد الكلي القابل للحياة (TVC) للبكتيريا القولونية التي تم اكتشاف عينة الجبن المحلية بها هو الفاصل الزمني للعشب 81 * 10^4 10.7–10^4 * 10^4 والملح 36 * 10^4 56–10^4 * 10^4 أثناء التخزين في 5 و 12 يومًا ، والخمائر وزادت القوالب من 5 * 103 إلى 2.8 * 104 CFU / مل بعد 12 يوم عند إضافة أعشاب الزعتر حسب أوقات مختلفة. التقييم الحسي للجبن المحلي بالأعشاب وخاصة الزعتر يمكن استخدام الزعتر والاعشاب الاخرى كمصدر غذائي فعال ورائع للجبن المحلي لا طاله عمرها الافتراضي حيث ان لها خصائص حافظه كمضاد للأكسدة لكل من التغذية والانسان ضد الميكروبات والامراض.

الكلمات المتاحية: زعتر ، الحسي ، محلل NIR ، ملح ، مدة الصلاحية ، جبن ، خميرة ، مضاد للجراثيم ، أعشاب.