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Effect of Thyme on The Quality and Shelf Life of Block Processed Cheese

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ABSTRAT

Effect of incorporation of thyme powder in making block processed cheese was investigated. Thyme powder was added in 0.1, 0.2, 0.3, 0.4 and 0.5% as a substitution in the base blend of Ras cheese. The processed product was tested for chemical composition (total solids, fat, total&soluble nitrogen, ash, salt and total volatile fatty acids) in fresh cheese. Physicochemical properties (pH, meltability, and oils separation) and sensory attributes were examined in the fresh processed cheese and throughout 3 months of storage at refrigerator (5ºC) or room temperature (25ºC). Incorporating thyme powder decreased TN, ash, salt in the resultant block processed cheese. Higher pH values with an increase in oil separation and firmness were noticed in cheese with thyme powder. The effect was more noticeable by increasing thyme powder in the blend. The SN and meltability were lower in the treatments with thyme powder than that of the control treatment. All processed cheese treatments were acceptable, and the addition of thyme powder in the blend up 0.1% to 0.3% improved the body & texture and enhanced the flavor and resulted in a better organoleptic quality. Storage of block cheese samples lowerd the pH values, meltability and sensory quality, while SN, oil separation and firmness increased.

Keywords: Processed cheese, thyme powder, chemical composition, meltability, oil separation and sensory evaluation.

INTRODUCTION

Processed cheese is becoming increasingly popular in Egypt and worldwide, with continuous increase in its consumption and production. It represents about a quarter of the total cheese imports of 120 thousand tons. The productions of the processed cheese, either spreadable or block type has reached about 10 thousand tons in the governmental and private sector (Awad *et al*., 2002). Processed cheese is desirable by consumers and producers because it can be made in greater diversity of type and intensity of flavor and texture. Three types of products are distinguished, bock, namely, block, processed cheese food and spread processed cheese. Processed cheese of better keeping quality could be made from several ingredients, by blending shredded natural cheese of different types and content of water, and by heating and constant agitating the blend under partial vacuum until a homogenous mass is obtained. (Mayer 1973Caric and Kalab, 1993). Cheese blend can only be stabilized by adding the emulsifying salt to change it into a homogenous paste. Cheese plend under action of heat contracts and shrivels, changing into a rubber like mass with oil and water separation. Process cheese is one of the most important sources in dairy products of calcium in a balanced diet and a significant source of protein as well as other nutrients. Improving the properties and the nutritive value of the processed cheese could be achieved by using different types, ages of cheese, flavoring materials, emulsifying salts and processing conditions. Many flavors have been used to develop processed such as ham, cucumber, mushrooms, salami, onions, shrimps, tomato juice and pungency mixed peppers (Knez, 1970, Zedan *et al*., 1992).

Thymes is an aromatic plant belonging to the *lamiaceae* family, used for medical and spice purposes almost everywhere in the world Thyme is largely of considerably abundant herb growing at different regions In Africa, and possesses a variety of the growing species of this family. The main uses of thyme in culinary and food processing are defined by the properties of thyme comonents for aroma and flavor, antioxidant and antimicrobial activities. It could also be used in the food and aroma industries as culinary ingredient and it serves as a preservative for foods, especially, because of its antioxidant effect. (Shelef *et al*., 1980, Aureli *et al*., 1992; and Gould 1996, Taylar and Robber, 1999, and Abou Dawood, 1999, Abd-Alla *et al*., 2000 and El-Nemer *et al*., 2003).

This work was then aimed to use different concentration of thyme in making good quality of block process cheese. The effect of these additives on the chemical, microbiological and sensory properties of the resultant cheese were measured during storage.

MATERIALS AND METHODS

Dried thyme was obtained from El Arish, and add at different ratios (0.1 /0.2 /0.3 /0.4 and 0.5%) to the blend used in making the processed cheese .

Ras cheese (fresh and 3 months old) were made as a mentioned by Hofi *et al*., (1970). Block processed cheese was made using Ras cheese and thyme powder in formulating the base blend.The final products were adjusted to contain 50±1% moisture and 45±1% fat in dry matter, 2.5% emulsifying salt (Joha SE) and 0.01% Nisaplin (Danisco cultor Denmark). The suitable amount of fresh and mature Ras cheese, thyme, butter oil, ater, emulsifying salt and Nisaplin as a preservative were added consecutively in a laboratory style-processing kettle locally made in Egypt (Awad, 1996). The mixture was cooked for 8 min. at 85-90ºC using indirect steam at pressure 2.2-5Kg/ cm2. The melted processed cheese was poured into carboard boxes (500g) lined with aluminum foil. The resultant cheese was analyzed when fresh and after 1 and 3 months during storage either at refrigerator (5±2ºC) or room temperature (25±2ºC). the composition of different formulations used is shown in Table (1).

Table 1. Chemical composition of Ras cheese used in formulation of block type processed cheese.

Components	Ras cheese	
	Mature	Fresh
Total solids	65.20	58.89
Fat	32.50	27.47
Total nitrogen	4.90	3.58
Soluble nitrogen	0.769	0.562
Salt	3.76	3.05
Ash	5.38	4.89
pH	4.82	5.30
TVFA	38.5	20.5
Carbohydrate	18.66	19.90

Cheese samples were tested for moisture and ash contents as mentioned in AOAC(1990). Total and soluble nitrogen, fat and salt contents were determined according

to the method described by Ling (1963). Fat was determined in mashed thyme powder using soxhelt method as mentioned in AOAC(1990). Total volatile fatty acids (TVFA) was determined according to Kosiowiski (1982)

Values were expressed as ml of 0.1N NaOH/ 100g.carbohydrate content was calculated by differences as follows: CHO- total solids – (fat+protein+ash+salt).

pH values were measured with a digital pH meter (chemcadet. Cole-palmer) Chicago 1 l by immersing the pH electrode (orion research Inc., Boston. MA) in the cheese samples. Melting quality was determined as described by Arnot *et al*., (1957). Oil separation index of block processed cheese was determined according to Thomas (1973). Firmness of samples was examined by the method recommended by Bourne and Constock (1986). Puncture test was based on using an (0.27)inch diameter of chatillon Gauge K, Tester-Precision instrument model (CAIL719-10). The yield point force was measured Lb/in2. The mean value of 10 recording was calculated and recorded.

Sensory attributes of samples from the resultant processed cheese were evaluated by training members. The sensory evaluation course was carried out in a room lighted with rapture adjusted to be 20ºC. samples were sensory scored according to Meyer (1973) for outer appearance (20 points), body&texture (40 points) as well as aroma&flavor (40 points). Thier were 8-10 panelists for each group of treatments and the course was reported three times.

Statistical analysis were performed according to SAS Institute (1990) using general linear model (GLM) with main effect of treatments. Duncan's multiple range was used to separate among means of three replicates at $p \leq 0.05$

RESULTS AND DISCUSSION

Chemical composition of block processed cheese with thyme powder (Table 3) showed that there were slight differences among all treatments in the total solids and F/DM. Control treatment without thyme powder was of slight and insignificant differences, compared with the processed cheese with level of thyme powder. Results inTable3 also showed slight changes in TN. Salt and TVFA slightly changed in all treatments of processed cheese with thyme powder, as compared with control. Increasing the percentage of thyme powder in the treatment decreased, to some extent, the above contents in the resultant processed cheese. The lower content of TN, ash, salt and TVFA in block processed cheese with thyme powder are mainly due to the lower contents of these components in thyme, compared with the control. The results are in agreement with Awad *et al*. (2003), who examined that addition of materials other than cheese such as fruits, vegetables and spices with low protein content in the base of processed cheese.

Table 2. Composition of different blends used in making of block type processed formulations.

Ingredients Control Ras cheese	Treatments T1	T2	T3	T4	T5
Mature	19.45	19.45	19.45	19.45	19.45	19.45
Fresh	61.27	61.27	61.27	61.27	61.27	61.27
Butter oil	0.45	0.45	0.45	0.45	0.45	0.45
Thyme powder	---	0.1	0.2	0.3	0.4	0.5
Emulsifying	2.5	2.5	2.5	2.5	2.5	2.5
Nisaplin	0.01	0.01	0.01	0.01	0.01	0.01
Water	16.32	16.32	16.32	16.32	16.32	16.32

Table 3. Chemical analysis of block processed cheese with different ratios of thyme powder in the base blend.

Treatments	Total solids	Fat/ DM	Total nitrogen	Ash	Salt	TVFA
Control	51.30 ^{B}	45.0 ^{C}	2.40 ^{A}	5.75 ^{B}	3.0 ^{A}	7.40 ^{C}
T_1	51.23 ^{B}	45.0 ^{B}	2.40 ^{A}	5.78 ^{B}	2.5 ^{A}	7.45 ^{B}
T_2	51.20 ^{B}	45.6 ^{B}	2.38 ^{B}	5.85 ^{A}	2.5 ^{A}	7.48 ^{B}
T_3	51.18 ^{C}	45.8 ^{B}	2.36 ^{B}	5.90 ^{A}	2.0 ^{B}	7.55 ^{A}
T_4	51.15 ^{C}	46.0 ^{A}	2.37 ^{B}	5.95 ^{A}	2.0 ^{B}	7.50 ^{A}
T_5	51.50 ^{A}	46.3 ^{A}	2.35 ^{B}	5.98 ^{A}	2.0 ^{B}	7.56 ^{A}

It could be seen from the results indicated in Table (4) the lowest pH value were detected in control treatment, while treatment with 0.5% thyme powder in the blend resulted in the highest pH value .Adding Ras cheese with thyme powder in the blend resulted in higher pH values of block-processed cheese. This could be due to the high pH value of thyme powder used in all treatments (Table 4), compared with the pH of Ras cheeses (4.46– 5.27) (Table 4).

The pH values decreased with extending the storage period. The decrease was more pronounced in samples stored at room temperature. The reduction in pH value during storage could be attributed to the limited growth and activity of the resistant microflora and enzymes in the product, which leads to hydrolysis of lactose to some acids. It could be also due to the hydrolysis of polymerized phosphate present in the emulsifying salts and their interaction with protein. An extensive hydrolysis occurred in lactose and polymerized phosphate at higher temperature (25ºC), which leads to more reduction in the pH values. These results agree with Tamime *et al*., (1990); Younis *et al*., (1991); Aly *et al*., (1995) and Awad *et al*., (2003)

Table 4. pH values of block processed cheese with different ratios of thyme powder in the base blend.

Treatments	Fresh	1 month		3 months	
		5ºC	25ºC	5ºC	25ºC
Control	5.46 ^{Ba}	5.42 ^{Ba}	5.40 ^{Bab}	5.35 ^{Bab}	5.27 ^{Bb}
T_1	5.57 ^{ABa}	5.53 ^{ABa}	5.51 ^{Bab}	5.46 ^{Bab}	5.35 ^{Bb}
T_2	5.64 ^{Aba}	5.60 ^{ABa}	5.55 ^{Aab}	5.52 ^{ABb}	5.45 ^{ABb}
T_3	5.71 $^{C Aa}$	5.68 ^{ABa}	5.65 ^{Aab}	5.62 ^{ABb}	5.50 ^{ABb}
T_4	5.75 ^{Aa}	5.70 ^{Aa}	5.68 ^{Aab}	5.66 ^{Aab}	5.58 ^{Ab}
T_5	5.79 ^{Aa}	5.75 ^{Aab}	5.70 ^{Aab}	5.70 ^{Aab}	5.60 ^{Ab}

See table (2) for details

A.B.C.: Means with same letter among treatments in the same storage period are not significantly different

a.b.c.: Means with same letter in the same treatments during storage period are not significantly different

Soluble nitrogen content (S.N) of block processed cheese was affected by adding thyme powder in the base blend cheese (Table 5). Among fresh processed the highest SN content. Adding thyme powder in the base formula increased SN content being highest with 0.5% of thyme powder. Differences in SN contents are due to different amounts of mature and fresh Ras cheese used in formulating blends. The higher ratio of thyme powder in the blends increased the SN content due to higher SN in Ras cheese base compared to thyme powder. Soluble nitrogen increased during storage in all treatments including the control being higher in cheeses stored at room temperature. The

changes in SN during storage could be the result of enzymatic activity of resistant proteinases present in the product. It could also be due to the hydrolysis of poly phosphates in emulsifying salts which cause more solubization of proteins. Meanwhile, these results are in agreement with that reported by Amine *et al*., (19900), Abdel El-Hamid *et al*., (2000a.b) and Awad *et al*., (2003)

Table 5. Soluble nitrogen content of block type processed cheese with different ratios of thyme powder in the base blend.

Treatments	Fresh	1 month		3 months	
		5ºC	25ºC	5ºC	25ºC
Control	2.356 ^{CDb}	2.375 ^{CDb}	2.397 ^{CDb}	2.399 ^{CDb}	2.589 ^{ABa}
T_1	2.356 ^{DEb}	2.370 ^{DEb}	2.390 ^{DEb}	2.369 ^{DEb}	2.45 ^{Bb}
T_2	2.361 ^{CDb}	2.381 ^{CDb}	2.45 ^{CDb}	2.392 ^{CDb}	2.420 ^{ABa}
T_3	2.367 $^{C\ Bcb}$	2.397 ^{Bcb}	2.56 ^{Bcb}	2.412 ^{Bcb}	2.59 ^{BBa}
T_4	2.373 ^{ABb}	2.405 ^{ABb}	2.677 ^{ABb}	2.425 ^{ABb}	2.725 ^{Aa}
T_5	2.379 ^{Ab}	2.416 ^{Ab}	2.688 ^{Ab}	2.456 ^{Ab}	2.765 ^{Aa}

See table (2) for details : Statistical analysis of the data showed significant differences among treatments and during storage of each treatments up to 3 months particularly at 25ºC

Incorporating thyme powder in block processed cheese blend resulted in an increase in oil index values (Table 6), and values increased with thyme powder in the blend. This could be related to the decrease in the intact casein which occurred due to replacing Ras cheese with thyme powder in the processed cheese formula. The higher ratios of thyme powder in the blend could lead to a loss in protein network, and in the property of fat emulsification. So it's easy to lose the difference among treatment in oil index could be due to the variations in amount of Ras cheese base and total nitrogen as well as the pH values in the final product. Which may affect the strength of protein network in the resultant processed cheese.

Oil separation index increased with extending the storage period particularly at higher temperature. This could be correlated to the decrease in pH values and the increase in soluble nitrogen count (more protein decomposition). Which resulted in lower degree of emulsification and higher fat leakage. The data agree with the finding of Younis *et al*., (1991 b) and Abd El-Hamid *et al*., (2000c).

Table 6. Oil separation index of block type processed cheese with different ratios of thyme powder in the base blend.

Treatments	Fresh	1 month		3 months	
		5ºC	25ºC	5ºC	25ºC
T_1	2.5 ^{Ee}	3.5 ^{Dd}	5.0 ^{Cd}	55 ^{Cc}	7.0 ^{Bb}
T_2	2.8 ^{Ee}	4.0 ^{Dd}	5.8 ^{Cb}	6.2 ^{Bc}	7.5 ^{Bb}
T_3	3.0 ^{Ed}	4.6 ^{Cd}	6.2 ^{Cb}	7.0 ^{Bb}	8.3 ^{Aa}
T_4	3.3 ^{Dd}	4.8 ^{Cd}	6.5 ^{Cb}	7.5 ^{Bb}	8.6 ^{Aa}
T_5	3.5 ^{Dd}	5.0 ^{Cd}	6.7 ^{Cb}	7.8 ^{Bb}	8.9 ^{Aa}
T_6	3.7 ^{Dd}	5.5 ^{Cc}	7.0 ^{Bb}	7.5 ^{Bb}	8.0 ^{Ab}

See table (2) for details

Table (7) showed that meltability values of block processed cheese with thyme powder were higher than that of control. The meltability significantly increased with increasing the thyme powder ratio in the blend. The increase in meltability of treatments with thyme powder could be due to the higher ratio of thyme oil (Table 6), which might act as stabilizer and lights bind the water in the resultant product. This is due to emulsion and make it less meltable. The meltability values increased with increasing the thyme powder. This is due to the decease occurred in the intact casein of the blend with increasing the thyme powder. The lower casein and protein in the formula resulted in a weak processed cheese emulsion (Cavalier-Salou and Cheftel 1991) and Awad (1996).

The cheese meltability showed a tendency toward decrease. During storage meltability values increased in all treatments even in control. The increase was more pronounced when the cheese was stored at room temperature (25± 2ºC). This changes could be due to the increase in soluble nitrogen content during storage.

Table 7. Meltability values (mm) of block type processed cheese with different ratios of thyme powder in the base blend.

Treatments	Fresh	1 month		3 months	
		5ºC	25ºC	5ºC	25ºC
T_1	65.50 ^{CD}	65.60 ^{CD}	65.90 ^{Cc}	62.20 ^{Cc}	66.50 ^{Cb}
T_2	65.50 ^{CD}	65.60 ^{CD}	66.22 ^{CD}	66.50 ^{Cc}	66.86 ^{Bc}
T_3	65.80 ^{Cc}	66.76 ^{Bc}	67.50 ^{BC}	67.90 ^{Bb}	68.50 ^{Ab}
T_4	66.00 ^{Cb}	66.95 ^{Bb}	67.75 ^{Bb}	68.50 ^{Ab}	68.85 ^{Aa}
T_5	66.50 ^{Bb}	66.90 ^{Bb}	68.50 ^{Aa}	68.85 ^{Aa}	69.00 ^{Aa}
T_6	67.88 ^{Ba}	68.00 ^{A}	68.50 ^{Aa}	68.90 ^{Aa}	69.20 ^{Aa}

See table (2) for details

Sensory evaluation of block processed cheese treatments Table (8) showed that there were no changes in the appearance of processed cheese with adding thyme powder up to 0.2%. Increasing the ratio up to 0.3% slightly affected the appearance, while with 0.5% the block cheese showed slight off color. The appearance of final product is affected by the ingredients used in formulating the blend. The body and texture of block processed cheese improved and the cheese showed more ability to slice with adding thyme powder in the blend. Treatments with up to 0.2-0.3% showed firm enough body and good texture with no defects while with higher thyme ratios the body started to be more hard and the texture showed slightly fine thyme powder particles which were more obvious with 0.6% thyme powder. As can be seen form Table (8). The flavor of resultant cheese enhanced and became more preferable to panelists with incorporating thyme powder in the blend up to 0.2-0.3% compared to the control. It seems that the flavor of cheese base with thyme powder at certain extent is more preferable than

that of cheese base alone. At 0.6% panels started to detect thyme powder flavor in the product but they couldn't recognize it at lower ratios. Total scores of black cheeses indicated that all resultant products were acceptable but addition of thyme powder in the blend up to 0.1-0.4% gave a better organoleptical quality compared to the control one. Only treatments with 0.6% exhibited significantly lower quality attributes compared to other treatments. In stored block processed cheese samples. The trend among treatments continued as same as in fresh samples. Storage of cheese products up to 3 months slightly lowered the total quality attributes and this effect was more marked in cheese samples stored at room temperature. These finding are in agreement with those of Tamime *et al*., (1990). AbdEl-Hamid *et al*., (2000) and El-Shobrawy *et al*., (2002).

Table 8. Sensory evaluation of block type processed cheese with different ratios of thyme powder in the base blend.

Storage period temp.	Character assessed		T_1	T_2	T_3	T_4	T_5	T_6
Fresh	O.A	(20)	20^{Aa}	20^{Aa}	19^{Aa}	19^{Aa}	18^{Ba}	17^{Ba}
	B&T	(40)	38^{Aba}	37^{Aa}	37^{Aa}	36^{Abb}	36	35^{Ba}
	A&F	(40)	37^{Ba}	37^{Aa}	36^{Aa}	36^{Aa}	35	34^{Bba}
	T	(100)	95^{Aa}	94^{Aa}	92^{Aa}	91^{Aa}	99	86^{Ba}
5ºC	O.A	(20)	19^{Ab}	19^{Ab}	19^{Ab}	18^{ABb}	17^{ABb}	15^{Bb}
	B&T	(40)	36^{Ab}	36^{Ab}	35^{Ab}	35^{Ab}	34^{Bb}	33^{Bb}
	A&F	(40)	35^{AB}	34^{Ab}	34^{Ab}	34^{Bb}	33^{Bb}	32^{Bb}
	T	(100)	90^{Ab}	89^{Ab}	88^{Ab}	88	84^{ABb}	80^{Bb}
3Month	O.A	(20)	18^{Ab}	19^{Ab}	17^{Ab}	18^{ABb}	17^{ABb}	14^{Bb}
	B&T	(40)	35^{Ab}	35^{Ab}	34^{Ab}	34^{Ab}	34^{Bb}	33^{Bb}
25ºC	A&F	(40)	35^{AB}	34^{Ab}	34^{Ab}	33^{Bb}	33^{Bb}	31^{Bb}
	T	(100)	88^{Ab}	88^{Ab}	85^{Ab}	86	84^{ABb}	78^{Bb}

O.A: Outer appearance **B&t: Body&texture** **A&F: Aroma&flavor** **T: Total score**

Table (9) shows that the total count of control significantly increased ($p \leq 0.05$) through the storage period while, counts of different treatments decreased up to first month then slightly till the end of storage period. Thyme powder concentration of 0.10, 0.20, 0.30, 0.40 and 0.50% respectively had the highest effect on (TC) especially 0.50% thyme. This suggests that the added spices (thyme powder) had antimicrobial effect on cheese microflora. These results are in agreement with that of Abd-Alla *et al*., (2000) and Hussein (2004). Statistical analysis showed significant differences in (TC) as affected by addition and storage period. The changes in psychrophilic bacteria count (PSC) followed similar trends as the (TC) Table (9). They increased all through the storage reaching a maximum after third 3 month of storage. To decrease the counts of psychrophilic and decrease ran parallel to the concentration of added thyme powder. Statistical analysis revealed significant differences ($p \leq 0.05$) in psychrophilic as affected by added thyme and storage period.

The hardness of processed cheese is shown in Tables (10). The blend without thyme powder was hard than all processed cheeses made from different ratios from thyme powder. Although having the same composition processed made using thyme powder were softer because there were no differences in chemical composition and pH among all processed cheeses, the differences in hardness should be related to characteristics of the Ras cheese. The type, characteristics and age of the base cheese play a major role in controlling the texture, viscoelastic, functional, microstructural and sensorial properties of processed cheese. The modification in the protein network of processed cheese by EPS could be one of the factors influencing hardness of processed cheese. The harness of processed cheese made by using ratios different from powder thyme (Table 10). This is due to changes in the base cheese during ripening. Such changes include proteolysis protein hydration, water redistribution, solubelization of colloidal calcium phosphate (18.20 and 30). The hardness of EPS Ras cheese at one month was lower ($p \leq 0.05$) than that at three month. This finding indicates that the effect of EPS on processed cheese characteristic is limited compared with other factors such as changes that take place during first month of base cheese ripening. The results also show the chewiness, which is the state ready for swallowing is lower in processed cheese made with powder thyme than in that without thyme powder (control, chewiness and gumminess are related to cheese hardness (Table 10).

Table 9. Changes in total count and clostridium of block processed cheese with different ratios of thyme powder in the base blend on 5C.

Treatments	Storage period (days)		
	Total counts (count x 10^6 cfu/g)		
	Fresh	1 month	3 month
T_1	35^{Bb}	42^{Ab}	73^{Aa}
T_2	22^{Cc}	6.7^{Eb}	12.5^{Dd}
T_3	20^{Cc}	4.2^{Eb}	9.6^{Dd}
T_4	18^{Dc}	3.6^{Ec}	7.8^{Dd}
T_5	14^{Dd}	2.5^{Ed}	6.5^{Dd}
T_6	10^{Dd}	2.0^{Ee}	4.6^{Dd}
	Closridium(count x 10^4 cfu/g)		
T1	ND	2.40^{Bc}	6.10^{Aa}
T2	ND	2.70^{Bc}	3.10^{Bb}
T3	ND	2.40^{Bc}	2.90^{Bb}
T4	ND	2.30^{Bd}	2.70^{Bc}
T5	ND	2.10^{Cd}	2.50^{Bc}
T6	ND	1.80^{Cd}	2.20^{Bd}

See table (2) for details

The major differences in hardness, gumminess and chewiness between the processed made from thyme

powder and control may be related to presence of thyme powder which could affected characteristics of processed cheese. This finding demonstrates the impact of the changes in base cheese during first month of ripening which might be more important than those occurring thereafter on the characteristics of the resulting processed cheese.

Table 10. Rheological properties of block type processed cheese with different ratios of thyme powder in the base blend.

	Hardness Months			Adhesiveness Months			Cohesiveness Months			Gumminess Months			Chewiness Months			Springiness Months		
	Fresh	1	3	Fresh	1	3	Fresh	1	3	Fresh	1	3	Fresh	1	3	Fresh	1	3
T1	29.1	53.3	81.6	0.157	0.102	0.083	0.83	0.73	0.73	24.1	38.9	59.5	45.47	118.07	184.85	1.89	3.03	3.11
T2	19.2	31.5	65.3	0.309	0.317	1.093	0.79	0.75	0.68	14.3	21.00	48.2	25.03	58.49	179.33	1.69	2.79	2.56
T3	22.3	23.2	49.2	0.304	0095	1.272	0.72	0.69	0.74	17.17	17.3	33.7	33.32	42.01	109.33	1.75	2.42	3.25
T4	4.3	15.3	37.9	0.134	0.925	0.515	0.76	0.75	0.73	3.1	10.6	28.0	9.15	28.41	69.55	1.88	2.41	2.45
T5	7.7	18.9	22,0	0.100	0.467	0.588	0.75	0.67	0.78	5.9	14.2	16.8	8.05	38.31	42.86	1.55	2.42	2.66
T6	7.6	19.5	21.8	0.74	0.495	0.569	0.72	0.66	0.63	5.7	10.6	14.8	7.95	28.40	39.69	1.42	2.31	2.68

In conclusion, block processed cheese can be produced with adding thyme powder up to 0.5% in the blend without any significant difference than that of control without addition. Impact of thyme powder up to 0.3% in the blend produced highly acceptable block cheese with even improved body&texture and much better flavor moreover.

CONCLUSION

Block processed cheese can be produced with adding thyme powder up to 0.4% in the blend without any significant difference than that of control without addition. Impact of thyme powder up to 0.4% in the blend produced highly acceptable block cheese with even improved body&texture and much better flavor. Moreover, the properties of thyme components for aroma and flavor, antioxidant and antimicrobial activities. The thymol and carvacrol, present in thyme essence, as well as the flavonoids and other polyphenols are considered to be involved in the antioxidant activity.

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تأثير إضافة الزعتر على جودة وفترة حفظ الجبن المطبوخ

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تم في هذا البحث دراسة إضافة الزعتر المجفف في صناعة الجبن المطبوخ وقد تم إضافة الزعتر المجفف إلى خلطة الجبن المطبوخ بنسب 1، . ، 2، 3، 4، 5، % إلى الخلطة الأساسية مع دراسة الخواص الكميائية (الجوامد ، الدهن ، النيتروجين الكلى والذائب ، الرماد ، الملح ونسبة الأحماض الدهنية الطيارة) بجانب تقدير الخواص الفيزيوكميائية (pH ، القابلية للانصهار ، القابلية لانفصال الدهن) كذلك تم تحكيم الجبن الناتج حسياً وهو طازج وأثناء التخزين في الثلاجة او على درجة حرارة الغرفة وتشير النتائج إلى ان إضافة الزعتر المجفف يؤدى إلى ارتفاع محتوى الجبن من النيتروجين الكلى والذائب والرماد والاحماض الدهنية الطيارة والقابلية للانصهار مع زيادة قيم القابلية لانفصال الدهن وكان التأثير واضح اكثر مع زيادة نسبة الزعتر المجفف المضافة للخلطة كما توضح النتائج ان جميع معاملات الجبن المطبوخ مقبولة حسيا وادت اضافة الزعتر المجفف حتى نسبة 4, .% الى حسن ملحوظ فى نكهة الجبن المطبوخ وقبليتها للتقطيع إلى شرائح وقد تمكن المحكمين من تميز الزعتر المجفف حتى 4, . ، 5, .% وهو مالم يحدث مع النسب الاقل اقل من (3, .%) وادى تخزين الجبن المطبوخ لمدة ثلاثة شهور إلى انخفاض ال pH وكذلك القابلية للانصهار