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USE OF RICE BRAN OIL AS NATURAL ANTIOXIDANT IN WHITE SOFT CHEESE MANUFACTURINE

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ABSTRACT: This study was carried out to determine the antioxidant activity and phenolic compounds of rice bran oil, also to evaluate the effect of added rice bran oil on the oxidative stability, microbial and sensory properties of soft cheese (Domiati). Rice bran oil was used in cheese manufacture at ratio of 0.1 and 0.2% (*W/W*) compared with cheese with 200 ppm of butylated hydroxyl anisol (BHA). Cheese treatments were stored at room temperature for four months and analyzed for chemical, microbiological, oxidative stability indices and sensory properties when fresh and then after 1, 2, 3 and 4 months of storage. Results showed that rice bran oil contains a high content of phenolic compounds and gave high antioxidant activity. Cheeses containing 0.2% of rice bran oil showed the highest oxidative stability (lowest in the peroxide, acid and Thiobarbituric acid (TBA) values), recommended better sensory properties and the lowest microbial count than the other treatments. Generally, cheese samples containing natural antioxidant (rice bran oil) showed lower peroxide, acid and TBA values compared with cheese containing BHA and control cheese along the storage period. From the results of this research it could be seen that addition of rice bran oil at a rate of 0.2% in manufacture of white soft cheese as a natural antioxidant to improve the oxidative stability, bacteriological and sensory quality of the resultant cheese during storage.

Key words: Antioxidant activity, phenolic compounds, rice bran oil, natural antioxidant, white soft cheese.

NTRODUCTION

Antioxidants are major ingredients that protect the quality of oils and fats by retarding oxidation (Jang *et al*., 2012). Synthetic antioxidants are used at legal limits to reduce deterioration, rancidity and oxidative discoloration (Abdulla *et al*., 2007). Butylated hydroxy anisol (BHA) and Butylated hydroxy toluene (BHT) are quite volatile and decompose easily at high temperatures (Bandyopadhyay *et al*., 2007). There are some serious problems concerning the safety and toxicity of such synthetic antioxidants related to their metabolism and possible absorption and accumulation in body organs and tissues (Ajila *et al*., 2007). Therefore, the search for preparation of useful natural antioxidants is highly desirable. Natural antioxidative compounds are found in numerous plant materials such as oil seeds, cereal crops, vegetables, fruits, leaves, barks and roots, spices and herbs (Yean and Philip, 2004). Many studies showed that natural antioxidants, as flavanoids and other phenolic phytochemical present in plants are associated with reduced chronic disease risk (Bandyopadhyay *et al*., 2008).

Rice bran oil (RBO) as an excellent source of natural antioxidants, which lowers human blood cholesterol more effectively than sunflower, corn and safflower oils. RBO shows an exceptionally high oxidative stability compared to soybean, palm, sesame, corn and most other popular vegetable oils (Bopitiya and Madhujith, 2014). Rice bran oil based products have extended shelf life since RBO is extremely stable against rancidity and oxidative deterioration (Akiri *et al*. 2010).

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Rice bran oil (RBO) is one of the best sources of tocols and oryzanol. Tocols (tocopherols and tocotrienols), a family of vitamin E-active substances, are wildly used as plant-based ingredients in the food, cosmetics and pharmaceutical industries (Abidi, 2003; Pengkumsri *et al*., 2015). Studies suggested that tocotrienols are more efficient antioxidant, anti-cancer agent and inhibitor of cholesterol synthesis than the tocopherols (Singh *et al.*, 2013). Gamma-oryzanol is one of the major components of RBO, and it is a mixture of several ferulate esters of triterpene alcohols and plant sterols (Friedman, 2013). Oryzanol is a well-known antioxidant compound and is linked with decreasing serum and plasma cholesterol, decreasing platelet aggregation, and cholesterol absorption. Moreover oryzanol has been used in the treatment of hyperlipidemia, and disorders of menopause (Patel and Naik, 2004).

Soft cheese is one of the most appreciated cheeses in Middle Eastern countries. The cheese is a pickled cheese (salt 2–15%), although it may be sold fresh. This type of cheese is produced either by enzymatic or acidic coagulation of fresh milk (buffalos' or cows' milk) or reconstituted skim milk powder with oils (Ramadan *et al*., 2014). It has also been made with or without the addition of starter cultures to cheese milk. Starter cultures govern the flavour and texture of the cheese, and help to suppress the growth of spoilage bacteria.

The present study was planned to measure the antioxidant activity and total phenolic compounds of rice bran oil and evaluation effect of added rice bran oil to white soft cheese to improve its oxidative stability.

MATERIALS AND METHODS

Fresh buffalo's milk (6% fat) was obtained from Dairy Technology Unit, Food Science Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt. Rice bran oil was purchased from local market. Powder animal rennet was obtained from Char-Hansen's Laboratories, Copenhagen, Denmark.

Pure calcium chloride was obtained from El-Gomhoria Co., Cairo, Egypt.

Food grade cooking salt (NaCl) was used in soft cheese making. Butylated hydroxyl anisole (BHA) was obtained from BDH chemical Ltd, Poole, and U.K

Determination of Total Phenolic Content

The concentration of total phenols in rice bran oil was measured by a UV spectrophotometer (Jenway-UV–VIS Spectrophotometer), based on a colorimetric oxidation/reduction reaction, as described by Škerget *et al*. (2005), with the use of Folin-Ciocalteu's reagent (AOAC, 1990).

Identification of Phenolic Compounds

Phenolic compounds of the samples were identified according to the method described by Goupy *et al*. (1999) and Mattila *et al*. (2000) using HPLC.

Determination of Radical Scavenging Activity

The electron donation ability of the rice bran oil was measured by bleaching of the purple coloured solution of the 2,2-diphenyl-1-picrylhydrazyl radical (DPPH) to shad yellow according to the method of Hatano *et al*. (1988) as modified by Gulcin *et al*. (2004).

Cheese Making

Fresh bulk buffalo's milk containing 6% fat was pasteurized at 63°C for 30 min., calcium chloride and sodium chloride were added at the ratios of 0.02% and 6% (*W/V*) respectively. The treated milk was divided into 4 portions. The first portion was left without any additives and served as a control (C). The BHA as synthetic antioxidant was added to the second portion at ratio of 200 ppm (C1). Rice bran oil was added to the other two parts (T1 and T2) at level of 0.1 and 0.2%, respectively. All milk treatments were renneted using 3 g of animal powder rennet to each 100 Kg cheese milk. Soft cheese treatments were made by the conventional method of making Domiati cheese (Fahmi and Sharara, 1950). Resultant cheeses were put in plastic containers with formerly boiled saline (10% salt) and stored at room temperature (25±1°C) for four months and sampled for analysis when fresh and then after 1, 2, 3 and 4 months of storage.

Chemical Analysis

Total solids, fat and total nitrogen (TN) contents of soft cheese samples were determined according to AOAC (2007). The protein content was obtained by multiplying the percentage of TN by 6.38. The pH value was measured using digital pH meter (HANNA, Instrument, Portugal) with glass electrode. The water soluble nitrogen percent (WSN/TN) was estimated as described by Innocente (1997).

The lipids were extracted from cheese samples using a method described by Kristensen *et al*. (2001). Acid value of extracted lipids was determined according to AOAC (2007). Peroxide value (PV) of extracted lipids was determined according to the method described by Egan *et al*. (1981). Thiobarbiuturic acid test (TBA) value was determined according to Keeny (1971).

Total volatile fatty acids (TVFAs) value were determined according to the method described by Kosikowski (1982). Values were expressed as ml of 0.1N NaOH/100 g cheese.

Microbiological Analysis

Cheese samples each of 10g, were taken at the age of 0, 1, 2, 3 and 4 months, then homogenized in sterile 90 ml of 0.1% peptone water. Serial 8 fold dilutions in sterile 0.1% peptone water were prepared for bacterial analysis. Plate count agar medium was used for determining the total bacterial count. Plates were incubated at 37°C for 2 days (Houghtby and Matuin, 1992). Potato Dextrose Agar was used for yeast and mould enumeration. Plates were incubated at 25°C for 5 days, according to Marshall (1992). Violet Red Bile Agar was used for the enumeration of coliforms. Plates were incubated at 37°C for 24 hr., according to Marshall (1992).

Sensory Properties of Cheese

The sensory properties of cheese samples were assessed by 10 panel members of the Dairy Sci., Dep., Fac. Agric., Zagazig, Univ. for flavour (50) body and texture (40) and appearance (10) according to Pappas *et al.* (1996).

Statistical Analysis

All data were statistically analyzed using the general linear models procedure of the statistical analysis system SAS (1998). Significances of differences were defined at $p < 0.05$. All experiments as well as related analysis results were repeated three times and all obtained data were expressed as an average.

RESULTS AND DISCUSSION

Total Phenolic Compounds

Rice bran oil was determined for total phenols (Table 1). The data showed that rice bran oil had the total phenols of 2.35 mg/g. Rice bran oil contains unsaponifiable lipids, which contain a unique complex of naturally occurring antioxidant components, tocopherols, tocotrienols and oryzanol. These compounds have high antioxidative properties. Similar results were reported by Singh *et al*. (2013).

Radical Scavenging Activity (RSA)

The results of radical scavenging activity (RSA) assay of rice bran oil shown in (Table 1). The RSA of rice bran oil are showen 74.70%. Tocopherols, tocotrienols and oryzanol that found in rice bran oil are phenolic compounds that acts as primary antioxidants or free radical scavengers. Similar results were reported by Sarmento *et al.* (2006) and Bopitiya and Madhujith (2014).

Table 1. Total phenolic compounds and radical scavenging activity of rice bran oil (using DPPH radical scavenging as measured by changes at 515 nm)

Item	Rice bran oil
Total phenolic compound	2.35 (mg/g)
Radical scavenging activity (RSA)	74.70 %

Identification of Phenolic Compounds by HPLC

Table 2 shows the content of phenolic compounds in rice bran oil. There was a great variation in the contents among the components identified in rice bran oil. Phenolic compounds are widely distributed in nature. It is suggested that their antioxidant activity is related to their cingulated rings and hydroxyl groups (Mattila *et al*., 2000). Phenolic compounds identified in rice bran oil namely tocopherols and tocotrinols were in amount ranging from 0.99-78.40 mg/ 100g. Similar results were reported by Kaewkool (2011) and Singh *et al*. (2013).

Gross Chemical Composition of White Soft Cheese

Chemical analyses were assessed by determining total solids (%), total nitrogen, fat/ DM (%), salt/ DM, the rate of proteolysis (SN/TN% and NPN/ TN%), the rate of lipolysis (TVFA), acidity and pH. Table 3 shows that white brined soft cheese containing rice bran oil at concentrations of 0.1 and 0.2% had the highest moisture content followed by control then cheese treated with BHA at ratio of 200 ppm. The moisture content of all cheese treatments were significantly ($P \leq 0.05$) decreased during storage period for four months at room temperature ($25 \pm 1^{\circ}C$).

The decrease in moisture content of cheeses along the storage period may be due to the curd concentration and whey expulsion resulting from acid development during the storage period. Similar results were reported by Salem *et al*. (2010).

Table 3 shows the fat content in white soft cheese made with full cream milk (6% fat) as affected by addition of rice bran oil at different concentrations. It could be observed that the Fat/DM content of experimental cheese samples increased significantly ($P \leq 0.05$) up to the end of storage period depending on the loss of moisture. Rice bran oil fortified cheese at different concentrations showed higher fat contents compared with other treatments. Similar results were reported by Abd El-Aziz *et al*. (2012) who manufacture soft cheese using ginger extract as natural antioxidant.

The salt/DM of all cheese treatments increased with the progress in storage period (Table 3). This could be due to the loss in water as a result of water exudation during pickling which in turn lead to a more salt concentration. Similar results were reported by Salem *et al*. (2010).

There was a significantly increasing trend ($P \leq 0.05$) in titratable acidity of all cheese treatments throughout the storage period. It was observed that control cheese and BHA fortified cheese (C and C1) had higher titratable acidity than other treatments, followed by rice bran oil fortified cheese. This may be due to higher antimicrobial activity of rice bran oil (Bardrunia, *et al*., 2013 ; Friedman, 2013). The trend of the changes in pH values of all treatments was opposite to that of titratable acidity (Table 4). PH values decreased in all treatments with the progress in storage period. Similar results were reported by Abd El-Aziz *et al*. (2012) .

Table 4 shows that TN% content of cheese samples slightly increased up to the end of storage period. There were no significant differences in TN% along with the storage period this may be due to high protein content and lower proteolysis in all treatments. Similar results were reported by Salem *et al*. (2010).

The Rate of Proteolysis

Soluble nitrogen content (as a percentage of total nitrogen, SN/TN%) of cheese samples during storage are shown in Table 5. Cheese containing rice bran oil had the highest (SN/TN%) during storage period compared with other treatments. (SN/TN%) content in cheese samples had significant differences between control and other treatments along with the storage period which might be attributed to the differences in moisture content. The increase in soluble nitrogen content in all cheese samples throughout storage period may be due to the breakdown of protein. Similar results were reported by Salem *et al*. (2010) and Ramadan *et al.* (2014)

Differences in non-protein nitrogen content as a percentage of total protein (NPN/TN%) of cheese samples during storage period are presented in Table 5. Generally, (NPN/TN%) content of cheese significantly increased with

Table 2. Content of the individual phenolic compounds in rice bran oil as determined by HPLC

Test item	Rice bran oil (mg/ 100 g)
α-tocoferol	5.48
β-tocoferol	ND
γ-tocoferol	2.49
δ-tocoferol	ND
α-tocotrienol	0.99
β-tocotrienol	ND
γ-tocotrienol	78.40
δ-tocotrienol	4.23

ND = Not Detected

Table 3. Chemical analyses of white soft cheese as affected by adding rice bran oil during storage at 25 ± 1˚C for four months

Sample	Storage period (month)														
	Moisture (%)					Fat/DM (%)					Salt/DM (%)				
	Fresh	1	2	3	4	0	1	2	3	4	0	1	2	3	4
C	62.02c	58.4c	56.24c	53.12c	51.2c	40.02d	41.82d	43.87c	45.68c	48.15c	14.13b	14.80a	15.84a	16.58a	18.12a
C1	61.98d	58.2d	56.20d	53.02d	51.14d	40.50c	41.86c	44.52b	45.12d	48.30b	14.25a	14.75a	15.75b	16.45b	16.93b
T1	62.40b	58.70b	56.42b	53.50b	51.60b	41.50b	42.37a	45.13a	46.06b	48.61a	13.53c	13.73c	14.20c	14.87d	15.20d
T2	62.46a	58.82a	56.60a	53.68a	51.72a	41.66a	42.28b	45.14a	46.63a	48.15c	13.32d	13.82b	14.30d	14.91c	15.48c

Means with the same letter are not significantly different

C: Control white soft cheese C_1: White soft cheese treated with 200 ppm BHA

T_1: White soft cheese treated with 0.1% rice bran oil. T_2: White soft cheese treated with 0.2% rice bran oil

Table 4. Chemical analyses of white soft cheese as affected by adding rice bran oil during storage at 25 ± 1˚C for four months

Sample	Storage period (month)														
	Acidity (%)					pH value					TN (%)				
	Fresh	1	2	3	4	0	1	2	3	4	0	1	2	3	4
C	0.25a	0.85a	1.46a	1.74a	2.20a	5.5b	4.52b	4.38b	4.32a	4.21a	2.42b	2.50a	2.72b	2.84b	2.92b
C1	0.24a	0.83b	1.42b	1.70b	2.14b	5.5b	4.52b	4.40a	4.33a	4.20a	2.40c	2.46c	2.68d	2.80d	2.88d
T1	0.20bc	0.80c	1.38c	1.64c	1.98c	5.70a	4.50a	4.38b	4.30ab	4.18b	2.44a	2.48b	2.74a	2.88a	2.94a
T2	0.20bc	0.80c	1.36d	1.62d	1.96d	5.70a	4.50a	4.36c	4.28b	4.16c	2.40c	2.44d	2.70c	2.82c	2.90c

Means with the same letter are not significantly different

C: Control white soft cheese C_1: White soft cheese treated with 200 ppm BHA

T_1: White soft cheese treated with 0.1% rice bran oil. T_2: White soft cheese treated with 0.2% rice bran oil

Table 5. Proteolysis and lipolysis of white soft cheese as affected by adding rice bran oil during storage at 25 ± 1˚C for four months

Sample	Storage period (month)														
	SN/TN%					NPN/TN%					TVFA (ml 0.1 N NaOH/100g)				
	Fresh	1	2	3	4	0	1	2	3	4	0	1	2	3	4
C	4.95c	10.8c	17.64c	21.83c	28.76c	3.71c	5.60c	7.72c	8.85c	9.64c	9.4c	14.6c	22.4c	24.3c	29.2c
C1	4.16d	9.75d	16.79d	21.42d	28.47d	3.33d	4.87d	6.71d	8.57d	9.72b	9.2d	14.3d	22.2d	24.3c	29.1c
T1	5.41b	11.16b	17.87b	22.65a	29.30b	3.41b	5.83b	7.93b	8.95b	10.07a	12.5b	17.6b	25.5b	28.6b	32.9b
T2	5.58a	11.33a	18.20a	22.29b	29.86a	4.31a	7.50a	8.80a	9.77a	10.07a	12.7a	17.8a	25.7a	28.8a	33.2a

Means with the same letter are not significantly different

C: Control white soft cheese

C_1: White soft cheese treated with 200 ppm BHA

T_1: White soft cheese treated with 0.1% rice bran oil.

T_2: White soft cheese treated with 0.2% rice bran oil

the progress in storage period. Cheese made with rice bran oil had the highest (NPN/TN%) content compared with other treatments. Similar results were reported by Salem *et al*. (2010), Abd El-Aziz *et al*. (2012) and Ramadan *et al*. (2014).

The Rate of Lipolysis

Table 5 shows the changes in total volatile fatty acids (TVFA) of soft cheese samples. There were significant differences in TVFA content of cheese as compared with control when fresh and during the storage period, which could be attributed to lipolysis of fat and the higher rate of proteolysis and formation free amino acids which could be converted to volatile fatty acids through specific metabolic pathways (Nakae and Elliott, 1965). Rice bran oil cheese had the highest TVFA content during storage than other treatments. Similar results were reported by Abd El-Aziz *et al*. (2012).

Oxidative Stability

Peroxide values (PV)

Results presented in Table 7 shows that cheese made with rice bran oil had the lower peroxide values than control and BHA cheese. On the other hand cheese made with rice bran oil (0.2%) had low peroxide values than control and BHA cheeses, when fresh and during the storage period.

The lower peroxide values of cheeses fortified with rice bran oil than control cheese is may be due to antioxidant activity of rice bran oil (Singh *et al*., 2013). The peroxide values increased significantly in different experimental cheeses as well as control with extended storage period up to the end of storage period. The obtained results are similar to those reported by Olmedo *et al*. (2013).

Acid value (AV)

As storage period progressed, the acid value (AV) increased gradually in all treatments as shown in Table 7. The AV of control cheese was significantly higher than that of experimental cheese and this may be due to the extensive fat hydrolysis and liberation of free fatty acids, which cause gradual increase in rancidity during storage. Control cheese had the highest AV followed by BHA treated cheese (C1) and finally rice bran oil fortified- cheese. The obtained results are similar to those reported by Abd El-Aziz *et al*. (2012) and Olmedo *et al*. (2013).

TBA Values

The trend of the changes in TBA values of all treatments was opposite to that of acid values (Table 7). TBA values increased in all treatments with the progress in storage period. The obtained results are similar to those reported by Azzam (2007).

Microbiological Examinations

Total bacterial count

Table 6 shows the differences in total bacterial counts of cheese, there were significant differences in viable bacterial count between control cheese and other cheese samples made with natural antioxidant. The results indicated that total bacterial count gradually increased till the first month of pickling period then decreased slightly up to the end of this period. Similar results were reported by kebary *et al.* (2015), who reported that during the storage of cheese, the total bacterial counts slightly increased during the first period of storage, and then gradually decreased till the end of the storage period. This could be attributed to the development of acidity in cheese. The obtained results also showed that control and BHA cheeses had higher total bacterial count than rice bran oil fortified cheese. This might be due to the antimicrobial activity of rice bran oil (Bardrunia *et al*., 2013; Friedman, 2013).

Moulds and Yeasts and Coliform Count

Moulds and yeasts began to appear after 2 month of storage in control and BHA cheese, however, they were only observed in rice bran oil-fortified cheese throughout the storage period. Rice bran oil is known to contain several compounds such as tocopherols and tocotrinols which possess antimicrobial activity against food spoilage organisms (Bardrunia *et al*., 2013; Friedman, 2013).

Coliforms were not detected in all cheese treatments either when fresh or during the storage period. This may be due to the high hygienic condition during the preparation and the development in the acidity in cheese during storage period. The obtained results are similar to those reported by El-Gazzar (1993), also obtained results are similar to those reported by Olmedo *et al*. (2013).

Organoleptic Properties

The average score points given for appearance, body characteristics and flavour of white soft cheese as affected by adding natural antioxidant are presented in Table 8. The results showed that there were significant differences between the control and all treatments when fresh and during storage period.Rice bran oil fortified cheese recorded the highest scores in sensory evaluation, and cheese made with rice bran oil at ratio of (0.2%) showed better flavour intensity and body characteristics than other cheeses.

Also, results showed that cheese made with rice bran showed similar score for appearance compared with other cheese treatments.It found that all additives improved cheese properties and over all acceptability.Also, organoleptic properties of all cheese treatments were improved by the progress of storage period until the end of storage. The obtained results are similar to those reported by Azzam (2007) Bandyopadhyay *et al*. (2008).

Table 6. Microbiological examination of white soft cheese as affected by adding rice bran oil during storage at 25 ± 1˚C for four months

Sample	Storage period (month)														
	Total count (cfu/g) 10^3					Yeast and mould (cfu/g)10^1					*E. coli* count (cfu/g) 10^1				
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
C	130	162	112	86	18	ND	ND	5	15	22	5	ND	ND	ND	ND
C1	112	130	80	20	8	ND	ND	2	12	17	2	ND	ND	ND	ND
T1	10	14	9	6	4	ND	ND	ND	5	8	ND	ND	ND	ND	ND
T2	8	12	5	5	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not detected

C: Control white soft cheese

C_1: White soft cheese treated with 200 ppm BHA

T_1: White soft cheese treated with 0.1% rice bran oil.

T_2: White soft cheese treated with 0.2% rice bran oil

Table 7. Oxidative stability of white soft cheese as affected by rice bran oil during storage at 25 ± 1˚C for four months

Sample	Storage period (month)														
	Peroxide value (meq/kg)					Acid value (mg KOH/g oil)					TBA value(O.D 532 nm)				
	Fresh	1	2	3	4	Fresh	1	2	3	4	Fresh	1	2	3	4
C	4.92a	7.40a	14.52a	20.3a	25.2a	0.76a	1.22a	2.45a	3.12a	4.24a	0.139 a	0.182 a	0.230a	0.324a	0.392a
C1	4.80b	7.12b	14.15b	19.6b	24.4b	0.74b	1.18b	2.12b	2.9 b	4.08b	0.139b	0.167b	0.210b	0.312b	0.32b
T1	4.72c	6.42c	9.36c	10.14c	12.62c	0.68bc	0.98c	1.62c	1.34c	1.82c	0.136ab	0.160c	0.170 c	0.182c	0.192c
T2	4.50d	5.18d	7.86d	9.20d	11.50d	0.64d	0.72d	0.86d	1.00d	1.14d	0.134b	0.140d	0.160 d	0.174d	0.184d

Means with the same letter are not significantly different

C: Control white soft cheese C_1: White soft cheese treated with 200 ppm BHA

T_1: White soft cheese treated with 0.1% rice bran oil. T_2: White soft cheese treated with 0.2% rice bran oil

Table 8. Organoleptic properties of white soft cheese as affected by adding rice bran oil during storage at 25 ± 1˚C for four months

Sample	Storage period (month)																			
	Appearance (10)					Flavour (50)					Body and texture (40)					Total (100)				
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
C	7	8	8	9	8	42	44	44	46	46	37	39	39	40	40	86ab	91a	91ab	95a	94ab
C1	7	8	8	9	8	40	42	43	43	45	36	38	40	40	40	83bc	88b	91ab	92ab	93ab
T8	7	8	8	9	8	43	45	45	46	47	38	38	40	40	40	88a	91a	91ab	95a	95a
T9	7	7	8	9	7	42	43	44	46	46	39	39	40	40	40	88a	89ab	92a	95a	93ab

Means with the same letter are not significantly different

C: Control white soft cheese C_1: White soft cheese treated with 200 ppm BHA

T_1: White soft cheese treated with 0.1% rice bran oil. T_2: White soft cheese treated with 0.2% rice bran oil

Conclusion

It is notable that rice bran oil has a strong antioxidant capacity relatively comparable to the activity of BHA. Therefore, it can be used as natural antioxidant in manufacturing white soft cheese to improve its oxidative stability during storage.

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استخدام زيت رجيع الكون كمضاد طبيعي للأكسدة في صناعة الجبن الأبيض الطري

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أجريت هذه الدراسة لتقدير النشاط المضاد للأكسدة ومحتوى المركبات الفينولية لزيت نخالة الأرز (رجيع الكون) ولتقييم تأثير إضافة زيت رجيع الكون على الثبات ضد الأكسدة والجودة الميكروبية والخصائص الحسية للجبن الأبيض الطري، وقد استخدم زيت رجيع الكون في صناعة الجبن بنسب ٠,١ و ٠,٢% مقارنة مع الجبن المصنع مع ٢٠٠ جزء في المليون من BHA والجبن المقارنة (بدون أى إضافات)، وتم تخزين الجبن على درجة حرارة الغرفة لمدة أربعة أشهر وتحليلها من حيث الاختبارات الكيماوية والميكروبيولوجية، والثبات ضد الأكسدة والخصائص الحسية بعد التصنيع مباشرة وبعد ١، ٢، ٣ و ٤ شهور من التخزين، ولقد أظهرت النتائج احتواء زيت رجيع الكون على نسبة عالية من مركبات الفينول وأعطى نشاط مضاد للأكسدة عالي، كما أوضحت النتائج أن الجبن المحتوى على ٠,٢% من زيت رجيع الكون أعطى أعلى معدلات من حيث الثبات ضد الأكسدة (الأقل قيم فى رقم البيروكسيد ورقم الحموضة وقيم الـ TBA) والخصائص الحسية والأقل فى المحتوى الميكروبى عن باقى المعاملات، وبشكل عام فان، عينات الجبن المحتوية على مضادات الأكسدة الطبيعية (زيت رجيع الكون) كانت أقل المعاملات إنخفاضاً في قيم البروكسيد والحموضة والTBA، مقارنة بالجبن المحتوية على الـ BHA وجبن المقارنة خلال فترة التخزين، ومن نتائج هذه البحث يمكن استخدام زيت نخالة الأرز (رجيع الكون) بمعدل ٠,٢% في صناعة الجبن الأبيض الطري كمضاد أكسدة طبيعي لتحسين الثبات التأكسدي والجودة الحسية والميكروبيولوجية للجبن.

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