Egypt. J. Food. Sci. **Vol. 48,** No.1, pp. 41-55 (2020)

Egyptian Journal of Food Science
http://ejfs.journals.ekb.eg/

The Effect of Adding Some Spices on the Physicochemical, Organoleptic and Microbiological Properties of Ras cheese

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Twenty-two different commercial spices were purchased from the local market of Damietta city and they were added in two forms (complete or crushed) during the manufacturing of Ras cheese. These spices were tested for their effect on the physicochemical, organoleptic, and microbiological properties of Ras cheese in fresh, after salting (one month), 2, 3, 4, and 5 months, respectively. The pH values ranged from (5 - 6) in all treatments. The moisture content and weight of Ras cheese wheels gradually decreased for all treatments at the end of the storage period. The percentage of decrease in the weight of the control sample was 25.7%, and the best sample was Ras cheese with crushed white pepper (17.14%) (this value made this treatment the best commercial one), the best treatment of Ras cheese for flavor with whole-grain of cumin, on the other side, the addition of Basil gave the cheese a new taste and demonstrated the taste of salt. The flavor decreased in cheese with black cumin and it was, the best texture appeared in the Ras cheese with basil. The appearance was very good, and it gave a new shape when adding mint and basil, where it gave a shape like Roquefort cheese. The highest score of color was obtained for Ras cheese with black pepper. Generally, the highest score was in treatment with cumin. The microbiological analysis showed that comparing the whole spice with crushed spices it was found that, crushed spices was better than whole spices in the case of the decreasing of microbial load. The best of crushed spices that decreased total bacterial count (TBC) was hot pepper (24.10%), total fungal count (TFC) was caraway (29.24%) and lactic acid bacteria (LAB) was white pepper (33.08%), respectively.

Keywords: Ras cheese, Herbs, Spices, Organoleptic properties, Physico-chemical properties, Microbiological analysis.

Introduction

Ras cheese is an Egyptian hard cheese made from cow and buffalo's milk. The composition of cheese has been described by Hofi et al., (1970). Spices are plants or parts of plants that have been used as flavoring agents in food preparation for thousands of years. Spices may reach consumers presenting poor quality, due to the loss of volatile compounds, microbial contamination (Baxter & Holzapfel, 1982 and Pafumi, 1986) or even due to insect infestation (Germano & Germano, 1998 and Santos et al., 1999). Spices and herbs have been used as flavor, colour, aroma, and enhancing agents and for the preservation of foods. There have been increasing studies on the role of spices and herbs as natural preservatives and for medicinal purposes. The bioactive compounds from spices and herbs have the potential to decrease or inhibit the risk of degenerative diseases such as diabetes, obesity, cancer, and cardiovascular diseases (Anderson et al., 1999). Antimicrobial properties of herbs and spices can be successfully used to control the growth of spoilage and pathogenic bacteria in dairy products. Phenolic compounds of herbs and spices are good substitutes for the artificial antimicrobial agents used in food manufacturing. Phenolic compounds such as tea catechins, oleuropein, ferulic acid, ellagic acid, and coumaric acid have been found to prevent the growth of some pathogenic bacteria (Staphylococcus aureus, Salmonella enteritidis

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Received:22/01/2020; accepted:04/03/2020
DOI: 10.21608/EJFS.2020.22885.1039

and Listeria monocytogenes) and fungi. (Bin et al., 2011 and El-Sayed & Youssef, 2019). Many authors isolated fungi and bacteria from Ras cheese (El-Fadaly et al., 2015b). The high biochemical activities of these microbes produce the typical aroma and taste (El-Fadaly et al., 2015a and c). On the other hand, the growth of such microbes most commonly produced a low quality and caused the problems of contamination and spoilage. The mould growth may also represent a health risk because of the possibility of mycotoxin production by some mould species. So, El-Fadaly et al. (2018) used natural products such as essential oil which obtained from spices for inhibiting microbial growth. The main aim of this study was to evaluate the effect of addition with some Egyptian spices and herbs on the physicochemical composition, microbiological analysis, and organoleptic properties of Ras cheese.

Materials and Methods

Fresh whole cows' and buffaloes' milk used in this work was obtained from Hendam laboratory, Elasafra, Dakhlia, Egypt, the chemical composition of milk used in Ras cheese manufacturing was fat 3.5%, protein 3.2%, and total solids content (TS) has to be given in theopen form. 12.5%. Local rennet (0.7 N) "Elamel Elmasry" was kindly obtained from Ayman Haekel Company, Damietta Governorate. Dry fine commercial food-grade salt was obtained from El-Nasr Company, Alexandria, Egypt. Liquid annatto (assay 4%) was purchased from MIFAD Company, Badr City, Egypt, and all other chemicals and solvents were purchased from El-Gomhoria for chemicals company, Mansoura, Egypt.

Spices and herbs

Twenty-two different commercial spices were purchased from the local market of Damietta city, namely mentioned in (Table 1). 11 spices were added it two forms complete and milled, powdered or crushed. The anther 11 spices were added with one form which as milled, powdered or crushed. Ten grams of each spices were added during the manufacturing of Ras cheese except the control. These spices were tested for their effect on the microbiological load of Ras cheese.

TABLE 1. English and scientific names for spices.

English Name	Scientific Name	English Name	Scientific Name
Black Pepper	*Piper nigrum*	**Fennel**	*Foeniculum vulgare*
White Pepper	*Piper nigrum*	**Capsicum**	*Capsicum annum*
Coriander	*Coriandrum Sativum*	**Paprika**	*Capsicum annuum*
Cumin	*Cuminum cyminum*	**Ginger**	*Zingiber officinalis*
Cardamom	*Elettaria cardamomum*	**Cinnamon**	*Cinnamomum verum*
Clove	*Syzygium aromaticum*	**Turmeric**	*Curcurma domestica*
Fenugreek	*Trigonella foenum-graecum*	**Mint**	*Mentha sp*
Black Cumin	*Nigella sativa*	**Thyme**	*Thymus vulgaris*
Nutmeg	*Myristica fragrans*	**Rosemary**	Rosmarinus officinalis
Anis	*Pinpinelle anisum*	**Basil**	Ocimum basilicum
Caraway	*Carum carvi*	**Sumac**	*Rhus sp*

Ras cheese making

In an attempt to imitate the widely used method among the cheese manufacturers in Hendam plant, Elasafra, Dakahlia for making Ras cheese. The procedure suggested by Abou-Donia (2002) for making Ras cheese was adopted. Standardized milk (3.5% fat) was heated to 32ºC using and sufficient rennet was added (2% W/V) to complete coagulation in 30 – 40 minutes. The coagulum was cut into small pieces about the size of chickpea grains and then vigorously stirred (by hand). The temperature of the vat was then raised to 45ºC over a period of around 40–50 minutes, and gentle stirring was maintained throughout. After the curd had settled and the whey drained out, salt was sprinkled over the curd at a rate of (1% w/w) and the curd was manually pushed to the sides of the fat and added (1% w/w) each spices or herbs. Moulds, lined with cheesecloth, were filled with sufficient curd to produce one finished cheese, and manual pressure was applied to expel some of the remaining whey. Light mechanical pressure follows over the next four hours at which point the cheese was reversed in the press and left

under pressure for over (approximately 18 hours) and placed in the salting chamber. After draining for a further day at ambient temperature (15 – 20ºC), the surfaces of each cheese were coated with a small amount of dry salt. After that most of this salt had been absorbed into the cheese wheel, so that the wheels were turned, and the dry salting process repeated once again. This dry salting produce was contained for a period of around thirty days, either every other day or once every three days. After completely salting transfer the wheels on the refrigerator (GP-1980; GEPSON) at (5-10ºC) for five months, thereafter, samples were taken after 1, 2, 3, 4, and 5 months.

Preparing for samples

The sampling procedure during the time of the experiment was as following:

Thirty-four cheese samples were made in this experiment. The first one was used as a control (without any spices additive) and added the spices (ground or in full form) in the other samples. Three cheese wheels were manufactured from each sample. In the second day taken first samples for analysis, namely (Fresh). At the end of the dry salting process (30 days), the second samples were taken, namely (After Salting). All cheese wheels were stored at (5–10ºC) for five months in a refrigerator (Relative humidity ≈60-70%). Thereafter, samples were taken after one, two, three, four, and five months. Two samples were taken from every cheese wheel for the microbiological examination, physicochemical analysis, and sensory evaluation. The samples were taken from the middle of the cheese wheel by cutting it using a sterilized knife.

Chemical analysis: The pH of the sample was measured at 17 to 20°C using a pH meter (Corning pH/ion analyzer 350, Corning, NY) after calibration with standard buffers (pH 4.0 and 7.0). The moisture content of cheese was detected according to the method described by AOAC (2012).

Microbiological analysis

Total bacterial count (TBC), total fungal count (TFC), and lactic acid bacteria count (LABC) were determined in Ras cheese samples in two stages, the first stage was at the beginning of experiment in zero time and the second stage was at the end the beginning of experiment after five months of salting. The changes in microbial load between the two stages were recorded as a percentage value according to the following equation (1):

*The changes in microbial load = $(A-B)/A \times 100$

*Where: A= the count of microbes in zero-time, B= the count of microbes after five months.

The positive value was considered as a stimulated agent and the negative value was considered as an inhibitor agent.

The total bacterial count of Ras cheese samples was determined according to APHA (1998) by pouring the plate method using nutrient agar medium (Difco, 2009). Plates were incubated at 30°C for 72h before counting. Also, the plating technique method was used for the counting of fungi, where samples were inoculated onto the PDA medium (Difco, 2009). Plats were incubated at 25°C for 5 days and the developed colonies of fungi were counted. The mean count of plates was recorded to calculate the fungal count (APHA, 1998). Lactic acid bacteria were determined using the MRS agar medium according to De Man et al. (1960). All plates were anaerobically incubated in a digital incubator (Switc, MPM Instruments s.r.l., Bernareggio/Made in Italy)at 37ºC for 48 h. All samples were done in three replicates.

Organoleptic Properties

This was carried out at Department of Dairy Science and Technology, Damietta University, including staff members and assistants by at least 30 panelists according to the scheme recommended by Hofi et al. (1970) with some modification, taking into consideration the maximum attainable. The full marks were 100 divided to 45, 40, 10, and 5 points for flavor, texture, appearance, and color.

Statistical analyses

The data obtained were statistically analyzed according to statistical analyses system user's guide (SAS, 1996).

Results and Discussion

Physicochemical properties of Ras cheese samples

Values of physicochemical examination of Ras cheese samples during storage were presented in Fig. 1 - 9. Results showed that the average pH values, moisture content, and weight of Ras cheese wheels samples in fresh, after salting (one month), 2, 3, 4, and 5 months, respectively. These results agree with those obtained by El-Soda (1990), Osman and Abbas (2001), Abou-Donia (2002); Awad et al. (2003), Osman (2003) and El-Fadaly et al. (2015c).

pH values of control Ras cheese and Ras cheese samples with modified spices: Results presented in Fig. 1 - 3 shows the pH values of Ras cheese wheels during storage. The pH values of control and all Ras cheese samples were decreased during storage periods (5 months), the values ranged from (5 - 6). pH of Ras cheese wheels was varied according to the treatment of salting, where they decreased from 6.29, 6.58, 6.54, 6.46, 6.34, 6.42 and 6.35 for fresh to 6.23, 6.32, 6.28, 6.20, 6.12, 6.17, and 6.18 after one month for crushed cumin, crushed black cumin, nutmeg, capsicum, ginger and sumac, respectively. While the pH values of Ras cheese wheels were slightly decreased from 7.19, 6.94, 6.33, 6.31 and 6.29 for fresh to 6.89, 6.82, 6.30, 6.30 and 6.23 after one month for black pepper, crushed white pepper, crushed coriander, cumin, and crushed cumin, respectively. On the other hand, the lowest pH of samples was recorded for Ras cheese with Fenugreek (5.44), Ras cheese with crushed Fenugreek (5.28) and Ras cheese with ginger (5.49) after storage period (5 months). Similar results were also obtained by Del-Nobile et al. (2007) and El-Fadaly et al. (2015c).

Moisture percentages of control Ras cheese and Ras cheese samples with modified spices

Data presented in Fig. 4 – 6 show that the average values of moisture content in fresh Ras cheese were 38.0, 38.4, 41.8, 42.1 and 42.4% for dry basis for fresh Ras cheese with cinnamon, white pepper, black cumin, crushed black cumin, and crushed Fenugreek, respectively, while the control sample was 40%. After 1st month of storage period, the moisture content decreased to 39 and 36.10% for (control and Ras cheese with crushed black cumin) and Ras cheese with cinnamon, while, Ras cheese samples with crushed black pepper, crushed clove, crushed anise, rosemary, sumac, and cardamom, respectively, recorded one value, which is 37%. Generally, the moisture content gradually decreased to 30 and 26.8% for cheese with black pepper and cheese with cinnamon, at the end of the storage period (five months of ripening), respectively. Similar trends were obtained by El-Soda (1990); Osman and Abbas (2001), and Osman (2003).

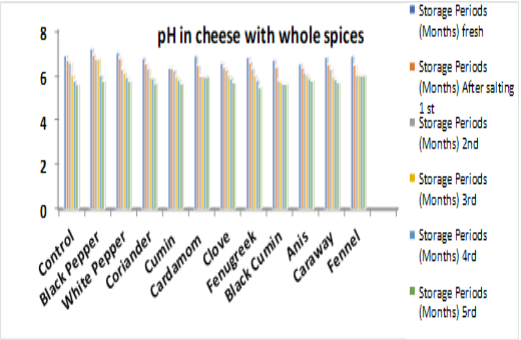

Fig.1. pH values in Ras cheese samples with whole spices.

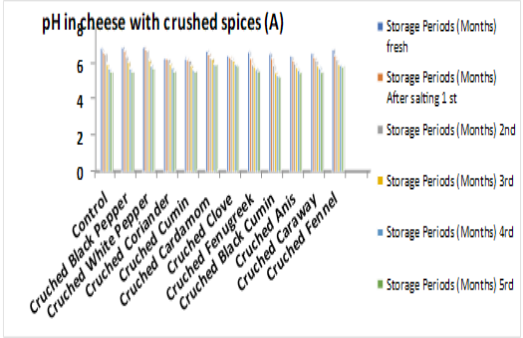

Fig.2. pH values in Ras cheese samples with crushed spices (Group A).

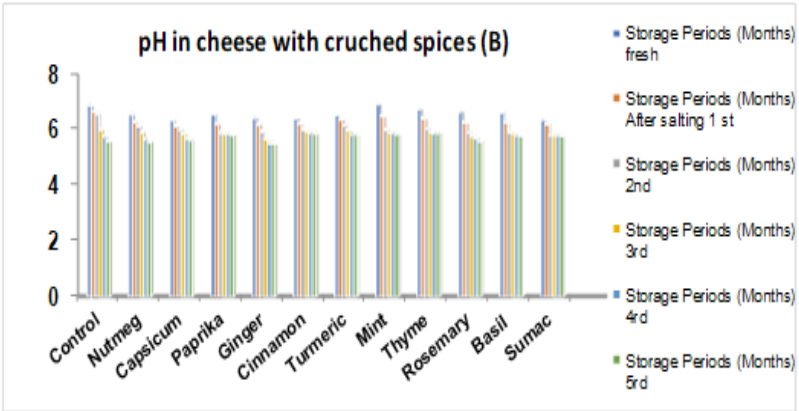

Fig.3. pH values in Ras cheese samples with crushed spices (Group B).

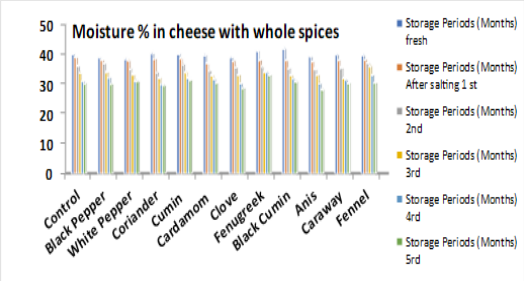

Fig.4. Moisture percent in Ras cheese samples with whole spices.

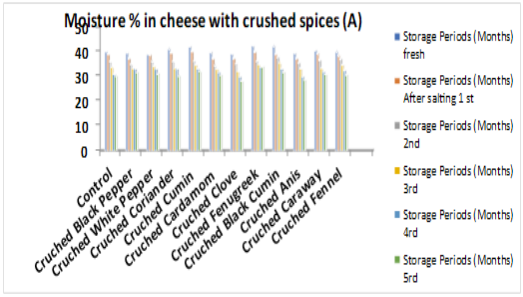

Fig.5. Moisture percent in Ras cheese samples with crushed spices (Group A).

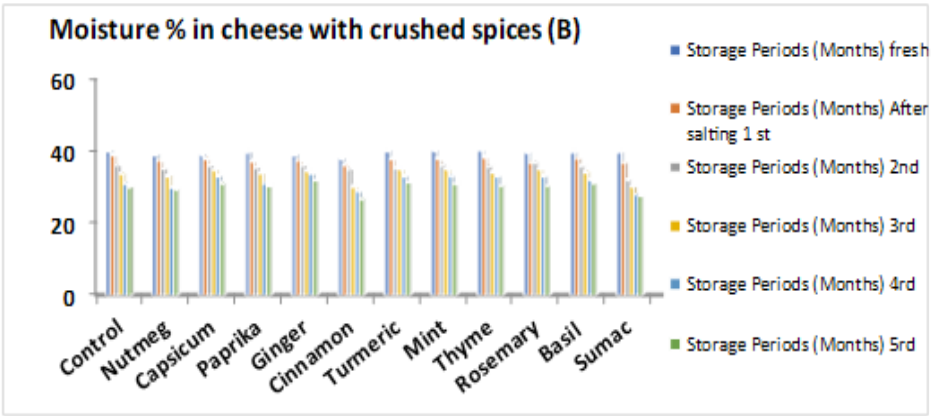

Fig.6. Moisture percent in Ras cheese samples with crushed spices (Group B).

Weight (gram) of control Ras cheese and Ras cheese samples with modified spices

Results presented in Fig. 7 – 9 shows the weight (gram) of Ras cheese wheels during storage. The weights of Ras cheese Wheels ranged between (1750 - 2000 grams) in zero time "fresh". The weight values in control and all cheese samples were decreased during storage periods (5 months). The weight of cheese is directly proportional to the moisture content of cheese. A Control sample was recorded a decrease in weight by 25.7%, whereas, the Ras cheese samples with white pepper, clove, black cumin, crushed black cumin, and paprika were recorded a weight loss of 20%. The best sample was Ras cheese with crushed white pepper, by decrease only 17.14% after five months. The highest decreases in weight of samples were 29.73, 30.77 and 30.77% for Ras cheese with capsicum, Nutmeg, and crushed cardamom, respectively, while the Ras cheese samples with rosemary, basil, and sumac were similar in the rate of weight losses (27.77%). These results are in agreement with those obtained by Osman and Abbas (2001), Abou-Donia (2002), Osman (2003) and El-Fadaly et al. (2015c).

Organoleptic properties of control Ras cheese and Ras cheese samples with modified spices

Organoleptic properties were carried out by means of the staff members and students in different ages of Faculty of Agriculture, Damietta University, with the participation of the colleague of Microbiology and Dairy Departments to judge the three organoleptic properties of Ras cheese, by 30 members (both male and female and, ages ranging between 20 and 60 years old).

Organoleptic properties in Ras cheese samples with modified whole Spices

The results showed that the flavor score in whole Ras cheese was 15 and 42 for fresh Ras cheese with whole spices. The flavor score increased in Ras cheese stored at storage temperature (15ºC) for five months. The flavor decreased in Ras cheese with black cumin. The flavor was the best in Ras cheese with whole-grain of cumin and fennel (Fig. 10).

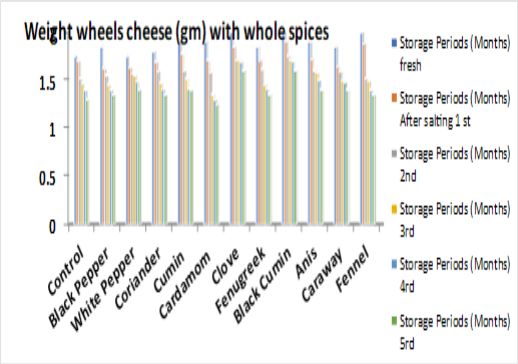

Fig.7.Weight of wheels in Ras cheese samples with whole spices.

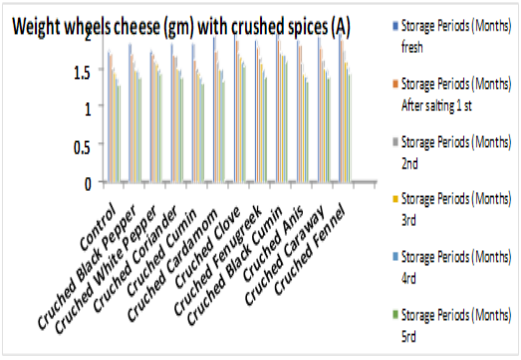

Fig.8. Weight of wheels in Ras cheese samples with crushed spices (Group A).

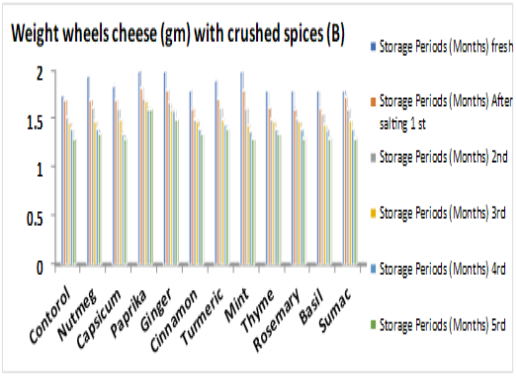

Fig.9. Weight of wheels in Ras cheese samples with crushed spices (Group B).

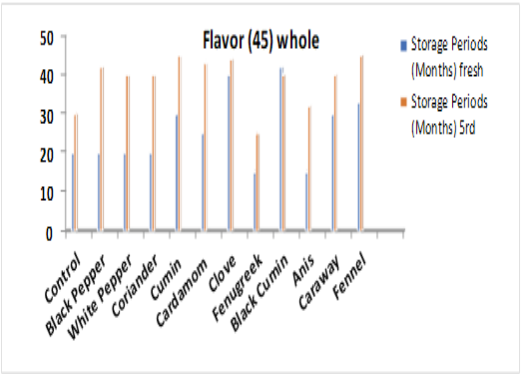

Fig.10.The flavour of Ras cheese samples with whole spices.

The texture was very good in all samples. The texture was increased in these samples during the storage period. The result was in range (35 – 40) points (Fig. 11). The appearance decreased in Ras cheese with anise, and not changes in Ras cheese with white pepper and caraway, in other samples the appearance was increased and up to the highest score in Ras cheese with whole-grain of cumin, cardamom, clove, and black cumin (Fig. 12). The color was increased in the samples, up to the highest score in (black pepper, cumin, clove, black cumin, and fennel). While the treatments with anise and caraway were stabled (Figure, 13). The results showed that the total score in fresh Ras cheese was in range (53 – 82) for fresh Ras cheese and after salting, respectively. The total score increased in Ras cheese stored at storage temperature (15ºC) for five months. At the end of five months storage, the total score was 82 and 100 for Ras cheese without spices, and at Ras cheese wheels with spices after salting, respectively. The highest score was in treatment with cumin (Fig. 14).

Organoleptic properties in Ras cheese samples with modified cruched Spices

Twenty-two types of crushed spices were used and divided into two groups.

The results showed that the flavor score in Ras cheese with crushed spices in group A was increased during the storage period. Slightly increasing in Ras cheese with crushed fenugreek, also the flavor was unacceptable. The best result in this group was in Ras cheese with crushed cumin and crushed fennel. The flavor decreased in Ras cheese with crushed black cumin and crushed cardamom (Fig. 15). The texture was increased in these samples during the storage period. The result was very good in treatments with (crushed black pepper, crushed black cumin, crushed fennel, and control treatment) (Fig. 16). The appearance decreased in Ras cheese with crushed fenugreek that the appearance was splotchy and unacceptable and decreased in Ras cheese with crushed anise, while, slightly increasing of appearance values in other treatments (Fig. 17). The color increased

gradually in this group that was very good in treated and untreated samples that were up to high score in samples with crushed black cumin, crushed fennel, and control but the color was stabled and no good in Ras cheese with crushed clove, crushed fenugreek and crushed caraway (Fig.18). The total score increased in Ras cheese stored at storage temperature (15ºC) during five months. At the end of five months storage, the total score was about 60 and 95 for Ras cheese without spices, and at Ras cheese wheels with spices after salting, respectively. The highest score was in treatments with crushed white pepper, crushed cumin, crushed cardamom, crushed black cumin, and crushed fennel (Fig. 19).

The results showed that the flavor scores in Ras cheese with crushed spices in group B were increased during the storage period. Slightly increasing in flavor Ras cheese with basil, also the flavor was very good for fresh cheese and after five months, as the addition of basil gave the cheese a new taste and demonstrated the taste of salt. Despite the good taste of Ras cheese with hot pepper (capsicum) but the result decreased after the storage period and the taste of capsicum was impermeable. The result was decreased too in treatments with cinnamon, mint and sumac. Similar results in Ras cheese with paprika, turmeric and control as the addition did not lead to a noticeable change in the flavor (Fig. 20). The texture changed during the storage period as the results showed that the best texture appeared in the Ras cheese with basil, rosemary, ginger, and control (Fig. 21). The appearance was very good in this group and gave a new shape to Ras cheese, especially when adding mint and basil, where it gave a shape similar to Roquefort cheese (Figure, 22). The color increased gradually in this group that was very good in treated and untreated samples that were up to a high score in treatment with capsicum (Fig. 23). The total score increased in Ras cheese stored at storage temperature (15ºC) for five months. At the end of five months storage, the total score was 55 and 97 for Ras cheese without spices, and in Ras cheese wheels with spices after salting, respectively. The highest score was in treatments with nutmeg, ginger, thyme, rosemary and basil (Fig. 24).

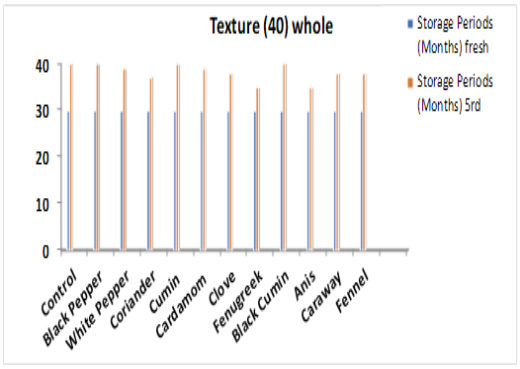

Fig.11.The texture of Ras cheese samples with whole spices.

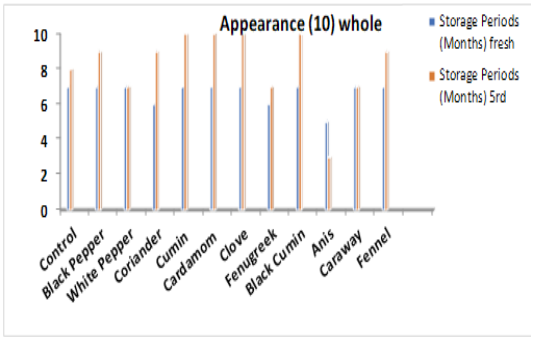

Fig.12.The appearance of Ras cheese samples with whole spices.

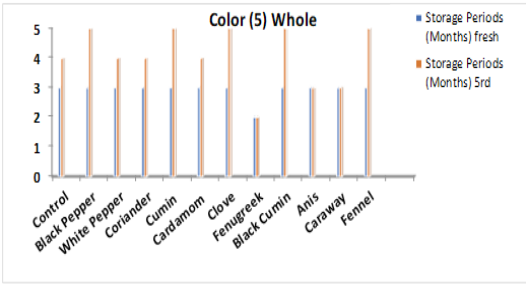

Fig.13.The color values of Ras cheese samples with whole spices.

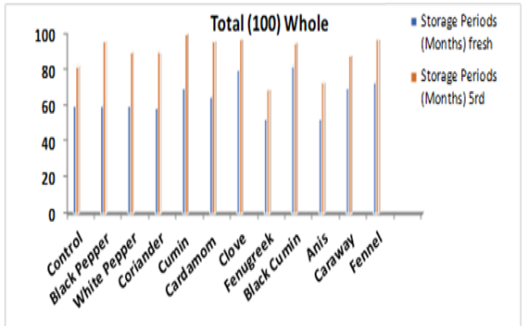

Fig. 14.Total score of Ras cheese samples with whole spices.

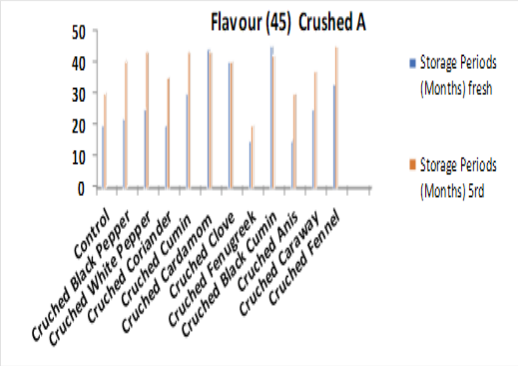

Fig.15. Flavour of Ras cheese samples with crushed spices (Group A).

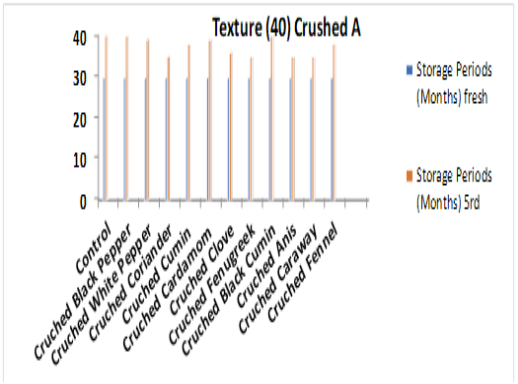

Fig.16. Texture of Ras cheese samples with crushed spices (Group A).

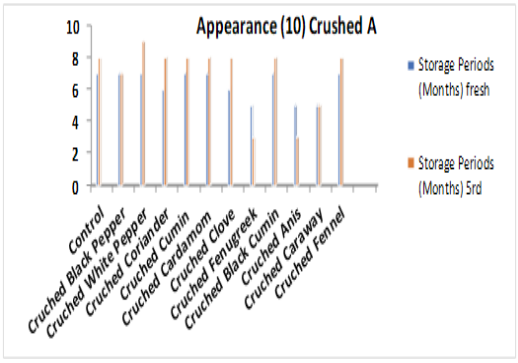

Fig.17. Appearance of Ras cheese samples with crushed spices (Group A).

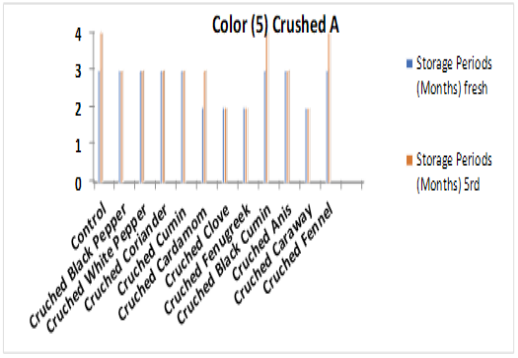

Fig.18. Color of Ras cheese samples with crushed spices (Group A).

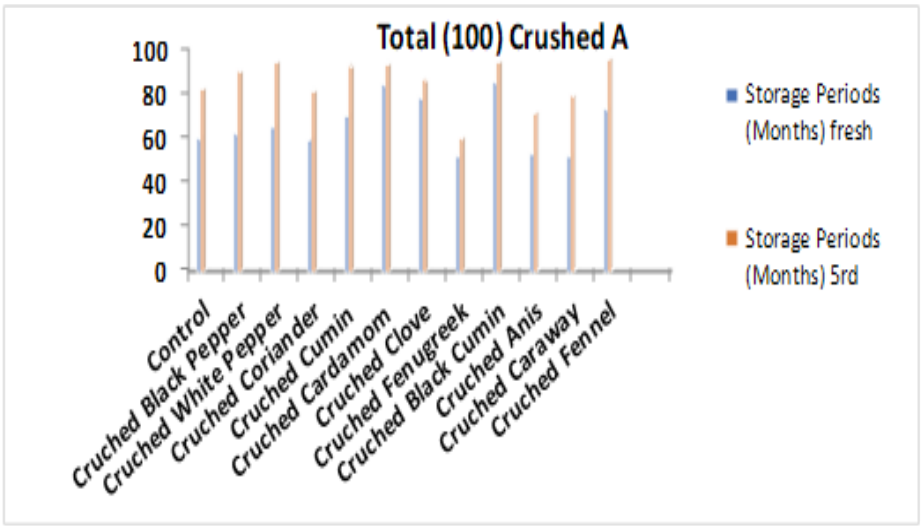

Fig.19.The total score of Ras cheese samples with crushed spices (Group A).

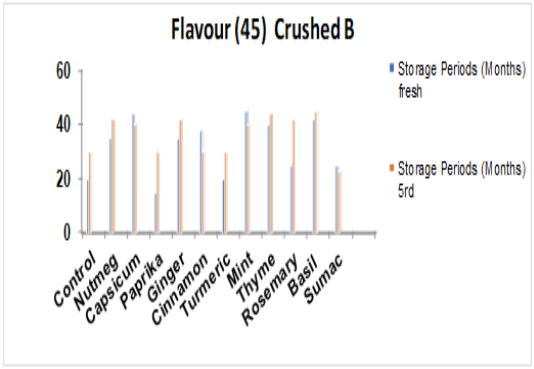

Fig.20. Flavour of Ras cheese samples with crushed spices (Group B).

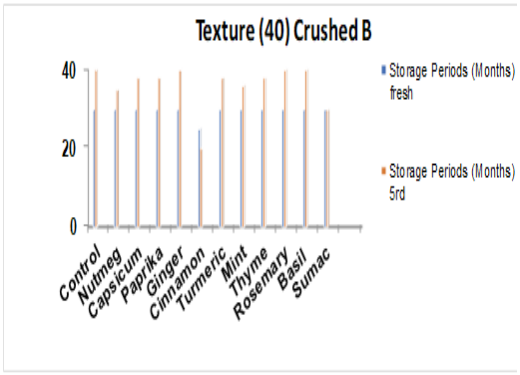

Fig.21.Texture of Ras cheese samples with crushed spices (Group B).

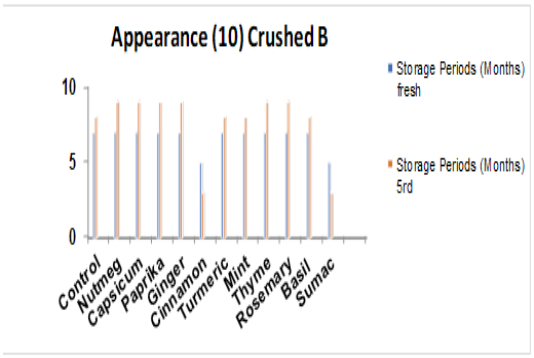

Fig.22. The appearance of Ras cheese samples with crushed spices (Group B).

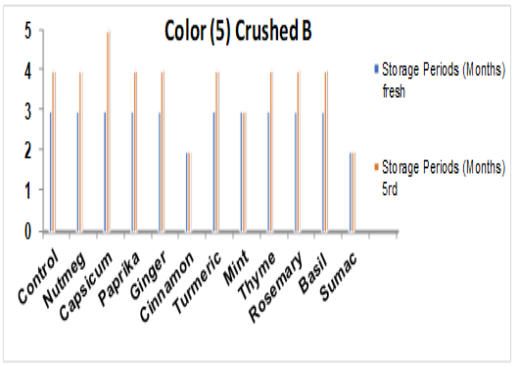

Fig.23. color of Ras cheese samples with crushed spices (Group B).

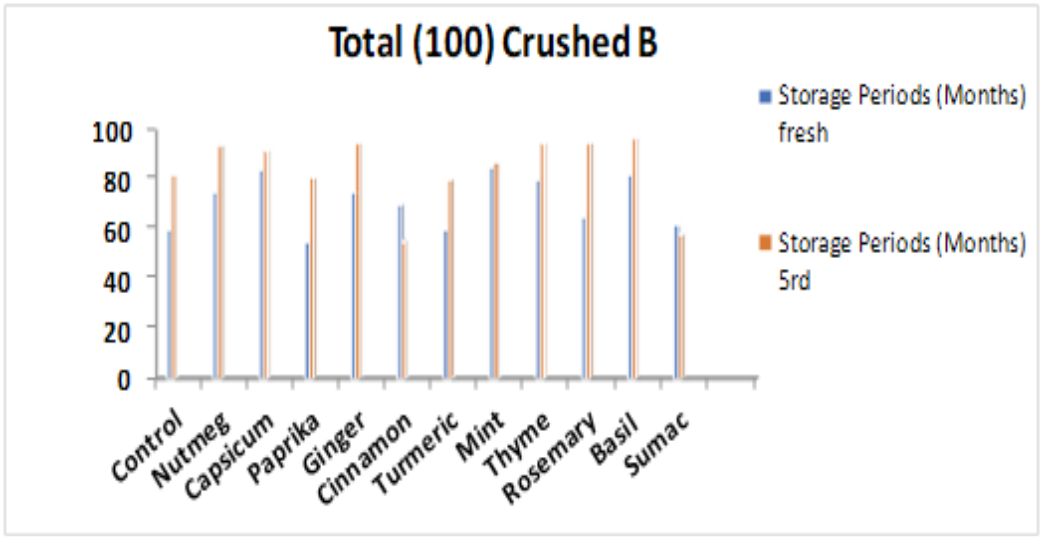

Fig.24.The total score of Ras cheese samples with crushed spices (Group B).

Microbiological analysis

Tables 2 and 3 show that, the effect of whole spices on the microbial load in fresh Ras cheese at zero time and after five months of salting. Comparing the results of the fifth month with zero time showed that, the salt and the spices decreased all microbial groups in all treatment except anise was equal to control in TBC.

Cardamom and funnel increased TBC and TFC. Cardamom increased TBC from 6.29 log cfu/g to 6.48 log cfu/g, this value equivalent 3.02%, also, Cardamom increased TFC from 5.13 log cfu/g to 5.35 log cfu/g (4.29%). Funnel also, increased TBC from 6.42 log cfu/g to 6.51 log cfu/g (1.40%), and it increased TFC from 4.83 log cfu/g to 5.10 log cfu/g (5.59%).

The highest decrease of TBC was in the case black pepper followed by control, coriander, black cumin, white pepper, and other spices until reached the lowest value in the case of anise with a percentage 15.99%, 14.84%, 13.36%, 13.25%, 11.40% and 0.00%, respectively. The highest decrease of TFC was in the case black cumin (28.98%) followed by white pepper (18.72%), control (18.56%), black pepper (17.32%), cumin (12.92%), coriander (11.31%) and other spices until reached the lowest value in the case of caraway (1.79%), respectively. Similar results were obtained by El-Fadaly et al. (2018) who studied the effect of volatile oils on the fungal growth. They found that most fungal strains were affected by examined volatile oils and the highest effect was in the case of clove oil followed by cinnamon oil and basil oil according to the inhibition values. All tested fungi were not sensitive towards Ginger, Marjoram, Thyme, Mint, Black seed, Black pepper and Rosemary oils. LAB decrease during this period until reached it maximum in the case of black cumin (31.12%) followed by coriander (21.58%), black cumin (20.15%), fenugreek (19.71%), control (19.02%), black pepper (18.97%), cumin (17.96%), white pepper (16.12%), caraway (14.20%), clove (11.26%), cardamom (11.24%), fennel (10.95%) until reached the lowest value in the case of anise (7.72%), respectively. At the end of the experiment (after five months), Tables (4 and 5) showed that, the effect of crushed spices on the microbial load in salted Ras cheese. Comparing the results of this month (fifth month) with zero time, the salt and the spices decreased all microbial groups in all treatments. But, cardamom increased TBC from 5.99 log cfu/g to 6.21 log cfu/g, this value equivalent 3.67%, also, cardamom increased TFC from 5.09 log cfu/g to 5.26 log cfu/g (3.34%). Thyme also, increased TBC from 6.42 log cfu/g to 6.48 log cfu/g (0.93%). The highest decrease of TBC was in the case hot pepper followed by ginger, cinnamon, mint, curcumin, black cumin, black pepper, white pepper, control, cumin, basil and other spices until reached the lowest value in the case of sumac with a percentage 24.10%, 20.43%, 17.16%, 16.22%, 15.81%, 15.80%, 15.75%, 15.49%, 14.84%, 12.65%, 12.19% and 0.64%, respectively. The highest decrease of TFC was in the case caraway (29.24%), followed by hot pepper (25.47%), black pepper (23.97%), cumin (23.32%), control (18.56%), cinnamon (17.78%), basil (17.64%), black cumin (17.40%), ginger (15.13%), curcumin (14.63%), anise (14.34%), mint (14.20%) and other spices until reached the lowest values in the case of thyme (3.40%), respectively. LAB decrease during this period until reached it maximum in the case of white pepper (33.08%), followed by black cumin (27.01%), thyme (25.65%), fenugreek (24.45%), basil (24.04%), cumin (23.83%), mint (23.78%), coriander (23.51%), anise (19.60), control (19.02%), caraway (18.55%), hot pepper (18.32%), cardamom (18.28%), until reached the lowest value in the case of sumac (6.29%), respectively.

Finally, the chemical composition of these spices could explain the strong effect of clove, cinnamon and basil oils as antimicrobial agents, because its chemical composition contained Eugenol ($C_{10}H_{12}O_2$), which considered a very strong effect agent on all microbial species. Moreover, the chemical composition of cinnamon oil and basil oil contained Linalool ($C_{10}H_{18}O$) and Limonene ($C_{10}H_{16}O_4$), which also responsible for their effect on microbial growth (El-Fadaly et al., 2018).

Conclusion

The weights of Ras cheese wheels ranged between (1750 – 2000 grams) at zero time. The flavor score increased in samples with whole spices and with crushed spices for five months. The texture was very good in all samples. The appearance decreased in Ras cheese with aniseand not changes in cheese with white pepper and caraway. The appearance was very good and gave a new shape when adding mint and basil. The highest score was in treatment with cumin, crushed white pepper, crushed cumin, crushed cardamom, crushed black cumin, crushed fennel, nutmeg, ginger, thyme, rosemary and basil. The best of the whole spice which decrease TBC, TFC and LAB were hot pepper (15.99%), white pepper (18.72%), and black cumin (31.12%), respectively.

TABLE 2. Comparison between the microbial load of Ras cheese treated with whole spices (zero time and after five-month of salting) and its changes in percentage .

The effect of whole spices on the microbial load (Log cfu/g) in fresh Ras cheese at zero time						
	Control	**Fennel**	**Caraway**	**Anise**	**Black cumin**	**Fenugreek**
TBC	6.67	6.42	6.4	6.40	6.34	6.58
TFC	5.71	4.83	5.02	5.30	6.35	5.27
LAB	5.89	5.39	5.14	5.18	6.33	5.53
The effect of whole spices on the microbial load (Log cfu/g) after five months of salted Ras cheese						
TBC	5.68	6.51	5.98	6.40	5.50	6.25
TFC	4.65	5.10	4.93	5.19	4.51	4.79
LAB	4.77	4.80	4.41	4.78	4.36	4.44
Changes in the microbial load (%)						
TBC	-14.84	+1.40	-6.56	0.00	-13.25	-5.02
TFC	-18.56	+5.59	-1.79	-2.08	-28.98	-9.11
LAB	-19.02	-10.95	-14.20	-7.72	-31.12	-19.71

The positive value (+) was considered as a stimulated agent and the negative value (-) was considered as inhibitor agent.

TABLE 3. Comparison between the microbial load of Ras cheese treated with whole spices (zero time and after five month of salting) and its changes in percentage .

The effect of whole spices on the microbial load (Log cfu/g) in fresh Ras cheese at zero time						
	Clove	**Cardamom**	**Cumin**	**Coriander**	**White pepper**	**Black pepper**
TBC	6.56	6.29	6.47	6.51	6.58	6.63
TFC	5.23	5.13	5.34	5.48	5.61	5.89
LAB	5.42	5.34	5.68	5.70	5.65	5.80
The effect of whole spices on the microbial load (Log cfu/g) after five months of salted Ras cheese						
TBC	6.47	6.48	6.00	5.64	5.83	5.57
TFC	5.06	5.35	4.65	4.86	4.56	4.87
LAB	4.81	4.74	4.66	4.47	4.74	4.70
Changes in the microbial load (%)						
TBC	-1.37	+3.02	-7.26	-13.36	-11.40	-15.99
TFC	-3.25	+4.29	-12.92	-11.31	-18.72	-17.32
LAB	-11.26	-11.24	-17.96	-21.58	-16.12	-18.97

The positive value (+) was considered as a stimulated agent and the negative value (-) was considered as inhibitor agent

TABLE 4.Comparison between the microbial load of Ras cheese treated with crushed spices in zero time and after five month of salting and its changes in percentage .

	The effect of crushed spices on the microbial load (Log cfu/g) in fresh Ras cheese at zero time											
	Control	**Rosemary**	**Thyme**	**Mint**	**Curcumin**	**Cinnamon**	**Ginger**	**Paprika**	**Hot pepper**	**Nutmeg**	**Fennel**	**Caraway**
TBC	6.67	6.42	6.42	6.35	6.45	6.47	6.46	6.38	6.68	6.19	6.43	6.5
TFC	5.71	4.88	5.13	4.93	4.92	4.95	5.22	4.96	5.3	5.03	4.72	6.19
LAB	5.89	5.41	5.38	5.34	5.4	5.39	5.35	5.31	5.46	5.27	5.39	5.39
	The effect of crushed spices on the microbial load (Log cfu/g) after five months of salted Ras cheese											
	Control	Rosemary	Thyme	Mint	Curcumin	Cinnamon	Ginger	Paprika	Hot pepper	Nutmeg	Fennel	Caraway
TBC	5.68	6.07	6.48	5.32	5.43	5.36	5.14	5.8	5.07	5.77	5.85	5.86
TFC	4.65	4.7	4.93	4.23	4.2	4.07	4.43	4.5	3.95	4.57	4.27	4.38
LAB	4.77	5.06	4	4.07	4.88	4.73	4.6	4.68	4.46	4.39	4.66	4.39
	Changes in the microbial load (%)											
TBC	-14.84	-5.45	0.95	-16.22	-15.81	-17.16	-20.43	-9.09	-24.10	-6.79	-9.02	-9.85
TFC	-18.56	-3.69	-3.40	-14.20	-14.63	-17.78	-15.13	-9.27	-25.47	-9.15	-9.53	-29.24
LAB	-19.02	-6.47	-25.65	-23.78	-9.63	-12.25	-14.02	-11.86	-18.32	-16.70	-13.54	-18.55

The positive value (+) was considered as stimulated agent and the negative value (-) was considered as inhibitor agent

TABLE 5. Comparison between the microbial load of Ras cheese treated with crushed spices in zero time and after five month of salting and its changes in percentage

The effect of crushed spices on the microbial load (Log cfu/g) in fresh Ras cheese at zero time											
	Anise	**Black cumin**	**Fenugreek**	**Clove**	**Cardamom**	**Cumin**	**Coriander**	**White pepper**	**Black pepper**	**Sumac**	**Basil**
TBC	6.33	6.39	6.4	6.42	5.99	6.48	6.42	6.65	6.54	6.29	6.4
TFC	5.37	5.23	5.12	5.29	5.09	5.36	5.44	5.32	5.59	4.92	5.16
LAB	5.46	5.48	5.44	5.47	5.47	5.75	5.53	6.62	5.69	5.41	5.49
The effect of crushed spices on the microbial load (Log cfu/g) after five months of salted Ras cheese											
	Anise	Black cumin	Fenugreek	Clove	Cardamom	Cumin	Coriander	White pepper	Black pepper	Sumac	Basil
TBC	6.03	5.38	5.79	5.86	6.21	5.66	5.85	5.62	5.51	6.25	5.62
TFC	4.6	4.32	4.74	4.74	5.26	4.11	4.71	4.74	4.25	4.51	4.25
LAB	4.39	4	4.11	4.68	4.47	4.38	4.23	4.43	4.96	5.07	4.17
Changes in the microbial load (%)											
TBC	-4.74	-15.80	-9.53	-8.72	3.67	-12.65	-8.88	-15.49	-15.75	-0.64	-12.19
TFC	-14.34	-17.40	-7.42	-10.40	3.34	-23.32	-13.42	-10.90	-23.97	-8.33	-17.64
LAB	-19.60	-27.01	-24.45	-14.44	-18.28	-23.83	-23.51	-33.08	-12.83	-6.29	-24.04
The positive value (+) was considered as stimulated agent and the negative value (-) was considered as inhibitor agent											

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تأثير إضافة بعض التوابل على الخواص الفيزيوكيميائية والحسية والميكروبيولوجية للجبن الراس

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تم شراء ٢٢ نوع مختلف من التوابل من السوق المحلية لمدينة دمياط وتمت إضافتها في شكلين (كامل أو مجروش) أثناء تصنيع الجبن الراس. تم إختبار تلك التوابل من حيث تأثيرها على الخواص الفيزيائية والكيميائية والحسية والميكروبيولوجية للجبن الراس الطازج وبعد التمليح (بعد شهر واحد من التصنيع) و ٢ و ٣ و ٤ و ٥ أشهر على التوالي.
تراوحت قيم الرقم الهيدروجيني بين ٥ إلى ٦ في جميع المعاملات. إنخفض محتوى الرطوبة ووزن أقراص الجبن الراس تدريجياً لجميع المعاملات في نهاية فترة التخزين. كانت النسبة المئوية للانخفاض في وزن عينة الكنترول ٢٥,٧٪، وكانت أفضل عينة في الفلفل الأبيض المسحوق (١٧,١٤٪) (هذه القيمة جعلت هذه المعاملة أفضل المعاملات تجارياً)، وكانت أسوأ العينات في فقدان الوزن ٣٠,٧٧٪ في جوزة الطيب. أفضل معاملة للجبن الراس من حيث النكهة كانت مع الحبوب الكاملة للكمون، على الجانب الآخر، أعطت إضافة الريحان للجبن طعمًا جديدًا وأظهرت طعم الملح. النكهة انخفضت في الجبن المعامل بالكمون الأسود وكان أسوأ نكهة مع الحلبة. ظهر أفضل ملمس في الجبن الراس مع الريحان وكانت أسوأ نتيجة مع القرفة. كان المظهر جيدًا جدًا وأعطى شكلًا جديدًا عند إضافة النعناع والريحان، حيث أعطى منظر يشبه الجبن الريكفورت. أعلى درجة من اللون كانت في حالة الفلفل الأسود وأسوأ درجة كانت في الفليفلة. بشكل عام، كانت أعلى الدرجات في الجبن المعامل بالكمون، ولكن النتيجة الأسوأ كانت في الجبن المعامل بالسماق. أظهر التحليل الميكروبيولوجي أنه عند مقارنة التوابل الكاملة مع التوابل المجروشة من حيث قدرتها على تقليل الحمل الميكروبي، وجد أن التوابل المجروشة أفضل من التوابل الكاملة. وكانت أفضل التوابل المطحونة التي تقلل من أعداد البكتيريا الكلية هي الفلفل الحار بنسبة ٢٤,١٠٪ وقللت الفطريات والخمائر الكلية في حالة الكراوية بنسبة ٢٩,٢٤٪ وأخيرا إنخفضت أعداد بكتيريا حمض اللاكتيك في حالة الفلفل الأبيض بنسبة ٣٣,٠٨ ٪.