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Oregano essential oil used as feed supplement: organic fermented goat milk products properties

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Abstract

The present work aimed at evaluating the effect of *Origanum vulgare* essential oil used as feed supplement on the physicochemical, rheological/textural and sensory properties of organic fermented goat milk products (kefir and spreadable-type cheese produced using the starter culture of kefir). Twenty-four animals of the same age and with similar milk yield and body weight were distributed into three groups. First group (A) was fed with the control diet, while in groups B and C, organic oregano essential oil of 1mL and 2mL, respectively, was added to the feed of each goat per day. The samples were analyzed for their physicochemical (pH, acidity and dry matter, fat and protein content), rheological/textural (firmness, consistency, cohesiveness, index of viscosity) and sensory (colour, aroma, acidity, viscosity/consistency, total acceptability) properties. The introduction of *Origanum vulgare* in the goats' diet increased acidity, aroma and acceptability of the fermented goat milk products, while it reduced rheological/textural properties of the spreadable-type cheese samples. The milk form B group resulted in the production of kefir samples with increased dry matter and fat content, rheological properties and consistency. It is concluded that the use of *Origanum vulgare* essential oil affected the properties of kefir and spreadable-type cheese derived from organic goat milk.

Keywords: *kefir, organic goat milk, Origanum vulgare, spreadable-type cheese.*

1. Introduction

In the last decade there has seen a significant increase in the use of aromatic plants and essential oils as feed additives in animal nutrition, due to their bioactivity. The components contained in essential oils have the potential to inhibit the growth of pathogenic bacteria, prevent tissue oxidation, and therefore improve growth performance and quality of animal products. Among aromatic plant essential oils, Origanum vulgare essential oil is known for its rich natural polyphenols content, which possesses intense antimicrobial, antifungal and antioxidant properties [1]. As it concerns goats' feed, the use of distilled Rosmarinus officinalis spp. leaves has been reported, and their effect on milk and cheese properties was evaluated [1].

Kefir is a fermented dairy product that is considered to be a natural probiotic that besides its nutritional value, it has been reported to improve a variety of health conditions [3]. The starter culture of kefir has the potential to be used to the production of spreadable-type cheeses and increase products functionality.

Thus the aim of the present work was to evaluate the effect of *Origanum vulgare* essential oil used as feed supplement on the properties of organic functional fermented goat milk products (kefir and spreadable-type cheese produced using the starter culture of kefir).

2. Materials and methods

Twenty-four animals of the same age and with similar milk yield and body weight were distributed into three groups. First group (A) was fed with the control diet, while in groups B and C, organic oregano essential oil of 1mL and 2mL, respectively, was added to the feed of each goat per day. The milk for the production of the dairy products was collected after 30 and 60 days of feed (4th and 8th week).

2.1Raw milk treatment

Immediately upon receipt, the milk was placed in a refrigerator (4°C) until use. It was then stirred very well to avoid phase separation, filtered using a simple filter medium (cheese-cloth) and a sufficient amount of it was taken to determine its physicochemical composition. Then the milk of each group (A, B, and C) was homogenized using an ultrasonic device (BANDELIN SONOPULS with UV 3400 tip, Berlin, Germany), which operated at 90% of its capacity at a frequency of 20 kHz. During the homogenization, the temperature of the milk was controlled so that it would not exceed 60°C. Then the milk of each group (A, B, and C) was divided into 2 batches for the preparation of the kefir and spreadable-type cheese samples.

2.2. Kefir production

Following homogenization the milk was heat-treated at 95°C for 5 min, cooled at 30°C, inoculated with the starter culture (KFA1, micro milk, srl, Cremosano, CR, ITALY) and incubated at 30°C until the pH dropped to 4.3-4.4 (approximately 20h). Kefir was then mixed and stored at 4°C for 24 h before analysis

2.3. Spreadable –type cheese production

The milk was heat-treated at 95°C for 5 min, cooled at 25°C and inoculated with the starter culture of kefir (KFA1, micro milk, srl, Cremosano, CR, ITALY). Rennet (Kyanous Stavros, Aristomenis Fikas & Co., Thessaloniki) was also added at a percentage of 0.1% (w/w) and the milk was let to coagulate at 25°C for about 18 h. The curd was then cut, left for 1 h at 18°C and transferred to special molds (with cheese-cloths) for drainage for about 24 h at 4°C. The next day the samples were removed from the molds, salted at a concentration of 1% (w/w), transferred to sterilized plastic containers and stored at 4°C for 24 h until analyzed.

Then the samples were subjected to physicochemical analysis, rheological measurements and sensory evaluation.

Two-way ANOVA was applied to the experimental data (3 groups of milk: A, B and C; 2 periods of milk receiving: 4th and 8th week), while Tukey test was used to distinguish the differences among samples (if there were any). Statistical analysis was performed by the use of Minitab 18.

3. Results and discussions

3.1. Physicochemical properties

Table 1 shows the results from the physicochemical analysis of the raw milk for both of the 2 periods (1st and 2nd) of milk receiving (4th and 8th week). According to ANOVA, the pH of the milk from the groups A and B at the 2nd examination period had statistical significant higher values when compared to all milk samples at the 1st examination period and to milk of group C at the 2nd examination period. As it concerns dry matter content, the milk from the groups B and C exhibited the highest values for both the examination periods.

The physicochemical properties of kefir and spreadable-type cheese samples are shown in **Tables 2 and 3,** respectively. The acidity of the fermented milk samples of groups B and C was higher when compared to control samples for both the examination periods.

Table 1. Physicochemical analysis of raw milk at the 1st and 2nd examination periods

Milk group	Examination period	pH	Dry matter (%)	Fat content (%)	Protein content (%)
A	1st	6.43	13.33	5.7	4.02
	2nd	6.60	13.77	6.0	4.33
B	1st	6.52	14.42	5.7	4.28
	2nd	6.66	15.02	6.2	4.51
C	1st	6.55	14.53	5.8	4.01
	2nd	6.57	14.92	6.1	4.14

Table 2. Physicochemical analysis of kefir at the 1st and 2nd examination perio

Milk group	Examination period	pH	Acidity (%)	Dry matter (%)	Fat content (%)	Protein content (%)
A	1st	4.31	1.15	13.77	5.3	4.18
	2nd	4.44	0.79	13.07	5.4	4.35
B	1st	4.26	1.27	14.48	5.6	4.24
	2nd	4.39	0.95	15.09	5.7	4.53
C	1st	4.29	1.28	14.28	5.4	4.01
	2nd	4.38	1.01	14.73	5.5	4.15

Table 3. Physicochemical analysis of spreadable-type cheese at the 1st and 2nd examination periods

Milk group	Examination period	pH	Acidity (%)	Dry matter (%)	Fat content (%)	Protein content (%)
A	1st	4.34	1.11	29.33	18.0	15.22
	2nd	4.40	0.81	29.63	18.5	15.47
B	1st	4.29	1.20	28.94	17.0	15.21
	2nd	4.37	0.89	29.03	17.5	15.60
C	1st	4.26	1.33	28.36	18.3	15.33
	2nd	4.35	1.07	28.85	18.0	15.47

Tables 4 and 5 shows the rheological properties of kefir and spreadable-type cheese samples, respectively. According to statistical analysis, the use of milk from group B resulted in the production of kefir samples with increased rheological properties for both the examination periods. This might be attributed to the increased dry matter and fat content that these samples exhibited. As it concerns spreadable-type cheese, the control samples exhibited the highest rheological properties for both of the examination periods. The reduced rheological properties of the samples from groups B and C, might be attributed to the decreased values of dry matter content that these samples exhibi

Table 4. Rheological analysis of kefir at the 1st and 2nd examination periods

Milk group	Examination period	Firmness (N)	Consistency (N × s)	Cohesiveness (N)	Index of Viscosity (N × s)
A	1st	1.68	10.61	0.85	0.803
	2nd	1.65	10.14	0.89	0.852
B	1st	1.85	12.14	1.22	0.978
	2nd	1.90	12.48	1.26	0.945
C	1st	1.68	9.96	0.87	0.789
	2nd	1.64	10.01	0.85	0.824

Table 5. Rheological analysis of spreadable-type cheese at the 1st and 2nd examination periods

Milk group	Examination period	Firmness (N)	Consistency (N × s)	Cohesiveness (N)	Index of Viscosity (N × s)
A	1st	31.9	478.3	67.5	19.2
	2nd	33.7	450.2	69.4	18.6
B	1st	27.1	397.2	63.6	24.3
	2nd	26.2	412.5	61.2	25.2
C	1st	24.8	324.2	56.9	18.3
	2nd	22.7	347.9	55.7	19.7

3.2. Sensory evaluation

The sensory properties of kefir and spreadable-type cheese samples are shown in **Tables 6 and 7**, respectively. The samples (kefir and spreadable-type cheese) of groups B and C exhibited increased values of aroma, acidity, and acceptability. The results from sensory evaluation are in accordance with physicochemical and rheological evaluation of the samples.

Table 6. Sensory evaluation of kefir at the 1st and 2nd examination periods

Milk group	Examination period	Color	Aroma	Acidity	Viscocity	Total acceptability
A	1st	13.2	11.2	10.7	10.2	11.2
	2nd	12.7	11.4	11.2	11.4	10.7
B	1st	12.3	13.2	14.2	14.2	12.9
	2nd	12.0	14.2	13.9	13.9	13.2
C	1st	13.4	13.9	12.2	11.8	12.5
	2nd	13.1	12.8	11.7	12.2	12.1

Table 7. Sensory evaluation of spreadable-type cheese at the 1st and 2nd examination periods

Milk group	Examination period	Color	Aroma	Acidity	Viscocity	Total acceptability
A	1st	14.2	10.1	11.2	14.1	11.7
	2nd	13.7	9.8	10.7	13.7	12.2
B	1st	12.5	12.3	11.9	12.6	14.1
	2nd	13.9	13.7	12.5	13.0	13.5
C	1st	13.1	11.9	14.2	11.2	13.0
	2nd	12.8	12.5	13.6	10.1	12.9

4. Conclusions

The fermented goat milk products of groups B and C exhibited the highest acidity, aroma and acceptability. Furthermore, kefir samples of group B showed increased values of dry matter and fat content, rheological properties and consistency However, the use of *Origanum vulgare* essential oil reduced rheological properties of the spreadable-type cheese samples

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