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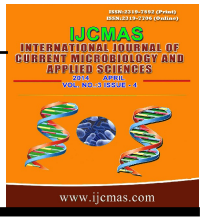

Original Research Article

Effect of cumin oil concentrations on chemical composition and sensory characteristics of Sudanese white cheese during ripening

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Keywords

White cheese, cumin oil, storage period, chemical composition

A B S T R A C T

This study was conducted to investigate the effect of different levels of cumin oil on chemical composition and sensory characteristics of white soft cheese. Thirty liters of cow's milk were purchased from Sudan University of Science and Technology Dairy Farm, the milk pasteurized at 72 ° □/ 1 minute, cooled to 40 ° □ then the milk processed into cheese after complete coagulation the curd was divided into three equal portions the first one is the control without cumin oil. To the second and the third portions of the curd 0.1 and 0.3 % cumin oil were added respectively. After whey drainage in each treatment the cheese samples were packed into plastic container with 300 gms cheese each and stored at room temperature for 14 days. Chemical and sensory evaluations were carried out for the cheese samples at zero, 7 and 14 days. The results indicated that significant variations were found in the titratable acidity, protein, ash and total solids contents among the control and the treated cheese samples, the highest titratable acidity was for the cheese sample with 0.3% cumin oil while the lowest one was for the control cheese. No significant differences were observed in the fat contents of the different treatments. The storage period had significant effect on the chemical composition of the cheese samples. As the storage period advanced the titratable acidity increase, the protein and the ash contents of the cheese samples decreased towards the end of the storage period while the fat content increase as the storage period progressed. The results revealed that the cumin oil had no effect on the colour and texture of the cheese samples. However the flavour and the taste were affected by the cumin oil addition , the highest flavour scores were for the cheese samples with cumin oil. The storage period significantly affected the sensory characteristics of the white cheese.

Introduction

In Sudan cheese processing is a major preservation method of surplus milk in rural areas especially during rainy season when plenty of milk is available. The product is an important nutrient for humans especially under conditions where other animal proteins are not available (Kosikowski, 1982). White cheese is the most popular type of cheese produced in Sudan, locally known as (Gibna Bayda). It

is a pickled soft cheese that is stored under anaerobic conditions in air tight containers filled with whey (El Oweni and Hamid, 2008). The cheese is usually left over night to drain the whey with or without pressing. Ripening takes place while the cheese was submerged in whey (Osman, 1987).

Its popularity has been increasing because of industrialization of its production. It is manufactured from raw and pasteurizes milk, is salty and acidic in taste. The use of spices as food additives has been widely practiced since ancient times. Spices have a definite role to play in enhancing the taste and flavour of any food and are believed to have medicinal value. They have been used in a large number of medicinal preparations for the treatment of several disorders, particularly of the digestive system (Muthamma et al., 2008).The black cumin seeds (*Nigella Sativa* L.), contain more than hundred different volatile components depending on the way and the region of cultivation (Khan, 1999, Paarakh, 2010). Cumin's distinctive flavour and strong, warm aroma is due to its essential oil content. The proximate composition and the physicochemical properties of the essential oil have been reported (Li and Jiang, 2004). The black cumin oilseed had been shown to be anticancer, antidiabetic, antiradical and immunomodulator, analgesic, antimicrobial, anti-inflammatory, spasmolytic, bronchodilator, hepatoprotective, antihypertensive and renal protective (Ramadan, 2007). The spice is well known appetizers and is considered essential in culinary art all over the world. Cumin is largely used in Sudanese kitchen and is locally known as (kammoun). This spice is an ingredient of most curry powders and many savoury spice mixtures, and is mainly used to prepare Mish dishes (fermented milk paste) in mixture with salt and peppers. In some countries, addition of traditional spices enhances the fermentation process and inhibits the growth of pathogenic organisms (Abdalla and El-Zubeir, 2006). No research was carried out on the addition of black cumin oil to Sudanese white cheese.

The main objective of this study was to investigate the effect of different levels of cumin oil on the chemical composition and sensory characteristics of Sudanese white cheese.

Materials and Methods

Treatments: Three treatments were carried out in this study and three level of storage period were used.

Materials

Cumin oil purchased from the local market, Cow's milk purchase from the University Dairy Farm.Powder animal rennet was obtained from Chr-Hansen's Laboratories, (Copenhagen, Denmark).Table salt from the local market.

Methods

White cheese making

White cheese was processed using 30 pounds of fresh cow's milk according to the method of Ali (1984).The milk was received from Sudan University Dairy Farm, Kuku. It was strained with a clean cloth into double jacketed vats. The salt was dissolved in a small part of milk then added to the whole raw milk in the vats to the required concentrations. Rennet tablets (Chr. Hansens Lab., Copenhagen, Denmark) were added at the rate of one tablet per 100 pounds of milk. The milk

was then stirred for 10 minutes and left for coagulation. After 2 – 3 hours the coagulated milk was cut for separation of whey; then the drained curd was divided into three parts the first treatment is the control without addition of cumin oil. To the second and third parts 0.1 and 0.3 % cumin oil concentrations were added respectively. The curd of each treatment was transferred to a wooden mould lined with a clean cloth and pressed by a heavy weight of about 2 Kg for 6 hours. Thereafter the cheese was removed from the mould and cut into small cubes of about 5 × 5 × 5 cm approximately. The whey was collected in a separate container boiled for five minutes and used for preservation of the particular cheese. The cheese samples (200 grams quantities) were packed into triplicate plastic containers of 400 grams capacity each containing 200 ml of the appropriate boiled whey. The containers were tightly closed and sealed with cellophane tapes around the cover. The containers were stored at room temperature which ranged from 35 – 37^{o}C for 14 days. Chemical analysis and sensory evaluation were carried out at zero, 7 and 14 days interval.

Chemical analysis

Titratable acidity%, Protein %, fat %, Total solids and ash contents were determined according to AOAC (2003).

Sensory evaluation

The panel consisted of 10 panelists from the staff members and students were selected to judge for sensory evaluation according to Larmond (1978).

Statistical analysis

Statistical analysis was carried out using ANOVA variance analysis through general linear model procedure of SPSS programme version 17). Least significant differences were used to separate means at $p < 0.05$.

Results and Discussion

Effect of cumin oil concentration on the chemical composition and sensory evaluation of Sudanese while cheese

The effect of cumin oil concentrations on the chemical composition of the Sudanese white cheese are presented in Table 1. As shown in the table the titratable acidity of the white soft cheese increased significantly (P< 0.001) with increase in cumin oil concentration. The highest titratable acidity (2.24±1.26%) was for the cheese samples with 0.3% cumin oil while the lowest one was for the control cheese samples (1.25±0.83%).

The results indicated that the fat contents of the cheese samples were not significantly (P>0.05%) different in all treatments. The protein content of the cheese samples with 0.3% cumin oil was significantly (P<0.05) higher (19.72± 6.32%) in comparison with the control cheese (17.80±6.16%).However, the protein content was not significantly different in the cheese samples with 0.1 and 0.3% cumin oil. The total solids contents of the cheese samples with 0.1% cumin oil was significantly (P<0.001) higher (52.75±5.16%) than that of the control cheese samples (48.21±8.43%). Cumin oil concentrations significantly affected the ash content of white cheese samples. The highest ash content (3.21±0.96%) was for the cheese samples with 0.3% cumin oil while the lowest one (2.55±1.25%) was for the control cheese samples.

Results in Table (2) present the effect of cumin oil concentrations on sensory characteristics of the white cheese. The colour and texture of the cheese samples were not significantly (P>0.05) affected by cumin oil concentrations.However, the flavour and taste of the cheese were significantly (P<0.001) affected by cumin oil concentrations.The highest flavour scores was recorded for the cheese samples with 0.3% cumin oil while the lowest one was for the control cheese.

Effect of Storage period on the chemical composition and sensory characteristics of Sudanese white cheese

Data in Table (3) showed the effect of storage period on the chemical composition of white cheese. The results revealed that the titratable acidity of the white cheese significantly (P<0.01) increased as the storage period progressed. At day zero the titratable acidity of the cheese samples was (0.15±0.001%) while after 14 days of storage it was 3.33±0.001%. The fat content of the cheese samples was significantly (P<0.001) affected by the storage period, after 7 days of storage the fat content was decreased but towards the end of the storage period it increased to 35.00±0.52% .As the storage period progressed the protein content of cheese samples significantly (P<0.001) increased. The total solids contents of the cheese sample showed the same trends as the protein contents.

Results in Table (4) illustrate sensory characteristic of the cheese samples as affected by storage period. The results indicated that significant variations (P>0.05) were observed in the colour, flavour, taste and texture of all treatments.The best colour was for the cheese samples at day 7 and thereafter decreased in scores. The favour, taste and texture of the cheese samples showed the same trend.

Effect of Cumin oil concentrations on chemical composition and sensory propeties of white soft cheese:-

Titratable acidity of the cheese was affected by cumin oil concentrations (Table 1). The high titratable acidities of the cheese with cumin oil could be attributed to acidic effect of cumin oil which increases the acidity of the cheese samples with cumin oil. These results were in agreement with those reported by Kur (1992); Nuser (2001);Hassanein *et al.* (2013) and Ramadan (2007).

Cumin oil concentration does not have any significant effect on the fat content of the cheese samples (Table 1). These results agreed with those of Hassanein *et al.* (2013).

Crude protein contents increased significantly(P<0.05) as cumin oil concentration increase these result was in accordance with that found by Hassanein *et al.* (2013) who stated that the protein content of cheese samples with cumin oil concentration was higher than that of the control cheese without cumin oil. The high protein content of the cheese samples with cumin oil might be due to the inhibition effect of cumin oil on the microorganisms in the cheese samples. The total solids contents showed the same trend as protein contents (Table 1).

The high ash content of the cheese samples with cumin oil concentration (Table 1) could be due to preservation effect of the cumin oil on the cheese components.These results were in line

Table.1 Effect of cumin oil on chemical composition of soft white cheese

Treatments	Chemical composition %				
	Titrat. acidity	Fat	Protein	Total solids	Ash
Control cheese	1.25± 0.83^{c}	29.04±5.60	17.80±6.16^{b}	48.21±8.43^{c}	2.55±1.25^{ca}
Cheese with0.1% cumin oil	1.52± 0.43^{b}	29.31±3.57	19.01±4.95^{ab}	51.75±8.66b^{a}	2.66±1.03^{a}
Cheese with0.3% cumin oil	2.24± 1.26^{a}	29.42±4.97	19.72±6.32^{a}	52.75±5.16^{a}	3.21±0.96^{b}
Level of Significant	**	NS	*	**	**

^{abc}**Means bearing different super scripts within columns are significantly different (P<0.001)**

Table.2 Effect of cumin oil on the sensory characteristics of soft white cheese.

Treatments	Sensory characters			
	Colour	Flavour	Taste	Texture
Control cheese	4.87±0.28b	4.33±0.40b	3.66±0.30b	5.93±0.33
Cheese with 0.1% cumin oil	4.80±0.28c	4.93±0.43b	3.53±0.32b	5.53±0.33
Cheese with 0.3 % cumin oil	5.42±0.27a	6.86±.34a	5.66±0.30a	6.20±0.32
Level of Sig.	**Ns**	*****	******	**NS**

^{abc}**Means bearing different super scripts within columns are significantly different(P<0.01)**

Table.3 Effect of Storage period on the chemical composition of soft white cheese

Storage Period/days	Chemical composition %				
	Titrat. acidity	Fat	Protein	Total solids	Ash
Zero	0.15±0.001^{c}	27.88±0.54^{b}	25.83±0.43^{a}	57.06±0.26 ^{a}	4.20±0.08^{a}
7	1.70±0.001^{b}	24.89±0.52^{c}	13.10±0.43^{c}	39.65±0.26^{c}	2.70±0.08^{b}
14	3.33±0.001^{a}	35.00±0.52^{a}	17.60±0.43^{b}	56.02±0.25^{b}	2.13±0.07^{c}
Sig.level	**	**	**	**	**

^{abc}**Means bearing different super scripts within columns are significantly different (P<0.001)**

Table.4 Effect of storage period on sensory characteristics of soft white cheese

Storage period/days	Sensory characters			
	Colour	Flavour	Taste	Texture
0	4.63±0.28^{b}	4.46±0.41^{b}	4.44±0.30^{a}	6.33±0.35^{a}
7	5.60±0.25^{a}	6.13±0.45^{a}	4.80±0.32^{a}	6.40±0.33^{a}
14	4.86±0.28^{b}	5.53±0.41^{a}	3.73±0.30^{b}	4.93±0.34^{b}
Level of Sig.	*	*	*	*

^{abc}**Means bearing different super scripts within columns are significantly different(P<0.05)**

with those reported by Ramadan (2007) and Hassanein et al. (2013).

Data shown in Table 2 indicate that the colour and texture did not affected by cumin oil concentration.However the flavor and taste scores of the cheese samples with cumin oil concentration were significantly higher than those of the control cheese samples.These results were similar to those found by Hassanein et al.(2013).

Effect of storage period on chemical composition and sensory properties of white soft cheese

The development of titratable acidity during storage till the day 14(Table 3) could be due to the growth of lactic acid bacteria which increased the level of lactic acid in the cheese (Walstra *et al.,* 1999). The results were in agreement with those reporte by ElOwni and Hamid (2008); Hamid and Abdelrahman (2012).

The decrease fat content of the cheese samples at day 7 (Table3) could be due to the lipolytic effect of the cheese microflora, however the increase fat content at the end of storage period probably due to high moisture loss during storage.These results were in line with those found by Hamid and Abdelrahman (2012).

The protein and Total solids contents of the cheese samples significantly increase during storage (Table 3) these findings were in line with those of Abdel Razig (1996) and Kim *et al.* (1992) who reported that the protein contents of cheese increased during ripening due to decrease in moisture contents. Other results indicated that the protein contents decreased during storage due to protein degradation leading to formation of water soluble compounds (Abdalla, 1992).

The increase due to continuous loss of moisture from the curd as a result of lactic acid development which causes curd contraction.

The storage period significantly ($P<0.05$) decrease the ash content of the cheese samples(Table 3). This could be due to the continous loss of moisture during storage. These results were in accordance with Hassanein et al. (2013); Hamid and Abdelrahman(212) and ElOwni and Hamid (2008).

The storage period showeed significantly($P< 0.05$) variations in all the sensory parameters(Table 4). The highet scores for all sensory characters were at day 7 the afterwards the scores decline might be due to the lipolytic and proteolytic actions of microorganisms.

It could be concluded that the cumin oil concentration had significant effect on the titratable acidity, protein, total solids and ash contents of white soft cheese and it improve the quality of white cheese during storage.

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