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IMPROVING QUALITY OF KAREISH CHEESE BY GAMMA IRRADIATION

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ABSTRACT: ***This investigation aims to study the possibility to utilize gamma irradiation to prolong the shelf-life of Kareish cheese. Kareish cheese was made from fresh buffalo's skim milk, and subjected to γ-irradiation with 0.0, 1.5 , 2.5 and 3.5 kGy, and stored in refrigerator. The sensory, microbial and chemical properties of Kareish cheese were evaluated during cold storage. The obtained results indicated that, the counts of total viable bacteria, molds and yeasts were decreased by applying gamma irradiation. Irradiation treatment caused a significant decrease in water soluble nitrogen, acidity ,counts of total viable bacterial , mould and yeast. The overall acceptability scores, moisture content and pH value of all treatments were gradually decreased as storage period proceeded, while acidity, total nitrogen and water soluble nitrogen of all treatments were gradually increased. In addition treatments of cheese with 1.5, 2.5 and 3.5 kGy respectively prolonged the shelf-life of Kareish cheese to 42, 48 and 54 days compared to 12 days for control treatment.***

Key words ***: Kareish cheese , gamma rays ..***

INTRODUCTION

The use of ionizing radiation as a food preservation technique has been recognized for many years as a means to reduce food losses, improve food safety, and extend shelf life. Furthermore, irradiation can be an effective way of reducing the incidence of food borne disease and treating a variety of potential problems in food supplies. The treatment of food with ionizing radiation is one of the most thoroughly researched techniques available to the food processing industry, and its use is currently permitted for use in over 55 countries worldwide for various application and purposes in a wide variety of foodstuffs and more than 30 countries have commercialized the technology *(IAEA, 2009)*, while it is not allowed in other countries. In 1981, the ICGFI (FAO/IAEA/WHO Expert Committee on the Wholesomeness of Irraditated Food) stated that "the irradiation of any food commodity up to an overall average dose of 10 kGy presents no toxicological hazard, introduces no special nutritional or microbiological problems" *(WHO, 1981)*.

Kareish cheese is one of the most popular cheese varieties consumed in Egypt especially the countryside owing to its high protein and low fat and price. The consumption of Kareish cheese has been increased lately by some people who are suffering from diabetes, obesity, heart diseases and liver diseases.

Growths of mold and yeast on the surface of Kareish cheese is the problem affecting the shelf –life during storage of Kareish cheese. The growth of mould and yeast on cheese surface not only detracts from the appearance but also may jeopardize the flavour of cheese. In addition growth of mould on cheese may produce the mycotoxins. The objectives of this study were to evaluate the possibility of improving the quality and extending the shelf- life of Kareish cheese by using gamma irradiation and to monitor the changes in chemical, microbiological and sensory properties during storage of Kareish cheese.

MATERIALS AND METHODS

Starter culture of Kareish cheese

***Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp*. bulgaricus* were obtained from Mircen (Ain Shams Unv. Egypt). These strains were activated separately three successive transfers in sterile skim milk.**

Cheese making

Fresh whole buffaloes' milk obtained from the herd of the Faculty of Agriculture, Minufiya University, Shibin El –Kom was heated to 40^{o}C and separated in the piolet plant of Department of Dairy Science and Technology Faculty of Agriculture, Minufiya University. The obtained skim milk was heated at 85 °C for 15 min. 2% of the starter (*Streptococcus thermophilus* and *lactobacillus delbrueckii* subsp. *bulgaricus)* was added to the skim milk at 41 °C and maintained at this temperature until complete coagulation. The resulting curd was scooped into three of the cheese mats and was left to drain. After two days, the cheese was weighted and then salted by 3% salt. The obtained cheese was divided into 60 equal pieces each piece 100 gram and each piece was packed into plastic packet and sealed. The 60 pieces were divided into four groups (each group 15 pieces). The four groups of Kareish cheese were exposed to gamma irradiation at doses 0, 1.5, 2.5 and 3.5 kGy and stored in a refrigerator at 5±1°C. The whole experiment was duplicated.

Chemical analysis

The moisture, total nitrogen and water soluble nitrogen contents, titratable acidity and pH values of cheese were determined according to *Ling (1963).*

Sensory evaluation of cheese

The pannel consisted of 5 judges from the staff members of the Food unit; Plant Research Department, Nuclear Research center , Atomic Energy Authority were evaluated Kareish cheese samples according to score sheet suggested by *Younis (1983).*

Microbiological Analysis

Total viable bacterial counts was determined using plate count agar media *(APHA, 1992).*

Mould and yeast counts were counted on Oxytetracycline glucose yeast extract agar medium according to *Oxoid (1982).*

Statistical analysis:

Factorial experiment was used to analyze all data and the Student Newman Keuls test was followed to make the multiple comparisons *(Steel and Torrie, 1980)* using Costat program. Significant differences were calculated at $p \leq 0.05$.

RESULTS AND DISCUSSION

Moisture content of all cheese treatments decreased significantly during storage period (Tables 1, 9 and 10). These results are in agreement with those reported by (Abou- Dawood and Abdou (1973); Mahran *et al.* (1976), El-Safty and Mehanna (1977), Ibrahim (1984), El-Batawy *et al.* (1988), Ibrahim *et al.* (1990), Kebary *et al.* (1997) and El-Sonbaty (2009). Irradiation of cheese treatments caused a significant decrease in moisture content of the resultant cheese treatments (Tables 1, 9 and 10). This decrease was proportional to the dose of irradiation. The reduction of moisture content might be due to the effect of irradiation, which decrease the water holding capacity of casein and subsequently the loss of whey and reduce the moisture content. These results are in accordance with those reported by Ibrahim (1984) and El-Batawy *et al.* (1990). Cheese treated with 2.5 and 3.5 kGy were significantly ($p \leq 0.05$) different from in moisture content control cheese, while there were not differ significantly ($p \leq 0.05$) when treated with 1.5 kGy (Tables 1, 9 and 10).

Total nitrogen content per dry matter of all cheese treatments did not change significantly ($p > 0.05$) as storage period proceeded (Tables 2, 9 and 10). Similar results were reported by El-Batawy *et al.* (1981), Badawi (1987), (1998), Khader *et al.* (1995) and Kebary *et al.* (1996). Total nitrogen content of all cheese treatments did not differ significantly ($p > 0.05$) from each other, which means that the irradiation treatments did not have a significant effect on total nitrogen content of Kareish cheese. The same trend was noticed by Ibrahim (1984), on Domiati cheese, El-Batawy *et al.* (1988) on Kareish cheese and Hammam (2005) on Ras cheese.

Table (1): Moisture content of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments / Storage period (days)	C*	T1	T2	T3
0	77.18	76.17	76.05	75.73
6	75.81	74.49	74.49	72.71
12	®75.4	74	73.74	72.12
18		73.25	72.31	69.95
24		72	71.7	69
30		71.11	70.31	68
36		69.9	68.5	65.9
42		®68.00	66.22	64.3
48			®64.50	62.1
54				®60.91

® = Unacceptable organoleptically and rejected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

Table (2): Total nitrogen % (on dry matter) of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments Storage period (days)	C*	T1	T2	T3
0	2.75	2.86	2.81	2.72
6	2.88	2.84	2.56	2.53
12	®2.80	2.88	2.75	2.93
18		2.87	2.75	2.78
24		2.85	2.89	2.77
30		2.78	2.77	2.96
36		2.76	2.84	2.82
42		2.88®	2.74	2.8
48			2.70®	2.89
54				2.72®

® = Unacceptable organoleptically and rejected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

Water soluble nitrogen content of all cheese treatments increased significantly during storage period (Tables 3, 9 and 10). This might be due to the protein degradation into water soluble nitrogenous compounds. These results are in agreement with those reported by Abou- Dawood and Abdou (1973), Mahran *et al.* (1976), El Safty and Mehanna (1977), El-Batawy *et al.* (1988), Ibrahim (1984) Kebary *et al.* (1997) and El-Sonbaty (2009) . Irradiation of cheese treatments caused a significant increase in water soluble nitrogen content of fresh cheese treatments (Tables 3, 9 and 10). This might be due to

the effect of gamma rays on enhancing the breakdown of insoluble protein. These results are in accordance with those reported by Umemato *et al.* (1968), Ibrahim (1984), El-Batawy *et al.* (1987) and Hammam (2005). Umemato *et al.* (1968) observed that, gamma irradiation of casein solution resulted in a progressive degradation of protein and liberation of tyrosine and non-protein nitrogen. Ibrahim (1984), mentioned that the increase of water soluble nitrogen. is probably due to the degradation of protein by gamma irradiation or production of proteolytic mutants of lactobacilli as suggested by Singh and Ranganathan (1974). Irradiation caused a significant decrease in the water soluble nitrogen content of cheese treatments during storage period (Tables 3, 9 and 10). There were negative correlation among irradiation doses and water soluble nitrogen content of cheese, which means that increasing the irradiation dose, decreased water soluble nitrogen content of cheese. These results might be due to the destructive effect of gamma irradiation on proteolytic bacteria. These results are agreement in with those reported by Ibrahim (1984) and El-Batawy *et al.* (1988) who noticed a destructive effect against total bacterial count that was induced as a result of exposing cheese to gamma rays which affect the water soluble nitrogen development of Kareish cheese during storage.

Table (3): Water soluble nitrogen content of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments / Storage period (days	C*	T1	T2	T3
0	0.22	0.22	0.24	0.26
6	0.31	0.27	0.28	0.29
12	0.38®	0.30	0.31	0.31
18		0.32	0.33	0.33
24		0.36	0.36	0.35
30		0.39	0.38	0.37
36		0.42	0.41	0.39
42		0.45®	0.44	0.42
48			0.46®	0.44
54				0.45®

® = Unacceptable organoleptically and rejected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

Titratable acidity values were nearly the same in fresh Kareish cheese treatments. Titratable acidity of fresh Kareish cheese treatments ranged from 1.29 – 1.30%. Titratable acidity of all cheese treatments increased significantly ($p \leq 0.05$) as storage period advanced (Tables 4, 9 and 10). The increase of titratable acidity is most likely due to the fermentation of residual

lactose. Similar results were reported by Abou-Dawood and Gomai (1977), Abdou *et al.* (1977), El-Shibiny *et al.* (1983), Salem and Abeid (1996) Kebary *et al.* (1997) and El-Sonbaty (2009). Irradiation caused a significant decrease in the titratable acidity of cheese treatments (Tables 4, 9 and 10). There were negative correlation among irradiation doses and acidity of cheese, which means that increasing the irradiation dose decreased the acidity of cheese. Cheese treated with 3.5 kGy had 1.72% TA after 54 days, while control cheese had 1.98 after 12 days only. These results might be due to inhibitory effect of irradiation against different microbial growth particularly lactic acid bacteria and consequently led to prolong the shelf-life of cheese. In addition, the preservative action of irradiation which due to the destructive effect on the cheese microorganisms combined with refrigeration storage improving the keeping quality of irradiated cheese and extended its shelf-life to 42 – 54 days although they contain low salt content (3%). Similar results were reported by El-Batawy *et al.* (1988) who noticed a destructive effect against total bacterial count was induced as a result of exposing cheese to gamma rays which affect the acid development of Kareish cheese during storage.

Table (4): The acidity content of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments / Storage Period (days)	C*	T1	T2	T3
0	1.3	1.3	1.3	1.29
6	1.84	1.41	1.33	1.29
12	1.98®	1.54	1.39	1.32
18		1.77	1.44	1.4
24		1.8	1.51	1.44
30		1.83	1.59	1.48
36		1.9	1.64	1.55
42		1.96®	1.68	1.62
48			1.72®	1.66
54				1.72®

® = Unacceptable organoleptically and rejected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

It is obvious that the pH values of fresh Kareish cheese treatments were almost similar and ranging from pH 4.70 to 4.73. The pH values of the control cheese decreased significantly ($p \leq 0.05$) and reached 4.30 after 12 days of cold storage only, while irradiated cheese treatments reached 4.28, 4.33 and 4.34 after storing for 42, 48 and 54 days for cheese treatments irradiated with 1.5, 2.5 and 3.5 kGy, respectively. Irradiation caused a significant ($p \leq 0.05$) increase in the pH values of cheese treatments (Tables 5, 9 and 10). There

were positive correlation among irradiation doses and pH values of cheese, which means that increasing the irradiation dose increased the pH values of cheese treatments. Control cheese exhibited the lowest pH value after 12 days of storage period, while cheese treated with 3.5 kGy exhibited the highest pH value at the same days followed by treatment treated with 2.5 kGy, then cheese treated with 1.5 kGy (Tables 5, 9 and 10).

Table (5): The pH value of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments / Storage period(days)	C*	T1	T2	T3
0	4.73	4.7	4.7	4.7
6	4.44	4.58	4.68	4.69
12	4.30®	4.42	4.49	4.67
18		4.35	4.45	4.55
24		4.33	4.4	4.52
30		4.31	4.37	4.45
36		4.28	4.36	4.45
42		4.28®	4.34	4.43
48			4.33®	4.36
54				4.34®

® = Unacceptable organoleptically and rejected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

Table (6): Total viable bacterial counts of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments / Storage period(days)	C*	T1	T2	T3
0	5×10^{7}	3×10^{6}	8×10^{5}	9×10^{4}
6	3×10^{6}	8×10^{5}	3×10^{5}	6×10^{4}
12	12×10^{5}®	2.6×10^{4}	12×10^{4}	2.6×10^{4}
18		18×10^{4}	7×10^{4}	10×10^{3}
24		13×10^{4}	3×10^{4}	7×10^{3}
30		3×10^{4}	11×10^{3}	3×10^{3}
36		18×10^{3}	7×10^{3}	23×10^{2}
42		13×10^{3}®	5×10^{3}	16×10^{2}
48			3×10^{3}®	11×10^{2}
54				7×10^{2}®

® = Unacceptable organoleptically and rejected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

These results might be due to the inhibitory action against different microbial growth particularly lactic acid bacteria and consequently led to prolong the shelf life of cheese. These results are in agreement with those reported by El-Batawy *et al.* (1988) on Kareish cheese and Ibrahim (1984) on Domiati cheese.

Total viable bacterial count of fresh cheese were 5×10^7, 3×10^6, 8×10^5 and 9×10^4 cfu g^{-1} for C, T_1, T_2 and T_3, treatments respectively while, the corresponding values at 12th days were 12×10^5, 2.6×10^4, 12×10^4 and 2.6×10^4 cfu g^{-1} in the same order. Irradiation caused a great reduction in the total viable bacterial count reaching 3×10^6, 8×10^5 and 9×10^4 cfu g^{-1} after applying the irradiation treatment. The rates of destruction due to radiation effect were at most one , two and tree log cycles for T_1, T_2 and T_3 treatments successively. Total viable bacterial counts of all cheese treatments decreased gradually as storage period progressed and reaching 13×10^3, 3×10^3 and 7×10^2 cfu g^{-1} at the end of storage period (42 , 48 and 54 days, respectively) (Table 6). These findings are in agreement with those obtained by Hammam (2005) who found that total bacterial count of irradiated Ultrafiltated skimmed milk cheese was decreased during the storage periods (4 weeks). El-Batawy *et al.* (1988) observed the same effect on irradiated and non irradiated Kareish cheese. Similar results were stated by El-Batawy *et al.* (1987) on Ras cheese and Ewais *et al.* (1989) on Bluecheese.

The count of mould and yeast in fresh samples were 9×10^1, 3×10^1 for control and T_1 treatments while T_2 and T_3 treatments were free from mould and yeast . Mould and yeast count were not detected in treatments T_2 and T_3 which treated with 2.5 and 3.5 kGy respectively during the first 6 and 12 days of storage period (Table 7), then moulds and yeasts appeared and increased slightly up to the end of storage period. The same trend was stated by El-Batawy *et al.* (1988) on nonirradiated and irradiated Kareish cheese. Control cheese showed a gradual increase in moulds and yeasts counts during the cold storage period and reaching 1.9×10^4 cfu g^{-1} after 12 days, when it was rejected. On the other hand mould and yeasts counts were slowly increased and reached to 3.3×10^3, 3×10^3 and 2.2×10^3 cfu g^{-1} after cold storage for 42, 48 and 54 days for T_1, T_2, and T_3 treatments, respectively.

It is obvious that the shelf-life or the keeping quality of irradiated cheeses were extended to 42, 48 and 54 days. This can be attributed to the destructive effect of gamma irradiation on the moulds and yeasts which are accounted as major factors in cheese spoilage even under cold storage conditions. The obtained results agree with similar results reported by El-Batawy *et al.* (1988), Ewais *et al.* (1989) Sallam (2003), Ismael (2004) and Hammam (2005). On the other hand, the rapid deterioration of non-irradiated cheese may be due to the decrease in pH values of cheeses which was found to activate the growth of moulds and yeasts and consequently enhanced cheese spoilage. Therefore, it could be concluded that the combined effect of gamma irradiation and cold storage temperature had an inhibitory effects against

different microbial growth particularly moulds and yeasts and therefore prolong the shelf-life of cheese. The same explanation was mentioned by Krcal *et al.* (1978), Ewais *et al.* (1989), Sallam (2003), Ismael (2004), Hammam (2005) and El-Batawy *et al.* (1988) on irradiated Kareish cheese stored in refrigerator where its shelf- life was prolonged up to 4 weeks compared with three weeks for non-irradiated cheese stored at the same condition.

Table (7): Moulds and yeasts count (cfu g^{-1})of irradiated and non irradiated Kareish cheese during storage in refrigerator

Treatments / Storage period(days)	C*	T1	T2	T3
0	9×10^1	3×10^1	ND	ND
6	7.7×10^2	15×10^1	ND	ND
12	1.9×10^4®	37×10^1	10.6×10^1	ND
18		42×10^1	14.6×10^1	3.9×10^1
24		65×10^1	20×10^1	5×10^1
30		12×10^2	5.4×10^2	16×10^1
36		2.4×10^3	13×10^2	29×10^1
42		3.3×10^3®	1.9×10^3	8.8×10^2
48			3×10^3®	1.7×10^3
54				2.2×10^3®

® = Unacceptable organoleptically and rejected.
ND = Not detected.
C* = cheese treatment was not irradiated (control)
T1 , T2 and T3 cheese treatments irradiated at the dose of 1.5 , 2.5 and 3.5 kGy.

Sensory evaluation scores of all Kareish cheese treatments decreased significantly ($p \leq 0.05$) as storage period advanced (Tables 8, 9 and 10). Fresh cheese treatments were not significantly different from each other, while the unirradiated cheese sample (control cheese) showed a rapid decrease in its quality after 6 days of cold storage showing slimy surface and yeasty flavour and became unacceptable with a slight bitter taste and were rejected after 12 days. This is obviously due to the growth of the microorganisms. Concerning the irradiated cheese with 1.5, 2.5 and 3.5 kGy, it can be observed that applying 2.5 and 3.5 kGy of gamma radiation gave the best result of scoring. All the irradiated cheese samples gained higher scoring points during the storage periods under refrigeration and remained in acceptable conditions (80 points) for 30 and 36 days for cheese irradiated with 2.5 and 3.5 kGy, respectively. It can be observed that as the storage period advanced the irradiated cheese remained in acceptable condition and the cheese flavour was not seriously changed.

Table(8): The sensory evaluation of irradiated and nonirradiated Kareish cheese during storage in refrigerator

Treatments	Sensory evaluation	Storage period (days)									
		Fresh	6	12	18	24	30	36	42	48	54
C*	*Appearance*	10	7	4	–	–	–	–	–	–	–
	Body & Text.	37	32	18	–	–	–	–	–	–	–
	Flavour	49	40	20	–	–	–	–	–	–	–
	Total	96	79	42®	–	–	–	–	–	–	–
T_1	Appearance	10	9	8	8	7.5	6	5	5		–
	Body & Text.	37	37	36	32	30	29	28	22		–
	Flavour	49	49	45	42	41	37	32	25		–
	Total	96	95	89	82	78.5	72	65	52®		–
T_2	Appearance	10	9	9	8	7.5	7	6	6	5	–
	Body & Text.	37	37	36	36	33	31	28	27	25	–
	Flavour	49	49	49	47	45	42	36	30	26	–
	Total	96	95	94	91	85.5	80	70	63	56®	–
T_3	Appearance	10	9	9	9	9	8	8	7	6.5	5
	Body & Text.	37	37	36	36	35	33	33	32	30	24
	Flavour	49	49	49	48	47	41	39	36	30	20
	Total	96	95	94	93	91	82	80	75	66.5	49®

Table (9): Statistical analysis of Kareish cheese properties

Cheese properties	Effect of cheese treatments					Effect of storage (days)			
	Mean Squares	Multiple comparison @				Mean Squares	Multiple comp0arison @		
		control	1.5 kGy	2.5 kGy	3.5 kGy		0	6	12
Moisture%	12.88265*	A	Ab	B	B	9.2140*	A	Ab	B
Total nitrogen (DM%)	0.001254631	A	A	A	A	0.0013777	A	A	A
W.S N.	0.090158*	A	C	B	B	0.1876*	C	B	A
Acidity	0.281977*	A	B	C	D	0.194202*	C	B	A
pH	0.062966*	D	C	B	A	0.16952*	A	B	C
Organoleptic	1105.583*	C	B	A	A	831.25*	A	B	C

*** Significant at 0.05 level.**

@ For each effect the different letters in the mean the multiple comparison are different from each Letter A is the highest mean followed by B , C…..etc.

Table (10): Statistical analysis of irradiated Kareish cheese properties

Cheese properties	Effect of cheese treatments				Effect of storage (days)								
	Mean Squares	Multiple comparison @			Mean Squares	Multiple comparison @							
		1.5 kGy	2.5 kGy	3.5 kGy		0	6	12	18	24	30	36	42
Moisture%	45.3060*	A	B	C	92.3271*	A	B	C	D	E	F	G	H
T.N (DM%	0.0055097	A	A	A	0.0071997	A	A	A	A	A	A	A	A
W.S N.	0.06539*	A	A	B	0.1022*	G	F	E	D	C	B	A	A
Acidity%	0.45548*	A	B	C	0.24491*	H	G	F	E	D	C	B	A
pH	0.11773*	C	B	A	0.1740*	A	B	C	D	E	F	F	G
Organolept	554.3437*	C	B	A	1249.642*	A	B	C	D	E	F	G	H

*Significant at 0.05 level.

@ For each effect the different letters in the mean the multiple comparison are different from each letter A is the highest mean followed by B , C…..etc.

This may be due to the combined effect of cold storage condition and the destructive effect of irradiation on the micro-organisms of the obtained cheese particularly moulds and yeasts and consequently led to prolonging the shelf life of cheese. These results are in agreement with those reported by Ibrahim (1984) and El-Batawy *et al.* (1988). It could be concluded that irradiation of Kareish cheese caused a significant decrease in water soluble nitrogen, titratable acidity, total viable bacterial counts mold and yeast and subsequently increased the shelf-life of cheese up to 54 days with adding 3.00% salt. These resulting cheeses will be very popular because the lower salt content and lower fat content for people suffering from hypertension, heart disease, liver disease, diabetic and the persons who are on diet.

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تحسين جوده خواص الجبن القريش باستخدام أشعه جاما

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الملخص العربي

يهدف هذا البحث إلى دراسة تأثير معامله الجبن القريش بأشعة جاما وتأثير ذلك على كل من الخواص الكيميائية و الميكروبيولوجية والحسية والمقدرة الحفظية للجبن الناتج ولذلك فقد تم تصنيع الجبن القريش من اللبن الجاموسي الفرز وتقسيمها إلى أربع أجزاء عوملت بجرعات صفر و١.٥ و٢.٥ ٣.٥ كيلو جرى على الترتيب ولقد أوضحت النتائج المتحصل عليها مايلي :

أدت معاملة الجبن بأشعة جاما إلى تناقص نسبة الرطوبة وزيادة نسبة النيتروجين الذائب في الماء بعد المعاملة مباشرة في حين لم تتأثر نسبه النيتروجين الكلى .

أدت معاملة الجبن بأشعة جاما إلى تناقص نسبة النتروجين الذائب في الماء والحموضة والعدد الكلى للبكتيريا الحية وعدد الفطريات و الخمائر في حين تحسنت درجات التحكيم الحسي وكان هذا التناقص متناسبا مع شدة المعاملة الإشعاعية.

ازدادت نسبة الحموضة والنتروجين الذائب في الماء وكذلك أعداد الفطريات والخمائر أثناء التخزين بينما انخفضت قيم الرقم الايدروجيني والعدد الكلى للبكتيريا وكذلك درجات التقييم الممنوحة للجبن

أدت المعاملة الإشعاعية إلى زيادة المقدرة الحفظية (القدرة على التخزين) حيث وصلت إلى ٤٢ و ٤٨ و ٥٤ يوما لمعاملات الجبن بجرعات إشعاعية ١.٥ و٢.٥ و٣.٥ كيلو جرى على الترتيب مقارنة بالجبن الغير معامل بالإشعاع التي حفظت لمدة ١٢ يوم فقط .