

Effect of Dietary Dried Thyme Leaves Supplementation on Performance of Lactating Goats

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Abstract

Thyme (*Thymus vulgaris* L.) is considered a promising natural dietary supplement that can enhance animal health and overall productivity due to its antioxidant and antibacterial properties. This study aimed to evaluate the effect of dried thyme leaves on the lactation performance of Saanen/Florida goats (crossbreed) and the chemical composition of the milk. Sixteen multiparous lactating goats were divided into two treatment groups (experimental and control) after 60 days of parturition, and monitored during a critical lactation period. Concentrate mixture was offered to animals of both groups, as well as alfalfa hay and wheat straw according to their nutritional needs. The experimental animals were fed the control ration plus 6 g thyme leaves/kg of concentrate mixture. The total duration of feeding experiment was 56 days and there were no differences in feed intake between the treatments. The analysis of the results showed that, regarding the milk yield, there was no significant difference between the experimental and the control groups ($P>0.05$). Milk fat content from experimental groups was significant lower ($P<0.05$), while the diets supplemented with thyme promoted milk protein and solid-not-fat contents throughout the feeding trial ($P<0.05$). Dietary dried thyme leaves supplementation, at level 6 g/kg concentrate feed, in isonitrogenous and iso (net energy) energetic diets for lactating goats did not affect their performance, increasing milk protein and solid-not-fat content, but decreasing milk fat content.

Keywords: feed ingredient, milk composition, milk yield, Saanen/Florida goats, *Thymus vulgaris*.

1. Introduction

Nutrition is a determining factor in achieving high milk yield and producing high-quality milk. The selection of appropriate feedstuffs and dietary supplements can affect both the quantity and the composition of the milk produced, enhancing fat, protein, and lactose levels. Particular emphasis is currently placed on the use of natural additives, such as herbal supplements, which contribute to improving animal health and reducing the use of chemical additives, thereby promoting more sustainable practices [1].

The use of herbal supplements in animal feed has been the subject of extensive research, highlighting their multiple benefits. Studies have shown that herbal additives can improve animal productivity and health, while also contributing to the reduction of environmental impacts. Thyme (*Thymus vulgaris* L.), in particular, has been shown to enhance antioxidant activity and improve milk composition, supporting natural feeding practices [2,3].

Thyme is a perennial, low-growing shrub commonly found in Mediterranean regions and is distinguished by its aromatic and therapeutic properties [4]. Thyme essential oil contains up to 2.5% volatile compounds, with thymol and carvacrol being the main phenolic constituents, accounting for 25–40% of the oil, while thymol usually occurs in higher concentrations than

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carvacrol This essential oil also contains cymene, linalool, borneol, bitter compounds, tannins, flavonoids, and terpenoids. These constituents contribute to the overall activity of thyme, which exhibits significant antimicrobial and therapeutic properties [2,3]. Carvacrol is known for its insecticidal activity and has been identified, together with thymol, as one of the active compounds responsible for the insecticidal effects of *Thymus vulgaris* essential oil [5].

Dried thyme leaves (*Thymus vulgaris* L.) constitute an excellent natural dietary supplement for dairy animals. They are rich in antioxidant, antibacterial, and anti-inflammatory compounds, which contribute to strengthening the immune system and maintaining animal health. In addition, their nutritional characteristics promote improvements in milk quality and quantity, while simultaneously reducing the environmental footprint of production. These properties make thyme an ideal ingredient for natural feeding, with an emphasis on sustainability and efficiency [6].

The aim of this study is to determine the effect of dietary supplementation of dried thyme leaves on the milk production and composition of Saanen/Florida lactating goats (crossbreed).

2. Materials and methods

2.1 Experiment: lactating goats

Sixteen multiparous lactating goats were divided into two groups (experimental: DTL6 and control: DTL0) after 60 days of parturition, which consisted of 4 subgroups of 2 goats each and monitored during a critical lactation period. The goats were evenly allocated, according to milk production and lactation stage (2nd lactation) and were housed in eight group pens (four subgroups-four pens per treatment). The eight pens were similar in terms of orientation and floor area occupied (2 m²/goat).

Concentrate mixture was offered to animals of all groups (dry matter, DM: 0.894 kg/goat/day, crude protein: 151 g/kg DM, net energy for lactation: 6.87 MJ/kg DM), as well as alfalfa hay (1.05 kg DM/goat/day) and wheat straw (0.37 kg DM/goat/day) according to their nutritional needs (Table 1). The other experimental animals (DTL6) were fed control ration plus 6 g dried thyme leaves (DTL)/kg of concentrate mixture. The total duration of feeding experiment was 56 days.

Feed intake was determined daily for each goat. Goats had free access to water and were machine milked twice daily at 07:00 and 18:00 h with a 2 × 24 DeLaval (Thessaloniki, Greece) milking machine. During the experimental period, the health status and behavior of all goats was monitored on daily basis.

Milk yield was recorded at twelve-day intervals (i.e., on days 61, 74, 88, 102 and 116 postpartum) from consecutive morning and afternoon milkings. Milking was conducted at a vacuum level of 34 kPa, pulsation rate of 150/min and pulsation ratio of 60/40. During 5 morning and afternoon milkings (i.e., on days 61, 74, 88, 102 and 116 postpartum), milk samples were collected from each goat, after cleaning and disinfecting the teats. The morning and afternoon milk samples of each goat, taken in proportion to the different yield, were pooled by treatment and kept refrigerated (+4 °C) until chemical analysis.

2.2 Milk Chemical analysis

Milk samples were analysed for fat, protein, lactose, and solids-not-fat (SNF) using infrared spectroscopy (MilkoScan 4000; FOSS, Hillerød, Denmark), according to AOAC method 972.16 [7]. Ash was calculated as SNF minus protein and lactose.

2.3 Statistical analysis

Performance and milk composition of goats were analyzed by one-way analysis of variance procedures, and significant differences among treatment means were tested using linear and quadratic contrasts [8]. The effect of treatment, time, and their interactions were included in the statistical model. The experimental unit was considered to be each the pen of lactating goats.

Results are presented as means, standard error of the mean (SEM), and statistical significance was declared at P<0.05. The statistical model was analysed using the SPSS statistical package [9].

3. Results and discussion

The effects of dietary supplementation with thyme leaves across the experimental period are presented in Table 2. The analysis of the results showed that, regarding the milk yield, there was no significant difference between the experimental and the control groups (P>0.05). Milk production showed a slight numerical increase in the DTL0

and DTL6 treatments as the study progressed; however, neither the effect of time nor the treatment × time interaction was statistically significant ($P>0.05$). During the experimental

period, daily milk yield in goats receiving dried thyme leaves did not differ compared to the control group (4,062 vs. 4,097 g/goat/day, $P>0.05$; Figure 1).

Table 1. Ingredient and chemical composition of lactating goats ration

	Basal concentrate mixture	Alfalfa hay	Wheat straw
Ingredient composition (g/kg, as mixed)			
Corn grain, ground	560		
Barley grain, ground	140		
Sunflower	100		
Soybean meal (440 g/kg CP)	160		
Limestone	10		
Vitamin-mineral premix ¹	30		
Chemical composition ² (g/kg DM)			
Dry matter (DM, as fed)	894	903	927
Crude protein (CP)	151.01	192	48
Crude fat	25.99	25	16
Neutral detergent fiber (NDF)	116.74	416	730
Acid detergent fiber (ADF)	55.60	328	494
Ash	103.75	110	76
Calcium	76.97	14.7	3.10
Phosphorus	51.29	2.80	1.0
Sodium	11.11	1.0	1.20
Net energy for lactation (NE _l , MJ/kg DM)	6.87	4.98	3.43

¹Premix contained 255 g/kg Ca, 45 g/kg P, 20 g/kg Mg and 60 g/kg Na and supplied/kg of concentrate: 9,500 IU vitamin A; 1,900 IU vitamin D₃; 11 mg vitamin E; 1.78 mg Co; 7.13 mg I; 47.5 mg Fe; 95 mg Mn; 0.18 mg Se; 30.9 mg Zn.

²All values were calculated from NRC (2001) values.

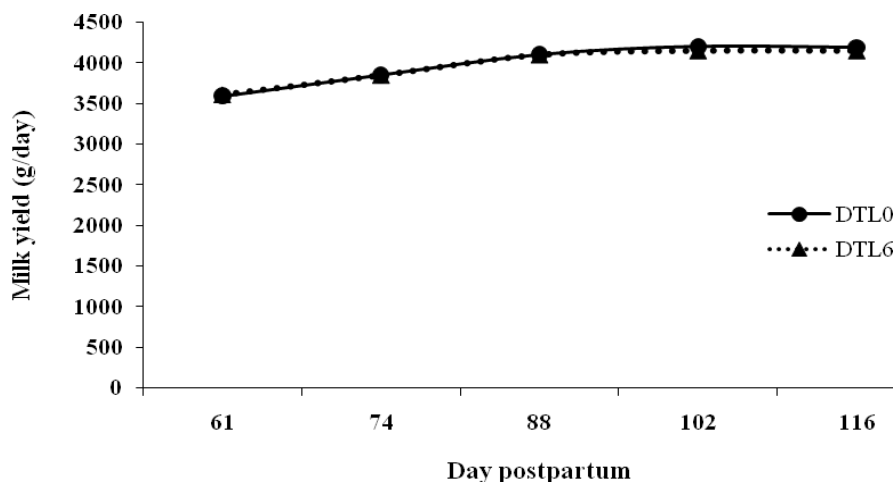


Figure 1. Lactation curves of ewes as influenced by supplemental dietary dried Thyme leaves (DTL) during the experiment (in total 56 days, days 61 to 116 postpartum); (●) DTL0, (▲) DTL6 (overall SEM = 62,333 g/day).

The maintenance of milk yield at satisfactory levels suggests that thyme can be incorporated into the diet without reducing the productive capacity of goats. However, Abd El Tawab et al. [10] reported improved lactational performance, particularly increased energy-corrected milk production, in Barki ewes supplemented with thyme. Similarly, Mohamed et al. [11] reported that the supplementation of thyme (*Thymus vulgaris*), either alone or in combination with sunflower oil, led to a significant increase in milk yield of dairy goats. The researchers attributed this effect to improved digestibility and the favorable modification of ruminal microbial fermentation. Another study in dairy goats [12], showed that plant additives rich in bioactive compounds can increase feed utilization efficiency, leading to higher production. Although in some cases the increase was not always statistically significant, the general trend toward enhanced productivity is evident.

The most pronounced change was recorded in milk fat content, where a statistically significant decrease was observed in the group that received

thyme. This decrease is probably associated with modification of ruminal microbial fermentation and changes in the production of precursors involved in lipogenesis. In the international literature, the findings vary. Kholif et al. [12] reported that the inclusion of plant extracts in the diets of small ruminants did not significantly affect fat content, whereas another study [13] recorded changes depending on the dosage and form of administration. This variation in results is attributed to factors such as the stage of lactation, the energy level of the diet, and the genetic potential of the animals, particularly in high-producing breeds such as Saanen.

In our study, milk protein and SNF content showed a statistically significant difference between treatments and, specifically, increase in DTL6 group compared to the Control group. This finding is in agreement with the study by Boutoail et al. [13], who reported that supplementation of dairy goat diets with non-distilled thyme leaves significantly increased milk protein content, along with fat, dry matter and polyunsaturated fatty acid contents.

Table 2. Milk yield and composition of lactating Saanen/Florida goats (crossbreed) during the experiment (in total 56 days, days 61 to 116 postpartum)

	Treatment ^{1,2}		SEM	Significance level ³		
	DTL0	DTL6		Treatment	Time	Treatment × Time
Milk yield (g/day)	4.097	4.062	62.333	0.795	0.277	0.999
Milk content (g/kg)						
Fat	36.84	27.35	1.310	<0.001	0.023	0.987
Protein	31.65	33.96	0.370	0.001	0.492	0.354
Lactose	44.15	43.97	0.227	0.692	0.071	0.684
SNF ⁴	83.15	85.14	0.410	0.015	0.371	0.748
Ash	7.33	7.41	0.023	0.056	0.468	0.088

¹ DTL0 = control treatment, DTL6 = treatment with 6 g dried thyme leaves (DTL)/kg concentrate mixture.

² Number of subgroups-pens (replicates)/treatment = 4. Number of goats/pen (replicate) = 2.

³ Numbers are probability values. Treatment × Time interactions for milk yield are illustrated in Figure 1. (Time: P=0.277, Treatment × Time: P=0.999).

⁴SNF = solid-not-fat.

The results of our study, also, showed that milk lactose and ash contents remained constant throughout the feeding trial. No significant changes in the mineral composition of milk following thyme supplementation was reported from other researchers too [11,13].

4. Conclusions

Dietary dried thyme leaves supplementation, at level 6 g/kg concentrate feed, in isonitrogenous and iso (net energy) energetic diets for lactating goats did not affect their performance, increasing milk protein and solid-not-fat content, but decreasing milk fat content.

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