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Physicochemical, Organoleptic and Microbiological Properties of Ras cheese Treated with certain Spices

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ABSTRACT

Twenty-two different commercial spices were added in two forms during making of Ras cheese, and examined for their physicochemical, organoleptic and microbiological properties of Ras cheese when fresh, after 1, 2, 3, 4, and 5 months. pH ranged from (5 - 6) in all treatments. The moisture content and weight of Ras cheese wheels decreased in all treatments at the end of the storage. Weight of the control sample was 25.7%, and 17.14% in cheese treated with crushed white pepper. The best treatment of Ras cheese for flavor with whole grain of cumin, on the other side, the addition of Basil resulted in a new salted. The flavor decreased in cheese with black cumin. The best texture appeared in the Ras cheese with basil, compared with cinnamon. 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. The highest score was in treatment with cumin. Microbiological analysis showed that crushed spices were 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. Spices may reach consumers presenting poor quality, due to the loss of volatile compounds, microbial contamination. Spices and herbs have been used as flavor, colour, aroma, enhancing agents and for preservation of foods. 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. 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* and *Listeria monocytogenes*) and fungi. (Hofi *et al.*, 1970, Baxter & Holzappel, 1982, Pafumi, 1986, Germano & Germano, 1998, Anderson *et al.*, 1999, Santos *et al.*, 1999, Bin *et al.*, 2011, El-Fadaly *et al.*, 2015a, and c, and El-Sayed & Youssef, 2019). Many authors isolated fungi and bacteria from Ras cheese. The high biochemical activities of these microbes produce the typical aroma and taste. 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 the microbial growth. The main aim of this study was to evaluate the effect of addition with some Egyptian spices and herbs on physico-chemical composition, microbiological analysis, organoleptic properties of Ras cheese.

MATERIALS AND METHODS

Fresh whole cows' and buffaloes' milks were obtained from Hendam laboratory, Elasafra, Dakhlia, Egypt, the chemical composition of milk used in cheese making was fat 3.5%, protein 3.2% and TS 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 chemicals and solvents were purchased from El-Gomhoria for chemicals company, Mansoura, Egypt.

Twenty-two different commercial spices mentioned in (Table (1)) were obtained from the local market of Damietta city. 11 spices were added in two forms (complete and milled), powdered or crushed. The other 11 spices were added in only one milled, powdered or crushed forms. Ten grams of each spices were added during making of Ras cheese, except the control. These spices were tested for their effect on the microbiological load of Ras cheese.

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Table 1. English and scientific name for spices.

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

In an attempt to imitate the commonly used method among the cheese manufacturers in Hendam plant, Elasaфра, Dakahlia for making Ras cheese, the procedure adopted by Abou-Donia (2002). After salting the wheels of cheese transferred to the refrigerator at (5-10°C) for five months, and examined samples were taken after 1, 2, 3, 4 and 5 months.

Thirty-four cheese treatment were made in this experiment. The first was used as a control (in the absence of spices), while the other treatment were made in the presence of spices (ground or in full form), in triplicate. Samples were taken for analysis when fresh and at the end of the dry salting process (30 days). Cheese wheels were stored at (5-10°C) for five months in a refrigerator, and examined when fresh and after 1, 2, 3, 4 and 5 months. Two samples were taken from every cheese wheel for the microbiological and physicochemical analysis and sensory evaluation. The samples were taken from the middle of the cheese wheel by cutting it using a sterilized knife. pH values of cheese were determined by using a standard digital electronic pH meter. The moisture content of cheese was detected according

Total bacterial count (TBC), total fungal count (TFC) and lactic acid bacterial count (LABC) were determined in Ras cheese samples at zero time and after five months of salting. The changes in microbial load (%) between the two stages were recorded according to the following equation:

$$*\text{The changes in microbial load} = \frac{A-B}{A} \times 100$$

*Where:

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

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

Total bacterial count of Ras cheese samples was determined incubation was carried at 30°C for 72h counting of fungi was also done by plating technique method onto PDA medium (Difco, 2009), at 25°C for 5 days (APHA, 1998). Lactic acid bacteria were enumerated using MRS agar medium according to De Man *et al.* (1960), and anaerobically incubated at 37°C for 48 h Samples were done in triplicates.

Organoleptic Properties were 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).

RESULTS AND DISCUSSION

Physicochemical Properties of Ras chees Samples:

Results presented in Figures (1 to 9) showed that the average of pH values, moisture content and weight of Ras cheese wheels samples when fresh and after 1, 2, 3, 4 and 5 months. Results presented in Figures (1 - 3) show that the pH values of control and all Ras cheese samples decreased during storage periods (5 months), the values ranged from (5 - 6). pH of Ras cheese wheels varied according to the used method of salting, as they decreased from 6.29, 6.58, 6.54, 6.46, 6.34, 6.42 and 6.35 in fresh treatments, 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 slightly decreased from 7.19, 6.94, 6.33, 6.31 and 6.29 in fresh treatments, 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 in 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 obtained by El-Soda (1990), Osman and Abbas (2001), Abou-Donia (2002), Awad *et al.* (2003), Osman (2003) and El-Fadaly *et al.* (2015), Del-Nobile *et al.* (2007) and El-Fadaly *et al.* (2015).

Data presented in Figures (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% in fresh Ras cheese with cinnamon, white pepper, black cumin, crushed black cumin and crushed Fenugreek, respectively, while the corresponding value in the control sample was 40%. After 1st month of storage period, the moisture content decreased to 39 and 36.10 in 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 the same value, which is 37%. Generally, the moisture content gradually decreased to 30 and 26.8% in cheese with black pepper and cheese with cinnamon, at the end of storage period (five months of ripening), respectively. Similar trends were obtained by El-Soda (1990); Osman and Abbas (2001), and Osman (2003).

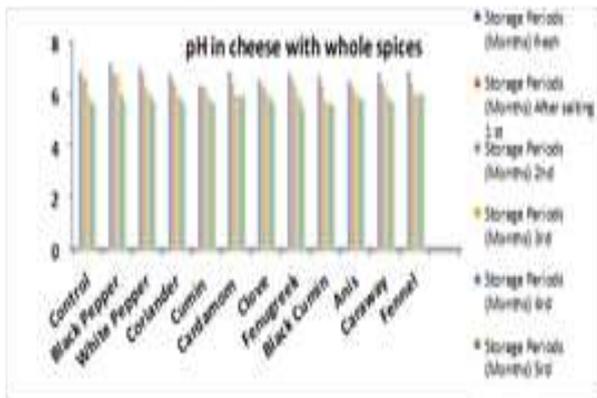


Figure 1. pH values in Ras cheese samples with whole spices.

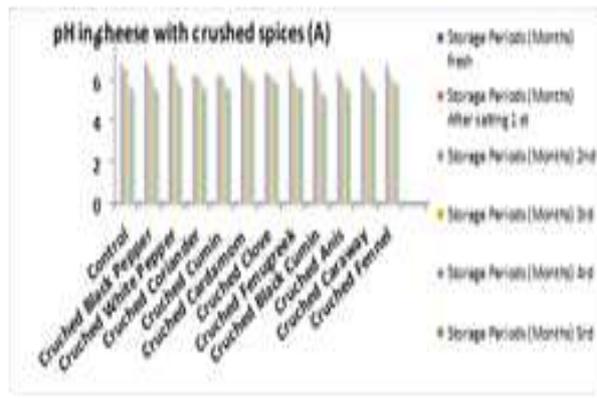


Figure 2. pH values in Ras cheese samples with crushed spices (Group A)

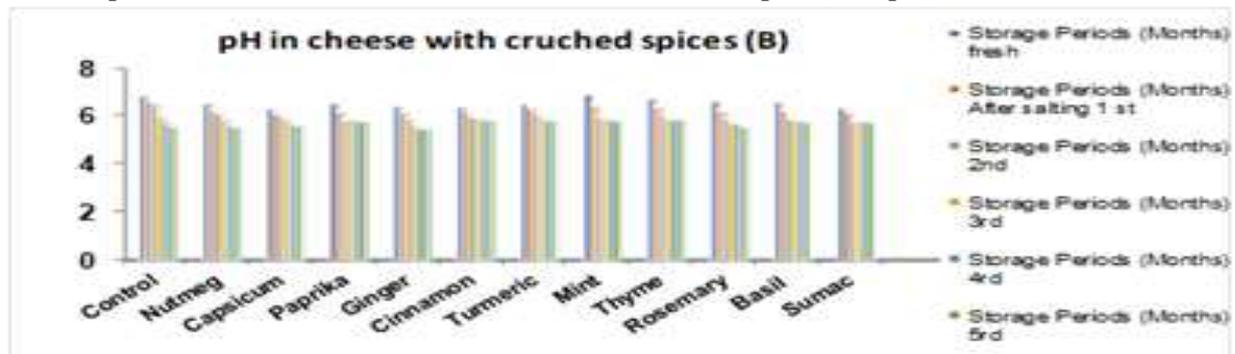


Figure 3. pH values in Ras cheese samples with crushed spices (Group B)

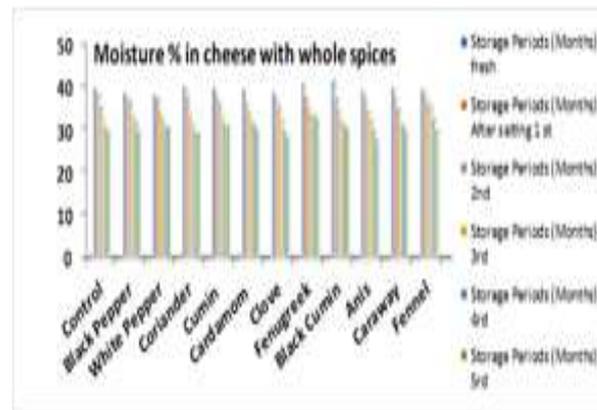


Figure 4. Moisture percent in Ras cheese samples with whole spices.

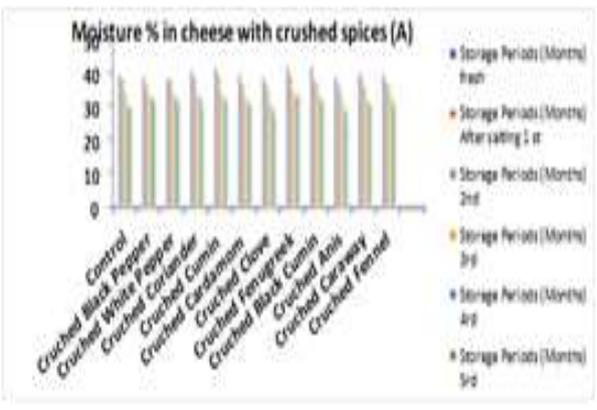


Figure 5. Moisture percent in Ras cheese samples with crushed spices (Group A)

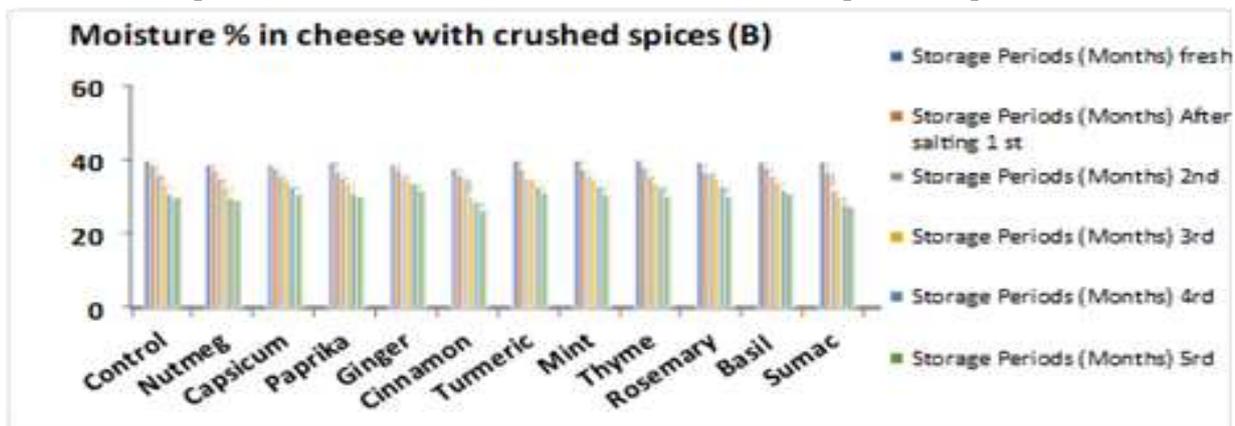


Figure 6. Moisture percent in Ras cheese samples with crushed spices (Group B)

Data presented in Figures (7 – 9) illustrate the weight (gram) of Ras cheese wheels during storage. The weights of Ras cheese Wheels ranged between (1750 - 2000 grams) when fresh at zero time. The weight values in control and all cheese samples decreased during storage periods (5 months). The weight of cheese is directly proportional to the moisture content of cheese. Weight of control treatment decreased by 25.7%, whereas cheese samples with white pepper, clove, Black Cumin, crush Black Cumin and Paprika recorded a weight loss of 20%.

The best sample was Ras cheese with crushed white pepper, which decreased by only 17.14% after five months. The highest decreases of 29.73, 30.77 and 30.77 were gained in cheese treated with capsicum, Nutmeg and crushed Cardamom, respectively, while the Ras cheese samples with Rosemary, Basil and Sumac were of the same rate of weight losses (27.77%)., which came in accordance of those results mentioned by Osman and Abbas (2001); Abou-Donia (2002); Osman (2003), and El-Fadaly et al. (2015).

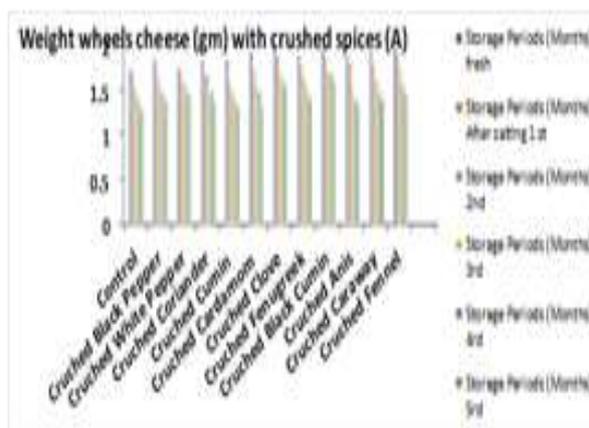
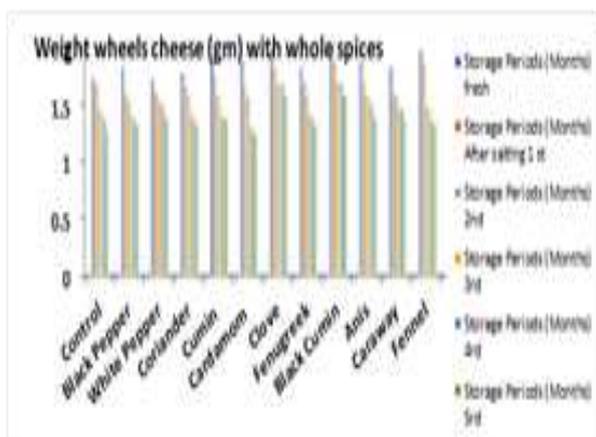


Figure 7. Weight of wheels in Ras cheese samples with whole spices.

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

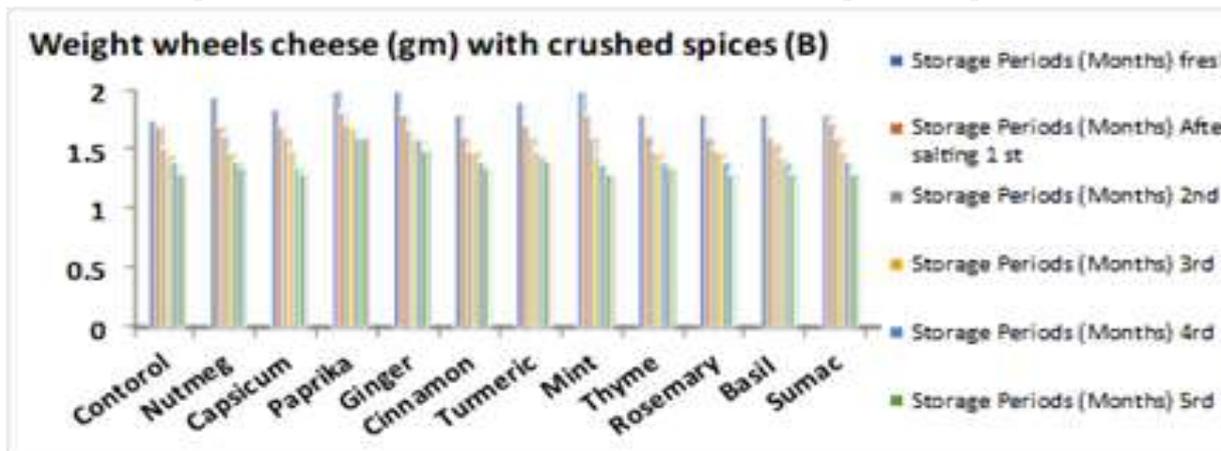


Figure 9. Weight of wheels in Ras cheese samples with crushed spices (Group B)

The obtained results of organoleptic properties of Ras cheese samples with modified whole spices were shown in (Figure, 10). It could be found that the achieved flavor score in whole cheese treatments with all of the examined spices ranged from 15 and 42 when fresh. The flavor score increased in Ras cheese stored at storage temperature (15°C) for five months. The flavor decreased in Ras cheese with black cumin and it was the worst flavor in Fenugreek. The flavor was the best in Ras cheese with whole grain of cumin and fennel (Figure, 10).

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. The worst result was in Ras cheese with fenugreek and anise (Figure, 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 (Figure, 12). The color was increased in the samples, up to the highest score in (black pepper, cumin, clove, black cumin and fennel). The worst score was in Ras cheese with fenugreek. While the treatments with anise and caraway was stabled (Figure, 13). Results showed that the total score in fresh treated cheese was in the range of 53 – 82, when fresh and after salting, respectively. The total score increased for 5 month- storage at 15°C. At the end of five months storage, the Total score of 82 and 100 was gained for cheese made in the absence of spices, and in cheese with spices after salting, respectively. The highest score was in treatment with cumin, while the worst result was in Ras cheese with fenugreek (Figure, 14).

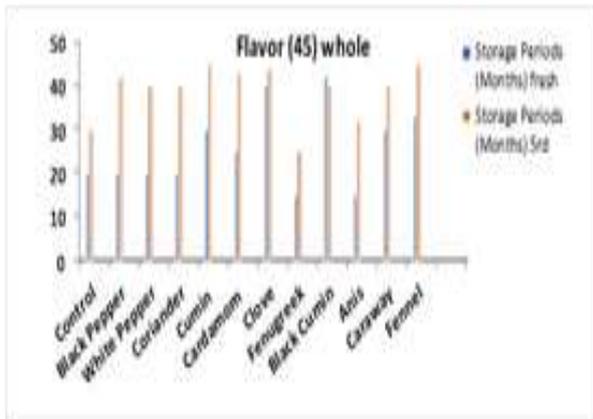


Figure 10. Flavour of Ras cheese samples with whole spices

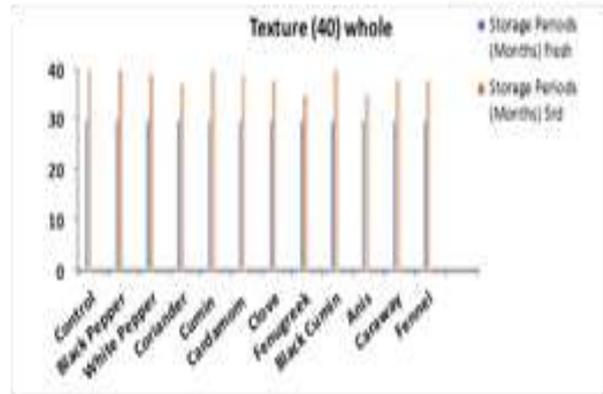


Figure 11. Texture of Ras cheese samples with whole spices

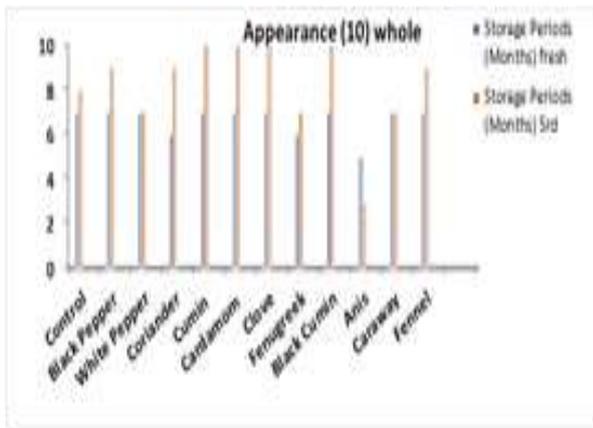


Figure 12. Appearance of Ras cheese samples with whole spices

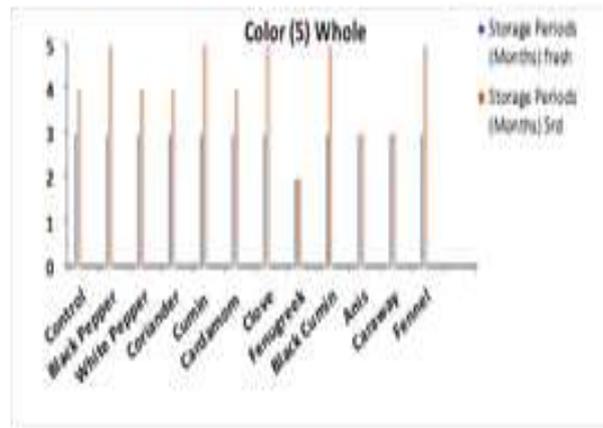


Figure 13. color of Ras cheese samples with whole spices

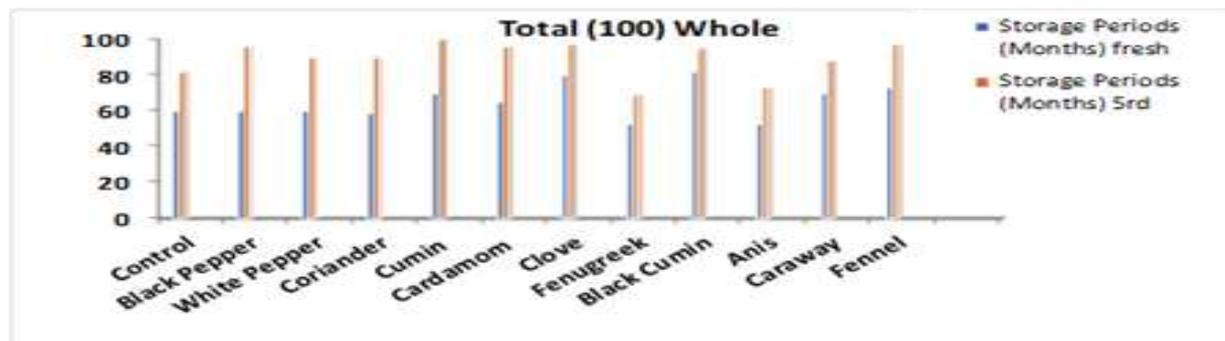


Figure 14. Total score of Ras cheese samples with whole spices

Twenty-two types of crushed spices were used and divided into two groups. Results showed that the flavor score in Ras cheese with crushed spices in group A increased during the storage period. Slight increase, however, was detected in Ras cheese with crushed fenugreek, accompanied with unacceptable flavor. The best result in this group was obtained in Ras cheese with crushed cumin and crushed fennel. The flavor decreased in Ras cheese with crushed black cumin and crushed cardamom (Figure, 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). The worst texture was in treatment with crushed coriander,

crushed fenugreek, crushed anise and crushed caraway (Figure, 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 (Figure, 17). The color increased gradually in this group that was very good in treated and untreated samples that was up to high score in samples with crushed black cumin, crushed fennel and control but the color was stable and no good in Ras cheese with crushed clove, crushed fenugreek and crushed caraway (Figure, 18). The total score increased in Ras cheese stored at storage temperature (15°C) 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, but worst result was in Ras cheese with fenugreek (Figure, 19).

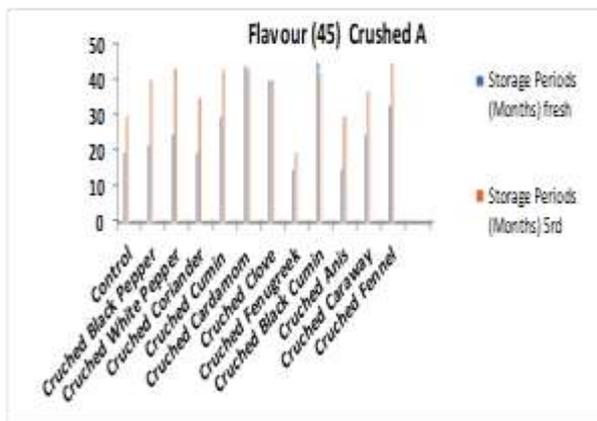


Figure 15. Flavour of Ras cheese samples with crushed spices (Group A)

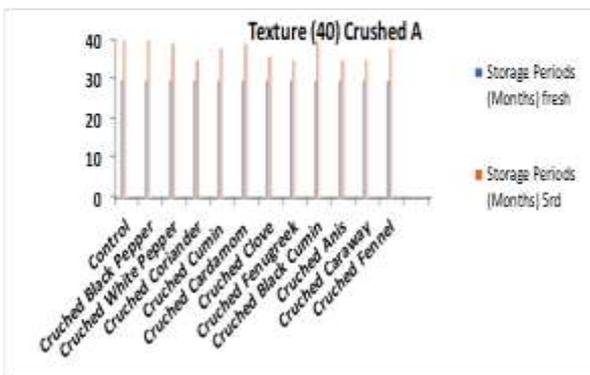


Figure 16. Texture of Ras cheese samples with crushed spices (Group A)

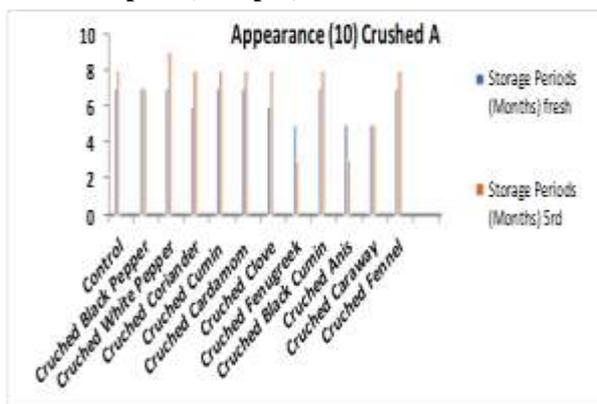


Figure 17. Appearance of Ras cheese samples with crushed spices (Group A)

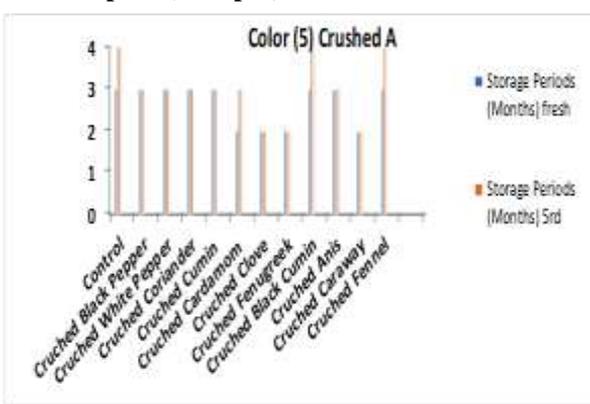


Figure 18. color of Ras cheese samples with crushed spices (Group A)

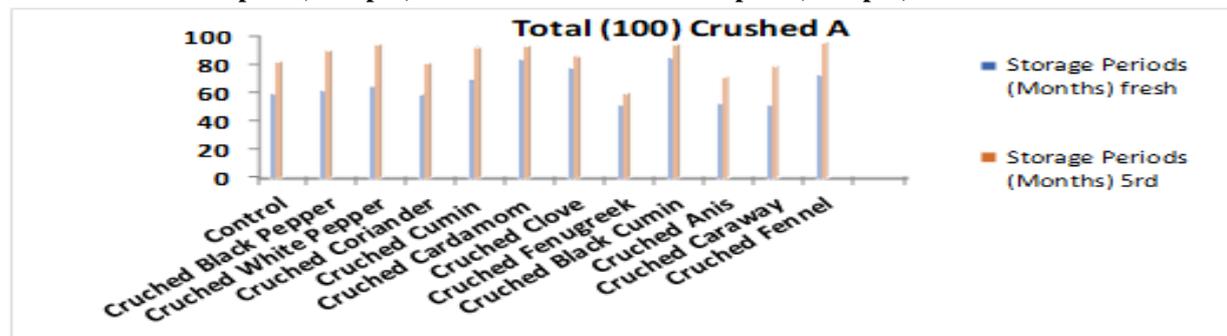


Figure 19. Total score of Ras cheese samples with crushed spices (Group A)

The results showed that the flavor score 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 a noticeable change in the flavor (Figure, 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. The worst texture was in the treatment with cinnamon (Figure, 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. The result was very bad in Ras cheese with cinnamon and sumac (Figure, 22). The color increased gradually in this group that was very good in treated and untreated samples that was up to a high score in treatment with capsicum. The color was bad in treatments with cinnamon and sumac (Figure, 23). The total score increased in Ras cheese stored at storage temperature

(15°C) for five months. At the end of five months storage, the total score was of 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, but worst result was in Ras cheese with cinnamon and sumac (Figure, 24). The effect of whole spices on the microbial load of fresh

Ras cheese is presented in Tables (2 and 3) when fresh and during storage. Comparing the results of the fifth month with zero time showed that the presence of either salt and the spices decreased all microbial groups in all of the treated samples, except in the presence of the anise, which was equal to control in TBC.

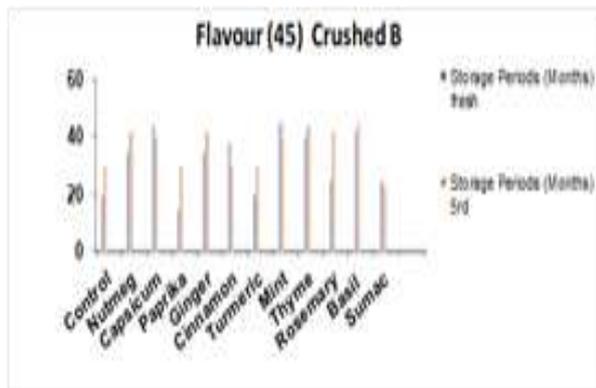


Figure 20. Flavour of Ras cheese samples with crushed spices (Group B)

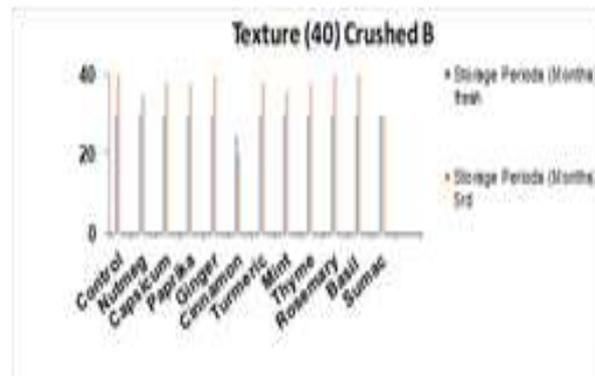


Figure 21. Texture of Ras cheese samples with crushed spices (Group B)

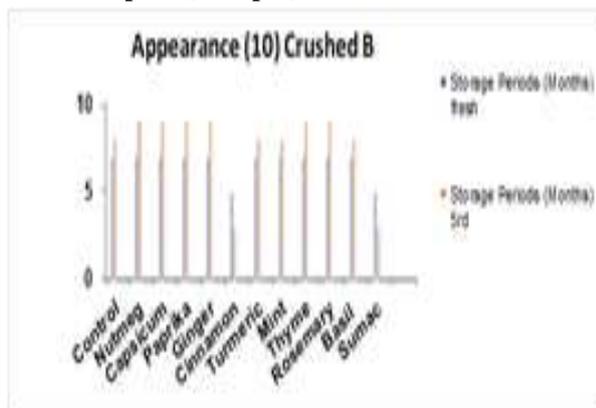


Figure 22. Appearance of Ras cheese samples with crushed spices (Group B)

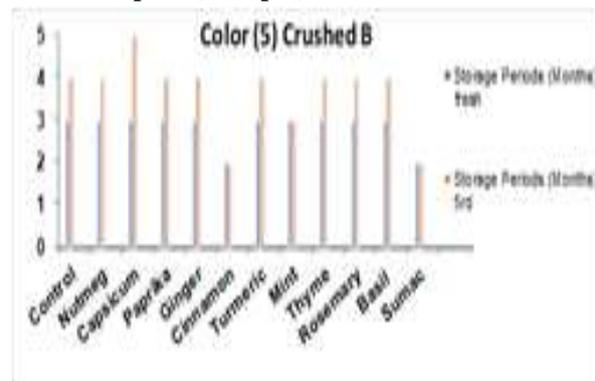


Figure 23. Color of Ras cheese samples with crushed spices (Group B)

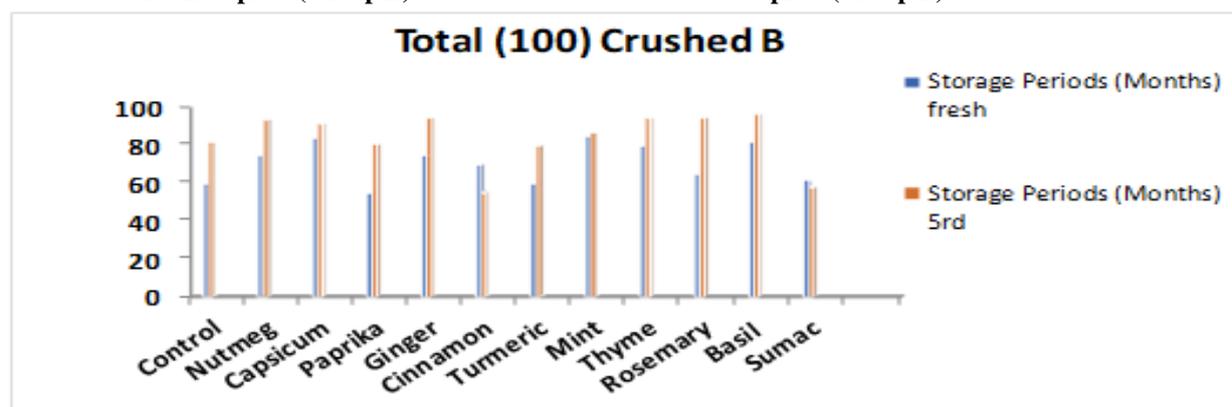


Figure 24. Total score of Ras cheese samples with crushed spices (Group B)

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, black cumin, coriander, white pepper and other spices until reached the lowest value in the case of anise with a percentage 15.99%, 14.84%, 13.39%, 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 case of caraway (1.79%), respectively case of caraway (1.79%), respectively. Similar results were observed by El-Fadaly *et al.* (2018)

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.

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 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	6.00	6.00	5.64	5.83	5.57
TFC	5.06	4.65	4.65	4.86	4.56	4.87
LAB	4.81	4.66	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 stimulated agent and the negative value (-) was considered as inhibitor agent

Data indicated in Tables (4 and 5) showed that the effect of crushed spices on the microbial load in salted Ras cheese. Comparing the results after 5 months with zero time, the salt and the spices decreased all microbial groups in all treatment. 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 (C₁₀H₁₂O₂), which considered a very strong effect agent on all microbial species. Moreover, the chemical composition of cinnamon oil and basil oil contained Linalool (C₁₀H₁₈O) and Limonene (C₁₀H₁₆O₄), which also responsible for their effect on the microbial growth (El-Fadaly *et al.*, 2018).

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

CONCLUSION

The weights of Ras cheese wheels ranged between (1750 – 2000 grams) in 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 anise, crushed fenugreek and with crushed anise after five months storage, and not changes in 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.

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 whole spice which decrease TBC, TFC and LAB were black pepper (15.99%), white pepper (18.72%) and black cumin (31.12%), respectively.

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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 التملح (بعد شهر واحد من التصنيع) 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 جيداً جداً وأعطى شكلاً جديداً عند إضافة النعناع والريحان، حيث أعطى منظر يشبه الجبن الريبفورت. 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 الكراوية بنسبة ٢٤.١٠٪ وقللت الفطريات والخمائر الكلية في حالة الفلفل الأسود بنسبة ٢٩.٢٤٪ وأخيراً إنخفضت أعداد بكتيريا حمض اللاكتيك في حالة الفلفل الأبيض بنسبة ٣٣.٠٨٪.